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DENTON, H. R.	Office of Nuclear Reactor Regulation, Director (post 851125

SUBJECT: Forwards response to BJ Youngblood 860402 request for addl info re NUREG-0737, TMI Action Item II.D.1 on relief & safety valve testing. Responses to Questions 3 & 4d postponed until addl info provided by NRC.
SEE RCPTS

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INDIANA & MICHIGAN ELECTRIC COMPANY

P.O. BOX 16631
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July 30, 1986
AEP:NRC:0585I

Donald C. Cook Nuclear Plant Unit Nos. 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
RESPONSE TO NRC, REQUEST FOR ADDITIONAL INFORMATION
REGARDING TMI ACTION ITEM II.D.1 ON RELIEF AND SAFETY
VALVE TESTING

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

References:

1. EPRI PWR Safety and Relief Valve Test Program Guide for Application of Valve Test Program Results to Plant-Specific Evaluations, Revision 2, Interim Report, July, 1982.

2. EPRI PWR Safety and Relief Valve Test Program Safety and Relief Valve Test Report, EPRI NP-2628-SR, Dec., 1982.

3. M. P. Alexich, Indiana & Michigan Electric Co., letter to H. R. Denton, NRC, "Donald C. Cook Nuclear Plant Units 1 and 2, NUREG-0737, Item II.D.1, PWR Relief and Safety Valve Test Program," AEP:NRC:0585D, December 15, 1983.

4. M. P. Alexich, Indiana & Michigan Electric Co., letter to H. R. Denton, NRC, "Response to NRC, Request for Additional Information Regarding Testing of the Pressurizer Safety and Relief Valves, Donald C. Cook Nuclear Plant, Units 1 and 2," AEP:NRC:0585H, July 15, 1985.

Dear Mr. Denton:

This letter and its attachments respond to B. J. Youngblood's letter of April 2, 1986, which requested additional information regarding TMI Action Item II.D.1 on relief and safety valve testing. Six questions were to be addressed, but in discussions with your staff, it was agreed that response to Questions 3 and 4d would be postponed until after additional information is provided to us by your staff. This letter and its attachments respond to the remaining questions in Mr. Youngblood's letter, as applicable to the Donald C. Cook Nuclear Plant, Units 1 and 2.

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The attachments to this letter contain the following information:

Attachment 1: Response to the questions in Mr. Youngblood's letter.
Attachment 2: Teledyne input on Question 4a.
Attachment 3: Teledyne input on Questions 4b and 4c.
Attachment 4: Stress analysis results for Question 5c.
Attachment 5: Westinghouse Report V-EC-108 related to Question 6.

This document has been prepared following Corporate procedures which incorporate a reasonable set of controls to ensure its accuracy and completeness prior to signature by the undersigned.

Very truly yours,

M. P. Alexich
Vice President 7/20/86

cm

Attachments

cc: (w/o attachments)
John E. Dolan
W. G. Smith, Jr. - Bridgman
R. C. Callen
G. Bruchmann
G. Charnoff
NRC Resident Inspector - Bridgman

ATTACHMENT 1 TO AEP:NRC:0585I

RESPONSE TO NRC REGARDING

REQUEST FOR ADDITIONAL INFORMATION

ON RELIEF AND SAFETY VALVE TESTING

Question 1: Safety Valve Inlet Pressure Drop

"The licensee gave the pressure drop values through the inlet piping as 14.4 psi for the plant specific safety valve and 15.8 psi for applicable EPRI test valve. These pressure drop values appear to be extremely low, when compared with the pressure drop values listed in Table B-3 of Reference 1 for various EPRI valve inlet configurations. Please verify the pressure drop values given previously. Present a recalculation of the total pressure drops through the inlet piping of D. C. Cook Units 1 and 2 safety valves and the applicable EPRI inlet piping arrangement. The total pressure drop should include both the frictional and accoustic [sic] wave components evaluated under steam conditions."

Response 1:

The previous calculation considered only the frictional component of inlet piping pressure drop. The pressure drop was recalculated using the method given in Reference 1, Appendix B. This method includes both frictional and acoustic wave components evaluated during both valve opening and closing. The results of the calculations are shown in the following table. The ΔP values for the EPRI test were taken from Table B-3 of Appendix B in Reference 1.

INLET PIPING PRESSURE DROP (psi)

	Cook Plant			EPRI Test
	Frictional Component	Acoustic Wave Component	Total ΔP	
Valve Opening	12.1	216.1	228.2	263
Valve Closing	5.8	146.8	152.6	181

The above results are based on the transient ΔP which is the controlling ΔP. Steady-state ΔP is the same as the frictional component given in the above table.

It is observed by comparison of the Cook Plant and EPRI test inlet piping pressure drop that the Cook Plant ΔP is lower than the EPRI inlet piping ΔP. Since the Cook Plant pressurizer safety valves (PSVs) do not utilize loop seals, steam discharge conditions noted in Appendix B of Reference 1 are applicable to the Cook Plant. Therefore, the performance of the Cook Plant pressurizer safety valves can be evaluated based on the performance of the EPRI tested valve, Crosby 6M6.

<u>Question 2</u>: Safety Valve Backpressure

"EPRI Test No. 1411, which was selected as a representative test of the D. C. Cook safety valve, showed that the maximum backpressure developed at the outlet of the test valve was 245 psia. The backpressure for the D. C. Cook safety valve was not given in the submittal. Please provide the predicted value of the maximum backpressure developed at the outlet of the D. C. Cook Units 1 and 2 safety valves in order to verify whether the plant specific pressure drop is bounded by the EPRI test."

<u>Response 2</u>:

Safety valve backpressure was calculated based on the procedure given in Reference 1, Appendix A. The approach assumes simultaneous discharge of all safety valves <u>or</u> all PORVs. Since Cook Plant PSVs do not utilize loop seals, the calculation was done only for steam conditions. Maximum pressurizer relief tank pressure (100 psig) was assumed. The backpressures were calculated using the actual discharge piping geometry and a two-phase homogeneous flow model. The Unit 2 piping geometry was used since it is slightly longer than that in Unit 1.

The homogeneous flow model considers the two phases to flow as a single phase possessing mean fluid properties. It provides more accurate pressure drop estimates for dispersed flow in the higher mass velocity ranges (2000 - 2500 Kg/M^2sec). The following assumptions are implicit in the model:

a) Entropy remains constant as fluid flows along the line.
b) Steam and water velocities are equal.
c) Steam and water are in thermodynamic equilibrium.
d) There is no dissipation of mechanical energy at the steam and water interface.
e) Suitably defined single-phase friction factor for two-phase flow was used.

The results of the calculations are shown in the following table:

Flow per Safety Valve (lb/hr)	Flow per PORV (lb/hr)	Total Flowrate (lb/hr)	Predicted Safety Valve Backpressure (psia)		
			SV-45A	SV-45B	SV-45C
458,000*	0	1,374,000	438.2	431.9	430.0
0	179,000	537,000	192.6	192.6	192.6

* This value is specified in Table B-1 of Reference 1.

Two EPRI "steam" tests (903 and 1411) were conducted on the Crosby 6M6 valve as shown in Table 3.5.1.b, Reference 2. Test 903 was conducted at high backpressure (665 psia) and Test 1411 at low backpressure (245 psia). Since the Cook valves maximum predicted backpressure (438 psia) is above that of Test 1411, this test is not applicable for demonstrating valve operability. Test 903, while conducted at sufficiently high backpressure, is also not applicable, since the valve ring settings were not representative of the ring settings on the Cook valves.

However, another test (929), which was a "loop seal" test, can be used as a basis for demonstrating satisfactory valve performance on steam at high backpressure. Test 929 was conducted on a valve with ring settings representative of the Cook valves and at high backpressure (710 psia). Although the valve chattered during this test as the water in the loop seal was expelled, the valve "stabilized on steam," (Note (4), Table 3.5.1.c in Reference 2). Therefore, it is concluded that the Crosby 6M6 valve operability on steam at high backpressure (710 psia) was demonstrated by Test 929. Since the Cook Plant PSV predicted maximum backpressure (438 psia) is enveloped by EPRI Test 929, Cook Plant PSV valve operability was demonstrated.

<u>Question 3</u>: (Awaiting further NRC clarification)

<u>Question 4</u>: Safety Valve and PORV Piping Stress Analysis

a. "Reference 4 indicates that details of the piping stress analysis for PORV discharge cases are contained in the Teledyne Reports TR-5364-1 and TR-5364-2. Our record shows that the above reports have not been submitted for review by the licensee. Please provide copies of the above reports so that the piping analysis pertinent to PORV discharge can be reviewed.

b. In the thermal hydraulic analysis of the piping discharge conditions, the computer codes REPIPE/SAP2SAP were used to calculate the fluid force time histories from RELAP5 analysis results. Provide verification of the REPIPE/SAP2SAP codes by showing that these codes produce accurate results for similar problems.

c. The licensee presented a verification of the structural analysis code, TMRSAP, using assumed force time histories in the form of ramp functions to represent the fluid forces exerted on the piping model (Question 16, Reference 4). In order to demonstrate that the computer code produces accurate results for the valve discharge problem analyzed, similar piping model and fluid forces must be used. The ramp shape force histories used in the verification problem does not realistically represent the type of fluid forces in a safety valve/PORV discharge event. Therefore, present a verification of the TMRSAP code using fluid forces representative of the valve discharge conditions."

Response 4a:

Included as Attachment 2 to this submittal are the Teledyne Reports requested by Question 4a.

Response 4b and 4c:

Included as Attachment 3 to this submittal is the response from Teledyne Engineering Services regarding the REPIPE/SAP2SAP codes and the TMRSAP code discussed in Questions 4b and 4c.

Question 4d: (Awaiting further NRC clarification)

Question 5: Piping Support Stresses

"The Teledyne stress report indicates that a number of pipe supports (8 in Unit 1 and 24 in Unit 2) exceeded their design loads. Subsequent reanalysis performed by the licensee concluded that, with the exception of a few supports which required modifications, the rest of the supports were found to be adequate to resist the revised loads. Since the licensee did not provide any detail concerning the reanalysis, a review of the support adequacy cannot be performed. Therefore provide the following information required for the evaluation.

a. Identify the governing code and standards used for support design.

b. List the load combination equations used including all the operation conditions as suggested in the EPRI Guide for Plant Specific Evaluations (Reference 2). Also specify the allowable stress limit applicable to each condition.

c. Provide a comparison of the worst case support stresses (or loads) with the applicable allowable stress limits (or allowable loads) and identify the load combinations associated with the worst stresses. These data should be presented for the questionable supports indicated in the Teledyne stress report."

Response 5a:

The governing codes and standards used for support design are as follows:

1. American Institute for Steel Construction (AISC) Code for auxiliary steel
2. Manufacturers Standardization Society (M.S.S.)-SP-58 for commercial pipe hanger attachments
3. Power Piping USAS B.31.1-1967 - for pipe integral attachments

Response 5b:

The load combination equations for normal and upset conditions are:

$$D_1 = \text{Normal (Weight Load)} + \text{Normal (Thermal Range Load)} \pm \text{OBE Load}$$

$$D_2 = \text{PORV Transient (Weight Load)} + \text{PORV Transient (Thermal Range Load)} \pm \sqrt{(\text{OBE Load})^2 + (\text{PORV Trans. Shock Load})^2}$$

The load summation shall not provide support component stress greater than 100% of that permitted by 5a.

The load combination equations for emergency conditions are:

$$E_1 = \text{Normal (Weight Load)} + \text{Normal (Thermal Range Load)} \pm \text{DBE Load}$$

$$E_2 = \text{SV Transient (Weight Load)} + \text{SV Transient (Thermal Range Load)} \pm \text{SV Transient (Shock Load)}$$

The load summation shall not produce support component stress greater than 133% of that permitted by 5a.

Additionally, 90% of yield stress shall not be exceeded.

Response 5c:

A tabulated summary for comparing the worst-case support stresses with the applicable stress limits for the supports identified in the Teledyne Stress Report is provided in Attachment 4. For three items noted in Attachment 4, stress comparisons will be made after as-built information is obtained from the plant.

Question 6: Valve Accelerations

"The licensee stated in Reference 3 that the Teledyne analysis showed that the maximum vertical acceleration of the D. C. Cook safety valve resulting from a piping discharge transient exceeded the design allowable of 2 g by less than 1 g. The licensee contended that these valves were successfully tested in the Westinghouse seismic test to 4 g in the vertical direction. Therefore, the predicted acceleration for the D. C. Cook valves, although exceeding the design allowable, would still be acceptable. However, the licensee did not provide any details of the test and its findings. Since NUREG-0737, Item II.D.I requires that the valve operability must be demonstrated for operating and transient conditions, the operability of the valves under the predicted g loadings must be assured. Therefore, provide a discussion of the seismic test performed by Westinghouse to demonstrate that the operability of the safety valve will not be impaired under the predicted acceleration level."

Response 6:

In the December 15, 1983, submittal, Reference 3, it was stated that "we were informed by Westinghouse... that the valves have been successfully seismically test for 4 g - vertical and 6 g - horizontal accelerations." That statement was based on a September 1, 1983, letter from Westinghouse, which stated: "The specified seismic accelerations under which the valve successfully completed seismic testing were 4 g - vertical and 6 g - horizontal."

In response to Question 6, Westinghouse informed us that upon further investigation, they learned from Crosby that the valve seismically tested was a forged valve design and not the cast version. Since Westinghouse supplied Cook Plant with cast valves, the seismic tests referred to above may not be directly applicable to the Cook PSVs.

However, a seismic analysis was performed for the cast version of the valve based on 4 g - vertical and 6 g - horizontal seismic accelerations. The analysis and results are contained in Crosby Valve and Gage Company Report No. EC-310, dated March, 1977, which is a proprietary report. Westinghouse did prepare and submit to us a summary of the report, V-EC-108, attached for reference (Attachment 5). The results of the seismic analysis showed a maximum stress in the valve body of 5058 psi (allowable = 18,700 psi) and a maximum stress in the valve bonnet of 5720 psi (allowable = 17,400 psi). The evaluation showed that the "valve remains structurally sound and maintains full operational capabilities" for the 4 g - vertical and 6 g - horizontal seismic conditions. Since the predicted maximum vertical acceleration of the Cook PSVs in the Teledyne analysis was less than 3 g, and the Crosby seismic analysis concludes that the valve maintains full operational capability under 4 g - vertical acceleration, it is concluded that the operability of the Cook PSV will not be impaired by the predicted acceleration level. It should be noted that the predicted maximum horizontal acceleration of the Cook PSVs in the Teledyne analysis was within the design allowable of 3 g, and hence within the tested value of 6 g, and is therefore acceptable.

ATTACHMENT 2

TO

AEP:NRC:0585I

TELEDYNE INPUT (QUESTION 4a)

ATTACHMENT 3

TO

AEP:NRC:0585I

TELEDYNE INPUT (QUESTIONS 4b AND 4c)

TELEDYNE
ENGINEERING SERVICES

130 SECOND AVENUE

WALTHAM, MASSACHUSETTS 02254-9195

(617) 890-3350 TWX (710) 324-7508

July 9, 1986
5364-73

American Electric Power Service Corp.
1 Riverside Plaza
Columbus, OH, 43216-6631

Attention: Mr. Osman Yasin

Subject: REPIPE Verification

Dear Gentlemen,

The REPIPE computer program is a Control Data Corporation (CDC) proprietary program. It is made available to the public on a fee basis. CDC is a Teledyne Engineering Services (TES) Approved Vendor. This means that TES quality assurance engineers have audited the CDC quality assurance program and have found it to meet our standards.

TES used the REPIPE version 3.10 computer program in the execution of Technical Reports TR-5364-1, 2, 3 and 4.

This program was used with the understanding that CDC had tested the program under their QA procedures. CDC QA records have been reviewed in the safety-related library for REPIPE version 3.10 as installed on KHE in April, 1983. Quality assurance testing was performed per the CDC SRQA program at that time. Test results are on file as lifetime records.

Very truly yours,

TELEDYNE ENGINEERING SERVICES

Lenin B. Semprucci
Principal Engineer

LBS:mld
cc: D. Messinger (TES)
R. Berks (TES)

TELEDYNE
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(617) 890-3350 TWX (710) 324-7508

June 5, 1986
5364-17

American Electric Power Service Corp.
1 Riverside Plaza
Columbus, OH, 43216-6631

Attn: Mr. J. L. Williams
Section Manager

Subject: D. C. Cook Nuclear Plant
NRC Questions Related to TMI Action Item II.D.1 on Relief and Safety Valve Testing, File No. DC-D-0353.36M

Ref: AEPSC letter dated 5/29/86 from Osman Yasin to L. B. Semprucci

Dear Sirs,

Enclosed you will find our response to NRC Questions 4b and 4c. Copies of Technical Reports TR-5364-1 and TR-5364-2 books 1, 2 and 3 are also enclosed as requested in Question 4a.

If there are any questions please call me at (617) 890-3350.

Very truly yours,

TELEDYNE ENGINEERING SERVICES

Lenin B. Semprucci
Principal Engineer

LBS:mld
cc: J.A. DiBello (AEPSC)
M.J. Noronha (AEPSC)
O. Yasin (AEPSC)
R. Wray (TES)
R.H. Berks (TES)
D.F. Landers (TES)

In response to question 4b which states:

> In the thermal hydraulic analysis of the piping discharge conditions, the computer codes REPIPE/SAP2SAP were used to calculate the fluid force time histories from RELAP5 analysis results. Provide verification of the REPIPE/SAP2SAP codes by showing that these codes produce accurate results for similar problems.

The REPIPE computer code is maintained and serviced by Control Data Corporation. Verification of REPIPE's capacity to develope a force time history from RELAP5 mod 1 is provided by Control Data Corporation.

SAP2SAP is a TES generated program which reformats SAP force time history files. SAP2SAP was used on the D.C. Cook force time history files generated by REPIPE for the following reasons.

The REPIPE program generates force time histories from RELAP output in SAP format. For each straight pipe segment in which a force time history occurs REPIPE assigns the positive force to the structural node at one end of the pipe segment and the negative force to the structural node at the other end. This requires two structural nodes associated with two force time history tables for every straight pipe segment. The D.C. Cook structural model was so big that the number of structural nodes with force time histories exceeded the capacity of the program. Therefore the SAP2SAP program was used to reduce the number of structural nodes being loaded by adding the force time histories of the nodes at each end of a pipe segment and replace the two force time histories with a single force time history applied to one structural node on the pipe segment.

The SAP2SAP program is simply an "arithimetic" program providing the user with several options. The program is independent of the valve discharge problem.

NRC question 4C states:

> The licensee presented a verification of the structural analysis code, TMRSAP, using assumed force time histories in the form of ramp functions to represent the fluid forces exerted on the piping model (Question 16, Reference 1). In order to demonstrate that the computer code produces accurate results for the valve discharge problem analyzed, similar piping model and fluid forces must be used. The ramp shape force time histories used in the verification problem does not realistically represent the type of fluid forces found in a safety valve PORV discharge event. Therefore, present a verification of the TMRSAP code using fluid forces representative of the valve discharge conditions.

In response to question 4C, TES provides the following:

The verification problem used by TES realistically represents the fluid forces found in a safety valve/PORV discharge event. This is evident by a comparison of the TES verification fluid loads with those used in the EPRI/CE Test Program (Ref. 2) shown in the following figures.

Figures 4-8, 4-10 and 4-12, from Ref. 2, illustrate the fluid loads (shown as solid lines) and the structural response (shown in dashed lines) corresponding to test #1411 of the EPRI/CE safety valve tests performed in response to NUREG 0737. We call your attention to the fluid loads (the structural response is not in question). It can be seen that these fluid loads are a ramp up to a peak value followed by a ramp down to the no load position.

Figures 3, 4, 5 and 6 present the fluid forces used in the TES verification problem. It can be seen that TES's verification fluid forces ramp up to a peak value and then ramp down to the no load position as do those in the EPRI/CE program. The TES verification problem geometry is not identical to the EPRI/CE test geometry (see figures 1 and 2), therefore one would not expect the magnitude and duration of the forces to be identical. The point is that the forces are similar in general configuration and therefore representative of the valve discharge problem.

The NRC reviewer's concern may be due to a misunderstanding of the TES forcing function.

The TES fluid forcing function as presented in the verification problem is a total elbow load. The forcing function presented in the EPRI/CE problem are net segment loads (known as unbalanced forces, or wave forces). The net segment load is the difference in the elbow loads at either end of the pipe segment. In order to compare the TES forcing function with the EPRI/CE forcing function, one must take the difference in the total elbow loads bounding each segment. This has been done in figures 3, 4, 5 and 6. Now it can be seen that the TES forcing function is indeed representative of the EPRI/CE forcing function.

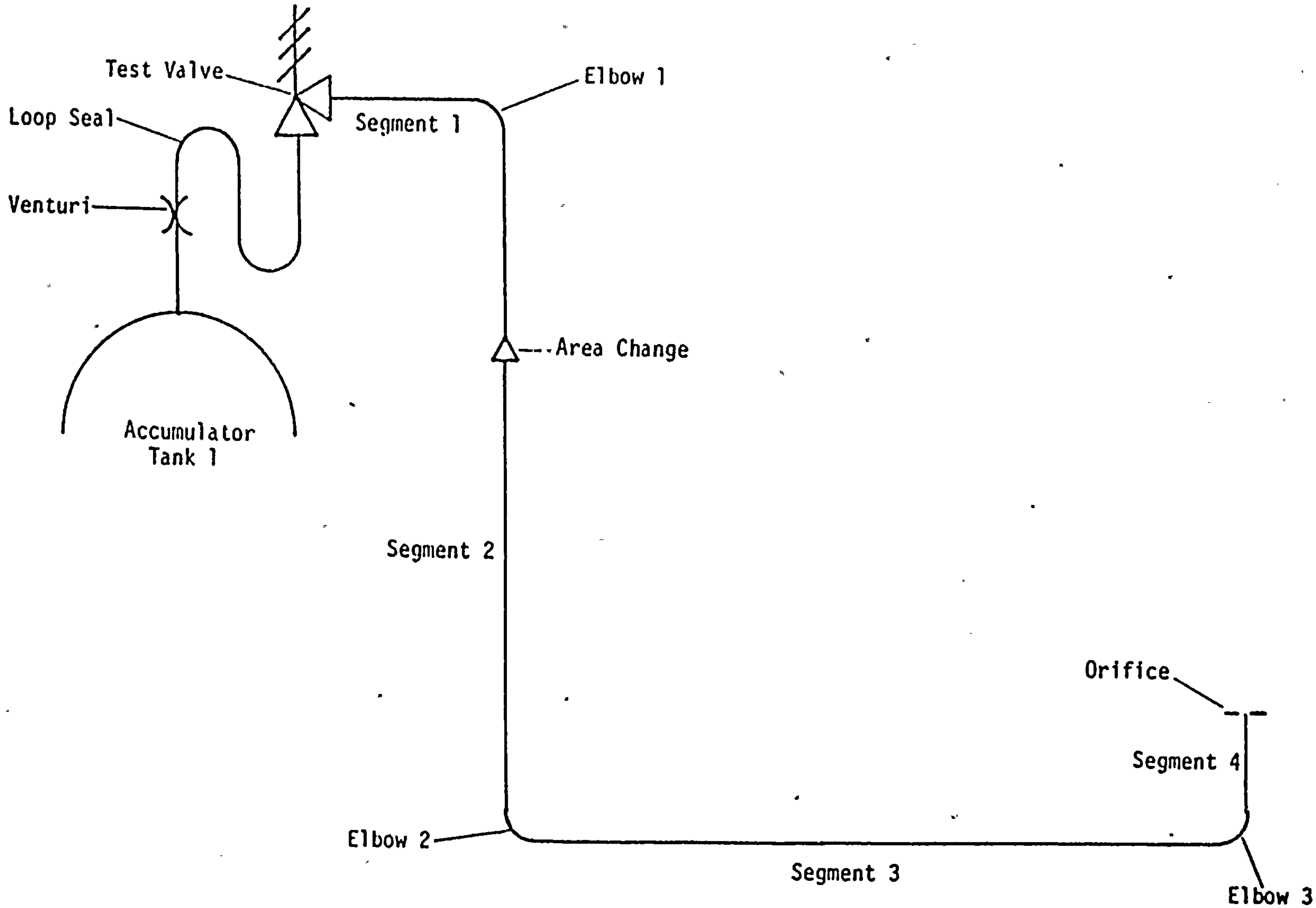
It must be further pointed out that the method by which THRSAP (or any dynamic program) solves a force time history problem is independent of the form of the forcing function. The analyst inputs the forcing function as a table of load versus time. Whether the function is a ramp, series of ramps or any arbitrary function doesn't matter to the program. The same equations are being solved with each time step. What is important is that the analyst chose the time steps properly.

As additional information on January 7-11, 1985, NRC personnel conducted an inspection at our facility in Waltham, Massachusetts (NRC Inspection Report and Docket No. 99900513/85-01 dated July 11, 1985). The purpose of this inspection was to review our Quality Assurance Program in the areas of computer code verification, computer code error handling procedures, and pipe support design calculations.

Regarding computer program verification, the following is an excerpt from the Report:

> "The development and verification of the computer program TMRSAP, which is used by TES in the design of safety-related items was reviewed during this inspection. Technical Engineering Procedures TEP-1-005, Application Computer Program Development, was reviewed and utilized throughout the inspection of TMRSAP.
>
> The computer code TMRSAP, which was developed internally by TES, is used for static and dynamic analysis of linear piping systems. It employs a finite element solution technique with a library consisting of curved and straight pipe elements, and a boundary element for simulation of pipe restraints. TMRSAP provides capability for analysis of such static loading as deadweight, thermal, and pressure elongation loadings. Capabilities for dynamic analysis include response spectrum and time history (both modal and direct) analysis. Solution methods include Gaussian elimination for static solutions, and determinant search for subspace iteration for the modal dynamic solutions. Direct integration is performed with the Wilson-O-method.
>
> TES verified TMRSAP by a comparison of the output of 22 verification problem solutions with either the results of hand calculations or the output of other computer codes (STARDYNE, EPIPE, ANSYS, and ADLPIPE). During this inspection all verification problems were reviewed. Although the verification of this code was done according to a general design control procedure (Section 3.0 of the TES Quality Assurance Manual), it was found to meet the requirements of the latest TES procedure controlling computer code verification (TES-1-005), with one exception. The exception was that the source code listing and computation outputs were not included in the verification

manual. However, the computation output includes a source code listing that was clearly identified in the verification manual and was readily available at the TES office. No violations or nonconformances were identified during this part of the inspection."



EPRI/CE SAFETY VALVE TEST GEOMETRY

FIG 1

TELEDYNE ENGINEERING SERVICES

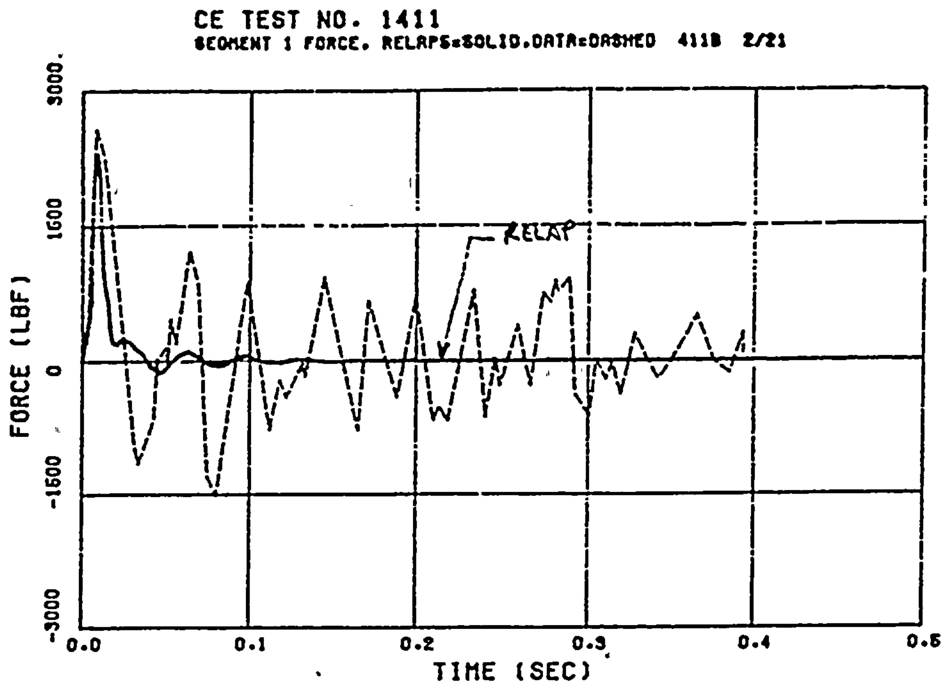
BY LBS DATE 6-5-86

CHKD. BY NA DATE NA

RESPONSE TO NRC QUESTIONS

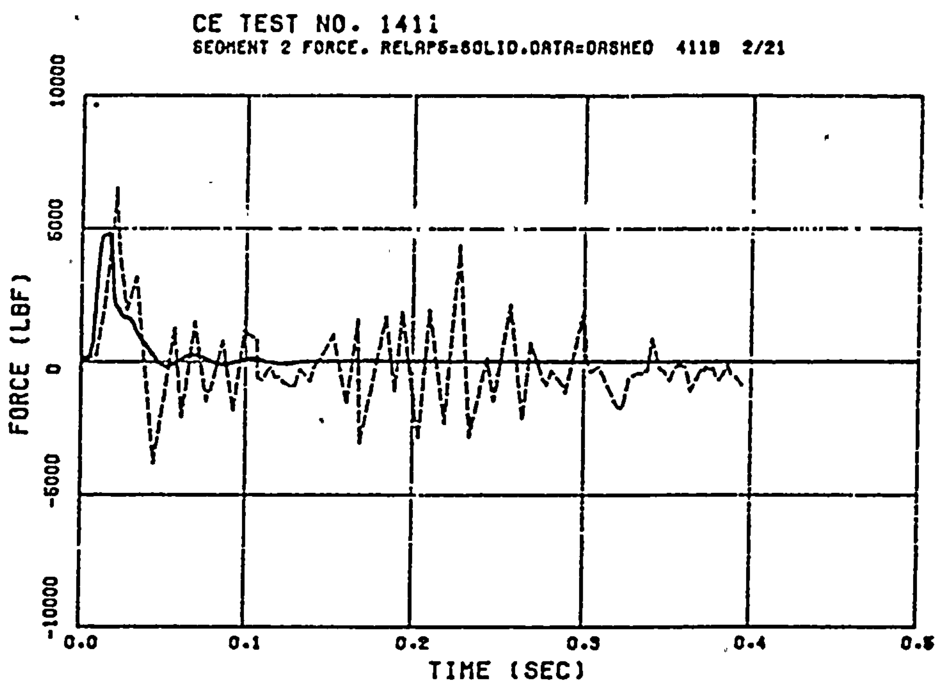
SHEET NO. ___ OF ___

PROJ. NO. 5364



(REF 2)

Figure 4-8. Comparison Plot of RELAP5/MOD1-Calculated Segment 1 Force with Experimental Data, Test 1411.



(REF 2)

Figure 4-10. Comparison Plot of RELAP5/MOD1-Calculated Segment 2 Force with Experimental Data, Test 1411.

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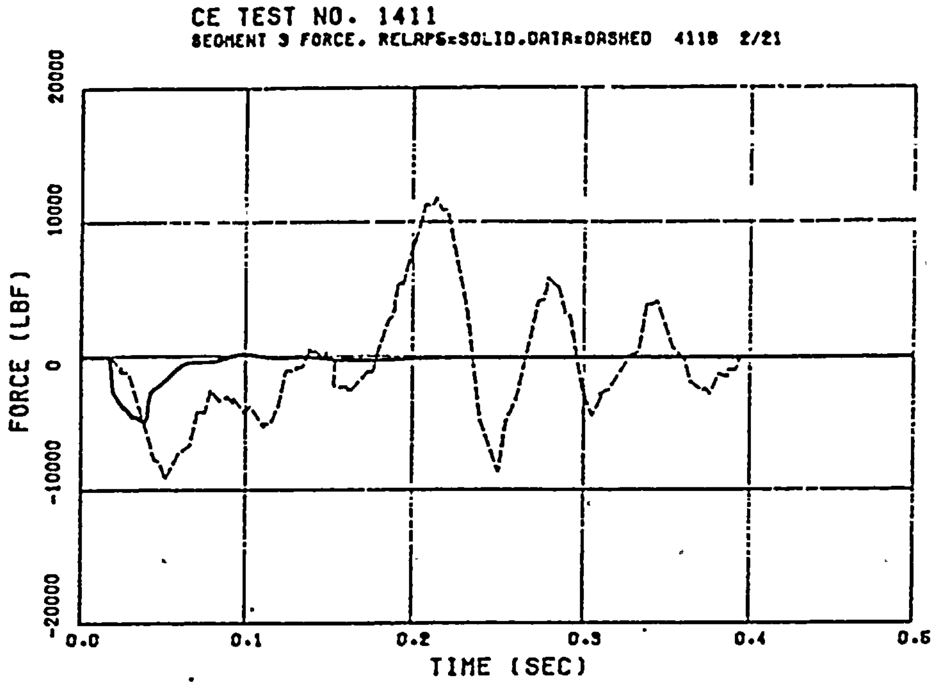

Figure 4-12. Comparison Plot of RELAP5/MOD1-Calculated Segment 3 Force with Experimental Data, Test 1411.

(REF 2)

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TES VERIFICATION MODEL

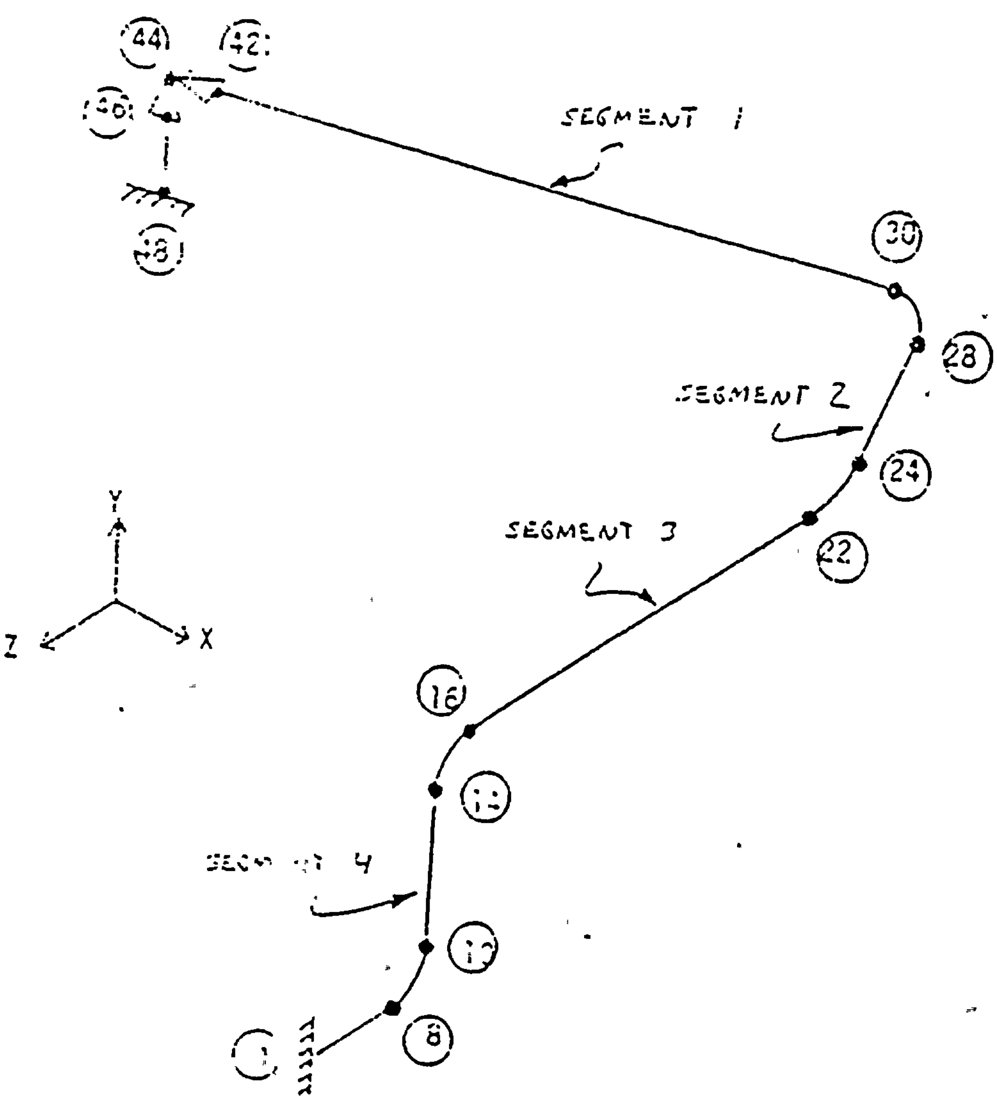

FIG 2.0

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NET SEGMENT LOAD

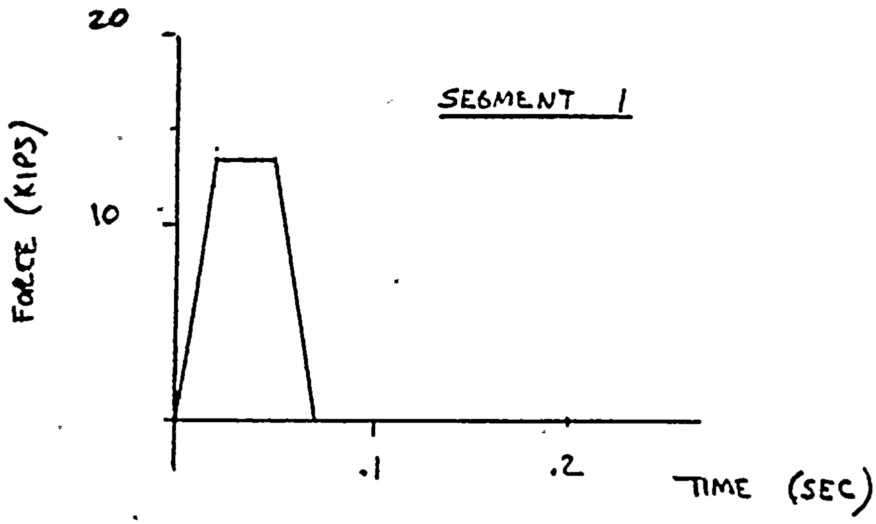

FIG 3.0

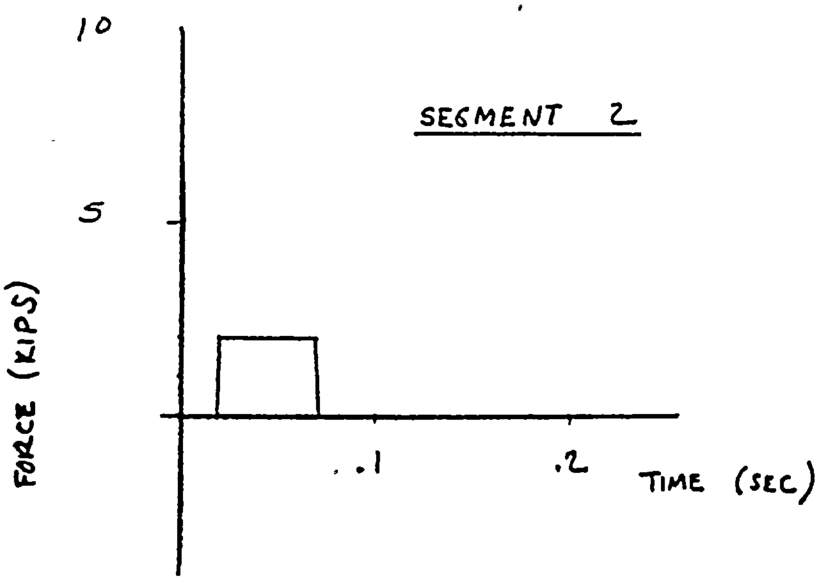

FIG. 4.0

TELEDYNE ENGINEERING SERVICES

BY LRS DATE 6-5-86 | RESPONSE TO NRC QUESTIONS | SHEET NO. ____ OF ____
CHKD. BY ____ DATE ____ | | PROJ. NO. 5364

NET SEGMENT LOAD

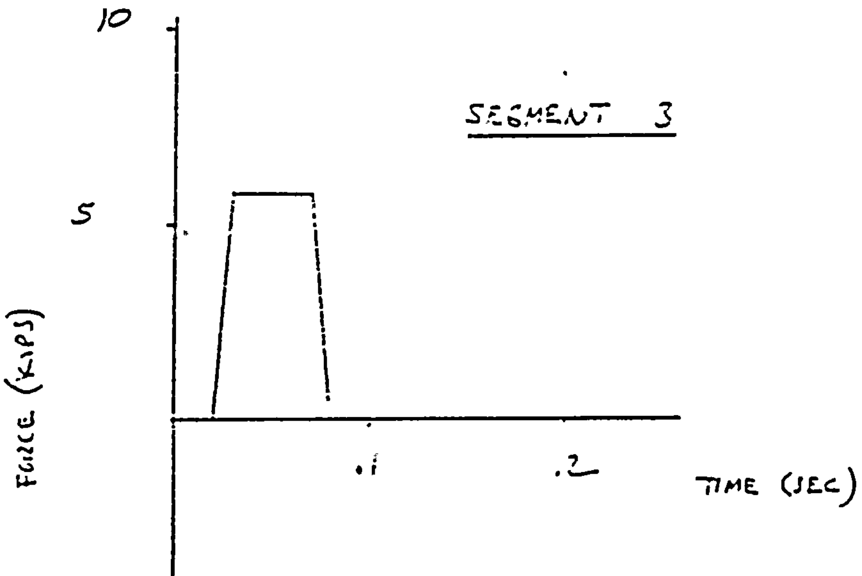

FIG 5.0

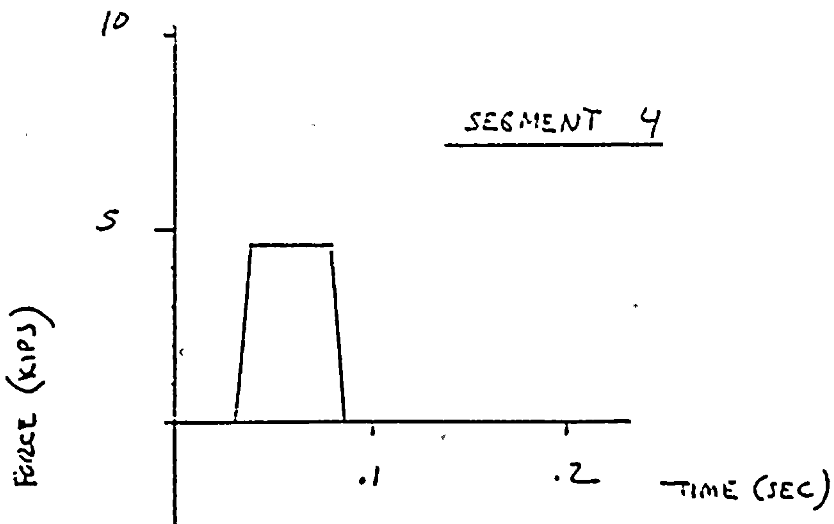

FIG 6.0

REFERENCES

1. M.P. Alexich, Indiana & Michigan Electric Co., letter to M.R. Denton, NRC, "Response to NRC Request for Additional Information Regarding Testing of the Pressurizer Safety and Relief Valves, Donald C. Cook Nuclear Plant, Units 1 and 2," AEP:NRC:0585H, July 15, 1985.

2. Application of RELAP5/MOD1 for calculation of Safety and Relief Valve Discharge Piping Hydrodynamic Loads, EPRI NP-2479, Project V102-28, Final Report, December 1982.

ATTACHMENT 4

TO

AEP:NRC:0585I

PIPING SUPPORT STRESS ANALYSIS

RESPONSE TO NRC QUESTION 5c
PORV/SV DISCHARGE ANALYSIS

UNIT NO. 1

Hanger Mark Number	Catalog Items Actual Load / Allow Load	Structural Steel Members Actual Stress/Allow Stress: Axial +Bending	Shear	Weld	Expansion Bolts	Remarks
1-GRC-R585	0.94	NA	NA	0.32	1.43*	Before Modification
	0.94	.98	0.18	0.32	0.45	After Modification
1-GRC-R589	NA	0.57	0.32	0.74	0.68*	No Modification
1-GRC-R591	0.72	0.60	0.33	0.40	NA	No Modification
1-GRC-R601	0.72	0.22	0.14	0.18	NA	No Modification
1-GRC-R608	0.42	NA	NA	0.22	NA	No Modification
1-GRC-R613	NA	0.27	0.08	0.39	NA	No Modification
1-GRC-S614	0.73	NA	NA	0.26	NA	No Modification
1-GRC-R616	NA	1.09	0.41	1.67	NA	Before Modification
	NA	0.98	0.41	0.76	NA	After Modification

* Based on "Teledyne Engineering Services" allowable expansion anchor loads.

RESPONSE TO NRC QUESTION 5c
PORV/SV DISCHARGE ANALYSIS

UNIT NO. 2

Hanger Mark Number	Catalog Items Actual Load / Allow Load	Structural Steel Members Actual Stress/Allow Stress: Axial +Bending	Shear	Weld	Expansion Bolts	Remarks
2-GRC-R585	NA	0.72	0.71	0.12	4.58*	Before Modification
	NA	0.72	0.71	0.08	0.99	After Modification
2-GRC-R586	SEE NOTE					Before Modification
	0.56	0.39	0.37	0.48	NA	After Modification
2-GRC-R587	3.12	1.07	0.56	0.96	NA	Before Modification
	0.53	0.44	0.40	0.19	NA	After Modification
2-GRC-R591	0.98	0.42	0.31	0.36	NA	Before Modification
	0.35	0.83	0.25	0.36	NA	After Modification
2-GRC-R600	1.07	0.87	0.06	0.72	NA	Before Modification
	NA	0.65	0.10	0.39	NA	After Modification

Note: Hanger 2-GRC-R586 was analyzed by Structural Design because it had to be relocated due to a field interference. Therefore, no calculations were performed for the "Before Modification" condition.

RESPONSE TO NRC QUESTION 5c
PORV/SV DISCHARGE ANALYSIS

UNIT NO. 2

Hanger Mark Number	Catalog Items Actual Load / Allow Load	Structural Steel Members Actual Stress/Allow Stress: Axial +Bending	Shear	Weld	Expansion Bolts	Remarks
2-GRC-R601	3.83	0.95	0.85	0.81	NA	Before Modification
	0.79	0.95	0.85	0.83	NA	After Modification
2-GRC-R624	5.66	NA	NA	1.11	NA	Before Modification
	0.62	NA	NA	0.57	NA	After Modification
2-GRC-S629	0.58	0.37	0.35	0.35	NA	No Modification
2-GRC-S631	0.93	NA	NA	0.11	0.91*	No Modification
2-GRC-S632	0.57	0.90	NA	0.19	1.85*	Before Modification
	0.57	0.95	NA	0.10	0.98	After Modification

* Based on "Teledyne Engineering Services" allowable loads on expansion anchors.

RESPONSE TO NRC QUESTION 5c
PORV/SV DISCHARGE ANALYSIS

UNIT NO. 2

Hanger Mark Number	Catalog Items Actual Load / Allowable Load	Structural Steel Members Actual Stress/Allowable Stress				Remarks
		Axial +Bending	Shear	Weld	Expansion Bolts	
2-GRC-S-594	0.33	0.37	0.23	0.45	NA	No Modification
2-GRC-S-596	0.35	0.074	0.11	*	0.58	No Modification
2-GRC-S-598	0.54	NA	NA	0.05	NA	No Modification
2-GRC-S-599	0.657	NA	NA	0.27	NA	No Modification
2-GRC-R-605	NA	0.156	NA	NA	NA	No Modification
2-GRC-R-607	NA	0.38	0.11	0.13	NA	No Modification
2-GRC-R-609	0.29	0.11	0.045	0.13	NA	No Modification

* Comparison of actual stress and allowable stress will be made after as-built information from the plant is obtained.

RESPONSE TO NRC QUESTION 5c
PORV/SV DISCHARGE ANALYSIS

UNIT NO. 2

Hanger Mark Number	Catalog Items Actual Load / Allowable Load	Structural Steel Members Actual Stress/Allowable Stress: Axial +Bending	Shear	Weld	Expansion Bolts	Remarks
2-GRC-R589	NA	.38	.18	.56	.45	No Modification
2-GRC-S611	.41	NA	NA	.11	NA	No Modification
2-GRC-R612	NA	.243	.357	.32	*	No Modification
2-GRC-R614	NA	.44	.3	*	NA	No Modification
2-GRC-S626	.48	.07	NA	.12	NA	No Modification
2-GRC-S630	.64	.04	NA	.07	NA	No Modification
2-GRC-R633	NA	.73	.26	.24	.94	No Modification

* Comparison of actual stress and allowable stress will be made after as-built information from the plant is obtained.

ATTACHMENT 5

TO

AEP:NRC:0585I

WESTINGHOUSE REPORT V-EC-108 (QUESTION 6)

RECEIVED
JUN 9 1986
P. & V

Westinghouse Electric Corporation
Power Systems
Energy Systems Service Division
Box 355
Pittsburgh Pennsylvania 15230-0355

AEP-86-592

June 5, 1986

Mr. J. D. Hoffman
Piping & Valves Section
American Electric Power Service Corporation
One Riverside Plaza
Columbus, Ohio 43216

American Electric Power Service Corporation
D. C. Cook Units 1 and 2
Summary of Pressurizer Safety Valve Seismic Evaluation

Dear Mr. Hoffman:

Enclosed please find a copy of the subject seismic evaluation as per your request. This summary was previously telecopied to you to give you an advance copy.

This mailing completes your request. Please call me if I can be of further service.

Very truly yours,

H. C. Walls, Manager
Mid-America Area
Projects Department

CAS/lee
7138f

cc: M. Marrocco

Calculation: V-EC-108 Rev. 0
File: 70502/220/5

SUMMARY OF SEISMIC EVALUATION
- PRESSURIZER SAFETY VALVE -
6RV58MSB
DONALD C. COOK UNITS 1 AND 2

Reference:
1. Westinghouse Equipment Specification No. 676279 Rev. 2, Spec. Sheet 1
2. Crosby Report No. EC-310 Rev. 0 (File: 70502/220/5)

Summary Prepared By: E. M. Petrosky [signature] E. M. Petrosky Date 5/8/86

Summary Reviewed By: T J Matty [signature] T. J. Matty Date 5/8/86

Westinghouse Electric Corporation
Power Systems Division
P.O. Box 355
Pittsburgh, PA 15230

1.0 INTRODUCTION AND EQUIPMENT DESCRIPTION

The object of the evaluation was to demonstrate the structural integrity and operability of the 6RV58MSB under loading due to 6g horizontal and 4g vertical seismic accelerations.

Both the valve body and bonnet were analyzed as pressurized thick-walled cylinders.

The 6RV58MSB is a 6 inch safety valve per Crosby Drawing H-51688. The valve has design conditions of 2500 psia at 650°F and is designed per ANSI-B-16.5. Its location numbers are 8010 A, B, and C.

2.0 METHODS OF QUALIFICATION

The valve body and bonnet of the 6RV58MSB were modeled as thick walled pressurized cylinders. Forces due to the seismic accelerations were applied to the center of gravity of the valve. Using conventional analyses, stresses were determined for the minimum cross section areas.

Although the 6RV58MSB was designed and built to ANSI-B-16.5, the stress criteria of the ASME Boiler and Pressure Vessel Code, Section III, were used as the basis for establishing allowable stress levels. Allowable stresses were set at or below yield to preclude any permanent deformations to the valve while simultaneously subjected to seismic and normal operating loads.

The valve body and bonnet were modeled as thick walled pressurized cylinders subjected to pressure, seismic and operational loading. Stresses were calculated using classical formulae. The maximum stresses in body and bonnet were less than the allowable stresses.

The valve satisfies the requirements that the minimum section modulus and minimum cross sectional metal area are greater than those of the connected piping. This assures that stresses in the valve body will be less than those in the connected piping at the piping-to-valve interface. By then limiting stresses in the piping due to pressure plus dead weight plus thermal plus seismic to less than yielded it is assured that the state of stress in the valve body will be elastic therefore precluding any permanent deformations in the valves for this conservative loading combination. These requirements assure that the structural integrity and operability of the valve will not be compromised by externally applied piping loads.

[illegible]

3.0 NATURAL FREQUENCY

The natural frequency of the 6RV58MSB was determined using a single-degree-of-freedom model with a single lumped mass at the center of gravity of the valve. The model conservatively assumes that the equivalent body and bonnet cylinders have dimensions equal to their minimum cross sections. The minimum natural frequency was found to be 216 Hz.

4.0 SUMMARY OF RESULTS

A. Valve Body: Maximum Stress - 5058 psi
Allowable Stress - 18,7000 psi

Bonnet: Maximum Stress - 5720 psi
Allowable Stress - 17,400 psi

B. The natural frequency of the valve assembly is greater than 33 Hz.

C. There are no appurtenances on the 6RV58MSB requiring qualification in order to demonstrate structural integrity and operability.

5.0 CONCLUSION

This evaluation shows that the 6RV58MSB valve remains structurally sound and maintains full operational capabilities for the conditions subjected.

TECHNICAL REPORT TR-5364-2
REVISION 0

BOOK 2 OF 10

DONALD C. COOK NUCLEAR GENERATING PLANT

ANALYSIS OF PRESSURIZER SAFETY/RELIEF VALVES DISCHARGE PIPING SYSTEM PER NUREG 0737, II.D.1, UNIT 2

JUNE 10, 1983

AMERICAN ELECTRIC POWER SERVICE CORPORATION
2 BROADWAY
NEW YORK, NEW YORK 10004

TECHNICAL REPORT TR-5364-2
REVISION 0

BOOK 2 OF 10

DONALD C. COOK NUCLEAR GENERATING STATION

ANALYSIS OF PRESSURIZER SAFETY/RELIEF VALVES DISCHARGE PIPING SYSTEM PER NUREG 0737, II. D.1, UNIT 2

JUNE 10, 1983

TELEDYNE ENGINEERING SERVICES

130 SECOND AVENUE
WALTHAM, MASSACHUSETTS 02254
617-890-3350

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

TABLE OF CONTENTS

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TABLE OF CONTENTS
(Continued)

TELEDYNE ENGINEERING SERVICES

TABLE OF CONTENTS
(Continued)

4.9 RELAP Input

The RELAP5 MOD1 input listings are included for each of the transient conditions.

Input Listing	Transient Case
4.9.1	PORV Solid 400° Liquid 0-400 msec
4.9.2	PORV Solid 400° Liquid Restart 400-600 msec
4.9.3	SV Cold Loop Seal (Quarter Model)

The PORV model has:

- 411 volumes
- 412 junctions
- 7 tee branches

The SRV model has:

- 190 volumes
- 191 junctions

Heat structures were not included in the RELAP model because of the program capacity. Including heat structures would have further reduced the number of available control volumes. This is a conservative assumption, ITI (Reference 18) showed higher loads were computed without heat structures.

4.9.1 PORV Solid 400° Liquid

LISTING OF INPUT DATA FOR CASE 1

```
=AEP UNIT2  1 LINE  RELAP5
*
*
*
*
*
*          ************************************************
*          ************************************************
*          **                                            **
*          **       UNIT 2 PORV MODEL,  SOLID CASE       **
*          **                                            **
*          ************************************************
*          ************************************************
*
*
*
*
*
*
*  AEP  D.C. COOK UNIT2
*  DISCHRAGE PIPING
*  THIS IS THE NUMBERING SYSTEM FOR UNIT2S' RELAP MODEL
*  WHERE COMPONENTS NUMBERED IN THE:
*        100'S ARE VALVE SV-45C AND ARC 1 LEVEL  669'-2"
*        200'S ARE VALVE SV-45B AND ARC 2 LEVEL  670'-10"
*        300'S ARE VALVE SV-45A ARN ARC 3 LEVEL  672'-6"
*        400'S ARE PORV NRV-151 AND ARC "A"
*        500'S ARE PORV NRV-153 AND ARC "B"
*        600'S ARE PORV NRV-152 AND ARC "C"
*        700'S ARE 6" DISCHARGE PIPING
*        800'S ARE 12" DISCH.
*        900'S QUENCH TANK PORTION
*        999  ATMOSPHERE
100 NEW TRANSNT
101 RUN
102 BRITISH BRITISH
104 NOACTION
*
***************************************
*         TIME STEP CONTROL           *
***************************************
*
201  0.400  1.0-7  2.0-4  11001  5  50  250
*
***************************************
*            MINOR EDITS              *
***************************************
*
301  MFLOWJ  415000000
302  MFLOWJ  490000000
303  MFLOWJ  493000000
304  MFLOWJ  388000000
305  MFLOWJ  811140000
306  MFLOWJ  811790000
307  MFLOWJ  307000000
308  MFLOWJ  207000000
```

BY KJG DATE 5-17-83
CHKD. BY CMM DATE 6-2-83

```
309  MFLOWJ   107000000
*
310  QUALS  400010000
311  QUALS  500010000
312  QUALS  600010000
313  QUALS  410210000
314  QUALS  485270000
315  QUALS  492110000
316  QUALS  389010000
317  QUALS  811140000
318  QUALS  811790000
319  QUALS  106010000
320  QUALS  106390000
321  QUALS  206010000
322  QUALS  206330000
323  QUALS  306010000
324  QUALS  306250000
*
325  P        400010000
326  P        500010000
327  P        600010000
328  P        410210000
329  P        485270000
330  P        492110000
331  P        389010000
332  P        811140000
333  P        811790000
334  P        106010000
335  P        106390000
336  P        206010000
337  P        206330000
338  P        306010000
339  P        306250000
*
*
*
*
*
****************************************************
**                                                **
**          FORCE  CARDS  FOR  REPIPE             **
**                                                **
****************************************************
*
*    *******   ARC 2, ELEVATION 670' 10",  SV-45B   ******
*
2001    5,151
2002    206010000,206020000,206030000,206040000,206050000
2003    206060000,206070000,206080000,206090000,206100000
2004    206110000,206120000,206130000,206140000,206150000
2005    206160000,206170000,206180000,206190000,206200000
2006    206210000,206220000,206230000,206240000,206250000
2007    206260000,206270000,206280000,206290000,206300000
2008    206310000,206320000,206330000
*
*
*
*
```

```
*       ****   FIRST C.V. DOWNSTREAM OF THE ARC    ****
*
*
2010    805010000
*
*
*
*
*       *****  12 INCH DISCHARGE DOWN TO THE QUENCH TANK   *****
*
*
2020    811190000,811200000,811210000,811220000,811230000
2021    811240000,811250000,811260000,811270000,811280000
2022    811290000,811300000,811310000,811320000,811330000
2023    811340000,811350000,811360000,811370000,811380000
2024    811390000,811400000,811410000,811420000,811430000
2025    811440000,811450000,811460000,811470000,811480000
2026    811490000,811500000,811510000,811520000,811530000
2027    811540000,811550000,811560000,811570000,811580000
2028    811590000,811600000,811610000,811620000,811630000
2029    811640000,811650000,811660000,811670000,811680000
2030    811690000,811700000,811710000,811720000,811730000
2031    811740000,811750000,811760000,811770000,811780000
2032    811790000,811800000,811810000,811820000,811830000
2033    811840000,811850000,811860000,811870000,811880000
2034    811890000,811900000,811910000,811920000,811930000
2035    811940000,811950000,811960000,811970000,811980000
2036    811990000,811180000
*
2040    813010000,813020000,813030000,813040000,813050000
2041    813060000,813070000,813080000,813090000,813100000
2042    813110000,813120000,813130000,813140000,813150000
2043    813160000,813170000,813180000,813190000,813200000
2044    813210000,813220000,813230000,813240000,813250000
2045    813260000,813270000,813280000,813290000,813300000
*
*
*
*       ******  PIPE DOWN INTO THE QUENCH TANK   ****
*
*
2050    901010000,901020000,903010000,903020000
2051    903030000
*
*
*
*
*
*
*
*
*
*       *****  PIPING UPSTREAM OF PORV NRV - 153   *****
*
*
*
*
*
```

```
*
*
*
*
*
***********************************
*           TRIPS                 *
***********************************
*
501  P  907010000  GT  NULL  0  114.7  L  *QUENCH TANK BLOW OUT PATCH
502  TIME  0  GT NULL 0  1.5  L  * JOB TERMINATION TRIP
503  TIME  0  GE NULL 0  0.0    L  *  VALVE OPEN
504  TIME  0  GE  NULL  0  5.0  L  *  VALVE CLOSED
600  502
*
*****************************************************
*           ***************************             *
*           * HYDRODYNAMIC COMPONENTS *             *
*           ***************************             *
*****************************************************
*
3850000  "PRESS4"  TMDPVOL
3850101  0.0  20.0  500.0  0.0  0.0  0.0  0.00005  0.0  11
3850200  3
3850201  0.0  2349.7  400.0  0.8  2420.0  400.0  1.2  2498.7  400.0
*
*        *************************************
*        *   PORV UPSTREAM PIPING            *
*        *************************************
*
*
3860000  "NOZ"  SNGLJUN
3860101  385000000  387000000  0.0  0.0  0.0  1100
3860201  1  0.0  0.0  0.0
*
*    6 INCH SCH.  160 PIPE
*
3870000  "PORVU"  PIPE
3870001  12
3870101  0.14653  12
3870301  0.328  1
3870302  0.5227  12
3870401  0.0  12
3870601  42.733  1
3870602  90.0  12
3870801  0.000151  0.0  12
3870901  0.0964  0.0964  1
3870902  0.0  0.0  11
3871001  00  12
3871101  1000  11
3871201  3  2349.7  400.0  0.0  0.0  12
3871300  1
3871301  0.0  0.0  0.0  11
*
3880000  "PORVU"  SNGLJUN
3880101  387010000  389000000  0.0  0.0  0.0  1000
3880201  1  0.0  0.0  0.0
*
```

```
*   6 X 6 X 3 INCH REDUCING TEE
*
3890000  "PORVU"  BRANCH
3890001  0
3890101  0.14653  0.25  0.0  0.0  90.0  0.25  0.000151  0.0  00
3890200  3  2349.7  400.0  0.0  0.0  0.0
*
4980000  "PORVU"  SNGLJUN
4980101  389010000  410000000  0.0  0.1836  0.1836  1000
4980201  1  0.0  0.0  0.0
*
*   3 INCH SCH. 160 PIPING
*
4100000  "PORV"  PIPE
4100001  21
4100101  0.03757  17
4100102  0.03387  18
4100103  0.0265  19
4100104  0.01912  20
4100105  0.01175  21
4100301  0.5  5
4100302  0.5278  11
4100303  0.5313  17
4100304  0.2657  21
4100401  0.0  21
4100601  0.0  5
4100602  90.0  11
4100603  0.0  21
4100801  0.000153  0.0  21
4100901  0.0  0.0  4
4100902  0.2172  0.2172  5
4100903  0.0  0.0  10
4100904  0.2172  0.2172  11
4100905  0.0  0.0  20
4101001  00  21
4101101  1000  20
4101201  3  2349.7  400.0  0.0  0.0  21
4101300  1
4101301  0.0  0.0  0.0  20
*
*   PORV VALVE NRV - 153
*
4150000  "PORV153"  VALVE
4150101  410010000  500000000  0.00806  0.0  0.0  0100
4150201  1  0.0  0.0  0.0
4150300  MTRVLV
4150301  503  504  1.0  0.0
*
4200000  "PORV"  SNGLJUN
4200101  389010000  425000000  0.0  0.0  0.0  1000
4200201  1  0.0  0.0  0.0
*
*    6  INCH  SCH.  160  PIPING
*
4250000  "PORV"  PIPE
4250001  5
4250101  0.1465  5
4250301  0.3889  3
```

```
4250302  0.375  5
4250401  0.0  5
4250601  90.0  3
4250602  0.0  5
4250801  0.000151  0.0  5
4250901  0.0  0.0  2
4250902  0.1836  0.1836  3
4250903  0.0  0.0  4
4251001  00  5
4251101  1000  4
4251201  3  2349.7  400.0  0.0  0.0  5
4251300  1
4251301  0.0  0.0  0.0, 4
*
4300000  "PORV"  SNGLJUN
4300101  425010000  435000000  0.0  0.0  0.0  1000
4300201  1  0.0  0.0  0.0
*
*     6 INCH   X 4 INCH    REDUCER
*
4350000  "PORV"  PIPE
4350001  2
4350101  0.1465  1
4350102  0.0716  2
4350301  0.2292  2
4350401  0.0  2
4350601  0.0  2
4350801  0.000151  0.0  1
4350802  0.000133  0.0  2
4350901  0.0577  0.0961  1
4351001  00  2
4351101  1000  1
4351201  3  2349.7  400.0  0.0  0.0  2
4351300  1
4351301  0.0  0.0  0.0  1

*
4400000  "PORV"  SNGLJUN
4400101  435010000  445000000  0.0  0.0  0.0  1000
4400201  1  0.0  0.0  0.0
*
*    4  INCH  SCH.  120  PIPING
*
4450000  "PORV"  PIPE
4450001  10
4450101  0.0716  10
4450301  0.35833  5
4450302  0.5  10
4450401  0.0  10
4450601  0.0  5
4450602  90.0  9
4450603  0.0  10
4450801  0.000133  0.0  10
4450901  0.0  0.0  4
4450902  0.1944  0.1944  5
4450903  0.0  0.0  8
4450904  0.1944  0.1944  9
4451001  00  10
```

```
4451101  1000  9
4451201  3  2349.7  400.0  0.0  0.0  10
4451300  1
4451301  0.0  0.0  0.0  9
*
4500000  "PORV"  SNGLJUN
4500101  445010000  455000000  0.0  0.0  0.0  1000
4500201  1  0.0  0.0  0.0
*
*     4 X 4 X 3  INCH REDUCING BRANCH
*
4550000  "PORV"  BRANCH
4550001  0
4550101  0.0716  0.5  0.0  0.0  0.0  0.0  0.000133  0.0. 00
4550200  3  2349.7  400.0  0.0  0.0  0.0
*
4600000   "PORV"   SNGLJUN
4600101  455010000  465000000  0.0  0.0  0.0  1000
4600201  1  0.0  0.0  0.0
*
*    4  INCH  SCH.  120  PIPING
*
4650000  "PORV"  PIPE
4650001  3
4650101  0.0716    3
4650301  0.25  3
4650401  0.0  3
4650601  0.0  3
4650801  0.000133  0.0  3
4650901  0.0  0.0  2
4651001  00  3
4651101  1000  2
4651201  3  2349.7  400.0  0.0  0.0  3
4651300  1
4651301  0.0  0.0  0.0  2
*
4700000  "PORV"  SNGLJUN
4700101  465010000  475000000  0.0  0.0  0.0  1000
4700201  1  0.0  0.0  0.0
*
*    4 INCH  X  3 INCH   REDUCER
*
4750000  "PORV"  PIPE
4750001  2
4750101  0.0716  1
4750102  0.0376  2
4750301  0.1667  2
4750401  0.0  2
4750601  0.0  2
4750801  0.000133  0.0  1
4750802  0.000153  0.0  2
4750901  0.0472  0.0730  1
4751001  00  2
4751101  1000  1
4751201  3  2349.7  400.0  0.0  0.0  2
4751301  0.0  0.0  0.0  1
*
4800000  "PORV"  SNGLJUN
```

```
4800101  475010000  485000000  0.0  0.0  0.0  1000
4800201  1  0.0  0.0  0.0
*
*   3  INCH  SCH.  160  PIPING
*
4850000  "PORV"  PIPE
4850001  27
4850101  0.0376  23
4850102  0.0339  24
4850103  0.0266  25
4850104  0.0192  26
4850105  0.0118  27
4850301  0.4375  4
4850302  0.4690  12
4850303  0.500  15
4850304  0.368  16
4850305   0.367   17
4850306   0.5405  23
4850307   0.41937  27
4850401  0.0  27
4850601  0.0  27
4850801  0.000153  0.0  27
4850901  0.0  0.0  26
4851001  00  27
4851101  1000  26
4851201  3  2349.7  400.0  0.0  0.0  27
4851300  1
4851301  0.0  0.0  0.0  26
*
*     PORV  VALVE  NRV - 151
*
4900000  "PORV"  VALVE
4900101  485010000  400000000  0.00806  0.0  0.0  0100
4900201  1  0.0  0.0  0.0
4900300  MTRVLV
4900301  503  504  1.0  0.0
*
4910000  "PORV"  SNGLJUN
4910101  455010000  492000000  0.0  0.095  0.095  1000
4910201  1  0.0  0.0  0.0
*
*   3  INCH  SCH.  160  PIPING
*
4920000  "PORV"  PIPE
4920001  11
4920101  0.0376  7
4920102  0.0339  8
4920103  0.0266  9
4920104  0.0192  10
4920105  0.0118  11
4920301  0.4881  7
4920302  0.4792  11
4920401  0.0  11
4920601  0.0  11
4920801  0.000153  0.0  11
4920901  0.0  0.0  10
4921001  00  11
4921101  1000  10
```

```
4921201  3  2349.7  400.0  0.0  0.0  11
4921300  1
4921301  0.0  0.0  0.0  10
*
*   PORV  VALVE  NRV - 152
*
4930000  "PORV"  VALVE
4930101  492010000  600000000  0.00806  0.0  0.0  0100
4930201  1  0.0  0.0  0.0
4930300  MTRVLV
4930301  503  504  1.0  0.0
*
*
*****************************************************
*    SAFETY VALVES DISCHARGE SECTION                *
*****************************************************
*
*
*
***********************************************************************
*    SAFETY VALVE-45C  DISCHARGING AT ELEV. 669'-2"  ARC  1     *
***********************************************************************
*
*
**
*  DISCHARGE PIPING
*
*  6  INCH  SCH.  40  PIPING
**
1060000  "DISCHA1"  PIPE
1060001  39
1060101  0.20069  39
1060301  0 526  4
1060302  1.094  14
* ARC STARTS HERE LEVEL 669-2"
1060303  1.000   20
1060304  0.8994  29
1060305  0.7436  35
* ARC ENDS
1060306  0.7980  39
1060401  0.0  39
1060601  0.0  4
1060602  -90.0  14
1060603  0.0  39
1060801  0.000152  0.0  39
1060901  0.0  0.0  3
1060902  0.1800  0.1800  4
1060903  0.0  0.0  13
1060904  0.1800  0.1800  14
1060905  0.0  0.0  38
1061001  00  39
1061101  1000  38
1061201  4  17.7  120.0  0.9284  0.0  39
1061300  1
1061301  0.0  0.0  0.0  38
*
1070000  "DISCHA1"  SNGLJUN
1070101  106010000  809000000  0.0  0.1560  0.1560  1000  *LOSSES FOR A 12 IN ELBOW
```

```
1070201  1  0.0  0.0  0.0
*
*
*
*********************************************************
*        MAIN DISCHARGE  12" HEADER TO QUENCH TANK      *
*********************************************************
*
*
*     12  X  12  X  6  INCH  REDUCING TEE
*
*     CONNECTS  SRV  PIPING  TO  MAIN  DISCHARGE
*
*
8090000  "DISCHA1"  BRANCH
8090001  0
8090101  0.77708  0.5  0.0  0.0  -90.0  -0.5  0.000169  0.0  00
8090200  4  17.7  120.0  0.9284
*
8100000  "DISCHA1"  SNGLJUN
8100101  809010000  811000000  0.0  0.0  0.0  1000
8100201  1  0.0  0.0  0.0
*
*     12   INCH  SCH.  40  DISCHARGE PIPING
*
8110000  "DISCH1A"  PIPE
8110001  99
8110101  0.7771  99
8110301  1.039  14
8110302  0.53025  18
8110303  0.5  22
8110304  0.53025  26
8110305  0.9875  56
8110306  0.475  66
8110307  0.49359  79
8110308  0.46875  87
8110309  0.50  95
8110310  0.875  99
8110401  0.0  99
8110601  -90.0  14
8110602  -45.0  18
8110603  -90.0  22
8110604  -45.0  26
8110605  -90.0  56
8110606  0.0  87
8110607  -90.0  95
8110608  0.0  99
8110801  0.000169  0.0  99
8110901  0.0  0.0  13
8110902  0.078  0.078  14
8110903  0.0  0.0  17
8110904  0.078  0.078  18
8110905  0.0  0.0  21
8110906  0.078  0.078  22
8110907  0.0  0.0  25
8110908  0.078  0.078  26
8110909  0.0  0.0  55
8110910  0.156  0.156  56
```

```
8110911  0.0  0.0  65
8110912  0.026  0.026  66
8110913  0.0  0.0  78
8110914  0.13  0.13  79
8110915  0.0  0.0  86
8110916  0.156  0.156  87
8110917  0.0  0.0  94
8110918  0.156  0.156  95
8110919  0.0  0.0  [illegible]
8111001  00  99
8111101  1000  98
8111201  4  17.7  120.0  0.9284  0.0  99
8111300  1
8111301  0.0  0.0  0.0  98
*
8120000  "DISCHA1"  SNGLJUN
8120101  811010000  813000000  0.0  0.0  0.0  1000
8120201  1  0.0  0.0  0.0
*
*    12  INCH  SCH.  40  DISCHARGE  PIPING
*
8130000  "DISCHA1" PIPE
8130001  30
8130101  0.7771  30
8130301  0.875  6
8130302  1.0  20
8130303  0.5  30
8130401  0.0  30
8130601  0.0  30
8130801  0.000169  0.0  30
8130901  0.0  0.0  5
8130902  0.156  0.156  6
8130903  0.0  0.0  19
8130904  0.156  0.156  20
8130905  0.0  0.0  29
8131001  00  30
8131101  1000  29
8131201  4  17.7  120.0  0.9284  0.0  30
8131300  1
8131301  0.0  0.0  0.0  29
*
*
*
************************************************************
*        SAFETY VALVE 458 AT ELEV. 670'-10" ARC 2          *
************************************************************
*
*
*
**
*   DISCHARGE  PIPING
*
*  6  INCH  SCH.  40  PIPING
**
2060000   "DISCHA2"  PIPE
2060001   33
2060101   0.20069   33
2060301   0.4635    4
```

```
2060302   0.927      14
*ARC  STARTS  LEVEL  670'-10"
2060303   0.955      23
2060304   0.727      29
2060308   0.7980     33
2060401   0.0        33
2060601.  0.0         4
2060602   -90.       14
2060603   0.0        33
2060801   0.000152  0.0   33
2060901   0.0  0.0  3
2060902  0.1800  0.1800     4
2060903   0.0  0.0  13
2060904  0.1800  0.1800     14
2060905   0.0  0.0  32
2061001     00       33
2061101    1000   32
2061201   4  17.7  120.0  0.9284  0.0  33
2061300   1
2061301   0.0  0.0  0.0  32
*
**************************************************
*    SAFETY VALVE 45A AT ELEV. 672'-6" ARC 3     *
**************************************************
*
*
*
**
*   DISCHARGE PIPING
*
*    6  INCH  SCH.  40  PIPING
**
3060000    "DISCHA3"  PIPE
3060001    25
3060101    0.20069  25
3060301    0.526      4
3060302    0.969     12
*   ARC  STARTS  LEVEL  672'-6"
3060303    0.635     15
3060304    0.991     18
3060305    0.991     21
3060306    0.799     25
*   ARC ENDS
3060401    0.0    25
3060601    0.0        4
3060602    -90.0    12
3060603    0.0      25
3060801    0.000152  0.0  25
3060901    0.0  0.0    3
3060902  0.1800  0.1800    4
3060903    0.0  0.0   11
3060904  0.1800  0.1800    12
3060905    0.0  0 0   24
3061001    00  25
3061101   1000  24
3061201    4  17.7   120.0  0.9284  0.0  25
3061300    1
3061301    0.0  0.0 0.0  24
```

```
*
*
*
*
*****************************************
*          PORV  PIPING                 *
*****************************************
*
*
*   PIPING  DOWNSTREAM  OF  VALVE  NRV - 153
*
*   3  INCH  SCH.  40  PIPING
*
*
5000000   "PORVB"   PIPE
5000001   16
5000101   0.05132  16   *  3 IN  SCH40S
5000301   0.497  3
5000302   0.556  6
    *   ARC  STARTS  LEVEL  684'-9"
5000303   0.365    7  *
5000304   0.6448  13
5000305   0.5892   16
5000401   0.0  16
5000601   0.0    3
5000602   -90.0  6
5000603   0.0    16
5000801   0.000153  0.0  16
5000901   0.0      0.0      2
5000902   0.2088  0.2088   3
5000903   0.0      0.0      5
5000904   0.2088  0.2088   6
5000905   0.0      0.0      15
5001001   00  16
5001101   1000  15
5001201   4  17.7  120.0  0.9284  0.0  16
5001300   1
5001301   0.0  0.0  0.0  15
*
5010000   "PORVB"  SNGLJUN   *  THIS JUNCTION IS ON ARC B
5010101   500010000  502000000  0.0  0.0  0.0  1000
5010201   1  0.0 0.0 0.0
*
*   4  INCH  X  3  INCH  DIFFUSER
*
5020000   "PORVB"  PIPE  * REDUCER ON ARC B 3IN X4IN
5020001   2
5020101   0.05132    1   *  3IN SCH40S
5020102   0.08840    2   *  4IN SCH40S
5020301   0.3385    2
5020401   0.0  2
5020601   0.0  2
5020801   0.000153  0.0  1
5020802   0.000134  0.0  2
5020901   0.0399  0.0544  1
5021001   00  2
5021101   1000  1
5021201   4  17.7  120.0 0.9284  0.0  2
```

```
5021300    1
5021301    0.0  0.0  0.0  1
*
*
5030000    "PORVB"  SNGLJUN  * ON ARC B
5030101    502010000  504000000  0.0  0.0  0.0  1000
5030201    1  0.0  0.0  0.0
*
*    4  X  4  X  3  INCH  BRANCH
*
5040000    "PORVB"  BRANCH  *  ON ARC B @ 242
5040001    0
5040101    0.0884  0.361 0.0  0.0  0.0  0.0  0.000134  0.0  00
5040200    4  17.7  120.0  0.9284  0.0  0.0
*
5050000    "PORVB"  SNGLJUN    * ON ARC B
5050101    504010000  506000000  0.0  0.0  0.0  1000
5050201    1  0.0  0.0  0.0
*
*    4  INCH  SCH.  40  PIPING
*
5060000   "PORVB" PIPE   *  ON ARC B
5060001    9
5060101    0.0884   9
5060301    0.6211   8
5060302    0.7607    9
5060401    0.0  9
5060601    0.0  9
5060801    0.000134  0.0  9
5060901   0.0  0.0  8
5061001    00  9
5061101    1000  8
5061201    4  17.7  120.0  0.9284  0.0  9
5061300    1
5061301    0.0  0.0  0.0  8
*
5070000    "PORVB"  SNGLJUN
5070101    506010000  508000000  0.0  0.0  0.0  1000
5070201    1  0.0  0.0  0.0
*
*    4  INCH  X  6  INCH  DIFFUSER
*
5080000    "PORVB" PIPE
5080001    2
5080101    0.0884   1
5080102    0.20069   2
5080301    0.5792  2
5080401    0.0  2
5080601    0.0  2
5080801    0.000134  0.0  1
5080802    0.000152  0.0  2
5080901    0.1483  0.0815  1
5081001    00  2
5081101    1000  1
5081201    4  17.7  120.0  0.9284  0.0  2
5081300    1
5081301    0.0  0.0  0.0  1
*
```

```
5090000   "PORVB" SNGLJUN   * ON ARC B
5090101   508010000  510000000  0.0  0.0  0.0 1000
5090201   1  0.0  0.0  0.0
*
*   6  X  6  X  3  INCH REDUCING  TEE
*
5100000   "PORVB" BRANCH   * ON ARC B @ 232
5100001   0
5100101   0.20069 0.25  0.0  0.0  0.0  0.0  0.000152  0.0  00
5100200   4  17.7  120.0  0.9284  0.0  0.0
*
5110000   "PORVB" SNGLJUN   *  ON ARC B
5110101  510010000  700000000   0.0  0.0 0.0  1000
5110201   1  0.0  0.0  0.0
*
*    PIPING  DOWNSTREAM  OF  VALVE  NRV - 151
*
*    3  INCH  SCH.  40  PIPING
*
4000000   "PORVA"  PIPE
4000001   8
4000101   0.05132  8
4000301   0.4141   4
4000302   0.4375   8
4000401   0.0  8
4000601   0.0  4
4000602   -90.0 8
4000801   0.000153  0.0  8
4000901   0.0  0.0  3
4000902   0.2088  0.2088  4
4000903  0.0  0.0  7
4001001   00  8
4001101   1000  7
4001201   4  17.7  120.0  0.9284  0.0  8
4001300   1
4001301   0.0  0.0  0.0   7
*
4010000   "PORVAB" SNGLJUN
4010101   400010000  510000000   0.0  0.1800  0.1800  1000
4010201   1  0.0  0.0  0.0
*
*    DOWNSTREAM  PIPING  FROM  VALVE  NRV - 152
*
*    3  INCH  SCH.  40  PIPING
*
6000000   "PORVC"  PIPE
6000001   7
6000101   0.05132 7
6000301   0.4722    3
6000302   0.4375    7
6000401   0.0  7
6000601   0.0  3
6000602   -90.0  7
6000801   0.000153  0.0  7
6000901   0.0  0.0  2
6000902   0.2088  0.2088  3
6000903   0.0  0.0  6
6001001   00  7
```

```
6001101   1000  6
6001201   4  17.7  120.0  0.9284  0.0  7
6001300   1
6001301   0.0  0.0  0.0  8
*
6010000   "PORVBC" SNGLJUN
6010101   600010000  504000000  0.0  0.1932  0.1932  1000
6010201   1  0.0  0.0  0.0
*
*     MAIN  HEADER  DOWNSTREAM  OF  PORV  PIPING
*
7000000   "PORVBD"  PIPE
7000001   12
7000101   0.20069  12
7000301   0.75  2
7000302   1.075  12
7000401   0.0  12
7000601   0.0   2
7000602   -90.  12
7000801   0.000152  0.0  12
7000901    0.0    0.0    1
7000902   0.1800  0.1800  2
7000903   0.0     0.0     11
7001001   00  12
7001101   1000  11
7001201   4  17.7  120.0  0.9284  0.0  12
7001300   1
7001301   0.0  0.0  0.0  11
*
7010000   "PORVD"  SNGLJUN
7010101   700010000  702000000  0.0  0.0  0.0  1000
7010201   1  0.0  0.0  0.0
*
*
*
*
*
*********************************************************
**                                                     **
**          MAIN ARC CONNECTIONS                       **
**                                                     **
*********************************************************
*
*
*
*    12 INCH  X  6 INCH   DIFFUSER ABOVE SRV ARCS ON MAIN DISCHARGE
*
*
*
7020000   "PORVD"  PIPE
7020001   3
7020101   0.20069  1
7020102   .77708   3
7020301   0.75  1
7020302   0.375  3
7020401   0.0  3
7020601   -90.0  3
7020801   0.000152  0.0  1
```

```
7020802   0.000169  0.0  3
7020901   0.4930  0.2045  1
7020902   0.0     0.0     2
7021001   00  3
7021101   1000  2
7021201   4  17.7  120.0  0.9284  0.0  3
7021300   1
7021301   0.0  0.0  0.0  2
*
8000000   "PORVD"  SNGLJUN
8000101   702010000  801000000  0.0  0.0  0.0  1000
8000201   1  0.0  0.0  0.0
*
3070000   "PORVD3"  SNGLJUN
3070101   306010000  801000000  0.0  0.156  0.156  1000 * 12 IN ELBOW LOSSES
3070201   1  0.0  0.0  0.0
*
*   12  X  12  X  6  INCH REDUCING TEE CONNECTS ARC WITH DISCHARGE
*
8010000  "PORVD"  BRANCH
8010001   0
8010101   0.77708  0.5  0.0  0.0  -90.  -0.5  0.000169  0.0  00
8010200   4  17.7  120.0  0.9284  0.0 0.0
*
8020000   "PORVD"  SNGLJUN
8020101   801010000  803000000  0.0  0.0  0.0  1000
8020201   1  0.0  0.0 0.0
*
8030000   "PORVD"  SNGLVOL
8030101   0.77708  1.1667  0.0  0.0 -90.  -1.1667  0.000169  0.0  00
8030200   4  17.7  120.0 0.9284  0.0  0.0
*
8040000   "PORVD"  SNGLJUN
8040101   803010000  805000000  0.0  0.0  0.0 1000
8040201   1  0.0  0.0  0.0
*
2070000   "PORVD"  SNGLJUN
2070101   206010000  805000000  0.0  0.156  0.156  1000 * 12 IN ELBOW LOSSES
2070201   1  0.0  0.0  0.0
*
*  12 X12 X 6 INCH REDUCING TEE. CONNECTS SRV ARC WITH DISCHARGE PIPING.
*
8050000   "PORVD"  BRANCH
8050001   0
8050101   0.77708  0.5  0.0  0.0  -90.  -0.5  0.000169 0.0 00
8050200   4  17.7  120.0  0.9284  0.0  0.0
*
8060000   "PORVD"  SNGLJUN
8060101   805010000  807000000   0.0  0.0  0.0  1000
8060201   1  0.0  0.0  0.0
*
8070000   "PORVD"  SNGLVOL
8070101   0.77708  1.1667 0.0 0.0 -90. -1.1667 0.000169 0.0 00
8070200   4  17.7  120.0  0.9284  0.0  0.0
*
8080000   "PORVD"  SNGLJUN
8080101   807010000  809000000  0.0  0.0  0.0  1000
8080201   1  0.0  0.0  0.0
```

```
*
9000000  "QTANKD"  SNGLJUN
9000101  813010000  901000000  0.0  0.1560  0.1560  1000
9000201  1  0.0  0.0  0.0
*
9010000  "QTANKD"  PIPE
9010001  2
9010101  0.77708  2
9010301  1.0833  2
9010401  0.0  2
9010601  -90.0  2
9010801  0.000169  0.0  2
9010901  0.0  0.0  1
9011001  00  2
9011101  1000  1
9011201  4  17.7  120.0  0.9284  0.0  2
9011300  1
9011301  0.0  0.0  0.0  1
*
*************************
**                     **
**    QUENCH   TANK    **
**                     **
*************************
*
9020000   "QTANK-IN"  SNGLJUN
9020101   901010000  903000000  0.  0.  0.   1000
9020201   1    0.  0.   0.
**
*    SPARGER  12 IN SCH40  PIPE
**
9030000   "SPARGER"  PIPE
*    NO OF VOLUMES
9030001   18
*    FLOW AREA
9030101   0.7773     18
*    VOL. LENGTHS
9030301   1.125      2
9030302   1.1333     7
9030303   1.0        18
*    VOL. VOLS.
9030401   0.0        18
*
*    VERTICAL ANGLES
9030601   -90.       7
9030602   0.0        18
*    PIPE  ROUGHNESS
9030801   1.69-4     0.0        18
*    JUNCTION  LOSS COEFF.
9030901   0.0        0.0        6
9030902   0.156      0.156      7
9030903   0.0        0.0        17
*    VOL. CONTROL FLAG
9031001   00         18
*    JUN. CONTROL FLAG
9031101   1000       17
*    INITIAL COND.
9031201   4     17.7   120.   0.9284   0.   2
```

```
9031202   3    17.7    120.     0.0       0.    18 .
*              JUN. INITIAL COND.
9031300   1
9031301   0.0  0.0  0.0       17
**
*    SPARGER   EXIT
**
9040000 "EXIT" SNGLJUN
9040101   903010000   905000000   0.0    1.0   1.0     0100
9040201   1    0.    0.    0.
**
*              WATER  VOL.
**
9050000   "QT. WATER" SNGLVOL
9050101   260.4706   5.6667   0.0   0.0   90.   5.6667  0.003  0.0   01
9050200   3    17.7       120.
**
*              INTERFACE
**
9060000   "INTERFACE"  SNGLJUN
9060101   905010000  907000000   0.0     0.0     0.0     1000
9060201   1    0.0  0.0  0.0
**
*              AIR  VOLUME
**
9070000   "QT.AIR"  SNGLVOL
9070101   260.4706  1.2439    0.0   0.0   90.   1.2439  0.003  0.0  01
9070200   4    17.7   120.    0.9284
**
*              RUPTURE DISC
**
9080000   "RUP.DISC"  VALVE
9080101   907010000   999000000     1.77  0.  0.   1100
9080201   1    0.    0.    0.
9080300   TRPVLV
9080301   501       *    VALVE OPENING TRIP
**
*    PIPE  OUTSIDE  ENVIRONMENT
**
9990000   "ATMOSPHERE"   TMDPVOL
9990101   10000.    10000.   0.0  0.0  0.0  0.0  .00001  0.0  11
9990200   4
9990201   0.0  17.7  120.  0.9284
.END OF CASE
```

4.9.2 PORV Solid 400° Liquid Restart

LISTING OF INPUT DATA FOR CASE 1

```
=THIS RESTARS RELAP 3 PORVS OPENING ON SOLID WATER UNIT2 RED
*
100 RESTART TRANSNT
101 RUN
*
103 2000
104 NOACTION
201 0.600  1.-7 2.-4 11001 5 50 250
*
*
* MINOR EDITS
*
301  MFLOWJ  415000000
302  MFLOWJ  490000000
303  MFLOWJ  493000000
304  MFLOWJ  388000000
305  MFLOWJ  811140000
306  MFLOWJ  811790000
307  MFLOWJ  307000000
308  MFLOWJ  207000000
309  MFLOWJ  107000000
*
310  QUALS  400010000
311  QUALS  500010000
312  QUALS  600010000
313  QUALS  410210000
314  QUALS  485270000
315  QUALS  492110000
316  QUALS  389010000
317  QUALS  811140000
318  QUALS  811790000
319  QUALS  106010000
320  QUALS  106390000
321  QUALS  206010000
322  QUALS  206330000
323  QUALS  306010000
324  QUALS  306250000
*
325  P      400010000
326  P      500010000
327  P      600010000
328  P      410210000
329  P      485270000
330  P      492110000
331  P      389010000
332  P      811140000
333  P      811790000
334  P      106010000
335  P      106390000
336  P      206010000
337  P      206330000
338  P      306010000
339  P      306250000
*
2001     5,151
2002     206010000,206020000,206030000,206040000,206050000
```

BY KJG DATE 5-20-83
CHKD. BY [illegible] DATE 6-2-83

```
2003      206060000,206070000,206080000,206090000,206100000
2004      206110000,206120000,206130000,206140000,206150000
2005      206160000,206170000,206180000,206190000,206200000
2006      206210000,206220000,206230000,206240000,206250000
2007      206260000,206270000,206280000,206290000,206300000
2008      206310000,206320000,206330000
*
*
*
*
*       ****  FIRST C.V. DOWNSTREAM OF THE ARC    ****
*
*
2010      805010000
*
*
*
*
*        *****  12 INCH DISCHARGE DOWN TO THE QUENCH TANK   *****
*
*
2020      811190000,811200000,811210000,811220000,811230000
2021      811240000,811250000,811260000,811270000,811280000
2022      811290000,811300000,811310000,811320000,811330000
2023      811340000,811350000,811360000,811370000,811380000
2024      811390000,811400000,811410000,811420000,811430000
2025      811440000,811450000,811460000,811470000,811480000
2026      811490000,811500000,811510000,811520000,811530000
2027      811540000,811550000,811560000,811570000,811580000
2028      811590000,811600000,811610000,811620000,811630000
2029      811640000,811650000,811660000,811670000,811680000
2030      811690000,811700000,811710000,811720000,811730000
2031      811740000,811750000,811760000,811770000,811780000
2032      811790000,811800000,811810000,811820000,811830000
2033      811840000,811850000,811860000,811870000,811880000
2034      811890000,811900000,811910000,811920000,811930000
2035      811940000,811950000,811960000,811970000,811980000
2036      811990000,811180000
*
2040      813010000,813020000,813030000,813040000,813050000
2041      813060000,813070000,813080000,813090000,813100000
2042      813110000,813120000,813130000,813140000,813150000
2043      813160000,813170000,813180000,813190000,813200000
2044      813210000,813220000,813230000,813240000,813250000
2045      813260000,813270000,813280000,813290000,813300000
*
*
*
*       ******   PIPE DOWN INTO THE QUENCH TANK  ****
*
*
2050      901010000,901020000,903010000,903020000
2051      903030000
*
*
*
3880000  "PORVU"  SNGLJUN
3880101  387010000  389000000  0.0  0.0  0.0  1000
```

```
3880201  1  0.0  0.0  0.0
20300100  MFLOWJ  415000000
20300200  MFLOWJ  493000000
20300300  MFLOWJ  490000000
20300400  MFLOWJ  388000000
20300500  MFLOWJ  811140000
20300600  MFLOWJ  811790000
20300700  MFLOWJ  307000000
20300800  MFLOWJ  207000000
20300900  MFLOWJ  107000000
*
20301000  QUALS  400010000
20301100  QUALS  500010000
20301200  QUALS  600010000
20301300  QUALS  410210000
20301400  QUALS  485270000
20301500  QUALS  492110000
20301600  QUALS  389010000
20301700  QUALS  811140000
20301800  QUALS  811790000
20301900  QUALS  106010000
20302000  QUALS  106390000
20302100  QUALS  206010000
20302200  QUALS  206330000
20302300  QUALS  306010000
20302400  QUALS  306250000
*
20302500  P       400010000
20302600  P       500010000
20302700  P       600010000
20302800  P       410210000
20302900  P       485270000
20303000  P       492110000
20303100  P       389010000
20303200  P       811140000
20303300  P       811790000
20303400  P       106010000
20303500  P       106390000
20303600  P       206010000
20303700  P       206330000
20303800  P       306010000
20303900  P       306250000
*
.END
```

4.9.3 SV Cold Loop Seal (Quarter Model)

LISTING OF INPUT DATA FOR CASE 1

```
=AEP UNIT2 1 LINE RELAP5
100 NEW TRANSNT
101 RUN
102 BRITISH BRITISH
104 NOACTION
* TIME STEP CONTROL
*
201 0.6000 1.0-7 2.0-4 11001 5 25 250
* MINOR EDITS
*
301 QUALS 007010000
302 QUALS 005200000
303 QUALS 013200000
304 P 005200000
305 P 007010000
306 P 007380000
307 MFLOWJ 006000000
308 MFLOWJ 005070000
309 MFLOWJ 014000000
310 P 007140000
311 P 011560000
312 P 013300000
313 MFLOWJ 007140000
314 MFLOWJ 007380000
315 MFLOWJ 011560000
*
*
2001 5,192,001010000,003010000,005010000
2002 005020000,005030000,005040000,005050000,005060000
2003 005070000,005080000,005090000,005100000,005110000
2004 005120000,005130000,005140000,005150000,005160000
2005 005170000,005180000,005190000,005200000,007010000
2006 007020000,007030000,007040000,007050000,007060000,007070000
2007 007080000,007090000,007100000,007110000,007120000
2008 007130000,007140000,007150000,007160000,007170000
2009 007180000,007190000,007200000,007210000,007220000
2010 007230000,007240000,007250000,007260000,007270000
2011 007280000,007290000,007300000,007310000,007320000
2012 007330000,007340000,007350000,007360000,007370000
2013 007380000,007390000,009010000,011010000,011020000
2014 011030000,011040000,011050000,011060000,011070000
2015 011080000,011090000,011100000,011110000,011120000
2016 011130000,011140000,011150000,011160000,011170000
2017 011180000,011190000,011200000,011210000,011220000
2018 011230000,011240000,011250000,011260000,011270000
2019 011280000,011290000,011300000,011310000,011320000
2020 011330000,011340000,011350000,011360000,011370000
2021 011380000,011390000,011400000,011410000,011420000
2022 011430000,011440000,011450000,011460000,011470000
2023 011480000,011490000,011500000,011510000,011520000
2024 011530000,011540000,011550000,011560000,011570000
2025 011580000,011590000,011600000,011610000,011620000
2026 011630000,011640000,011650000,011660000,011670000
2027 011680000,011690000,011700000,011710000,011720000
2028 011730000,011740000,011750000,011760000,011770000
2029 011780000,011790000,011800000,011810000,011820000
```

BY CMM DATE 2-9-83
CHKD. BY LOS DATE 2-9-83

TELEDYNE ENGINEERING SERVICES

```
2030  011830000,011840000,011850000,011860000,011870000
2031  011880000,011890000,011900000,011910000,011920000
2032  011930000,011940000,011950000,011960000,011970000
2033  011980000,011990000,013010000,013020000,013030000
2034  013040000,013050000,013060000,013070000,013080000
2035  013090000,013100000,013110000,013120000,013130000
2036  013140000,013150000,013160000,013170000,013180000
2037  013190000,013200000,013210000,013220000,013230000
2038  013240000,013250000,013260000,013270000,013280000
2039  013290000,013300000,015010000
*
*TRIPS
*
502  TIME  0  GT NULL 0  1.500  L  * JOB TERMINATION TRIP
503  TIME  0  GE NULL 0  0.0    L  *  VALVE OPEN
504  TIME  0  GE  NULL  0  5.0  L  *  VALVE CLOSED
600  502
*
*  HYDRODYNAMIC COMPONENTS
*
*
* PRESSURIZER
*
0010000  "PRESS1"  TMDPVOL
0010101  0.0  20.0  500.0  0.0  0.0  0.0  0.00005  0.0  11
0010200  2
0010201  0.0  2500.0  1.0  0.1  2514.0  1.0  0.3  2555.0  1.0  0.5  2600.0  1.0
0010202  0.7  2687.0  1.0  0.9  2700.0  1.0  1.1  2740.0  1.0  1.3  2745.0  1.0
0010203  1.5  2747.0  1.0  1.7  2748.0  1.0  1.9  2750.0  1.0  2.0  2750.0  1.0
0010204  2.5  2750.0  1.0
*
*  LOOP SEAL GEOMETRY
*
0020000  "LPSL"  SNGLJUN
0020101  001000000  003000000  0.0  0.0  0.0  1000  * THIS IS A SHORT RADIUS ELBOW LEAVING
0020201  1  0.0  0.0  0.0
*
0030000  "LPSL" SNGLVOL
0030101  0.1465  1.0  0.0  90.0  0.0  0.0  0.000151  0.0  00
0030200    2  2500.0  1.0
*
0040000  "LPSL"  SNGLJUN
0040101  003010000  005000000  0.0  0.1838  0.1838  1000
0040201  1  0.0  0.0  0.0
*
0050000  "LPSL"  PIPE
0050001  20
0050101  0.1465  20
0050301  0.50  10
0050302  0.574  20
0050401  0.0  20
0050601  -90.0  7
0050602  0.0  10
0050603  90.0  20
0050801  0.000151  0.0  20
0050901  0.0  0.0  6
0050902  0.1838  0.1838  7
0050903  0.0  0.0  9
```

```
0050904  0.1838  0.1838  10
0050905  0 0  0.0  19
0051001  00  20
0051101  1000  19
0051201  3  2500.0  584.4  0.0  0.0  1
0051202  3  2500.0  451.1  0.0  0.0  2
0051203  3  2500.0  352.1  0.0  0.0  3
0051204  3  2500.0  276.8  0.0  0.0  4
0051205  3  2500.0  218.1  0.0  0.0  5
0051206  3  2500.0  169.3  0.0  0.0  6
0051207  3  2500.0  141.1  0.0  0.0  20
0051300  1
0051301  0.0  0.0  0.0  19
*
******************************
*  VALVE  6M6  CROSBY SAFETY
******************************
0060000  "SRV"  VALVE
0060101  005010000  007000000  0.022  0.0  0.0  0100
0060201  1  0.0  0.0  0.0
0060300  MTRVLV
0060301  503  504  100.0  0.0  *  CROSBY 6M6  OPENING IN 10 MSEC
*
*  DISCHARBE PIPING
0070000  "DISCHA1"  PIPE
0070001  39
0070101  0.20069  39
0070301  0.526  4
0070302  1.094  14
* ARC STARTS HERE LEVEL 669-2"
0070303  0.84167  17
0070304  0.842  20
0070305  0.8425  23
0070306  0.844  26
0070307  0.8433  29
0070308  0.8333  32
0070309  0.8333  35
* ARC ENDS
0070310  0.91750  39
0070401  0.0  39
0070601  0.0  4
0070602  -90.0  14
0070603  0.0  39
0070801  0.000152  0.0  39
0070901  0.0  0.0  3
0070902  0.1800  0.1800  4
0070903  0.0  0.0  13
0070904  0.1800  0.1800  14
0070905  0 0  0.0  38
0071001  00  39
0071101  1000  38
0071201  4  14.7  120.0  0.9284  0.0  39
0071300  1
0071301  0.0  0.0  0.0  38
*
0080000  "DISCHA1"  SNGLJUN
0080101  007010000  009000000  0.0  0.1560  0.1560  1000  *LOSSES FOR A 12 IN ELBOW
0080201  1  0.0  0.0  0.0
```


TELEDYNE ENGINEERING SERVICES

```
*
* INPUT A BRANCH HERE FOR A COMPLETE MODEL
*
0090000  "DISCHA1"  SNGLVOL
0090101  0.7771  0.5  0.0  0.0  -90.0  -0.5  0.000169  0.0  00
0090200  4  14.7  120.0  0.9284
*
0100000  "DISCHA1"  SNGLJUN
0100101  009010000  011000000  0.0  0.0  0.0  1000
0100201  1  0.0  0.0  0.0
*
0110000  "DISCH1A"  PIPE
0110001  99
0110101  0.7771  99
0110301  1.039  14
0110302  0.53025  18
0110303  0.5  22
0110304  0.53025  26
0110305  0.9875  56
0110306  0.475  68
0110307  0.49359  79
0110308  0.46875  87
0110309  0.51172  95
0110310  0.95  99
0110401  0.0  99
0110601  -90.0  14
0110602  -45.0  18
0110603  -90.0  22
0110604  -45.0  26
0110605  -90.0  56
0110606  0.0  87
0110607  -90.0  95
0110608  0.0  99
0110801  0.000169  0.0  99
0110901  0.0  0.0  13
0110902  0.078  0.078  14
0110903  0.0  0.0  17
0110904  0.078  0.078  18
0110905  0.0  0.0  21
0110906  0.078  0.078  22
0110907  0.0  0.0  25
0110908  0.078  0.078  26
0110909  0.0  0.0  55
0110910  0.156  0.156  56
0110911  0.0  0.0  65
0110912  0.156  0.156  68
0110913  0.0  0.0  78
0110914  0.156  0.156  79
0110915  0.0  0.0  86
0110916  0.156  0.156  87
0110917  0.0  0.0  94
0110918  0.156  0.156  95
0110919  0.0  0.0  98
0111001  00  99
0111101  1000  98
0111201  4  14.7  120.0  0.9284  0.0  99
0111300  1
0111301  0.0  0.0  0.0  98
```

```
*
0120000  "DISCHA1"  SNGLJUN
0120101  011010000  013000000  0.0  0.0  0.0  1000
0120201  1  0.0  0.0  0.0
*
0130000  "DISCHA1"  PIPE
0130001  30
0130101  0.7771  30
0130301  0.95  8
0130302  1.0  20
0130303  0.5  30
0130401  0.0  30
0130601  0.0  30
0130801  0.000169  0.0  30
0130901  0.0  0.0  5
0130902  0.156  0.156  6
0130903  0.0  0.0  19
0130904  0.156  0.156  20
0130905  0.0  0.0  29
0131001  00  30
0131101  1000  29
0131201  4  14.7  120.0  0.9284  0.0  30
0131300  1
0131301  0.0  0.0  0.0  29
*
0140000  "DISCH1A"  SNGLJUN
0140101  013010000  015000000  0.0  0.0  0.0  0100
0140201  1  0.0  0.0  0.0
*
0150000  "ATMOS"  TMDPVOL
0150101  10000.0  10000.0  0.0  0.0  0.0  0.0  0.00001  0.0  11
0150200  4
0150201  0.0  14.7  120.0  0.9284
*
* PLOT CARDS
*
20300100  QUALS  007010000
20300200  QUALS  005200000
20300300  QUALS  013200000
20300400  P      005200000
20300500  P      007010000
20300600  P      007380000
20300700  MFLOWJ 006000000
20300800  MFLOWJ 005070000
20300900  MFLOWJ 014000000
20301000  P      007140000
20301100  P      011560000
20301200  P      013300000
20301300  MFLOWJ  007140000
20301400  MFLOWJ  007380000
20301500  MFLOWJ  011660000
.END OF CASE
```

4.10 REPIPE Input.

These are input listings of Control Data Corporation's RELAP post-processor, REPIPE. Each set represents direction cosines of the RELAP model as well as structural node assignments. On the Unit 2 PORV model, it was necessary to break up the model in two sections because of REPIPE's size limitations.

Input Set	Model Section
4.10.1	A
4.10.2	B
4.10.3	Quarter Model

4.10.1 Model Section A PORV Unit 2

```
$PIPES
INLINE=3,KBLOCK=200,KPIPE=10,KPLOT(1)=1,KWAVE=1,
KPRINT=-1,KPNV=1,KSTEP=3,
NDROPV=385010000,206330000,811190000$
342    386000000    -0.3710    0.6786    0.6340/
340   -387010000    -0.3710    0.6786    0.6340/
339    387010000     0.0    1.0    0.0/
339    387020000     0.0    1.0    0.0/
339    387030000     0.0    1.0    0.0/
339    387040000     0.0    1.0    0.0/
339    387050000     0.0    1.0    0.0/
339    387060000     0.0    1.0    0.0/
339    387070000     0.0    1.0    0.0/
339    387080000     0.0    1.0    0.0/
339    387090000     0.0    1.0    0.0/
339    387100000     0.0    1.0    0.0/
339    387110000     0.0    1.0    0.0/
339    388000000     0.0    1.0    0.0/
339    420000000     0.0    1.0    0.0/
339    425010000     0.0    1.0    0.0/
339    425020000     0.0    1.0    0.0/
336   -387020000     0.0    1.0    0.0/
336   -387030000     0.0    1.0    0.0/
336   -387040000     0.0    1.0    0.0/
336   -387050000     0.0    1.0    0.0/
336   -387060000     0.0    1.0    0.0/
336   -387070000     0.0    1.0    0.0/
336   -387080000     0.0    1.0    0.0/
336   -387090000     0.0    1.0    0.0/
336   -387100000     0.0    1.0    0.0/
336   -387110000     0.0    1.0    0.0/
336   -388000000     0.0    1.0    0.0/
336   -420000000     0.0    1.0    0.0/
336   -498000000     0.0    1.0    0.0/
336   -425010000     0.0    1.0    0.0/
336   -425020000     0.0    1.0    0.0/
336   -425030000     0.0    1.0    0.0/
334    425030000     0.7844    0.0    0.6202/
334    425040000     0.7844    0.0    0.6202/
334    430000000     0.7844    0.0    0.6202/
330   -425040000     0.7844    0.0    0.6202/
330   -430000000     0.7844    0.0    0.6202/
330   -435010000     0.7844    0.0    0.6202/
334    435010000     0.7844    0.0    0.6202/
334    440000000     0.7844    0.0    0.6202/
334    445010000     0.7844    0.0    0.6202/
334    445020000     0.7844    0.0    0.6202/
334    445030000     0.7844    0.0    0.6202/
334    445040000     0.7844    0.0    0.6202/
330   -440000000     0.7844    0.0    0.6202/
330   -445010000     0.7844    0.0    0.6202/
330   -445020000     0.7844    0.0    0.6202/
330   -445030000     0.7844    0.0    0.6202/
330   -445040000     0.7844    0.0    0.6202/
330   -445050000     0.7844    0.0    0.6202/
328    445050000     0.0    1.0    0.0/
328    445060000     0.0    1.0    0.0/
328    445070000     0.0    1.0    0.0/
328    445080000     0.0    1.0    0.0/
....
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BY KJG DATE 5-21-83
CHKD. BY MR DATE 5/24/83

324	-445060000	0.0	1.0	0.0/
324	-445070000	0.0	1.0	0.0/
324	-445080000	0.0	1.0	0.0/
324	-445090000	0.0	1.0	0.0/
322	445090000	0.9138	0.0	-0.4062/
322	450000000	0.9138	0.0	-0.4062/
322	460000000	0.9138	0.0	-0.4062/
322	465010000	0.9138	0.0	-0.4062/
322	465020000	0.9138	0.0	-0.4062/
322	470000000	0.9138	0.0	-0.4062/
318	-450000000	0.9138	0.0	-0.4062/
318	-460000000	0.9138	0.0	-0.4062/
318	-491000000	0.9138	0.0	-0.4062/
318	-465010000	0.9138	0.0	-0.4062/
318	-465020000	0.9138	0.0	-0.4062/
318	-470000000	0.9138	0.0	-0.4062/
318	-475010000	0.9138	0.0	-0.4062/
3181	475010000	0.8212	0.0	-0.5707/
3181	480000000	0.8212	0.0	-0.5707/
3181	485010000	0.8212	0.0	-0.5707/
3181	485020000	0.8212	0.0	-0.5707/
3181	485030000	0.8212	0.0	-0.5707/
316	-480000000	0.8212	0.0	-0.5707/
316	-485010000	0.8212	0.0	-0.5707/
316	-485020000	0.8212	0.0	-0.5707/
316	-485030000	0.8212	0.0	-0.5707/
316	-485040000	0.8212	0.0	-0.5707/
3161	485040000	0.5557	0.0	-0.8314/
3161	485050000	0.5557	0.0	-0.8314/
3161	485060000	0.5557	0.0	-0.8314/
3161	485070000	0.5557	0.0	-0.8314/
314	-485050000	0.5557	0.0	-0.8314/
314	-485060000	0.5557	0.0	-0.8314/
314	-485070000	0.5557	0.0	-0.8314/
314	-485080000	0.5557	0.0	-0.8314/
3141	485080000	0.2178	0.0	-0.9760/
3141	485090000	0.2178	0.0	-0.9760/
3141	485100000	0.2178	0.0	-0.9760/
3141	485110000	0.2178	0.0	-0.9760/
312	-485090000	0.2178	0.0	-0.9760/
312	-485100000	0.2178	0.0	-0.9760/
312	-485110000	0.2178	0.0	-0.9760/
312	-485120000	0.2178	0.0	-0.9760/
3121	485120000	-0.1543	0.0	-0.9880/
3121	485130000	-0.1543	0.0	-0.9880/
3121	485140000	-0.1543	0.0	-0.9880/
3121	485150000	-0.1543	0.0	-0.9880/
310	-485130000	-0.1543	0.0	-0.9880/
310	-485140000	-0.1543	0.0	-0.9880/
310	-485150000	-0.1543	0.0	-0.9880/
310	-485160000	-0.1543	0.0	-0.9880/
3101	485160000	-0.9272	-0.0262	-0.3745/
308	485170000	-0.9272	-0.0262	-0.3745/
308	485180000	-0.9272	-0.0262	-0.3745/
308	485190000	-0.9272	-0.0262	-0.3745/
308	485200000	-0.9272	-0.0262	-0.3745/
308	485210000	-0.9272	-0.0262	-0.3745/
308	485220000	-0.9272	-0.0262	-0.3745/
308	485230000	-0.9272	-0.0262	-0.3745/
308	485240000	-0.9272	-0.0262	-0.3745/

308	485250000	-0.9272	-0.0262	-0.3745/
308	485260000	-0.9272	-0.0262	-0.3745/
3081	-485170000	-0.9272	-0.0262	-0.3745/
294	-485180000	-0.9272	-0.0262	-0.3745/
294	-485190000	-0.9272	-0.0262	-0.3745/
294	-485200000	-0.9272	-0.0262	-0.3745/
294	-485210000	-0.9272	-0.0262	-0.3745/
294	-485220000	-0.9272	-0.0262	-0.3745/
294	-485230000	-0.9272	-0.0262	-0.3745/
294	-485240000	-0.9272	-0.0262	-0.3745/
294	-485250000	-0.9272	-0.0262	-0.3745/
294	-485260000	-0.9272	-0.0262	-0.3745/
294	-490000000	-0.9272	-0.0262	-0.3745/
292	490000000	-0.9272	-0.0262	-0.3745/
292	400010000	-0.9272	-0.0262	-0.3745/
292	400020000	-0.9272	-0.0262	-0.3745/
292	400030000	-0.9272	-0.0262	-0.3745/
288	-400010000	-0.9272	-0.0262	-0.3745/
288	-400020000	-0.9272	-0.0262	-0.3745/
288	-400030000	-0.9272	-0.0262	-0.3745/
288	-400040000	-0.9272	-0.0262	-0.3745/
286	400040000	0.0	-1.0	0.0/
286	400050000	0.0	-1.0	0.0/
286	400060000	0.0	-1.0	0.0/
286	400070000	0.0	-1.0	0.0/
230	-400050000	0.0	-1.0	0.0/
230	-400060000	0.0	-1.0	0.0/
230	-400070000	0.0	-1.0	0.0/
230	-401000000	0.0	-1.0	0.0/
320	491000000	0.3746	0.0185	-0.9272/
320	492010000	0.3746	0.0185	-0.9272/
320	492020000	0.3746	0.0185	-0.9272/
320	492030000	0.3746	0.0185	-0.9272/
320	492040000	0.3746	0.0185	-0.9272/
320	492050000	0.3746	0.0185	-0.9272/
320	492060000	0.3746	0.0185	-0.9272/
320	492070000	0.3746	0.0185	-0.9272/
320	492080000	0.3746	0.0185	-0.9272/
320	492090000	0.3746	0.0185	-0.9272/
320	492100000	0.3746	0.0185	-0.9272/
348	-492010000	0.3746	0.0185	-0.9272/
348	-492020000	0.3746	0.0185	-0.9272/
348	-492030000	0.3746	0.0185	-0.9272/
348	-492040000	0.3746	0.0185	-0.9272/
348	-492050000	0.3746	0.0185	-0.9272/
348	-492060000	0.3746	0.0185	-0.9272/
348	-492070000	0.3746	0.0185	-0.9272/
348	-492080000	0.3746	0.0185	-0.9272/
348	-492090000	0.3746	0.0185	-0.9272/
348	-492100000	0.3746	0.0185	-0.9272/
348	-493000000	0.3746	0.0185	-0.9272/
346	493000000	0.3746	0.0185	-0.9272/
346	600010000	0.3746	0.0185	-0.9272/
346	600020000	0.3746	0.0185	-0.9272/
344	-600010000	0.3746	0.0185	-0.9272/
344	-600020000	0.3746	0.0185	-0.9272/
344	-600030000	0.3746	0.0185	-0.9272/
404	600030000	0.0	-1.0	0.0/
404	600040000	0.0	-1.0	0.0/
404	600050000	0.0	-1.0	0.0/

404	600060000	0.0	-1.0	0.0/
240	-600040000	0.0	-1.0	0.0/
2402	-600050000	0.0	-1.0	0.0/
2402	-600060000	0.0	-1.0	0.0/
2402	-601000000	0.0	-1.0	0.0/
284	498000000	-0.9272	0.0	-0.3746/
284	410010000	-0.9272	0.0	-0.3746/
284	410020000	-0.9272	0.0	-0.3746/
284	410030000	-0.9272	0.0	-0.3746/
284	410040000	-0.9272	0.0	-0.3746/
282	-410010000	-0.9272	0.0	-0.3746/
282	-410020000	-0.9272	0.0	-0.3746/
282	-410030000	-0.9272	0.0	-0.3746/
282	-410040000	-0.9272	0.0	-0.3746/
282	-410050000	-0.9272	0.0	-0.3746/
280	410050000	0.0	1.0	0.0/
280	410060000	0.0	1.0	0.0/
280	410070000	0.0	1.0	0.0/
280	410080000	0.0	1.0	0.0/
280	410090000	0.0	1.0	0.0/
280	410100000	0.0	1.0	0.0/
278	-410060000	0.0	1.0	0.0/
278	-410070000	0.0	1.0	0.0/
278	-410080000	0.0	1.0	0.0/
278	-410090000	0.0	1.0	0.0/
278	-410100000	0.0	1.0	0.0/
278	-410110000	0.0	1.0	0.0/
276	410110000	0.9270	-0.0218	0.3745/
276	410120000	0.9270	-0.0218	0.3745/
276	410130000	0.9270	-0.0218	0.3745/
276	410140000	0.9270	-0.0218	0.3745/
276	410150000	0.9270	-0.0218	0.3745/
276	410160000	0.9270	-0.0218	0.3745/
276	410170000	0.9270	-0.0218	0.3745/
276	410180000	0.9270	-0.0218	0.3745/
276	410190000	0.9270	-0.0218	0.3745/
276	410200000	0.9270	-0.0218	0.3745/
264	-410120000	0.9270	-0.0218	0.3745/
264	-410130000	0.9270	-0.0218	0.3745/
264	-410140000	0.9270	-0.0218	0.3745/
264	-410150000	0.9270	-0.0218	0.3745/
264	-410160000	0.9270	-0.0218	0.3745/
264	-410170000	0.9270	-0.0218	0.3745/
264	-410180000	0.9270	-0.0218	0.3745/
264	-410190000	0.9270	-0.0218	0.3745/
264	-410200000	0.9270	-0.0218	0.3745/
264	-415000000	0.9270	-0.0218	0.3745/
262	415000000	0.9270	-0.0218	0.3745/
262	500010000	0.9270	-0.0218	0.3745/
262	500020000	0.9270	-0.0218	0.3745/
260	-500010000	0.9270	-0.0218	0.3745/
260	-500020000	0.9270	-0.0218	0.3745/
260	-500030000	0.9270	-0.0218	0.3745/
257	500030000	0.0	-1.0	0.0/
257	500040000	0.0	-1.0	0.0/
257	500050000	0.0	-1.0	0.0/
252	-500040000	0.0	-1.0	0.0/
252	-500050000	0.0	-1.0	0.0/
252	-500060000	0.0	-1.0	0.0/
250	500060000	0.7559	0.0	-0.6547/

248	-500070000	0.7559	0.0	-0.6547/
2481	500070000	0.7170	0.0	-0.6971/
2481	500080000	0.7170	0.0	-0.6971/
2481	500090000	0.7170	0.0	-0.6971/
246	-500080000	0.7170	0.0	-0.6971/
246	-500090000	0.7170	0.0	-0.6971/
246	-500100000	0.7170	0.0	-0.6971/
2461	500100000	0.3736	0.0	-0.9276/
2461	500110000	0.3736	0.0	-0.9276/
2461	500120000	0.3736	0.0	-0.9276/
244	-500110000	0.3736	0.0	-0.9276/
244	-500120000	0.3736	0.0	-0.9276/
244	-500130000	0.3736	0.0	-0.9276/
2441	500130000	0.0282	0.0	-0.9996/
2441	500140000	0.0282	0.0	-0.9996/
2441	500150000	0.0282	0.0	-0.9996/
2441	501000000	0.0282	0.0	-0.9996/
242	-500140000	0.0282	0.0	-0.9996/
242	-500150000	0.0282	0.0	-0.9996/
242	-501000000	0.0282	0.0	-0.9996/
242	-502010000	0.0282	0.0	-0.9996/
2421	502010000	-0.2531	0.0	-0.9674/
240	-503000000	-0.2531	0 0	-0.9674/
2401	503000000	-0.3508	0.0	-0.9364/
2401	601000000	-0.3508	0.0	-0.9364/
238	-505000000	-0.3508	0.0	-0.9364/
2381	505000000	-0.6395	0.0	-0.7688/
2381	506010000	-0.6395	0.0	-0.7688/
2381	506020000	-0.6395	0.0	-0.7688/
2381	506030000	-0.6395	0.0	-0.7688/
236	-506010000	-0.6395	0.0	-0.7688/
236	-506020000	-0.6395	0.0	-0.7688/
236	-506030000	-0.6395	0.0	-0.7688/
236	-506040000	-0.6395	0.0	-0.7688/
2361	506040000	-0.9576	0.0	-0.2882/
2361	506050000	-0.9576	0.0	-0.2882/
2361	506060000	-0.9576	0.0	-0.2882/
2361	506070000	-0.9576	0.0	-0.2882/
234	-506050000	-0.9576	0.0	-0.2882/
234	-506060000	-0.9576	0.0	-0.2882/
234	-506070000	-0.9576	0.0	-0.2882/
234	-506080000	-0.9576	0.0	-0.2882/
2341	506080000	-0.9998	0.0	-0.0175/
2341	507000000	-0.9998	0.0	-0.0175/
2341	508010000	-0.9998	0.0	-0.0175/
2341	509000000	-0.9998	0.0	-0.0175/
2341	511000000	-0.9998	0.0	-0.0175/
226	-507000000	-0.9998	0.0	-0.0175/
226	-508010000	-0.9998	0.0	-0.0175/
226	-509010000	-0.9998	0.0	-0.0175/
226	-511000000	-0.9998	0.0	-0.0175/
226	-700010000	-0.9998	0.0	-0.0175/
224	700010000	0.0	-1.0	0.0/
224	700020000	0.0	-1.0	0.0/
224	700030000	0.0	-1.0	0.0/
224	700040000	0.0	-1.0	0.0/
224	700050000	0.0	-1.0	0.0/
224	700060000	0.0	-1.0	0.0/
224	700070000	0.0	-1.0	0.0/
224	700080000	0.0	-1.0	0.0/

224	700090000	0.0	-1.0	0.0/
224	700100000	0.0	-1.0	0.0/
224	700110000	0.0	-1.0	0.0/
224	701000000	0.0	-1.0	0.0/
68	-700030000	0.0	-1.0	0.0/
68	-700040000	0.0	-1.0	0.0/
68	-700050000	0.0	-1.0	0.0/
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68	-700090000	0.0	-1.0	0.0/
68	-700100000	0.0	-1.0	0.0/
68	-700110000	0.0	-1.0	0.0/
68	-701000000	0.0	-1.0	0.0/
68	-702010000	0.0	-1.0	0.0/
224	702010000	0.0	-1.0	0.0/
224	702020000	0.0	-1.0	0.0/
224	800000000	0.0	-1.0	0.0/
224	307000000	0.0	-1.0	0.0/
224	802000000	0.0	-1.0	0.0/
224	804000000	0.0	-1.0	0.0/
224	207000000	0.0	-1.0	0.0/
224	806000000	0.0	-1.0	0.0/
224	808000000	0.0	-1.0	0.0/
224	107000000	0.0	-1.0	0.0/
224	810000000	0.0	-1.0	0.0/
224	811010000	0.0	-1.0	0.0/
224	811020000	0.0	-1.0	0.0/
224	811030000	0.0	-1.0	0.0/
224	811040000	0.0	-1.0	0.0/
224	811050000	0.0	-1.0	0.0/
224	811060000	0.0	-1.0	0.0/
224	811070000	0.0	-1.0	0.0/
224	811080000	0.0	-1.0	0.0/
224	811090000	0.0	-1.0	0.0/
224	811100000	0.0	-1.0	0.0/
224	811110000	0.0	-1.0	0.0/
224	811120000	0.0	-1.0	0.0/
224	811130000	0.0	-1.0	0.0/
68	-700020000	0.0	-1.0	0.0/
68	-800000000	0.0	-1.0	0.0/
68	-802000000	0.0	-1.0	0.0/
68	-804000000	0.0	-1.0	0.0/
68	-806000000	0.0	-1.0	0.0/
68	-808000000	0.0	-1.0	0.0/
68	-810000000	0.0	-1.0	0.0/
68	-811010000	0.0	-1.0	0.0/
68	-811020000	0.0	-1.0	0.0/
68	-811030000	0.0	-1.0	0.0/
68	-811040000	0.0	-1.0	0.0/
68	-811050000	0.0	-1.0	0.0/
68	-811060000	0.0	-1.0	0.0/
68	-811070000	0.0	-1.0	0.0/
68	-811080000	0.0	-1.0	0.0/
68	-811090000	0.0	-1.0	0.0/
68	-811100000	0.0	-1.0	0 0/
68	-811110000	0.0	-1.0	0.0/
68	-811120000	0.0	-1.0	0.0/
68	-811130000	0.0	-1.0	0.0/
68	-811140000	0.0	-1.0	0.0/

66	811140000	-0.2356	-0.7071	0.6667/
66	811150000	-0.2356	-0.7071	0.6667/
66	811160000	-0.2356	-0.7071	0.6667/
66	811170000	-0.2356	-0.7071	0.6667/
64	-811150000	-0.2356	-0.7071	0.6667/
64	-811160000	-0.2356	-0.7071	0.6667/
64	-811170000	-0.2356	-0.7071	0.6667/
64	-811180000	-0.2356	-0.7071	0.6667/
198	305000000	-0.9975	0.0	0.0709/
198	306010000	-0.9975	0.0	0.0709/
198	306020000	-0.9975	0.0	0.0709/
198	306030000	-0.9975	0.0	0.0709/
195	-306010000	-0.9975	0.0	0.0709/
195	-306020000	-0.9975	0.0	0.0709/
195	-306030000	-0.9975	0.0	0.0709/
195	-306040000	-0.9975	0.0	0.0709/
190	306040000	0.0	-1.0	0.0/
190	306050000	0.0	-1.0	0.0/
190	306060000	0.0	-1.0	0.0/
190	306070000	0.0	-1.0	0.0/
190	306080000	0.0	-1.0	0.0/
190	306090000	0.0	-1.0	0.0/
190	306100000	0.0	-1.0	0.0/
190	306110000	0.0	-1.0	0.0/
186	-306050000	0.0	-1.0	0.0/
186	-306060000	0.0	-1.0	0.0/
186	-306070000	0.0	-1.0	0.0/
186	-306080000	0.0	-1.0	0.0/
186	-306090000	0.0	-1.0	0.0/
186	-306100000	0.0	-1.0	0.0/
186	-306110000	0.0	-1.0	0.0/
186	-306120000	0.0	-1.0	0.0/
184	306120000	-0.9359	0.0	-0.3523/
184	306130000	-0.9359	0.0	-0.3523/
184	306140000	-0.9359	0.0	-0.3523/
182	-306130000	-0.9359	0.0	-0.3523/
182	-306140000	-0.9359	0.0	-0.3523/
182	-306150000	-0.9359	0.0	-0.3523/
1821	306150000	-0.6354	0.0	-0.7722/
1821	306160000	-0.6354	0.0	-0.7722/
1821	306170000	-0.6354	0.0	-0.7722/
180	-306160000	-0.6354	0.0	-0.7722/
180	-306170000	-0.6354	0.0	-0.7722/
180	-306180000	-0.6354	0.0	-0.7722/
1801	306180000	-0.0516	0.0	-0.9987/
1801	306190000	-0.0516	0.0	-0.9987/
1801	306200000	-0.0516	0.0	-0.9987/
178	-306190000	-0.0516	0.0	-0.9987/
178	-306200000	-0.0516	0.0	-0.9987/
178	-306210000	-0.0516	0.0	-0.9987/
1781	306210000	0.2639	0.0	-0.9645/
1781	306220000	0.2639	0.0	-0.9645/
1781	306230000	0.2639	0.0	-0.9645/
1781	306240000	0.2639	0.0	-0.9645/
176	-306220000	0.2639	0.0	-0.9645/
176	-306230000	0.2639	0.0	-0.9645/
176	-306240000	0.2639	0.0	-0.9645/
176	-307000000	0.2639	0.0	-0.9645/
104	105000000	0.7169	0.0	0.6972/
104	106010000	0.7169	0.0	0.6972/

104	106020000	0.7169	0.0	0.6972/
104	106030000	0.7169	0.0	0.6972/
98	-106010000	0.7169	0.0	0.6972/
98	-106020000	0.7169	0.0	0.6972/
98	-106030000	0.7169	0.0	0.6972/
98	-106040000	0.7169	0.0	0.6972/
96	106040000	0.0	-1.0	0.0/
96	106050000	0.0	-1.0	0.0/
96	106060000	0.0	-1.0	0.0/
96	106070000	0.0	-1.0	0.0/
96	106080000	0.0	-1.0	0.0/
96	106090000	0.0	-1.0	0.0/
96	106100000	0.0	-1.0	0.0/
96	106110000	0.0	-1.0	0.0/
96	106120000	0.0	-1.0	0.0/
96	106130000	0.0	-1.0	0.0/
90	-106050000	0.0	-1.0	0.0/
90	-106060000	0.0	-1.0	0.0/
90	-106070000	0.0	-1.0	0.0/
90	-106080000	0.0	-1.0	0.0/
90	-106090000	0.0	-1.0	0.0/
90	-106100000	0.0	-1.0	0.0/
90	-106110000	0.0	-1.0	0.0/
90	-106120000	0.0	-1.0	0.0/
90	-106130000	0.0	-1.0	0.0/
90	-106140000	0.0	-1.0	0.0/
88	106140000	0.2657	0.0	0.9641/
88	106150000	0.2657	0.0	0.9641/
88	106160000	0.2657	0.0	0.9641/
86	-106150000	0.2657	0.0	0.9641/
86	-106160000	0.2657	0.0	0.9641/
86	-106170000	0.2657	0.0	0.9641/
861	106170000	-0.3889	0.0	0.9213/
861	106180000	-0.3889	0.0	0.9213/
861	106190000	-0.3889	0.0	0.9213/
84	-106180000	-0.3889	0.0	0.9213/
84	-106190000	-0.3889	0.0	0.9213/
84	-106200000	-0.3889	0.0	0.9213/
841	106200000	-0.8464	0.0	0.5326/
841	106210000	-0.8464	0.0	0.5326/
841	106220000	-0.8464	0.0	0.5326/
82	-106210000	-0.8464	0.0	0.5326/
82	-106220000	-0.8464	0.0	0.5326/
82	-106230000	-0.8464	0.0	0.5326/
821	106230000	-0.9999	0.0	0.0162/
821	106240000	-0.9999	0.0	0.0162/
821	106250000	-0.9999	0.0	0.0162/
80	-106240000	-0.9999	0.0	0.0162/
80	-106250000	-0.9999	0.0	0.0162/
80	-106260000	-0.9999	0.0	0.0162/
801	106260000	-0.8289	0.0	-0.5595/
801	106270000	-0.8289	0.0	-0.5595/
801	106280000	-0.8289	0.0	-0.5595/
78	-106270000	-0.8289	0.0	-0.5595/
78	-106280000	-0.8289	0.0	-0.5595/
78	-106290000	-0.8289	0.0	-0.5595/
781	106290000	-0.4813	0.0	-0.8766/
781	106300000	-0.4813	0.0	-0.8766/
781	106310000	-0.4813	0.0	-0.8766/
76	-106300000	-0.4813	0.0	-0.8766/

```
76     -106310000     -0.4813    0.0     -0.8766/
76     -106320000     -0.4813    0.0     -0.8766/
761     106320000     -0.2356   -0.7071   0.6667/
761     106330000     -0.2356   -0.7071   0.6667/
761     106340000     -0.2356   -0.7071   0.6667/
74     -106330000     -0.2356   -0.7071   0.6667/
74     -106340000     -0.2356   -0.7071   0.6667/
74     -106350000     -0.2356   -0.7071   0.6667/
741     106350000     0.2639    0.0     -0.9645/
741     106360000     0.2639    0.0     -0.9645/
741     106370000     0.2639    0.0     -0.9645/
741     106380000     0.2639    0.0     -0.9645/
72     -106360000     0.2639    0.0     -0.9645/
72     -106370000     0.2639    0.0     -0.9645/
72     -106380000     0.2639    0.0     -0.9645/
72     -107000000     0.2639    0.0     -0.9645/
99999/
 $STEPS TSTEP(1)=0.001,0.200,-1,-1$
```

4.10.2 Model Section B PORV Unit 2

```
$PIPES
INLINE=3,KBLOCK=200,KPIPE=10,KPLOT(1)=1,KWAVE=1,
KPRINT=-1,KPNV=1,KSTEP=3,
NDROPV=206010000,903030000,805010000,811180000$
154   206010000    -0.4181    0.0    0.9084/
154   206020000    -0.4181    0.0    0.9084/
154   206030000    -0.4181    0.0    0.9084/
148  -206020000    -0.4181    0.0    0.9084/
148  -206030000    -0.4181    0.0    0.9084/
148  -206040000    -0.4181    0.0    0.9084/
146   206040000     0.0    -1.0    0.0/
146   206050000     0.0    -1.0    0.0/
146   206060000     0.0    -1.0    0.0/
146   206070000     0.0    -1.0    0.0/
146   206080000     0.0    -1.0    0.0/
146   206090000     0.0    -1.0    0.0/
146   206100000     0.0    -1.0    0.0/
146   206110000     0.0    -1.0    0.0/
146   206120000     0.0    -1.0    0.0/
146   206130000     0.0    -1.0    0.0/
140  -206050000     0.0    -1.0    0.0/
140  -206060000     0.0    -1.0    0.0/
140  -206070000     0.0    -1.0    0.0/
140  -206080000     0.0    -1.0    0.0/
140  -206090000     0.0    -1.0    0.0/
140  -206100000     0.0    -1.0    0.0/
140  -206110000     0.0    -1.0    0.0/
140  -206120000     0.0    -1.0    0.0/
140  -206130000     0.0    -1.0    0.0/
140  -206140000     0.0    -1.0    0.0/
138   206140000    -0.8064    0.0    0.5913/
138   206150000    -0.8064    0.0    0.5913/
138   206160000    -0.8064    0.0    0.5913/
136  -206150000    -0.8064    0.0    0.5913/
136  -206160000    -0.8064    0.0    0.5913/
136  -206170000    -0.8064    0.0    0.5913/
1361  206170000    -0.9998    0.0    0.0191/
1361  206180000    -0.9998    0.0    0.0191/
1361  206190000    -0.9998    0.0    0.0191/
134  -206180000    -0.9998    0.0    0.0191/
134  -206190000    -0.9998    0.0    0.0191/
134  -206200000    -0.9998    0.0    0.0191/
1341  206200000    -0.8285    0.0   -0.5599/
1341  206210000    -0.8285    0.0   -0.5599/
1341  206220000    -0.8285    0.0   -0.5599/
132  -206210000    -0.8285    0.0   -0.5599/
132  -206220000    -0.8285    0.0   -0.5599/
132  -206230000    -0.8285    0.0   -0.5599/
1321  206230000    -0.4217    0.0   -0.9067/
1321  206240000    -0.4217    0.0   -0.9067/
1321  206250000    -0.4217    0.0   -0.9067/
130  -206240000    -0.4217    0.0   -0.9067/
130  -206250000    -0.4217    0.0   -0.9067/
130  -206260000    -0.4217    0.0   -0.9067/
1301  206260000     0.0323    0.0   -0.9995/
1301  206270000     0.0323    0.0   -0.9995/
1301  206280000     0.0323    0.0   -0.9995/
128  -206270000     0.0323    0.0   -0.9995/
128  -206280000     0.0323    0.0   -0.9995/
```

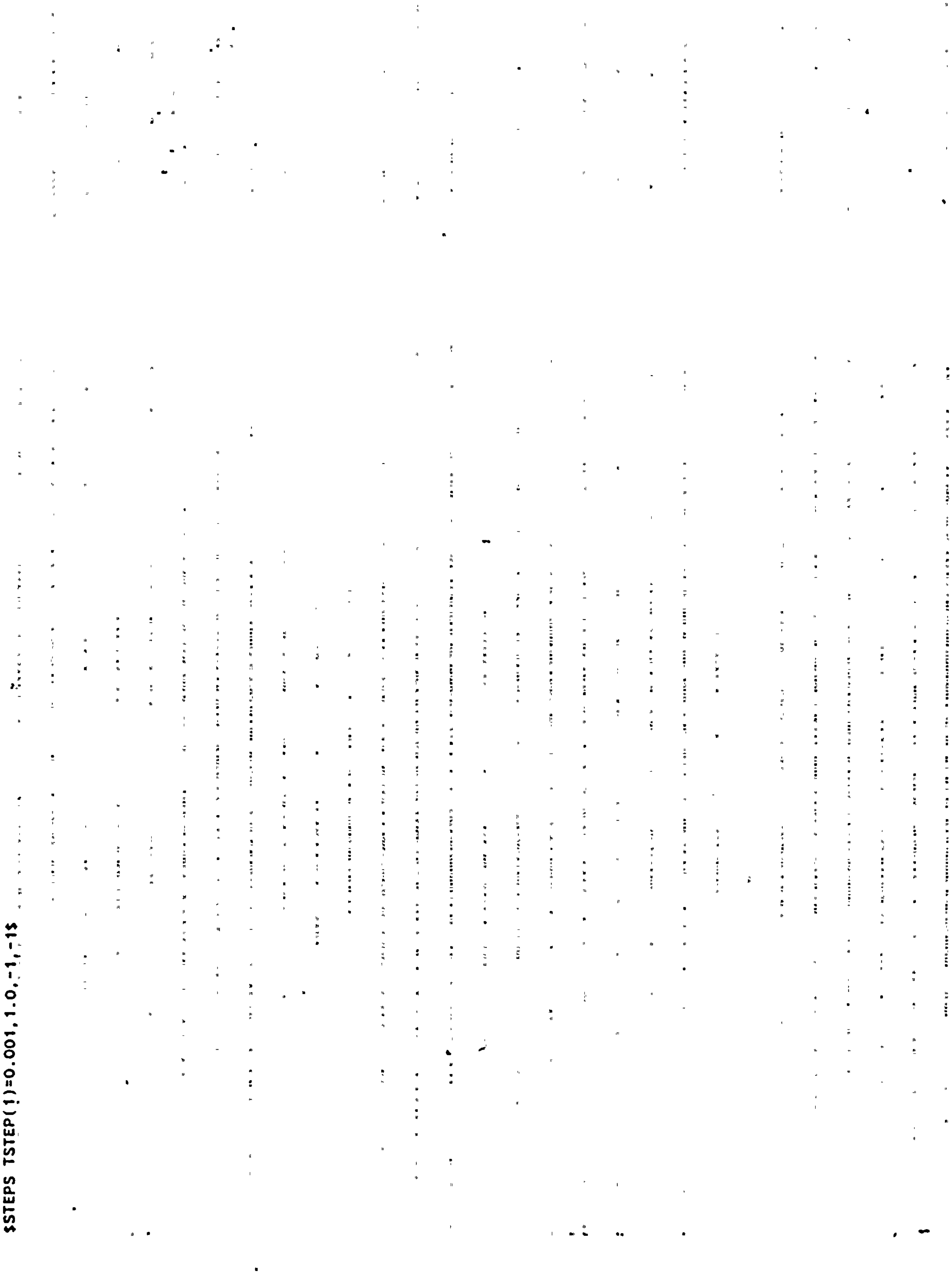
BY KJG DATE 5-21-83
CHKD. BY ML DATE 5-26-83

128	-206290000	0.0323	0.0	-0.9995/
1281	206290000	0.2639	0.0	-0.9645/
1281	206300000	0.2639	0.0	-0.9645/
1281	206310000	0.2639	0.0	-0.9645/
1231	206320000	0.2639	0.0	-0.9645/
126	-206300000	0.2639	0.0	-0.9645/
126	-206310000	0.2639	0.0	-0.9645/
126	-206320000	0.2639	0.0	-0.9645/
126	-207000000	0.2639	0.0	-0.9645/
62	811180000	0.0	-1.0	0.0/
62	811190000	0.0	-1.0	0.0/
62	811200000	0.0	-1.0	0.0/
62	811210000	0.0	-1.0	0.0/
58	-811190000	0.0	-1.0	0.0/
58	-811200000	0.0	-1.0	0.0/
58	-811210000	0.0	-1.0	0.0/
58	-811220000	0.0	-1.0	0.0/
56	811220000	0.2356	-0.7071	-0.6667/
56	811230000	0.2356	-0.7071	-0.6667/
56	811240000	0.2356	-0.7071	-0.6667/
56	811250000	0.2356	-0.7071	-0.6667/
54	-811230000	0.2356	-0.7071	-0.6667/
54	-811240000	0.2356	-0.7071	-0.6667/
54	-811250000	0.2356	-0.7071	-0.6667/
54	-811260000	0.2356	-0.7071	-0.6667/
52	811260000	0.0	-1.0	0.0/
52	811270000	0.0	-1.0	0.0/
52	811280000	0.0	-1.0	0.0/
52	811290000	0.0	-1.0	0.0/
52	811300000	0.0	-1.0	0.0/
52	811310000	0.0	-1.0	0.0/
52	811320000	0.0	-1.0	0.0/
52	811330000	0.0	-1.0	0.0/
52	811340000	0.0	-1.0	0.0/
52	811350000	0.0	-1.0	0.0/
52	811360000	0.0	-1.0	0.0/
52	811370000	0.0	-1.0	0.0/
52	811380000	0.0	-1.0	0.0/
52	811390000	0.0	-1.0	0.0/
52	811400000	0.0	-1.0	0.0/
52	811410000	0.0	-1.0	0.0/
52	811420000	0.0	-1.0	0.0/
52	811430000	0.0	-1.0	0.0/
52	811440000	0.0	-1.0	0.0/
52	811450000	0.0	-1.0	0.0/
52	811460000	0.0	-1.0	0.0/
52	811470000	0.0	-1.0	0.0/
52	811480000	0.0	-1.0	0.0/
52	811490000	0.0	-1.0	0.0/
52	811500000	0.0	-1.0	0.0/
52	811510000	0.0	-1.0	0.0/
52	811520000	0.0	-1.0	0.0/
52	811530000	0.0	-1.0	0.0/
52	811540000	0.0	-1.0	0.0/
52	811550000	0.0	-1.0	0.0/
46	-811270000	0.0	-1.0	0.0/
46	-811280000	0.0	-1.0	0.0/
46	-811290000	0.0	-1.0	0.0/
46	-811300000	0.0	-1.0	0.0/
46	-811310000	0.0	-1.0	0.0/

46	-811320000	0.0	-1.0	0.0/
46	-811330000	0.0	-1.0	0.0/
46	-811340000	0.0	-1.0	0.0/
46	-811350000	0.0	-1.0	0.0/
46	-811360000	0.0	-1.0	0.0/
46	-811370000	0.0	-1.0	0.0/
46	-811380000	0.0	-1.0	0.0/
46	-811390000	0.0	-1.0	0.0/
46	-811400000	0.0	-1.0	0.0/
46	-811410000	0.0	-1.0	0.0/
46	-811420000	0.0	-1.0	0.0/
46	-811430000	0.0	-1.0	0.0/
46	-811440000	0.0	-1.0	0.0/
46	-811450000	0.0	-1.0	0.0/
46	-811460000	0.0	-1.0	0.0/
46	-811470000	0.0	-1.0	0.0/
46	-811480000	0.0	-1.0	0.0/
46	-811490000	0.0	-1.0	0.0/
46	-811500000	0.0	-1.0	0.0/
46	-811510000	0.0	-1.0	0.0/
46	-811520000	0.0	-1.0	0.0/
46	-811530000	0.0	-1.0	0.0/
46	-811540000	0.0	-1.0	0.0/
46	-811550000	0.0	-1.0	0.0/
46	-811560000	0.0	-1.0	0.0/
44	811560000	0.0	0.0	-1.0/
44	811570000	0.0	0.0	-1.0/
44	811580000	0.0	0.0	-1.0/
44	811590000	0.0	0.0	-1.0/
44	811600000	0 0	0.0	-1.0/
44	811610000	0.0	0.0	-1.0/
44	811620000	0.0	0.0	-1.0/
44	811630000	0.0	0.0	-1.0/
44	811640000	0.0	0.0	-1.0/
44	811650000	0.0	0.0	-1.0/
42	-811570000	0.0	0.0	-1.0/
42	-811580000	0.0	0.0	-1.0/
42	-811590000	0.0	0.0	-1.0/
42	-811600000	0.0	0.0	-1.0/
42	-811610000	0.0	0.0	-1.0/
42	-811620000	0.0	0.0	-1.0/
42	-811630000	0.0	0.0	-1.0/
42	-811640000	0.0	0.0	-1.0/
42	-811650000	0.0	0.0	-1.0/
42	-811660000	0.0	0.0	-1.0/
40	811660000	0.2588	0.0	-0.9659/
40	811670000	0.2588	0.0	-0.9659/
40	811680000	0.2588	0.0	-0.9659/
40	811690000	0.2588	0.0	-0.9659/
40	811700000	0.2588	0.0	-0.9659/
40	811710000	0.2588	0.0	-0.9659/
40	811720000	0.2588	0.0	-0.9659/
40	811730000	0.2588	0.0	-0.9659/
40	811740000	0.2588	0.0	-0.9659/
40	811750000	0.2588	0.0	-0.9659/
40	811760000	0.2588	0.0	-0.9659/
40	811770000	0.2588	0.0	-0.9659/
40	811780000	0.2588	0.0	-0.9659/
38	-811670000	0.2588	0.0	-0.9659/
38	-811680000	0.2588	0.0	-0.9659/

38	-811690000	0.2588	0.0	-0.9659/
38	-811700000	0.2588	0.0	-0.9659/
38	-811710000	0.2588	0.0	-0.9659/
38	-811720000	0.2588	0.0	-0.9659/
38	-811730000	0.2588	0.0	-0.9659/
38	-811740000	0.2588	0.0	-0.9659/
38	-811750000	0.2588	0.0	-0.9659/
38	-811760000	0.2588	0.0	-0.9659/
38	-811770000	0.2588	0.0	-0.9659/
38	-811780000	0.2588	0.0	-0.9659/
38	-811790000	0.2588	0.0	-0.9659/
36	811790000	1.0	0.0	0.0/
36	811800000	1.0	0.0	0.0/
36	811810000	1.0	0.0	0.0/
36	811820000	1.0	0.0	0.0/
36	811830000	1.0	0.0	0.0/
36	811840000	1.0	0.0	0.0/
36	811850000	1.0	0.0	0.0/
36	811860000	1.0	0.0	0.0/
34	-811800000	1.0	0.0	0.0/
34	-811810000	1.0	0.0	0.0/
34	-811820000	1.0	0.0	0.0/
34	-811830000	1.0	0.0	0.0/
34	-811840000	1.0	0.0	0.0/
34	-811850000	1.0	0.0	0.0/
34	-811860000	1.0	0.0	0.0/
34	-811870000	1.0	0.0	0.0/
33	811870000	0.0	-1.0	0.0/
33	811880000	0.0	-1.0	0.0/
33	811890000	0.0	-1.0	0.0/
33	811900000	0.0	-1.0	0.0/
33	811910000	0.0	-1.0	0.0/
33	811920000	0.0	-1.0	0.0/
33	811930000	0.0	-1.0	0.0/
33	811940000	0.0	-1.0	0.0/
28	-811880000	0.0	-1.0	0.0/
28	-811890000	0.0	-1.0	0.0/
28	-811900000	0.0	-1.0	0.0/
28	-811910000	0.0	-1.0	0.0/
28	-811920000	0.0	-1.0	0.0/
28	-811930000	0.0	-1.0	0.0/
28	-811940000	0.0	-1.0	0.0/
28	-811950000	0.0	-1.0	0.0/
26	811950000	1.0	0.0	0.0/
26	811960000	1.0	0.0	0.0/
26	811970000	1.0	0.0	0.0/
26	811980000	1.0	0.0	0.0/
26	812000000	1.0	0.0	0.0/
26	813010000	1.0	0.0	0.0/
26	813020000	1.0	0.0	0.0/
26	813030000	1.0	0.0	0.0/
26	813040000	1.0	0.0	0.0/
26	813050000	1.0	0.0	0.0/
20	-811960000	1.0	0.0	0.0/
20	-811970000	1.0	0.0	0.0/
20	-811980000	1.0	0.0	0.0/
20	-812000000	1.0	0.0	0.0/
20	-813010000	1.0	0.0	0.0/
20	-813020000	1.0	0.0	0.0/
20	-813030000	1.0	0.0	0.0/

20	-813040000	1.0	0.0	0.0/
20	-813050000	1.0	0.0	0.0/
20	-813060000	1.0	0.0	0.0/
18	813060000	0.0	0.0	1.0/
18	813070000	0.0	0.0	1.0/
18	813080000	0.0	0.0	1.0/
18	813090000	0.0	0.0	1.0/
18	813100000	0.0	0.0	1.0/
18	813110000	0.0	0.0	1.0/
18	813120000	0.0	0.0	1.0/
18	813130000	0.0	0.0	1.0/
18	813140000	0.0	0.0	1.0/
18	813150000	0.0	0.0	1.0/
18	813160000	0.0	0.0	1.0/
18	813170000	0.0	0.0	1.0/
18	813180000	0.0	0.0	1.0/
18	813190000	0.0	0.0	1.0/
12	-813070000	0.0	0.0	1.0/
12	-813080000	0.0	0.0	1.0/
12	-813090000	0.0	0.0	1.0/
12	-813100000	0.0	0.0	1.0/
12	-813110000	0.0	0.0	1.0/
12	-813120000	0.0	0.0	1.0/
12	-813130000	0.0	0.0	1.0/
12	-813140000	0.0	0.0	1.0/
12	-813150000	0.0	0.0	1.0/
12	-813160000	0.0	0.0	1.0/
12	-813170000	0.0	0.0	1.0/
12	-813180000	0.0	0.0	1.0/
12	-813190000	0.0	0.0	1.0/
12	-813200000	0.0	0.0	1.0/
10	813200000	-1.0	0.0	0.0/
10	813210000	-1.0	0.0	0.0/
10	813220000	-1.0	0.0	0.0/
10	813230000	-1.0	0.0	0.0/
10	813240000	-1.0	0.0	0.0/
10	813250000	-1.0	0.0	0.0/
10	813260000	-1.0	0.0	0.0/
10	813270000	-1.0	0.0	0.0/
10	813280000	-1.0	0.0	0.0/
10	813290000	-1.0	0.0	0.0/
6	-813210000	-1.0	0.0	0.0/
6	-813220000	-1.0	0.0	0.0/
6	-813230000	-1.0	0.0	0.0/
6	-813240000	-1.0	0.0	0.0/
6	-813250000	-1.0	0.0	0.0/
6	-813260000	-1.0	0.0	0.0/
6	-813270000	-1.0	0.0	0.0/
6	-813280000	-1.0	0.0	0.0/
6	-813290000	-1.0	0.0	0.0/
6	-813300000	-1.0	0.0	0.0/
4	900000000	0.0	-1.0	0.0/
4	901010000	0.0	-1.0	0.0/
4	901020000	0.0	-1.0	0.0/
4	902000000	0.0	-1.0	0.0/
4	903010000	0.0	-1.0	0.0/
2	-901010000	0.0	-1.0	0.0/
2	-902000000	0.0	-1.0	0.0/
2	-903010000	0.0	-1.0	0.0/
2	-903020000	0.0	-1.0	0.0/



99999/
$STEPS TSTEP(1)=0.001,1.0,-1,-1$

4.10.3 Quarter Model

```
$PIPES
INLINE=3,KBLOCK=601,KPIPE=0,KPLOT(1)=1,KWAVE=1,
KPRINT=-1,KPNV=1,KSTEP=3,NDROPV=1010000,15010000$
1   002000000  -1.0  0.0  0.0/
2  -004000000  -1.0  0.0  0.0/
3   004000000   0.0 -1.0  0.0/
3   005010000   0.0 -1.0  0.0/
3   005020000   0.0 -1.0  0.0/
3   005040000   0.0 -1.0  0.0/
3   005050000   0.0 -1.0  0.0/
3   005060000   0.0 -1.0  0.0/
4  -005010000   0.0 -1.0  0.0/
4  -005020000   0.0 -1.0  0.0/
4  -005030000   0.0 -1.0  0.0/
4  -005040000   0.0 -1.0  0.0/
4  -005050000   0.0 -1.0  0.0/
4  -005060000   0.0 -1.0  0.0/
4  -005070000   0.0 -1.0  0.0/
5   005070000  -1.0  0.0  0.0/
5   005080000  -1.0  0.0  0.0/
5   005090000  -1.0  0.0  0.0/
6  -005080000  -1.0  0.0  0.0/
6  -005090000  -1.0  0.0  0.0/
6  -005100000  -1.0  0.0  0.0/
7   005100000   0.0  1.0  0.0/
7   005110000   0.0  1.0  0.0/
7   005120000   0.0  1.0  0.0/
7   005130000   0.0  1.0  0.0/
7   005140000   0.0  1.0  0.0/
7   005150000   0.0  1.0  0.0/
7   005160000   0.0  1.0  0.0/
7   005170000   0.0  1.0  0.0/
7   005180000   0.0  1.0  0.0/
7   005190000   0.0  1.0  0.0/
8  -005110000   0.0  1.0  0.0/
8  -005120000   0.0  1.0  0.0/
8  -005130000   0.0  1.0  0.0/
8  -005140000   0.0  1.0  0.0/
8  -005150000   0.0  1.0  0.0/
8  -005160000   0.0  1.0  0.0/
8  -005170000   0.0  1.0  0.0/
8  -005180000   0.0  1.0  0.0/
8  -005190000   0.0  1.0  0.0/
8  -008000000   0.0  1.0  0.0/
9   008000000  -1.0  0.0  0.0/
9   007010000  -1.0  0.0  0.0/
9   007020000  -1.0  0.0  0.0/
9   007030000  -1.0  0.0  0.0/
10 -007010000  -1.0  0.0  0.0/
10 -007020000  -1.0  0.0  0.0/
10 -007030000  -1.0  0.0  0.0/
10 -007040000  -1.0  0.0  0.0/
11  007040000   0.0 -1.0  0.0/
11  007050000   0.0 -1.0  0.0/
11  007060000   0.0 -1.0  0.0/
11  007070000   0.0 -1.0  0.0/
11  007080000   0.0 -1.0  0.0/
11  007090000   0.0 -1.0  0.0/
11  007100000   0.0 -1.0  0.0/
11  007110000   0.0 -1.0  0.0/
```

BY CAM DATE 2-9-83

CHKD. BY LCS DATE 2-9-83

```
11  007120000  0 0 -1.0  0.0/
11  007130000  0.0 -1.0  0.0/
12 -007050000  0.0 -1.0  0.0/
12 -007060000  0.0 -1.0  0.0/
12 -007070000  0.0 -1.0  0.0/
12 -007080000  0.0 -1.0  0.0/
12 -007090000  0.0 -1.0  0.0/
12 -007100000  0.0 -1.0  0.0/
12 -007110000  0.0 -1.0  0.0/
12 -007120000  0.0 -1.0  0.0/
12 -007130000  0.0 -1.0  0.0/
12 -007140000  0.0 -1.0  0.0/
14   007140000  -.258  0.0 -.966/
14   007150000  -.258  0.0 -.966/
14   007160000  -.258  0.0 -.966/
15  -007150000  -.258  0.0 -.966/
15  -007160000  -.258  0.0 -.966/
15  -007170000  -.258  0.0 -.966/
16   007170000   .337  0.0 -.942/
16   007180000   .337  0.0 -.942/
16   007190000   .337  0.0 -.942/
17  -007180000   .337  0.0 -.942/
17  -007190000   .337  0.0 -.942/
17  -007200000   .337  0.0 -.942/
18   007200000   .793  0.0 -.609/
18   007210000   .793  0.0 -.609/
18   007220000   .793  0.0 -.609/
19  -007210000   .793  0.0 -.609/
19  -007220000   .793  0 0 -.609/
19  -007230000   .793  0.0 -.609/
20   007230000   .994  0.0 -.1132/
20   007240000   .994  0.0 -.1132/
20   007250000   .994  0.0 -.1132/
21  -007240000   .994  0.0 -.1132/
21  -007250000   .994  0.0 -.1132/
21  -007260000   .994  0 0 -.1132/
22   007260000   .910  0.0  .415/
22   007270000   .910  0.0  .415/
22   007280000   .910  0.0  .415/
23  -007270000   .910  0.0  .415/
23  -007280000   .910  0.0  .415/
23  -007290000   .910  0.0  .415/
24   007290000   .555  0.0  .8321/
24   007300000   .555  0.0  .8321/
24   007310000   .555  0.0  .8321/
25  -007300000   .555  0.0  .8321/
25  -007310000   .555  0.0  .8321/
25  -007320000   .555  0.0  .8321/
26   007320000  .0183  0 0 .9998/
26   007330000  .0183  0.0 .9998/
26   007340000  .0183  0.0 .9998/
27  -007330000  .0183  0.0 .9998/
27  -007340000  .0183  0.0 .9998/
27  -007350000  .0183  0.0 .9998/
28   007350000  -.264  0.0  .965/
28   007360000  -.264  0.0  .965/
28   007370000  -.264  0.0  .965/
28   007380000  -.264  0.0  .965/
29  -007360000  -.264  0.0  .965/
29  -007370000  -.264  0.0  .965/
```

29	-007380000	-.264	0.0	.965/
29	-008000000	-.264	0.0	.965/
30	008000000	0.0	-1.0	0.0/
30	010000000	0.0	-1.0	0.0/
30	011010000	0.0	-1.0	0.0/
30	011020000	0.0	-1.0	0.0/
30	011030000	0.0	-1.0	0.0/
30	011040000	0.0	-1.0	0.0/
30	011050000	0.0	-1.0	0.0/
30	011060000	0.0	-1.0	0.0/
30	011070000	0.0	-1.0	0.0/
30	011080000	0.0	-1.0	0.0/
30	011090000	0.0	-1.0	0.0/
30	011100000	0.0	-1.0	0.0/
30	011110000	0.0	-1.0	0.0/
30	011120000	0.0	-1.0	0.0/
30	011130000	0.0	-1.0	0.0/
31	-010000000	0.0	-1.0	0.0/
31	-011010000	0.0	-1.0	0.0/
31	-011020000	0.0	-1.0	0.0/
31	-011030000	0.0	-1.0	0.0/
31	-011040000	0.0	-1 0	0.0/
31	-011050000	0.0	-1.0	0.0/
31	-011060000	0.0	-1.0	0.0/
31	-011070000	0.0	-1.0	0.0/
31	-011080000	0.0	-1.0	0.0/
31	-011090000	0.0	-1.0	0.0/
31	-011100000	0.0	-1.0	0.0/
31	-011110000	0.0	-1.0	0.0/
31	-011120000	0.0	-1.0	0.0/
31	-011130000	0.0	-1.0	0.0/
31	-011140000	0.0	-1.0	0.0/
32	011140000	.316	-.707	-.948/
32	011150000	.316	-.707	-.948/
32	011160000	.316	-.707	-.948/
32	011170000	.316	-.707	-.948/
33	-011150000	.316	-.707	-.948/
33	-011160000	.316	-.707	-.948/
33	-011170000	.316	-.707	-.948/
33	-011180000	.316	-.707	-.948/
34	011180000	0.0	-1.0	0.0/
34	011190000	0.0	-1.0	0.0/
34	011200000	0.0	-1.0	0.0/
34	011210000	0.0	-1.0	0.0/
35	-011200000	0.0	-1.0	0.0/
35	-011210000	0.0	-1.0	0.0/
35	-011220000	0.0	-1.0	0.0/
36	011220000	-.316	-.707	.948/
36	011230000	-.316	-.707	.948/
36	011240000	-.316	-.707	.948/
36	011250000	-.316	-.707	.948/
37	-011230000	-.316	-.707	.948/
37	-011240000	-.316	-.707	.948/
37	-011250000	-.316	-.707	.948/
37	-011260000	-.316	-.707	.948/
38	011260000	0.0	-1.0	0.0/
38	011270000	0.0	-1.0	0.0/
38	011280000	0.0	-1.0	0.0/
38	011290000	0.0	-1.0	0.0/
38	011300000	0.0	-1.0	0.0/

38	011310000	0.0	-1.0	0.0/
38	011320000	0.0	-1.0	0.0/
38	011330000	0.0	-1.0	0.0/
38	011340000	0.0	-1.0	0.0/
38	011350000	0.0	-1.0	0.0/
38	011360000	0.0	-1.0	0.0/
38	011370000	0.0	-1.0	0.0/
38	011380000	0.0	-1.0	0.0/
38	011390000	0.0	-1.0	0.0/
38	011400000	0.0	-1.0	0.0/
38	011410000	0.0	-1.0	0.0/
38	011420000	0.0	-1.0	0.0/
38	011430000	0.0	-1.0	0.0/
38	011440000	0.0	-1.0	0.0/
38	011450000	0.0	-1.0	0.0/
38	011460000	0.0	-1.0	0.0/
38	011470000	0.0	-1.0	0.0/
38	011480000	0.0	-1.0	0.0/
38	011490000	0.0	-1.0	0.0/
38	011500000	0.0	-1.0	0.0/
38	011510000	0.0	-1.0	0.0/
38	011520000	0.0	-1.0	0.0/
38	011530000	0.0	-1.0	0.0/
38	011540000	0.0	-1.0	0.0/
38	011550000	0.0	-1.0	0.0/
39	-011270000	0.0	-1.0	0.0/
39	-011280000	0.0	-1.0	0.0/
39	-011290000	0.0	-1.0	0.0/
39	-011300000	0.0	-1.0	0.0/
39	-011310000	0.0	-1.0	0.0/
39	-011320000	0.0	-1.0	0.0/
39	-011330000	0.0	-1.0	0.0/
39	-011340000	0.0	-1.0	0.0/
39	-011350000	0.0	-1.0	0.0/
39	-011360000	0.0	-1.0	0.0/
39	-011370000	0.0	-1.0	0.0/
39	-011380000	0.0	-1.0	0.0/
39	-011390000	0.0	-1.0	0.0/
39	-011400000	0.0	-1.0	0.0/
39	-011410000	0.0	-1.0	0.0/
39	-011420000	0.0	-1.0	0.0/
39	-011430000	0.0	-1.0	0.0/
39	-011440000	0.0	-1.0	0.0/
39	-011450000	0.0	-1.0	0.0/
39	-011460000	0.0	-1.0	0.0/
39	-011470000	0.0	-1.0	0 0/
39	-011480000	0.0	-1.0	0.0/
39	-011490000	0.0	-1.0	0.0/
39	-011500000	0.0	-1.0	0.0/
39	-011510000	0.0	-1.0	0.0/
39	-011520000	0.0	-1.0	0.0/
39	-011530000	0.0	-1.0	0.0/
39	-011540000	0.0	-1.0	0.0/
39	-011550000	0.0	-1.0	0.0/
39	-011560000	0.0	-1.0	0.0/
40	011560000	0.0	0.0	-1.0/
40	011570000	0.0	0.0	-1.0/
40	011580000	0.0	0.0	-1.0/
40	011590000	0.0	0.0	-1.0/
40	011600000	0.0	0.0	-1.0/

```
40   011610000   0.0  0.0 -1.0/
40   011620000   0.0  0.0 -1.0/
40   011630000   0.0  0.0 -1.0/
40   011640000   0.0  0.0 -1.0/
40   011650000   0.0  0.0 -1.0/
41  -011570000   0.0  0.0 -1.0/
41  -011580000   0.0  0.0 -1.0/
41  -011590000   0.0  0.0 -1.0/
41  -011600000   0.0  0.0 -1.0/
41  -011610000   0.0  0.0 -1.0/
41  -011620000   0.0  0.0 -1.0/
41  -011630000   0.0  0.0 -1.0/
41  -011640000   0.0  0.0 -1.0/
41  -011650000   0.0  0.0 -1.0/
41  -011660000   0.0  0.0 -1.0/
42   011660000  -.259  0.0  .966/
42   011670000  -.259  0.0  .966/
42   011680000  -.259  0.0  .966/
42   011690000  -.259  0.0  .966/
42   011700000  -.259  0.0  .966/
42   011710000  -.259  0.0  .966/
42   011720000  -.259  0.0  .966/
42   011730000  -.259  0.0  .966/
42   011740000  -.259  0.0  .966/
42   011750000  -.259  0.0  .966/
42   011760000  -.259  0.0  .966/
42   011770000  -.259  0.0  .966/
42   011780000  -.259  0.0  .966/
43  -011670000  -.259  0.0  .966/
43  -011680000  -.259  0.0  .966/
43  -011690000  -.259  0.0  .966/
43  -011700000  -.259  0.0  .966/
43  -011710000  -.259  0.0  .966/
43  -011720000  -.259  0.0  .966/
43  -011730000  -.259  0.0  .966/
43  -011740000  -.259  0.0  .966/
43  -011750000  -.259  0.0  .966/
43  -011760000  -.259  0.0  .966/
43  -011770000  -.259  0.0  .966/
43  -011780000  -.259  0.0  .966/
43  -011790000  -.259  0.0  .966/
44   011790000  -1.0  0.0  0.0/
44   011800000  -1.0  0.0  0.0/
44   011810000  -1.0  0.0  0.0/
44   011820000  -1.0  0.0  0.0/
44   011830000  -1.0  0.0  0.0/
44   011840000  -1.0  0.0  0.0/
44   011850000  -1.0  0.0  0.0/
44   011860000  -1.0  0.0  0.0/
45  -011800000  -1.0  0.0  0.0/
45  -011810000  -1.0  0.0  0.0/
45  -011820000  -1.0  0.0  0.0/
45  -011830000  -1.0  0.0  0.0/
45  -011840000  -1.0  0.0  0.0/
45  -011850000  -1.0  0.0  0.0/
45  -011860000  -1.0  0.0  0.0/
45  -011870000  -1.0  0.0  0.0/
46   011870000   0.0 -1.0  0.0/
46   011880000   0.0 -1.0  0.0/
46   011890000   0.0 -1.0  0.0/
```

```
48    011900000   0.0 -1.0  0.0/
48    011910000   0.0 -1.0  0.0/
48    011920000   0.0 -1.0  0.0/
48    011930000   0.0 -1.0  0 0/
48    011940000   0.0 -1.0  0.0/
47   -011880000   0.0 -1.0  0.0/
47   -011890000   0.0 -1.0  0.0/
47   -011900000   0.0 -1.0  0.0/
47   -011910000   0.0 -1.0  0.0/
47   -011920000   0.0 -1.0  0.0/
47   -011930000   0.0 -1.0  0.0/
47   -011940000   0.0 -1.0  0.0/
47   -011950000   0.0 -1.0  0.0/
48    011950000  -1.0  0.0  0.0/
48    011960000  -1.0  0.0  0.0/
48    011970000  -1.0  0.0  0.0/
48    011980000  -1.0  0.0  0.0/
48    011990000  -1.0  0.0  0.0/
48    012000000  -1.0  0.0  0.0/
48    013010000  -1.0  0.0  0.0/
48    013020000  -1.0  0.0  0.0/
48    013030000  -1.0  0.0  0.0/
48    013040000  -1.0  0.0  0.0/
48    013050000  -1.0  0.0  0.0/
49   -011960000  -1.0  0.0  0.0/
49   -011970000  -1.0  0.0  0.0/
49   -011980000  -1.0  0.0  0.0/
49   -011890000  -1.0  0.0  0.0/
49   -012000000  -1.0  0.0  0.0/
49   -013010000  -1.0  0.0  0.0/
49   -013020000  -1.0  0.0  0.0/
49   -013030000  -1.0  0.0  0.0/
49   -013040000  -1.0  0.0  0.0/
49   -013050000  -1.0  0.0  0.0/
49   -013060000  -1.0  0.0  0.0/
50    013060000   0.0  0.0 -1.0/
50    013070000   0.0  0.0 -1.0/
50    013080000   0.0  0.0 -1.0/
50    013090000   0.0  0.0 -1.0/
50    013100000   0.0  0.0 -1.0/
50    013110000   0.0  0.0 -1.0/
50    013120000   0.0  0.0 -1.0/
50    013130000   0.0  0.0 -1.0/
50    013140000   0.0  0.0 -1.0/
50    013150000   0.0  0.0 -1.0/
50    013160000   0.0  0.0 -1.0/
50    013170000   0.0  0.0 -1.0/
50    013180000   0.0  0.0 -1.0/
50    013190000   0.0  0.0 -1.0/
51   -013070000   0.0  0.0 -1.0/
51   -013080000   0.0  0.0 -1.0/
51   -013090000   0.0  0.0 -1.0/
51   -013100000   0.0  0.0 -1.0/
51   -013110000   0.0  0.0 -1.0/
51   -013120000   0.0  0.0 -1.0/
51   -013130000   0.0  0.0 -1.0/
51   -013140000   0.0  0.0 -1.0/
51   -013150000   0.0  0.0 -1.0/
51   -013160000   0.0  0.0 -1.0/
51   -013170000   0.0  0.0 -1.0/
```

```
51   -013180000   0.0   0.0  -1.0/
51   -013190000   0.0   0.0  -1.0/
51   -013200000   0.0   0.0  -1.0/
52    013200000   1.0   0.0   0.0/
52    013210000   1.0   0.0   0.0/
52    013220000   1.0   0.0   0.0/
52    013230000   1.0   0.0   0.0/
52    013240000   1.0   0.0   0.0/
52    013250000   1.0   0.0   0.0/
52    013260000   1.0   0.0   0.0/
52    013270000   1.0   0.0   0.0/
52    013280000   1.0   0.0   0.0/
52    013290000   1.0   0.0   0.0/
53   -013210000   1.0   0.0   0.0/
53   -013220000   1.0   0.0   0.0/
53   -013230000   1.0   0.0   0.0/
53   -013240000   1.0   0.0   0.0/
53   -013250000   1.0   0.0   0.0/
53   -013260000   1.0   0.0   0.0/
53   -013270000   1.0   0.0   0.0/
53   -013280000   1.0   0.0   0.0/
53   -013290000   1.0   0.0   0.0/
53   -014000000  1.0   0.0   0.0/
99999/
 $STEPS TSTEP(1)=0.001,0.600$
```

4.11 APPENDIX A

TELEDYNE ENGINEERING SERVICES

BY SH DATE 8-24-82
CHKD. BY SGC DATE 8-25-82
[illegible] 6-1-83

AMERICAN ELECTRIC POWER
DC. COOK UNITS 1 & 2
PIPE PROPERTIES

SHEET NO. 1 OF 1
PROJ. NO. 5364

PIPE PROPERTIES

SIZE	SCHEDULE	I.D. (in.)	FLOW AREA (ft²)	FRICTION FACTOR f	ε/d	ROUGHNESS ε (ft)	* K ELBOW 12 f
[illegible]	40	3.068	.05132	.0174	.0006	1.53×10^{-4}	.2088
3"	160	2.624	.03757	.0181	.0007	1.53×10^{-4}	.2172
4"	40	4.026	.08840	.0161	.0004	1.34×10^{-4}	.1932
[illegible]	120	3.624	.07160	.0162	.00044	1.33×10^{-4}	.1944
[illegible]	40	6.065	.20069	.015	.0003	1.52×10^{-4}	.1800
[illegible]	160	5.189	.14653	.0153	.00035	1.51×10^{-4}	.1836
[illegible]	40	11.938	.77708	.013	.00017	1.69×10^{-4}	.1560

* RESISTANCE DUE TO BEND ONLY FOR 1.5d BENDS

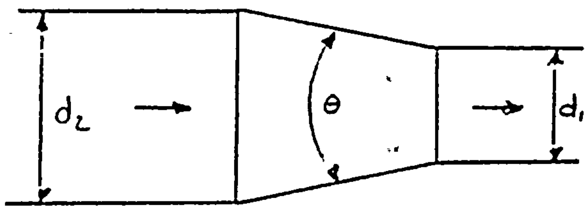
REF: CRANE TECHNICAL PAPER No. 410

TELEDYNE ENGINEERING SERVICES

BY JBM DATE 12-8-82
CHKD. BY JEY DATE 12-8-82
JBJ 6-1-83

AMERICAN ELECTRIC POWER
D.C. COOK UNITS 1 & 2
LOSSES IN REDUCERS

SHEET NO. 1 OF 1
PROJ. NO. 5364



$\beta = \frac{d_1}{d_2}$

IF : $\theta \leq 45°$

FORWARD LOSS COEFFICIENTS

$K = 0.8 \left(\sin \frac{\theta}{2}\right)(1-\beta^2)$

REVERSE LOSS COEFFICIENTS

$K = 2.6 \left(\sin \frac{\theta}{2}\right)(1-\beta^2)^2$

SIZE	d_1	d_2	β	θ	K, FORWARD	K, REVERSE
12" SCH 40 × 6" SCH 40S	6.065"	11.938"	.5080	40.3°	.2045	.4930
6" SCH 40S × 4" SCH 40S	4.026"	6.065	.6638	21°	.0815	.1483
4" SCH 40S × 3" SCH 40	3.068"	4.026"	.7620	13.66°	.0399	.0544
3" SCH 160 × 4" SCH 120	2.624"	3.624"	.7241	14.25°	.0472	.0730
4" SCH 120 × 6" SCH 160	3.624"	5.189"	.6984	16.19°	.0577	.0961
6" SCH 40S × 3" SCH 40	3.068"	6.065"	.5059	30.48°	.1565	.3784

REFERENCE: CRANE TECHNICAL PAPER 410 p. A-26

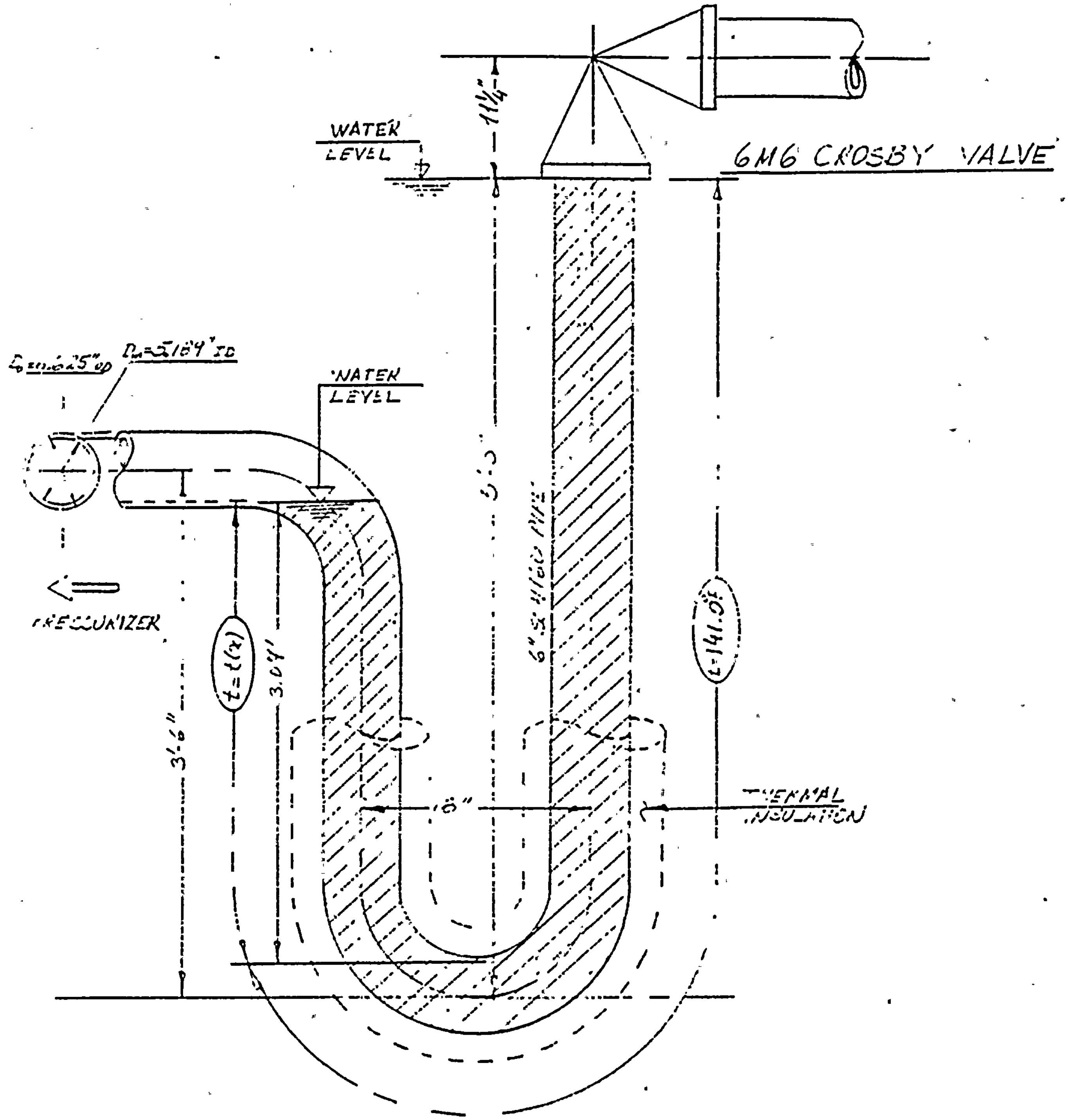
K IS TAKEN WITH RESPECT TO THE SMALLER DIAMETER PIPE.

TELEDYNE ENGINEERING SERVICES

BY BAT DATE 12-17-82
CHKD. BY [illegible] DATE [illegible]

AEP D.C. COOK UNIT 1
SV LINE LOOP SEAL TEMP DISTRIBUTION

SHEET NO. 1 OF 12
PROJ. NO. 5364



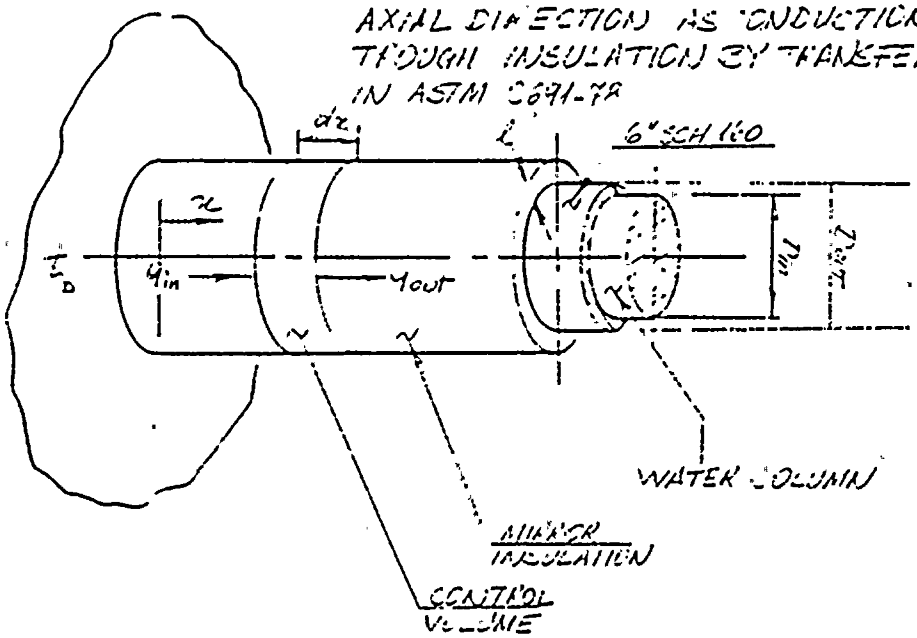
D.C. COOK UNIT 1
SAFETY VALVE LINE-LOOP SEAL
GEOMETRY

TELEDYNE ENGINEERING SERVICES

BY: FAT DATE: 12-17-82 | AEP D.C. COOK UNIT 1 SV LINE LOOP SEAL TEMP. DISTRIBUTION | SHEET NO. 2 OF 12
CHKD. BY: WL DATE: | | PROJ. NO. 5364

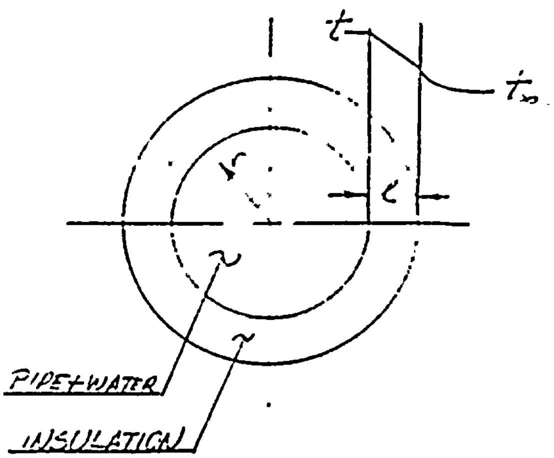
DERIVATION OF ENERGY EQUATION

ASSUMPTION 1: LOOP SEAL PIPING IS MODELED AS STRAIGHT PIPE WITH FINITE LENGTH WITH BOUNDARY CONDITIONS DESCRIBED BELOW. HEAT IS TRANSFERED BOTH IN AXIAL DIRECTION AS CONDUCTION AND IN RADIAL DIRECTION THROUGH INSULATION BY TRANSFERENCE EQUATION AS DESCRIBED IN ASTM C691-78



PIPE MODEL

ASSUMPTION 2: TEMPERATURE ACROSS CROSS-SECTION OF THE PIPE INCLUDING WATER AND WALL IS CONSTANT.



q_{in} (CONDUCTED INTO ELEMENT) $= -[(KA)_{pipe} + (KA)_{water}]\frac{dt}{dx}$

$$q_{in} = -(KA)_{eff}\frac{dt}{dx} \qquad \text{WHERE } (KA)_{eff} = (KA)_{pipe} + (KA)_{water}$$

q_{out} (CONDUCTED OUT OF ELEMENT) $= q_{in} + \Delta q$

$$q_{out} = \left[-(KA)_{eff}\frac{dt}{dx} + \frac{d}{dx}\left(-KA_{eff}\frac{dt}{dx}\right)dx\right]$$

TEMPERATURE DISTRIBUTION ACROSS THE CROSS-SECTION OF PIPE

$(KA)_{eff}$ = EQUIVALENT THERMAL CONDUCTANCE OF PIPE IN AXIAL DIRECTION

t = TEMPERATURE AS A FUNCTION OF x

q_s (TRANSFERED OUT OF SURFACE OF THE PIPE) $= T_r A_s (t_{in} - t_\infty)$

(REF: ASTM C591-75)

WHERE: A_s = SURFACE AREA OF PIPE $(ft^2) = \pi D_o dx$

t_{in} = TEMPERATURE OF PIPE + WATER (ASSUMED EQUAL)

t_∞ = PIPE ENVIRONMENT TEMPERATURE = 120 °F

T_r = THERMAL TRANSFERENCE $\frac{Btu}{hr\text{-}ft^2\text{-}F}$

ENERGY EQUATION FOR THE CONTROL VOLUME

$$q_{in} = q_{out} + q_s$$

$$-(kA)_{eff}\frac{dt}{dx} = \left\{-(kA)_{eff}\frac{dt}{dx} + \frac{d}{dx}\left[-(kA)_{eff}\frac{dt}{dx}\right]dx\right\} + T_r \pi D_o dx (t - t_\infty)$$

$$(KA)_{eff}\frac{d^2t}{dx^2} = T_r \pi D_o (t - t_\infty)$$

LET $\theta = t - t_\infty$ THEN $\frac{d\theta}{dx} = \frac{dt}{dx}$ AND $\frac{d^2\theta}{dx^2} = \frac{d^2t}{dx^2}$

LET $m^2 = \frac{T_r \pi D_o}{(KA)_{eff}}$

THEREFORE:

$$\frac{d^2\theta}{dx^2} = m^2\theta$$

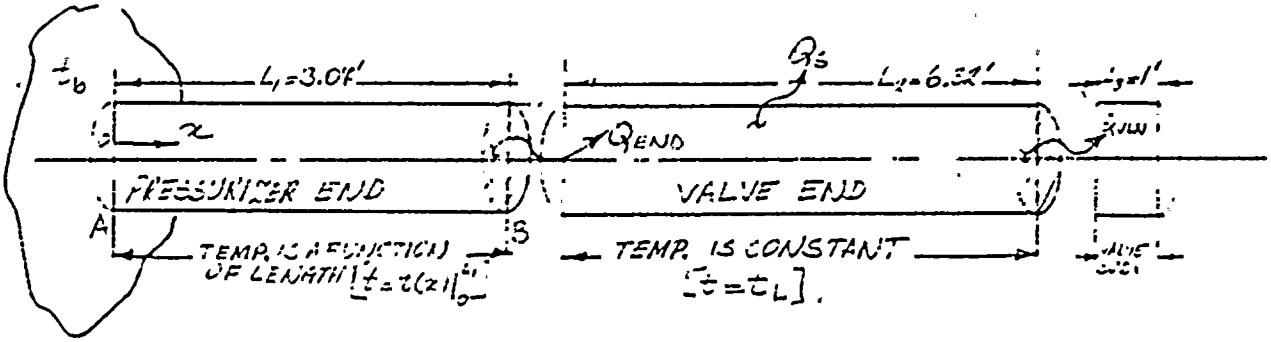
$$\theta = C_1 e^{mx} + C_2 e^{-mx}$$

$$t = C_1 e^{mx} + C_2 e^{-mx} + 120$$

EQUATION—(1)
GENERAL TEMPERATURE DISTRIBUTION EQN.

BY SAF DATE 12-20-81	AEP D.C. COOK UNIT 1	SHEET NO. 4 OF 12
CHKD. BY [illegible] DATE 1-7-82	S.V. LINE LOOP SEAL TEMP. DISTRIBUTION	PROJ. NO. 5364

ASSUMPTION 3. TEMPERATURE VARIES ONLY IN THE PRESSURIZER END OF THE LOOP SEAL AND REMAINS CONSTANT AT THE VALVE END OF THE LOOP SEAL. THIS IS DUE TO THE CIRCULATION OF WATER IN THE VALVE END OF LOOP SEAL BECAUSE OF NATURAL CONVECTION (REF. PAGE 1 OF THIS ANALYSIS).



LOOP SEAL MODEL

BOUNDARY CONDITIONS FOR EQN 1

1- $x = 0$ $\quad t = t_0 = 668°F$ (SAT. STEAM TEMP. @ 2500 psia)

2- $x = 3.07$ ft $\quad -(kA)_{eff} \left. \frac{dt}{dx} \right|_{x=3.07} = Q_{END}$

$$-(kA)_{eff}\left[mC_1 e^{mx} - mC_2 e^{-mx}\right] = Q_{END} \qquad \text{EQN. (2)}$$

C_1 AND C_2 ARE FOUND FROM EQN. 1 AND EQN. 2

T_r (TRANSMISSIVITY) IS A FUNCTION OF TEMPERATURE AND FROM THE TELECON BETWEEN "TES" AND "DIAMOND POWER" DATED (12-16-81)

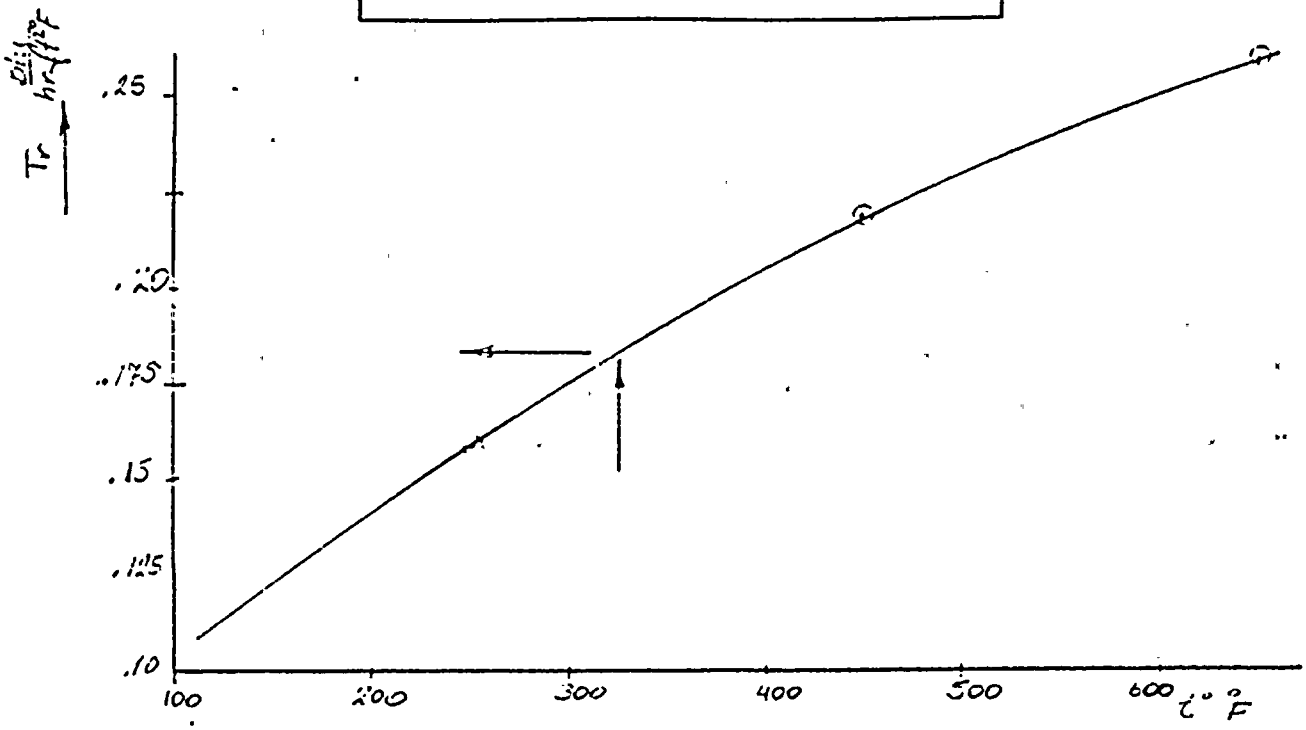
T_r $\frac{Btu}{hr\ ft^2\ °F}$	TEMP °F
0.259	650
0.219	450
0.158	250

TELEDYNE ENGINEERING SERVICES

BY: BAI DATE: 12-20-82
CHKD. BY: MF DATE: 1-3-83

AEP D.C. COOK UNIT 1
S.V. LINE LOOP SEAL TEMP. DISTRIBUTION

SHEET NO. 5 OF 12
PROJ. NO. 5364



PLOT OF TRANSMISSIVITY VS TEMPERATURE FROM DATA ON TELECON BETWEEN "TES" AND "DIAMOND POWER" DATED (12-16-82)

ASSUMED AVERAGE FLUID TEMPERATURE = 325 °F

FROM PLOT $T_r = 0.18 \frac{Btu}{hr\,ft^2\,°F}$ @ $t = 325$ °F

$(KA)_{eff} = (KA)_{PIPE} + (KA)_{WATER}$

$A_{PIPE} = 13.22 \ in^2$

$A_{WATER} = 21.1 \ in^2$

ESTIMATED AVERAGE VALUES

$K_{PIPE} \simeq 7.9 \frac{Btu}{hr\text{-}ft\text{-}°F}$ (REF.* PIPE MAT. SPECT. DCCPM104QCS PROVIDED BY AEP AND ASME III BOILER & PRESSURE VESSEL CODE)

$K_{WATER} = 0.38 \frac{Btu}{hr\text{-}ft\text{-}°F}$ (REF: HEAT TRANSFER, J. P. HOLMAN Fig 1.3) FIRST EDITION

$(KA)_{eff} = 0.78 \ \frac{Btu\text{-}ft}{hr\text{-}°F}$

(*NOTE: PIPE IS MADE OF ASTM A-376 GRADE TP316 SEAMLESS AUSTENITIC STEEL)

ASSUME $t = 145°F$ AT VALVE END OF LOOPSEAL

$$Q_{END} = Q_S + Q_{VLV}$$

Q_S = HEAT LOSS ACROSS INSULATION FROM VALVE END OF LOOP-SEAL

$$Q_S = T_r A_S (t_L - t_\infty)$$

WHERE $A_S = D_o \pi L_2$ SURFACE AREA OF VALVE END OF LOOPSEAL

$T_r = 0.120 \frac{Btu}{ft^2 hr\ F}$ @ 145°F (FROM PLOT AT PAGES OF THIS ANALYSIS)

(NOTE: DIFFERENT T_r IS USED IN EQN. 1 AND Q_S SINCE MEAN TEMPERATURES ARE DIFFERENT)

$$Q_S = (0.120)(0.55 \times \pi \times 6.32)[145 - 120]$$

$$Q_S = 32.76 \ \frac{Btu}{hr}$$

VALVE END HEAT LOSS IS ASSUMED AS HEAT FLOWING TROUGH A SOLID VALVE BODY WITH $L_3 = 1'$ EQUIVALENT LENGTH AND D_o DIAMETER.

$$Q_{VLV} = (kA)_{steel} \frac{t_L - t_\infty}{L_3}$$

$$Q_{VLV} = (7.9)(0.24) \frac{145 - 120}{1.0}$$

$$Q_{VLV} = 47.28 \ \frac{Btu}{hr}$$

$$Q_{END} = Q_S + Q_{VLV}$$

$$Q_{END} = 80.04 \ \frac{Btu}{hr}$$

BY CAT DATE 12-21-82 | AEP D.C. COOK UNIT 1 | SHEET NO. 7 OF 12
CHKD. BY [illegible] DATE [illegible] | S.V LINE LOOP SEAL TEMP. DISTRIBUTION | PROJ. NO. 5364

TEMPERATURE DISTRIBUTION EQUATION @ $0 < x < L_1 = 3.07$

$$t = C_1 e^{mx} + C_2 e^{-mx} + 120$$

SOLVE FOR C_1 AND C_2 USING BOUNDARY CONDITIONS:

$x = 0$ $\quad t = t_b = 668\ °F$ BOUNDARY CON. 1

$$-(kA)_{eff} \left.\frac{dt}{dx}\right|_{x=L_1} = Q_{END}$$ BOUNDARY CON. 2

$$-m \times 0.78 \left[C_1 e^{mL_1} - C_2 e^{-mL_1} \right] = 80.04$$

$$m = \left[\frac{h_r \pi D_o}{(kA)_{eff}} \right]^{1/2}$$

$$m = \left[\frac{0.162 \pi \cdot 2.55}{0.78} \right]^{1/2}$$

$m = 0.64$

SUBSTITUTING BOUNDARY CONDITIONS:

FROM B.C. 1 $\quad C_1 e^{0.64(0)} + C_2 e^{-0.64(0)} = 548$ ——— EQN (2)

FROM BC. 2 $\quad -C_1 e^{0.64L_1} + C_2 e^{-0.64L_1} = (1/k..)[Q_s + Q_{VLV}]$ ——— EQN. (3)

AFTER SUBSTITUTING

$C_1 + C_2 = 548$

$-7.13\, C_1 + 0.14\, C_2 = 160.08$

TWO EQUATIONS WITH TWO UNKNOWNS AFTER SOLVING

$C_1 = -11.5$ AND $C_2 = 559.50$

TEMPERATURE DISTRIBUTION EQUATION BECOMES

$$t = -11.5\, e^{0.64x} + 559.5\, e^{-0.64x} + 120 \qquad @\ 0 < x < 3.07$$

CHECKING ASSUMED $t = t_L = 145°$ @ $x = 3.07$ ft

PROCEDURE: FIND A(t) BY SUBSTITUTING $x = 3.07$ AND COMPARE THIS (t) BY ASSUMED $t = 145°F$

$$t = -11.5\, e^{(0.64)(3.07)} + 559.5\, e^{-(0.64)(3.07)} + 120$$

$$t_{found} = 113.44\ °F < t_{ass} = 145°F$$

ASSUME: $t = t_L = 135°F$

EQNS (2) AND (3) BECOMES:

$$\begin{cases} C_1 + C_2 = 548 \\ -7.13\, C_1 + 0.14\, C_2 = 96.00 \end{cases}$$

$Q_{vlv} = 28.44$ Btu/hr
$Q_s = .456$ Btu/hr
$Q_{END} = 40.0$

AFTER SOLVING

$C_1 = -2.68$

$C_2 = 550.68$ AND TEMP. DISTRIBUTION:

$$t = -2.68\, e^{0.64x} + 550.68\, e^{-0.64x} + 120$$

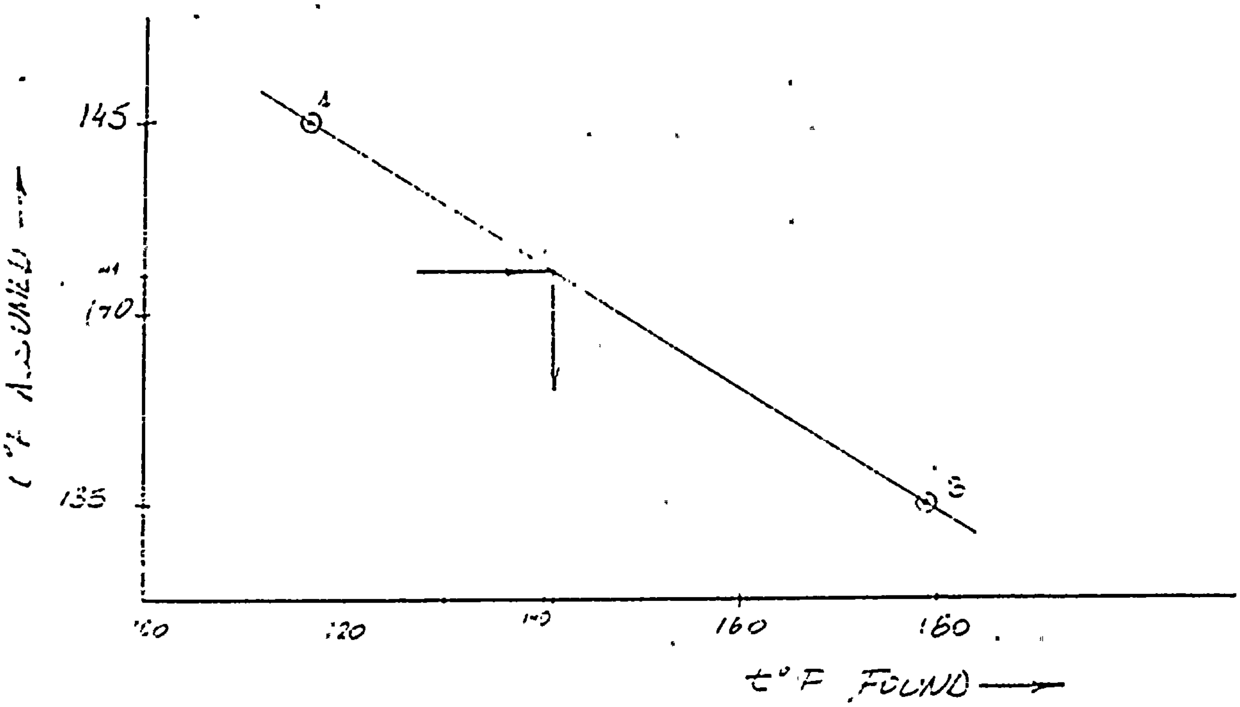
@ $x = 3.07$ $t_{found} = 178.08\ °F > t_{ass} = 135°F$

TELEDYNE ENGINEERING SERVICES

BY SAT DATE 12-21-82 CHKD. BY DATE

A E P D.C. COOK UNIT 1
S.V. LINE LOOP SEAL TEMP. DISTRIBUTION

SHEET NO. 9 OF 12
PROJ. NO. 5364



AFTER PLOTING t_{ass} VS. t_{found} AND BY VISUAL INTERPOLATION
(PROCEDURE: FIND $t_{ass} = t_{found}$ ON LINE A-B)
NEW t_{ass} = 141 °F

SUBSTITUTING $t_{ass} = 141$ °F INTO EQN (2) AND EQN (3)

$Q_S = 27.52 \ \frac{Btu}{hr}$

$Q_{VLV} = 39.32 \ \frac{Btu}{hr}$

$Q_{END} = 67.34$ Btu/hr

$$\begin{cases} C_1 + C_2 = 548 \\ -7.13C_1 + 0.14C_2 = 134.67 \end{cases}$$

$C_1 = -7.97$ $\quad C_2 = 555.97$

$$t = -7.97e^{0.64x} + 555.97e^{-0.64x} + 120$$

@ $x = 3.07$; $t_{FOUND} = 141.08$ °F $\approx t_{ass} = 141.00$

TELEDYNE ENGINEERING SERVICES

4-298

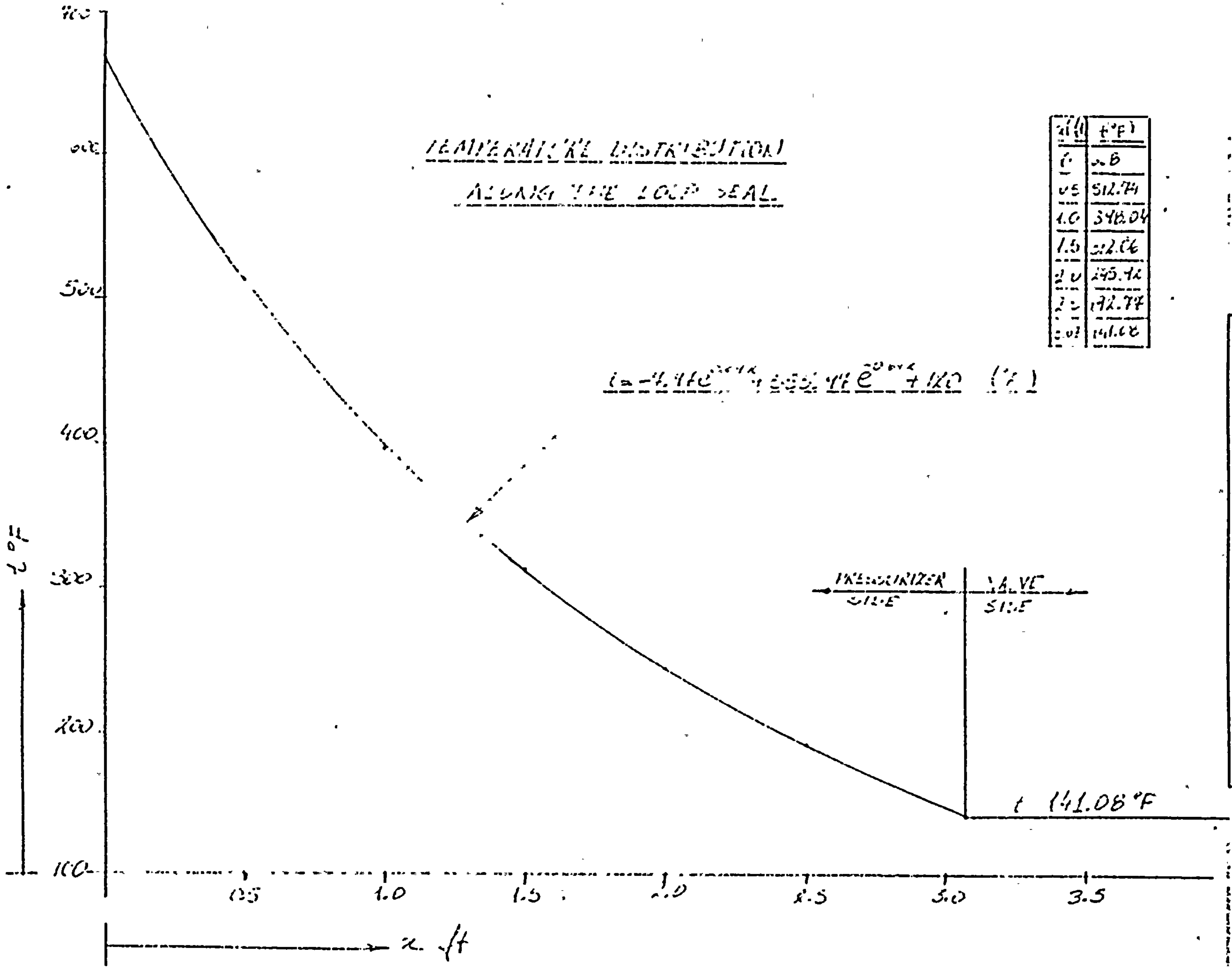
BY [illegible] DATE [illegible]
CHKD. BY [illegible] DATE [illegible]

AEP D.C. COOK
S.V. LINE - TYPICAL TEMP DISTRIBUTION

SHEET NO. 10 OF [illegible]
PROJ. NO. 5364

TEMPERATURE DISTRIBUTION ALONG THE LOOP SEAL

x(ft)	t(°F)
0	[illegible]
0.5	512.74
1.0	348.04
1.5	[illegible]
2.0	245.42
2.5	192.77
3.07	141.08



BY BAT DATE 12-21-81 CHKD. BY [illegible] DATE [illegible]

AEP D.C. COOK UNIT 1
S.V. LINE LCCP SEAL TEMP. DISTRIBUTION

CHECKING $T_r = 0.182 \frac{Btu}{hr\,ft^2\,°F}$ FOR $T_{AVE} = 325°F$ (PAGE 5)

AREA UNDER $t = t(x)$ CURVE @ $0 < x < L_1 = 3.07'$

$$AREA = \int_0^{L_1} t(x)\,dx$$

$$= \int_0^{L_1} [-8.47 e^{(0.64)x} + 555.47 e^{-(.64)x} + 120]\,dx$$

$$= -\frac{8.47}{0.64} e^{0.64x}\Big|_{x=0}^{3.07} - \frac{555.47}{0.64} e^{-(.64)x}\Big|_{x=0}^{3.07} + 120x\Big|_{x=0}^{3.07}$$

$$= (-93.63 + 13.45) - (121.75 - 868.70) + (368.4)$$

$$AREA = 1033.96 \ °F\text{-}ft$$

$$t_{AVE} = \frac{1033.96}{3.07}$$

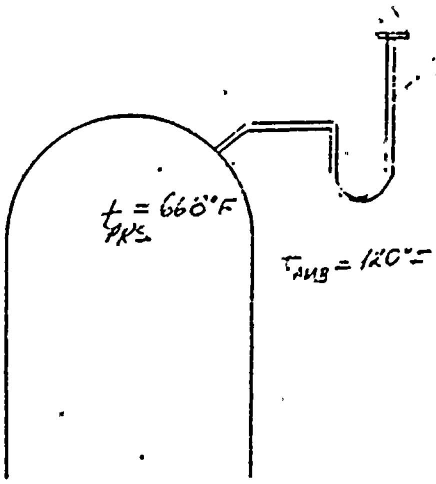
$t_{AVE} = 338.42°F$ — 4% DIFFERENCE FROM THE ASSUMED $t_{AVE} = 325°F$ WHICH IS ACCEPTABLE

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

BY SAJ DATE 12-22-82 | AEP D. C. COOK UNIT 1 — S.V. LINE LOOPSEAL TEMP. DISTRIBUTION | SHEET NO. 12 OF 12
CHKD. BY ___ DATE ___ | PROJ. NO. 5364

CHEKING THE RADIATION EFFECTS ON LOOP SEAL BY TAKING CONSERVATIVE VALUES FOR THE WORST CASE



ASSUME THE LOOPSEAL AS LUMPED VOL.

AVERAGE TEMPERATURE OF LOOP SEAL

$$t_{AVE}\Big)_{LS} = \frac{C\rho A L_1 (338.42) + C\rho A L_2 (141.08)}{C\rho A (L_1 + L_2)} = 205.6$$

$t_{AVE} = 205.60°F = 665.60°R$ $L_1 = 3.07'$

WHERE ρ : DENSITY $L_2 = 6.32'$
A : CROSS-SECTIONAL AREA
C_p : HEAT CAPACITY

FROM PAGE 5 $T_F = .145 \frac{Btu}{hr\,ft^2}$ @ $t = 212.71°F$

$$\frac{q}{A} = (.145)(205.6 - 120) = 12.41 \frac{Btu}{hr\,ft^2}$$

T_S – SURFACE TEMP. OF LOOP SEAL USING NEWTON'S LAW OF COOLING, $h = 5 \frac{Btu}{hr\,°F\,ft^2}$

$12.41 = 5(T_S - 120)$
$T_S = 122.48°F$

PRESSURIZER :

MAX. HEAT LOSS FROM PRESSURIZER $\frac{q}{A} = 80 \frac{Btu}{ft^2\,°F\,hr}$ (REF: METALLIC INSULATION AEP SPEC. NO. DCCSG102QCS)

t_p SURFACE TEMP. OF PRESSURIZER $80 = 5(t_p - 120)$

$t_p = 136°$

ASSUMING : RADIATION SHAPE FACTORS = 0.5
EMISSIVITY ≅ 0.03 (SINCE SURFACES ARE MIRROR)
(REF: MARKS MECH. ENG. HANDBOOK 8th EDITION)

STEFAN-BOLTZMANN CONST. $\sigma = 0.1714 \times 10^{-8} \frac{Btu}{hr\,ft^2\,R^4}$

$$\frac{q}{A}\Big)_{RAD} = \sigma \epsilon F_{12} (T_p^4 - T_S^4) = (0.03)(0.5)(.1714 \times 10^{-8})[596^4 - 582^4]$$

$$\frac{q}{A}\Big)_{RAD} = 0.294 \frac{Btu}{hr\text{-}ft^2}$$

RADIATION HEAT TRANSFER HAS NEGLIGIBLE EFFECT ON LOOP SEAL TEMP. DISTRIBUTION

BY CMM DATE 1-11-82 | TEMPERATURE DISTRIBUTION DETERMINATION - UNIT 2 | SHEET NO. 1 OF 1
CHKD. BY KJG DATE 5-24-83 | | PROJ. NO. 5364

USING THE EQUATION:

$$t = -7.97e^{0.64x} + 555.97e^{-0.64x} + 120 \ (°F).$$

WHERE x = AXIAL DISTANCE AWAY FROM PRESSURIZER ALONG LOOP SEAL

ACCURATE $0 \leq x \leq 3.07$ (FT)

FOR VALUES $x > 3.07$ t = 141.08 °F

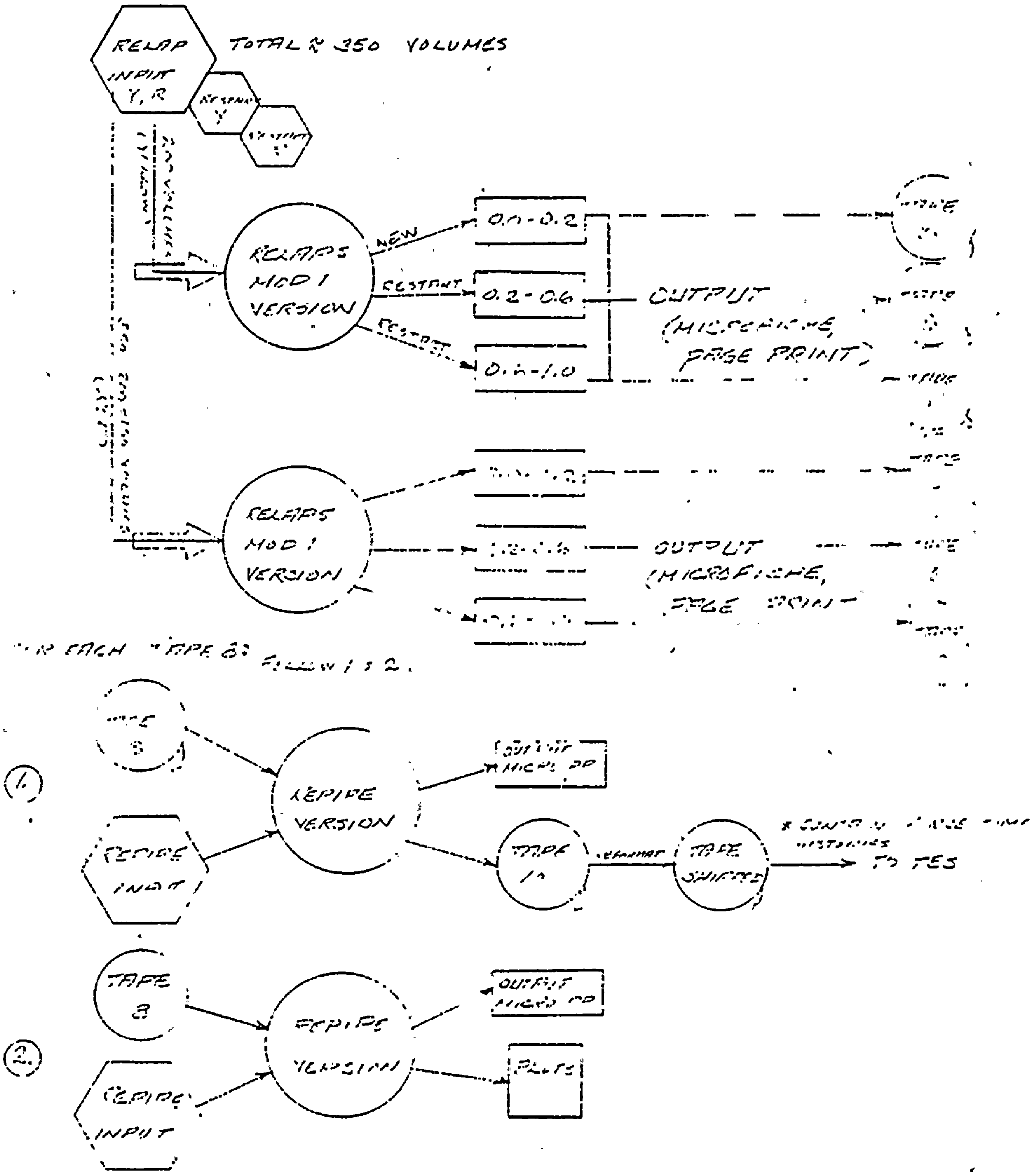
REF: EAI HAND CALC 2-22-82

CONTROL VOLUME	x VALUE (FT)	t (DETERMINED) (°F)
501	0.25	534.4
502	0.75	451.1
503	1.25	352.1
504	1.75	276.8
505	2.25	218.1
506	2.75	169.3
507	3.25	141.1
↓		↓
520	VALVE	

TELEDYNE ENGINEERING SERVICES

BY JHM DATE 5-4-83 | COMPUTER USAGE FOR THERMAL ANALYSIS | SHEET NO. 1 OF 2
CHKD. BY KG DATE 5-24-83 | PROJ. NO. 5364

TRANSIENTS:
1. LOOPSEAL (SATURATED) STEAM CASE @ CDC
2. SOLID 400° WATER CASE

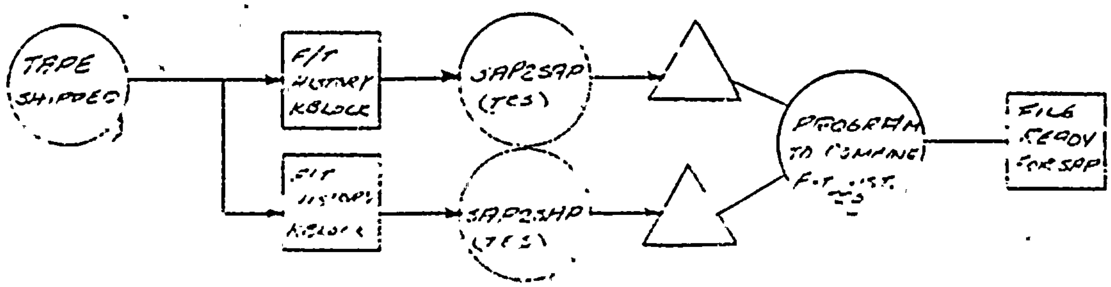


TELEDYNE ENGINEERING SERVICES

BY JHM DATE 5-4-83
CHKD. BY KJG DATE 5-24-83

COMPUTER USAGE FOR THERMAL ANALYSIS.

SHEET NO. 2 OF 2
PROJ. NO. 5364



BY OMM DATE 3-28-83
CHKD. BY KJG DATE 5-9-83

PORV UNIT 1 BOUNDARY CONDITIONS

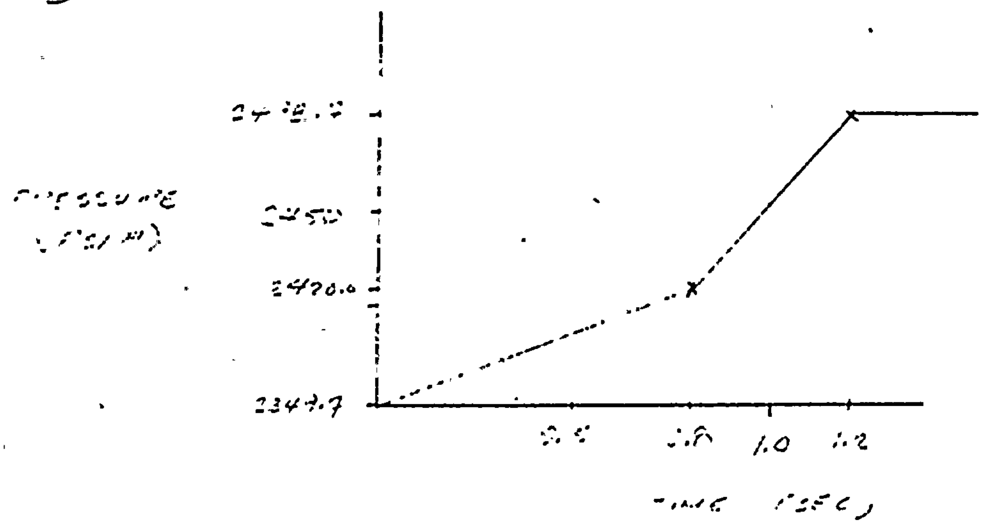
SHEET NO. 1 OF 1
PROJ. NO. 5364

(1.) VALVE OPENING TIME, PORV : 1.0 SEC

MASONEILAN : REF

(TIME) REF: TABLE 4.5.2-1 PG 4-50 EPRI SAFETY & RELIEF VALVE TEST REPORT (NP-2292)

(2.) PRESSURIZER CONDITIONS :



REF : TES LETTER TO LOS 11-29-82 ; CURVE PG 6 OF 7

(3.) VALVE FLOW AREA CALCULATED KNOWING STEAM FLOW RATE = 179,000 lbm/HR. REF: PG 4-53 EPRI SAFETY AND RELIEF VALVE TEST REPORT (NP-2292)
AND RUN BAICORD AREA = 0.00806 FT²

(4.) QUALITY USED IN UPSTREAM PIPING TO SIMULATE CONDENSATE SEE KJG CALC

TELEDYNE ENGINEERING SERVICES

BY JMM	DATE 5-?-83	NON-CONDENSIBLE GAS QUALITY CALCULATION FOR INITIAL COND. UNITS 1 & 2	SHEET NO. 1 OF 1
CHKD. BY [illegible]	DATE 5-26-83		PROJ. NO. 5364

FOR INITIAL CONDITIONS OF:

$P_T = 17.7$ psia

$T = 120°$ F $\qquad P_v = 1.6924$ psia

SPECIFIC HUMIDITY $\gamma = \frac{M_w}{M_a} = \frac{\text{MASS OF WATER VAPOR}}{\text{MASS OF AIR}} = \frac{V_a}{V_w}$

$$\gamma = \frac{R_a T / P_a}{R_w T / P_w} = 0.622 \frac{P_w}{P_a}$$

$$\gamma = 0.622 \frac{1.6924 \text{ psia}}{16.008 \text{ psia}}$$

$$\gamma = 0.06576$$

NONCONDENSIBLE GAS (AIR) QUALITY $= 1 - \gamma = 0.93424$

5.0 STRUCTURAL ANALYSIS

Deadweight, thermal, seismic and force/time history analyses were performed for the pressurizer safety and relief valve discharge piping using the TMRSAP computer program; a modified version of SAPIV. The computer model used was based on TES isometric drawing E-5761, Revision 2 included in Section 7.0. In general, the structural analysis was done in accordance with AEP letter dated November 29, 1982 from Mr. Sam Ulan of AEP to Mr. L. B. Semprucci of TES (Reference 2) and AEP letter dated March 15, 1983 from Mr. Sam Ulan of AEP to Mr. Pat Harrison of TES (Reference 3). Section 6.0 contains all of the results for the analyses performed.

Only the piping shown on drawing E-5761 was included in the analysis. Branch lines not in the scope of work were decoupled in accordance with the procedure outlined in TES letter 5364-21 dated February 2, 1983 (Reference 8); that is if the moment of inertia of the main run of pipe is greater than or equal to 40 times the moment of inertia of the branch, the branch line was decoupled.

Valve drawing 88405-1 listed the weight of valves NMO-151, 152 and 153 as being 352 pounds and this value was used by TES in the deadweight and seismic analyses. However, per Reference 7, TES was informed by AEP that the valve weight was actually 400 pounds. TES reran the deadweight and seismic analyses and determined that the net result of the valve weight change was negligible. Since pipe stresses and support loads had already been extracted and calculated based on the 352 pound valve weight, it was decided not to revise the deadweight and seismic analyses. The valve weight was changed to 400 pounds prior to executing the PORV transient shock analysis.

5.1 Deadweight Analysis

The effects of pipe weight, water weight and insulation weight were considered in the deadweight analysis. In addition, concentrated weights were located wherever branch lines were decoupled, at flanges, and at valve cg's. The weights used for decoupled branch lines were calculated in accordance with the procedure defined in TES letter 5364-25, dated February 14, 1983 (Reference 9). Per Reference 3, only the normal operating deadweight case was analyzed.

A summary of the weights and forces applied in the deadweight analysis are shown in Table 5-1.

5.2 Thermal Analysis

Three thermal cases were analyzed; normal operation, PORV operation, and SV operation. Temperature distributions for the PORV and SV cases were obtained from the RELAP5 output. Throughout this report, thermal case 1 refers to normal operation, thermal case 2 refers to PORV operation, and thermal case 3 refers to SV operation. Results of thermal case 3 are given only for the nodes, supports, and valves which are part of the quarter model, described in Section 2.

Boundary displacements were calculated for the quench tank nozzle, pressurizer nozzles and support 1-GRC-R-616, which connects to the pressurizer, for all thermal conditions analyzed. These calculations are shown in Section 6.6.

5.3 Seismic Analysis

Seismic analysis was performed for both the operating basis earthquake (OBE) and design basis earthquake (DBE). For each of these conditions, two analyses were made; one considering response spectra applied in the X and Y directions and one considering response spectra applied in the Y and Z directions. All seismic values reported in Section 6 are based (per node) on the analysis direction yielding the larger results.

For the OBE analysis, the horizontal spectra was obtained by enveloping Containment Crane Wall Figures for elevations 651'-3", 663'-4", 675'-4" and 687'-6". The figures used were based on .5% equipment damping and 2% structural damping. Prior to enveloping the figures, the peaks of each curve were broadened +/-15%, in accordance with NRC Regulatory Guide 1.122.

For the vertical direction Containment Base Slab, elevation 597'6" was used with .5% equipment damping and 2% structural damping. The peaks of this curve were also broadened +/-15% and two-thirds of the value obtained from the figure was used in the spectra.

For the DBE analysis, the spectra for the horizontal and vertical directions were obtained in the same manner as for the OBE analysis; except that 5% structural damping was used rather than 2%.

The procedures described above are in accordance with the November 29, 1982 letter from AEP (Reference 2) and TES letter 5364-33, dated April 8, 1983 (Reference 10).

The figures used and spectra obtained are detailed in Section 6.6.

5.4 Force/Time History Analysis

5.4.1 PORV Transient

Two potential PORV transients exist, condensate and solid water. Based on a preliminary analysis, of Unit 1, it was determined that the solid water case was the dominating condition throughout the piping system, therefore, only the solid water case was analyzed for Unit 2.

The solid water analysis was performed at one millisecond intervals for a length of one second. All loads peaked previous to one second, indicating that the analysis was performed for a sufficient length of time.

5.4.2 SV Transient

A quarter model analysis was performed for the SV transient shock condition. This analysis, which considered the opening of valve SV-45C only, resulted in catastrophic failure of the piping system. For economic reasons, it was decided that no further evaluation of the SV transient shock condition would be considered until the system was modified.

TELEDYNE ENGINEERING SERVICES

PROJECT: 5364 8 JUNE 1983
D. C. COOK UNIT 2
DEADWEIGHT DATA
TABLE 5-1

BY [signature] DATE 6-8-83
CHKD [signature] DATE 6/8/83
SHEET NO.____ OF ______

MAIN RISER

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER
2	12" SCH. 40	34.748 *	(P) I W
4 THRU 176	12" SCH. 40	4.458	(P) I W
219 THRU 230	6" SCH. 40S	1.582	(P) I W

* FLANGE WEIGHT DISTRIBUTED OVER 2.042' ADDED TO PIPE WEIGHT.

APPLIED FORCES

NODE	FORCE LBS.
50	3281

NOTE; APPLIED FORCES REPRESENT THE SETTINGS OF CONSTANT FORCE SUPPORTS AT THE NODES INDICATED. ALL FORCES ARE APPLIED IN THE +Y GLOBAL DIRECTION.

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
1000	122
1001	20
1005	12

SRV LOOP C (REFERS TO SRV LOOP CONTAINING VALVE SV-45C, THIS NOTATION IS TYPICAL OF LOOPS B AND A ALSO.)

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER
72 THRU 97	6" SCH. 40S	1.582	(P) I W
94 THRU 103	6" SCH. 40S	2.632	(P) (I) W
107 THRU 116	6" SCH. 160	5.575	(P) (I) (W)
118 THRU 124	6" SCH. 160	4.904	(P) (I) W

APPLIED FORCES

NODE	FORCE LBS.
99	1054

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
102	81
105	685
1006	164

TELEDYNE ENGINEERING SERVICES

PROJECT: 5364 8 JUNE 1983
D. C. COOK UNIT 2
DEADWEIGHT DATA

TABLE 5-1 Cont.

BY DWB DATE 6-8-83
CHKD DMD DATE 6/8/83
SHEET NO.____ OF ______

SRV LOOP B

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER		
126 THRU 143	6" SCH. 40S	1.582	(P)	I	W
144 THRU 152	6" SCH. 40S	2.632	(P)	(I)	W
156 THRU 166	6" SCH. 160	5.575	(P)	(I)	(W)
168 THRU 174	6" SCH. 160	4.904	(P)	(I)	W

APPLIED FORCES

NODE	FORCE LBS.
147	1072

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
153	81
1540	685
155	164
1007	14

SRV LOOP A

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER		
176 THRU 187	6" SCH. 40S	1.582	(P)	I	W
188 THRU 196	6" SCH. 40S	2.632	(P)	(I)	W
200 THRU 210	6" SCH. 160	5.575	(P)	(I)	(W)
212 THRU 218	6" SCH. 160	4.904	(P)	(I)	W

APPLIED FORCES

NODE	FORCE LBS.
189	983

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
197	81
1980	685
199	164
1008	14

TECHNICAL REPORT TR - 5364 - 2
REV. NO. 0

TELEDYNE ENGINEERING SERVICES

PROJECT: 5364 8 JUNE 1983
D. C. COOK UNIT 2
DEADWEIGHT DATA TABLE 5-1 Cont.

BY DMB DATE 6-8-83
CHKD DMB DATE 6/8/83
SHEET NO.____ OF ________

PORV LOOP 151 (REFERS TO PORV LOOP CONTAINING VALVES NMO-151 AND NRV-151, THIS NOTATION IS TYPICAL OF LOOPS 152 AND 153 ALSO.)

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER		
230	3" SCH. 40S	.632	(P)	I	W
286 THRU 292	3" SCH. 40S	1.190	(P)	(I)	W
296 THRU 308	3" SCH. 160	1.948	(P)	(I)	(W)
310 THRU 316	3" SCH. 160	1.753	(P)	(I)	W
318 THRU 330	4" SCH. 120	2.200	(P)	(I)	W
332 THRU 342	6" SCH. 160	4.825	(P)	(I)	W

APPLIED FORCES

NODE	FORCE LBS.
290	798
304	858
316	634

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
295	480
301	400
1003	14
1002	14

TECHNICAL REPORT TR - 5364 - 2
REV. NO. 0

TELEDYNE ENGINEERING SERVICES

PROJECT: 5364 8 JUNE 1983
D. C. COOK UNIT 2
DEADWEIGHT DATA
TABLE 5-1 Cont.

BY AWB DATE 6-8-83
CHKD DMD DATE 6/8/83
SHEET NO.____ OF ______

PORV LOOP 152

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER
240 THRU 402	3" SCH. 40S	.632	(P) I W
404 THRU 346	3" SCH. 40S	1.190	(P) (I) W
350 THRU 320	3" SCH. 160	1.948	(P) (I) (W)

APPLIED FORCES

NODE	FORCE LBS.
400	732

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
349	480
355	400

PORV LOOP 153

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER
232 THRU 240	4" SCH. 40S	.899	(P) I W
242 THRU 259	3" SCH. 40S	.632	(P) I W
257 THRU 262	3" SCH. 40S	1.190	(P) (I) W
266 THRU 276	3" SCH. 160	1.948	(P) (I) (W)
278 THRU 284	3" SCH. 160	1.772	(P) (I) W

APPLIED FORCES

NODE	FORCE LBS.
261	720
274	637

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
265	480
271	400
1004	14

6.0 ANALYTICAL RESULTS

6.1 Stress Summary

Stress calculations were based on the 1967 Edition of the ANSI B31.1 Code (Reference 11), the AEP letter dated November 29, 1982 (Reference 2), and the AEP letter dated March 15, 1983 (Reference 3). These stress combinations were performed:

A1 normal pressure stress + deadweight stress $\leq S_h$

A2 normal thermal stress range $\leq (1.25\ S_c + .25\ S_h)$

B1 normal pressure stress + deadweight stress + OBE stress $\leq 1.2\ S_h$

B2 PORV transient pressure stress + deadweight stress + $\left[(\text{OBE stress})^2 + (\text{PORV transient shock stress})^2\right]^{1/2} \leq 1.2\ S_h$

B3 PORV transient thermal stress range $\leq 1.25\ S_c + .25\ S_h$

C1 normal pressure stress + deadweight stress + DBE stress $\leq 1.8\ S_h$

C2 SV transient pressure stress + deadweight stress + SV transient shock stress $\leq 1.8\ S_h$

C3 SV transient thermal stress range $\leq 1.25\ S_c + .25\ S_h$

Stresses were not calculated for equation A3 since all node points passed the equation A2 stress criteria with the exception of node 230B. For this node, equation A3 stress was calculated and was less than the allowable. Stresses for equations C2 and C3 are presented only for those nodes that are part of the quarter model.

The TMRPASS computer program was used, when possible, to aid in the stress calculations. The program; however, does not allow for intensification factors to be omitted in the torsional direction as does the B31.1 code, therefore, at any intensified nodes, the torsional moments are intensified.

Allowable stresses were obtained by using the maximum temperature experienced during any loading case to determine S_h. The value of S_c was based on 70°F per Reference 2. A summary of the allowable stresses is given in Table 6.1-1.

Section 119.6.1 of the B31.1 code indicates that the thermal range stress calculations shall be based on the range between the minimum and maximum temperature. The worst thermal moments due to all conditions considered were reviewed and found to be satisfactory.

Stresses were calculated as follows:

Pressure

$$\frac{Pd^2}{D^2-d^2}$$

Deadweight

$$\frac{.75i\ M_A}{Z}$$

Thermal

$$\frac{i\ M_C}{Z}$$

Seismic

$$\frac{.75i\ M_B}{Z}$$

Force/Time History

$$\frac{.75i\ M_D}{Z}$$

where:

d = inside diameter of pipe
D = outside diameter of pipe
i = intensification factor
M_A = resultant moment due to deadweight loadings
M_B = resultant moment due to seismic loadings
M_C = range of resultant moments due to thermal loadings
M_D = resultant moment due to force/time history analysis

TECHNICAL REPORT TR - 5364 - 2
REV. NO. 0

TELEDYNE ENGINEERING SERVICES

PROJECT: 5364 3 JUNE 1983
D. C. COOK UNIT 2
SUMMARY OF ALLOWABLES TABLE 6.1-1

BY AMB DATE 6-3-83
CHKD DMD DATE 6/3/83
SHEET NO._____ OF __________

MAIN RISER

NODES	MATERIAL	TEMPERATURE (F)	Sh (PSI)
2 THRU 24	SA-358-316 CL 1	430	16210
26 THRU 36	"	326	16744
38 THRU 51	"	337	16678
52 THRU 71	"	354	16576
72 THRU 219	"	348	16612
222 THRU 226	SA-312-304	380	15070
228 THRU 230	"	413	14898

SRV LOOPS

NODES LOOP C	NODES LOOP B	NODES LOOP A	MATERIAL	TEMPERATURE (F)	Sh (PSI)
72 THRU 82	126 THRU 136	176 THRU 182	SA-312-304	348	15262
84 THRU 92	138 THRU 143	184 THRU 187	"	370	15130
94 THRU 96	144 THRU 146	188 THRU 190	"	430	14830
98	148	195	"	460	14710
103	152	196	"	460	11740 *
107	156	200	SA-376-316	653	11600 *
108 THRU 124	158 THRU 174	202 THRU 218	SA-376-316	653	16000

NOTE; LOOP C REFERS TO SRV LOOP CONTAINING VALVE SV-45C THIS IS TYPICAL OF LOOPS B AND A ALSO.
* ALLOWABLE AS PER NOTE (6),TABLE A-1 OF B 31.1.0, 1967 CODE.

TECHNICAL REPORT TR - 5364 - 2
REV. NO. 0

TELEDYNE ENGINEERING SERVICES

PROJECT: 5364 3 JUNE 1983
D. C. COOK UNIT 2
SUMMARY OF ALLOWABLES TABLE 6.1-1 Cont.

BY AMB DATE 6-3-83
CHKD DMD DATE 6/3/83
SHEET NO._____ OF __________

PORV LOOP 151

NODES	MATERIAL	TEMPERATURE (F)	Sh (PSI)
230	SA-312-304	413	14898
286 THRU 290	"	480	14630
292 THRU 318	"	653	14300
320 THRU 342	SA-376-316	653	16000

PORV LOOP 152

NODES	MATERIAL	TEMPERATURE (F)	Sh (PSI)
240 THRU 344	SA-312-304	480	14630
346	SA-312-304	653	14300
350 THRU 356	SA-376-304	653	14300

PORV LOOP 153

NODES	MATERIAL	TEMPERATURE (F)	Sh (PSI)
232 THRU 236	SA-312-304	413	14898
238 THRU 260	SA-312-304	480	14630
262	SA-312-304	653	14300
266 THRU 284	SA-376-304	653	14300

NOTE: PORV LOOP 151 REFERS TO THE PORV LOOP CONTAINING VALVES NMO-151 AND NRV-151. THIS IS TYPICAL OF LOOPS 152 AND 153.

6.1.1 Equation A-1 Stresses

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SmS DATE: 5/4/83
CHECKED BY: [illegible] DATE: 5-4-83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
2	0	0	0	16.2
4	↓	.3	.3	↓
6	↓	.4	.4	↓
7	↓	.2	.2	↓
8	↓	.3	.3	↓
10	↓	.7	.7	↓
12	↓	1.0	1.0	↓
14	↓	.5	.5	↓
16	↓	.6	.6	↓
18	↓	1.1	1.1	↓
20	↓	1.5	1.5	↓
21	↓	.8	.8	↓
24	↓	.8	.8	↓
26	↓	.8	.8	16.7
28	↓	.9	.9	↓
32	↓	.5	.5	↓
33	↓	.9	.9	↓
34	↓	1.0	1.0	↓
36	↓	1.0	1.0	↓
38	↓	.9	.9	16.7

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/11/83

CHECKED BY: ________ DATE: ________

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
40	0	.4	.4	16.7
42		.3	.3	
44		.9	.9	
46		1.3	1.3	
48		.6	.6	
49		.6	.6	
50		.6	.6	
51		.4	.4	
52		.4	.4	16.6
54		.2	.2	
56		.4	.4	
58		.6	.6	
60		.3	.3	
62		.6	.6	
64		.4	.4	
66		.3	.3	
68		.3	.3	
70		.2	.2	
71		.3	.3	
72R		.4	.4	16.6

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: Sms DATE: 5/4/83
CHECKED BY: JMB DATE: 5-4-83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
72R	0	.6	.6	16.6
73		.4	.4	
126R		.6	.6	
126R		.6	.6	
127		.4	.4	
176R		.3	.3	
176R		.2	.2	
219		.4	.4	
222		1.5	1.5	15.1
224		2.9	2.9	
226		2.6	2.6	
228		1.3	1.3	14.9
230R		.9	.9	
230R		1.6	1.6	
232		3.0	3.0	
234		2.9	2.9	
236		2.0	2.0	
238		1.3	1.3	14.6
240R		1.1	1.1	
240R		1.3	1.3	

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 5/4/83
CHECKED BY: [signature] DATE: 5-4-83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
242	0	2.0	2.0	14.6
244	↓	1.6	1.6	↓
246	↓	1.2	1.2	↓
248	↓	1.1	1.1	↓
250	↓	1.5	1.5	↓
252	↓	1.8	1.8	↓
258	↓	1.7	1.7	↓
259	↓	1.5	1.5	↓
257	↓	2.6	2.6	↓
260	↓	1.3	1.3	↓
262	↓	2.9	2.9	14.3
266	2.9	3.0	5.9	↓
268	↓	3.6	6.5	↓
272	↓	3.5	6.4	↓
274	↓	2.7	5.6	↓
276	↓	3.1	6.0	↓
278	↓	3.4	6.3	↓
279	↓	3.4	6.3	↓
280	↓	2.2	5.1	↓
282	↓	1.6	4.5	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SmS DATE: 5/4/83
CHECKED BY: DMB DATE: 5-4-83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
284B	2.9	.9	3.8	14.3
72B	0	2.0	2.0	15.3
74	↓	1.0	1.0	↓
76		.6	.6	
78		.3	.3	
80		.3	.3	
82		.4	.4	
84		.4	.4	15.1
86		.3	.3	↓
88		1.2	1.2	
90		1.5	1.5	
92		.9	.9	
97		1.0	1.0	14.8
94		1.2	1.2	↓
100		.3	.3	
96		.5	.5	
98		.8	.8	14.7
103		.5	.5	11.7
107	3.5	.7	4.2	11.6
108	3.5	.8	4.3	16.0

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DWB DATE: 5-4-83
CHECKED BY: DMD DATE: 5/4/83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
110	3.5	.6	4.1	16.0
111		.6	4.1	
112		.6	4.1	
114		.3	3.8	
116		.3	3.8	
118		.6	4.1	
120		.7	4.2	
122		1.0	4.5	
124	↓	1.0	4.5	↓
126B	0	.7	.7	15.3
128		.4	.4	
130		.4	.4	
132		.4	.4	
134		.2	.2	
136		.2	.2	↓
138		1.0	1.0	15.1
140		1.4	1.4	
142		.8	.8	
143		.9	.9	↓
144	↓	1.1	1.1	14.8

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMB DATE: 5-4-83
CHECKED BY: DMS DATE: 5/4/83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
145	0	.3	.3	14.8
146		.6	.6	14.8
148		1.0	1.0	14.7
152		.5	.5	11.7
156	3.5	.8	4.3	11.6
158		.9	4.4	16.0
160		.7	4.2	
161		.7	4.2	
162		.7	4.2	
164		.5	4.0	
166		.5	4.0	
168		.8	4.3	
170		.9	4.4	
172		1.2	4.7	
174		1.2	4.7	
176 B	0	.7	.7	15.3
178		.6	.6	
180		.3	.3	
182		.3	.3	
184		.9	.9	15.1

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMB DATE: 5-4-83
CHECKED BY: SMS DATE: 5/4/83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
186	0	1.3	1.3	15.1
187		.9	.9	15.1
188		1.0	1.0	14.8
192		.3	.3	
190		.5	.5	
195		1.0	1.0	14.7
196		.6	.6	11.7
200	3.5	.8	4.3	11.6
202		.9	4.4	16.0
204		.6	4.1	
205		.6	4.1	
206		.6	4.1	
208		.3	3.8	
210		.3	3.8	
212		.7	4.2	
214		.8	4.3	
216		1.1	4.6	
218		1.1	4.6	
230B	0	3.2	3.2	14.9
286	0	6.4	6.4	14.6

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/4/83
CHECKED BY: DWB DATE: 5-4-83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
288	0	6.7	6.7	14.6
290	↓	3.6	3.6	14.6
292	⊥	3.9	3.9	14.3
296	2.9	2.1	5.0	↓
298	↓	1.4	4.3	↓
302	↓	1.8	4.7	↓
304	↓	2.5	5.4	↓
306	↓	2.0	4.9	↓
308	↓	1.7	4.6	↓
310	↓	1.3	4.2	↓
312	↓	3.2	6.1	↓
314	↓	.9	3.8	↓
316	⊥	1.1	4.0	↓
318	4.1	5.6	9.7	⊥
320R	↓	4.3	8.4	16.0
320R	↓	3.1	7.2	↓
322	↓	3.3	7.4	↓
324	↓	3.1	7.2	↓
325	↓	3.1	7.2	↓
326	⊥	2.7	6.8	⊥

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/4/83
CHECKED BY: DMB DATE: 5-4-83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
328	4.1	2.5	6.6	16.0
330	↓	2.4	6.5	↓
332	↓	2.6	6.7	↓
334	3.5	.8	4.3	↓
336	↓	.7	4.2	↓
284R	↓	.7	4.2	16.0
284R	↓	.6	4.1	↓
338	↓	.4	3.9	↓
339	↓	.6	4.1	↓
340	↓	.7	4.2	↓
342	↓	.8	4.3	↓
240B	0	1.3	1.3	14.6
241	↓	1.3	1.3	↓
402	↓	3.5	3.5	↓
404	↓	4.7	4.7	↓
344	↓	3.5	3.5	↓
346	↓	.9	.9	14.3
350	2.9	.7	3.6	↓
352	↓	.9	3.8	↓
356	↓	.4	3.3	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/4/83
CHECKED BY: DMB DATE: 5-4-83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
320B	2.9	3.1	6.0	16.0

6.1.2 Equation A-2 Stresses

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DmD DATE: 5/4/83
CHECKED BY: RMB DATE: 5-4-83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
2	.7	27.6
4	7.2	
6	6.7	
7	2.5	
8	2.6	
10	7.4	
12	8.2	
14	3.2	
16	3.7	
18	10.1	
20	8.8	
21	3.3	
24	3.3	
26	5.4	27.7
28	7.2	
32	2.7	
33	7.4	
34	9.2	
36	10.4	
38	10.7	

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SMD DATE: 5/4/83
CHECKED BY: AMB DATE: 5-4-83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
40	9.8	27.7
42	9.9	↓
44	12.0	↓
46	11.9	↓
48	2.6	↓
49	2.5	↓
50	2.3	↓
51	1.4	↓
52	2.8	↓
54	2.8	↓
56	2.8	↓
58	2.9	↓
60	1.1	↓
62	2.9	↓
64	2.8	↓
66	2.9	↓
68	3.1	↓
70	1.1	↓
71	1.1	↓
72R	2.3	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 5/4/83
CHECKED BY: [signature] DATE: 5-4-83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
72 R	2.2	27.7
73	1.1	↓
126R	1.7	↓
126R	2.1	↓
127	.6	↓
176R	.9	↓
176R	2.8	↓
219	4.5	↓
222	10.3	27.2
224	12.2	↓
226	10.2	↓
228	4.5	↓
230R	7.5	↓
230R	2.5	↓
232	3.0	↓
234	2.9	↓
236	3.3	↓
238	7.2	27.1
240R	8.7	↓
240R	12.1	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DmD DATE: 5/4/83
CHECKED BY: DMB DATE: 5-4-83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
242	9.8	27.1
244	11.2	↓
246	16.7	
248	13.2	
250	23.5	
252	14.2	
258	9.5	
259	9.2	
257	16.4	
260	15.2	↓
262	8.1	27.0
266	4.2	↓
268	3.9	
272	3.8	
274	3.9	
276	4.0	
278	4.2	
279	4.1	
280	5.1	
282	5.3	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SmS DATE: 5/4/83
CHECKED BY: DMB DATE: 5-4-83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
284B	6.4	27.0
72B	4.3	27.3
74	2.5	
76	2.2	
78	1.9	
80	1.8	
82	2.1	
84	2.5	27.2
86	2.4	
88	5.0	
90	4.6	
92	1.9	
97	.6	27.1
94	.9	
100	1.0	
96	2.2	
98	2.8	
103	1.2	26.4
107	.5	26.4
108	.5	27.4

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SMB DATE: 5/4/83
CHECKED BY: DMB DATE: 5-4-83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
110	.7	27.4
111	.6	↓
112	.7	↓
114	.8	↓
116	.8	↓
118	.8	↓
120	.8	↓
122	.8	↓
124	.7	↓
126B	6.8	27.3
128	3.0	↓
130	2.5	↓
132	2.5	↓
134	2.8	↓
136	2.9	↓
138	6.7	27.2
140	6.3	↓
142	2.6	↓
143	.9	↓
144	1.0	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/4/83
CHECKED BY: DMB DATE: 5-4-83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
145	1.5	27.1
146	4.7	27.1
148	5.4	27.1
152	1.8	26.4
156	1.7	26.4
158	.9	27.4
160	1.2	
161	1.1	
162	1.2	
164	1.4	
166	1.3	
168	1.2	
170	1.2	
172	1.2	
174	1.1	
176B	10.0	27.3
178	4.5	27.3
180	3.5	27.3
182	3.3	27.3
184	7.9	27.2

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/4/83
CHECKED BY: [signature] DATE: 5-4-83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
186	7.4	27.2
187	.6	27.2
188	2.0	27.1
192	2.2	27.1
190	4.9	27.1
195	5.8	27.1
196	2.6	26.4
200	1.2	26.4
202	1.8	27.4
204	2.4	↓
205	2.2	↓
206	2.4	↓
208	2.7	↓
210	2.4	↓
212	2.2	↓
214	2.2	↓
216	2.2	↓
218	2.0	↓
230 B	29.6*	27.2
286	6.9	27.1

* EQUATION A3 STRESS IS $32.8 < 42.1 = 1.25(S_C + S_H)$
∴ node 230 B stress is acceptable

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/4/83
CHECKED BY: DMB DATE: 5-4-83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
288	10.3	27.1
290	5.3	27.1
292	5.0	27.0
296	2.8	
298	3.4	
302	4.3	
304	4.6	
306	5.6	
308	6.6	
310	5.4	
312	6.9	
314	1.7	
316	2.3	
318	1.7	
320R	1.5	27.4
320R	2.7	
322	2.3	
324	3.6	
325	3.0	
326	5.9	

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: Smd DATE: 5/4/83
CHECKED BY: RMB DATE: 5-4-83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
328	6.2	27.4
330	5.6	↓
332	6.3	↓
334	2.1	↓
336	2.6	↓
284 R	2.4	27.4
284 R	2.7	↓
338	3.9	↓
339	5.3	↓
340	5.6	↓
342	5.1	↓
240 B	15.3	27.1
241	5.7	↓
402	6.3	↓
404	11.2	↓
344	14.2	↓
346	7.2	27.0
350	3.5	↓
352	3.4	↓
356	3.9	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SmS DATE: 5/4/83
CHECKED BY: DMB DATE: 5-4-83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
320B	6.5	27.4

6.1.3 Equation B-1 Stresses

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DATE: 5/4/83
CHECKED BY: DATE: 5-4-83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)		ALLOWABLE STRESS (KSI)
2	0	0	0	0		19.5
4		.3	.2	.5	XY	
6		.4	0	.4	XY	
7		.2	0	.2	XY	
8		.3	0	.3	XY	
10		.7	.1	.8	XY	
12		1.0	0	1.0	XY	
14		.5	.1	.6	XY	
16		.6	0	.6	XY	
18		1.1	.1	1.2	XY	
20		1.5	.2	1.7	XY	
21		.8	0	.8	YZ	
24		.8	0	.8	YZ	
26		.8	.3	1.1	YZ	20.1
28		.9	.2	1.1	XY YZ	
32		.5	.1	.6	XY	
33		.9	.2	1.1	XY	
34		1.0	.1	1.1	XY	
36		1.0	.1	1.1	XY	
38		.9	.2	1.1	XY	20.0

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: Smd DATE: 5/4/83
CHECKED BY: DMB DATE: 5-4-83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
40	0	.4	.2	.6 XY	20.0
42	↓	.3	.3	.6 XY	↓
44		.9	.2	1.1 YZ	
46		1.3	.2	1.5 XY	
48		.6	.3	.9 YZ	
49		.6	.2	.8 YZ	
50		.6	.2	.8 XY	
51		.4	.3	.7 XY	
52		.4	.2	.6 XY YZ	19.9
54		.2	.1	.3 YZ	↓
56		.4	.1	.5 YZ	
58		.6	.2	.8 XY	
60		.3	.1	.4 XY	
62		.6	.2	.8 XY	
64		.4	.2	.6 XY	
66		.3	.2	.5 XY	
68		.3	.2	.5 XY	
70		.2	.3	.5 YZ	
71		.3	.4	.7 YZ	
72R		.4	.8	1.2 YZ	19.9

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DHB DATE: 5/4/83
CHECKED BY: [illegible] DATE: 5-4-83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
72R	0	.6	.8	1.4 YZ	19.9
73		.4	.6	1.0 YZ	
126R		.6	.8	1.4 YZ	
126R		.6	.9	1.5 YZ	
127		.4	.5	.9 YZ	
176R		.3	.5	.8 YZ	
176R		.2	.4	.6 YZ	
219		.4	1.1	1.5 YZ	
222		1.5	2.8	4.3 YZ	18.1
224		2.9	2.0	4.9 YZ	
226		2.6	2.5	5.1 YZ	
228		1.3	1.9	3.2 YZ	17.9
230R		.9	2.4	3.3 YZ	
230R		1.6	2.1	3.7 YZ	
232		3.0	2.3	5.3 YZ	
234		2.9	2.3	5.2 YZ	
236		2.0	2.2	4.2 YZ	
238		1.3	3.7	5.0 XY	17.6
240R		1.1	4.0	5.1 XY	
240R		1.3	2.9	4.2 YZ	

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/4/83
CHECKED BY: DMB DATE: 5-4-83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
242	0	2.0	3.5	5.5 YZ	17.6
244		1.6	2.6	4.2 YZ	
246		1.2	2.8	4.0 YZ	
248		1.1	4.0	5.1 YZ	
250		1.5	5.3	6.8 YZ	
252		1.8	7.7	9.5 YZ	
258		1.7	8.6	10.3 YZ	
259		1.5	7.6	9.1 YZ	
257		2.6	10.2	12.8 YZ	
260		1.3	7.8	9.1 YZ	
262		2.9	5.5	8.4 YZ	17.2
266	2.9	3.0	2.3	8.2 XY	
268		3.6	2.4	8.9 YZ	
272		3.5	3.1	9.5 YZ	
274		2.7	2.9	8.5 YZ	
276		3.1	2.8	8.8 YZ	
278		3.4	2.9	9.2 YZ	
279		3.4	2.9	9.2 YZ	
280		2.2	4.7	9.8 YZ	
282		1.6	5.1	9.6 YZ	

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 5/4/83
CHECKED BY: [signature] DATE: 5-4-83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
284B	2.9	.9	6.7	10.5 YZ	17.2
72B	0	2.0	1.1	3.1 XY	18.3
74		1.0	.7	1.7 XY	
76		.6	.5	1.1 XY	
78		.3	.4	.7 XY	
80		.3	.2	.5 XY	
82		.4	.3	.7 YZ	
84		.4	.6	1.0 YZ	18.2
86		.3	.7	1.0 YZ	
88		1.2	1.2	2.4 YZ	
90		1.5	1.4	2.9 YZ	
92		.9	.8	1.7 YZ	
97		1.0	.9	1.9 YZ	17.8
94		1.2	1.3	2.5 YZ	
100		.3	1.3	1.6 YZ	
96		.5	2.3	2.8 YZ	
98		.8	2.4	3.2 YZ	17.7
103		.5	1.4	1.9 YZ	14.1
107	3.5	.7	.4	4.6 XY	13.9
108	3.5	.8	2.2	6.5 YZ	19.2

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMB DATE: 5/4/83
CHECKED BY: AMB DATE: 5-4-83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
110	3.5	.6	2.5	6.6 YZ	19.2
111	↓	.6	2.5	6.6 YZ	↓
112	↓	.6	2.5	6.6 YZ	↓
114	↓	.3	2.2	6.0 YZ	↓
116	↓	.3	1.4	5.2 YZ	↓
118	↓	.6	1.2	5.3 YZ	↓
120	↓	.7	1.2	5.4 YZ	↓
122	↓	1.0	1.3	5.8 XY	↓
124	↓	1.0	1.3	5.8 XY	↓
126B	0	.7	1.0	1.7 XY	18.3
128	↓	.4	.4	.8 XY	↓
130	↓	.4	.3	.7 YZ	↓
132	↓	.4	.4	.8 XY	↓
134	↓	.2	.7	.9 XY	↓
136	↓	.2	1.0	1.2 XY	↓
138	↓	1.0	2.0	3.0 XY	18.2
140	↓	1.4	2.1	3.5 XY	↓
142	↓	.8	1.3	2.1 XY	↓
143	↓	.9	1.3	2.2 XY	↓
144	↓	1.1	1.3	2.4 XY	17.8

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DHD DATE: 5/4/83
CHECKED BY: DMB DATE: 5-4-83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
145	0	.3	1.4	1.7 XY	17.8
146	↓	.6	3.2	3.8 XY	17.8
148	↓	1.0	3.3	4.3 XY	17.7
152	↓	.5	1.5	2.0 XY	14.1
156	3.5	.8	.5	4.8 YZ	13.9
158	↓	.9	2.5	6.9 XY	19.2
160	↓	.7	2.9	7.1 XY	↓
161	↓	.7	2.9	7.1 XY	↓
162	↓	.7	2.9	7.1 XY	↓
164	↓	.5	2.5	6.5 XY	↓
166	↓	.5	1.5	5.5 XY	↓
168	↓	.8	1.2	5.5 YZ	↓
170	↓	.9	1.3	5.7 YZ	↓
172	↓	1.2	1.5	6.2 YZ	↓
174	↓	1.2	1.5	6.2 YZ	↓
176B	0	.7	.7	1.4 YZ	18.3
178	↓	.6	.4	1.0 YZ	↓
180	↓	.3	.8	1.1 YZ	↓
182	↓	.3	1.3	1.6 YZ	↓
184	↓	.9	2.5	3.4 YZ	18.2

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 5/4/83
CHECKED BY: [signature] DATE: 5-4-83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
186	0	1.3	2.5	3.8 YZ	18.2
187		.9	1.2	2.1 YZ	18.2
188		1.0	1.1	2.1 YZ	17.8
192		.3	1.1	1.4 YZ	17.8
190		.5	1.9	2.4 YZ	17.8
195		1.0	1.9	2.9 YZ	17.7
196		.6	1.1	1.7 YZ	14.1
200	3.5	.8	.5	4.8 XY	13.9
202		.9	2.2	6.6 YZ	19.2
204		.6	2.6	6.7 YZ	
205		.6	2.6	6.7 YZ	
206		.6	2.6	6.7 YZ	
208		.3	2.3	6.1 YZ	
210		.3	1.4	5.2 YZ	
212		.7	1.1	5.3 XY	
214		.8	1.2	5.5 XY	
216		1.1	1.4	6.0 XY	
218		1.1	1.4	6.0 XY	
230B	0	3.2	9.5	12.7 YZ	17.9
286	0	6.4	6.3	12.7 YZ	17.6

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 5/4/83
CHECKED BY: [illegible] DATE: 5-4-83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
288	0	6.7	5.8	12.5 YZ	17.6
290		3.6	4.7	8.3 YZ	17.6
292		3.9	5.2	9.1 YZ	17.2
296	2.9	2.1	4.0	9.0 YZ	
298		1.4	3.5	7.8 YZ	
302		1.8	4.0	8.7 YZ	
304		2.5	3.8	9.2 YZ	
306		2.0	3.8	8.7 YZ	
308		1.7	4.0	8.6 YZ	
310		1.3	3.9	8.1 YZ	
312		3.2	3.4	9.5 YZ	
314		.9	2.6	6.4 YZ	
316		1.1	2.6	6.6 YZ	
318	4.1	5.6	1.9	11.6 XY	
320 R		4.3	1.4	9.8 XY	19.2
320 R		3.1	1.5	8.7 YZ	
322		3.3	1.6	9.0 YZ	
324		3.1	1.6	8.8 YZ	
325		3.1	1.6	8.8 YZ	
326		2.7	1.9	8.7 YZ	

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMB DATE: 5/4/83
CHECKED BY: DMB DATE: 5-4-83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
328	4.1	2.5	1.7	8.3 YZ	17.2
330	↓	2.4	1.7	8.2 YZ	19.2
332	↓	2.6	2.1	8.8 YZ	↓
334	3.5	.8	.6	4.9 YZ	↓
336	↓	.7	.7	4.9 YZ	↓
284R	↓	.7	.6	4.8 YZ	19.2
284R	↓	.6	.8	4.9 YZ	↓
338	↓	.4	.9	4.8 YZ	↓
339	↓	.6	1.1	5.2 YZ	↓
340	↓	.7	1.2	5.4 YZ	↓
342	↓	.8	1.1	5.4 YZ	↓
240B	0	1.3	6.9	8.2 XY	17.6
241	↓	1.3	5.4	6.7 XY	↓
402	↓	3.5	4.0	7.5 XY	↓
404	↓	4.7	5.3	10.0 XY	↓
344	↓	3.5	4.7	8.2 XY	↓
346	↓	.9	4.0	4.9 XY	17.2
350	2.9	.7	3.1	6.7 XY	↓
352	↓	.9	2.7	6.5 XY	↓
356	↓	.4	3.1	6.4 XY	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/4/83
CHECKED BY: [illegible] DATE: 5-4-83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
320B	2.9	3.1	4.0	10.0 XY	19.2

6.1.4 Equation B-2 Stresses

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: Dmb DATE: 6/8/83
CHECKED BY: [illegible] DATE: 6-8-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
2	.6	0	0	0	.6	19.5
4	↓	.3	.2	.1	1.1	↓
6	↓	.4	0	0	1.0	↓
7	↓	.2	0	0	.8	↓
8	↓	.3	0	0	.9	↓
10	↓	.7	.1	0	1.4	↓
12	↓	1.0	0	0	1.6	↓
14	↓	.5	.1	.1	1.2	↓
16	↓	.6	0	.1	1.3	↓
18	↓	1.1	.1	.1	1.8	↓
20	↓	1.5	.2	.1	2.3	↓
21	.7	.8	0	.1	1.6	↓
24	↓	.8	0	.1	1.6	↓
26	↓	.8	.3	.2	1.9	20.1
28	↓	.9	.2	.1	1.8	↓
32	↓	.5	.1	.1	1.3	↓
33	↓	.9	.2	.1	1.8	↓
34	↓	1.0	.1	.1	1.8	↓
36	↓	1.0	.1	.1	1.8	↓
38	↓	.9	.2	.1	1.8	20.0

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: Smd DATE: 6/8/83

CHECKED BY: RMB DATE: 6-8-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
40	.7	.4	.2	.2	1.4	20.0
42		.3	.3	.2	1.4	
44		.9	.2	.2	1.9	
46		1.3	.2	.1	2.2	
48		.6	.3	.4	1.8	
49		.6	.2	.4	1.7	
50		.6	.2	.4	1.7	
51		.4	.3	.5	1.7	
52		.4	.2	.2	1.4	19.9
54		.2	.1	.1	1.0	
56		.4	.1	.1	1.2	
58		.6	.2	.2	1.6	
60		.3	.1	.2	1.2	
62		.6	.2	.2	1.6	
64		.4	.2	.2	1.4	
66		.3	.2	.2	1.3	
68		.3	.2	.2	1.3	
70		.2	.3	.3	1.3	
71		.3	.4	.2	1.4	
72R	.9	.4	.8	.2	2.1	

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 6/8/83
CHECKED BY: DWB DATE: 6-8-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
72R	.9	.6	.8	.2	2.3	19.9
73	↓	.4	.6	.2	1.9	↓
126R	↓	.6	.8	.2	2.3	↓
126R	↓	.6	.9	.2	2.4	↓
127	↓	.4	.5	.3	1.9	↓
176R	↓	.3	.5	.2	1.7	↓
176R	↓	.2	.4	.1	1.5	↓
219	↓	.4	1.1	.6	2.6	↓
222	1.0	1.5	2.8	.9	5.4	18.1
224	1.0	2.9	2.0	.6	6.0	↓
226	1.0	2.6	2.5	.4	6.1	↓
228	1.5	1.3	1.9	.5	4.8	17.9
230R	1.5	.9	2.4	.8	4.9	↓
230R	1.5	1.6	2.1	.5	5.3	↓
232	1.5	3.0	2.3	1.1	7.0	↓
234	1.1	2.9	2.3	1.0	6.5	↓
236	1.1	2.0	2.2	1.3	5.7	↓
238	2.3	1.3	3.7	1.7	7.7	17.6
240R	2.3	1.1	4.0	1.2	7.6	↓
240R	2.3	1.3	2.9	1.2	6.7	↓

Technical Report
TR-5364-2
[illegible]vision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DmD DATE: 6/8/83
CHECKED BY: [illegible] DATE: 6-8-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
242	2.3	2.0	3.5	1.3	8.0	17.6
244	↓	1.6	2.6	1.8	7.1	↓
246	↓	1.2	2.8	2.2	7.1	↓
248	↓	1.1	4.0	1.8	7.8	↓
250	↓	1.5	5.3	1.8	9.4	↓
252	↓	1.8	7.7	1.4	11.9	↓
258	↓	1.7	8.6	2.4	12.9	↓
259	↓	1.5	7.6	2.8	11.9	↓
257	↓	2.6	10.2	2.8	15.5	↓
260	↓	1.3	7.8	2.5	11.8	↓
262	2.9	2.9	5.5	3.9	12.5	17.2
266	↓	3.0	2.3	4.5	11.0	↓
268	↓	3.6	2.4	3.7	10.9	↓
272	↓	3.5	3.1	4.0	11.5	↓
274	↓	2.7	2.9	1.3	8.8	↓
276	↓	3.1	2.8	1.1	9.0	↓
278	↓	3.4	2.9	1.3	9.5	↓
279	↓	3.4	2.9	1.3	9.5	↓
280	↓	2.2	4.7	1.7	10.1	↓
282	↓	1.6	5.1	1.3	9.8	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DmD DATE: 6/8/83
CHECKED BY: [signature] DATE: 6-8-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
284B	2.9	.9	6.7	4.4	11.8	17.2
72B	.7	2.0	1.1	.3	3.8	18.3
74	↓	1.0	.7	.2	2.4	↓
76	↓	.6	.5	.2	1.8	↓
78	↓	.3	.4	.3	1.5	↓
80	↓	.3	.2	.2	1.3	↓
82	↓	.4	.3	.2	1.5	↓
84	.3	.4	.6	.2	1.3	18.2
86	↓	.3	.7	.1	1.3	↓
88	↓	1.2	1.2	.1	2.7	↓
90	↓	1.5	1.4	.1	3.2	↓
92	↓	.9	.8	.2	2.0	↓
97	↓	1.0	.9	.2	2.2	17.8
94	↓	1.2	1.3	.1	2.8	↓
100	↓	.3	1.3	.1	1.9	↓
96	↓	.5	2.3	.1	3.1	↓
98	.1	.8	2.4	.1	3.3	17.7
103	.1	.5	1.4	.1	2.0	14.1
107	3.5	.7	.4	0	4.6	13.9
108	3.5	.8	2.2	0	6.5	19.2

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 6/8/83
CHECKED BY: [illegible] DATE: 6-8-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
110	3.5	.6	2.5	0	6.6	19.2
111	↓	.6	2.5	0	6.6	↓
112	↓	.6	2.5	0	6.6	↓
114	↓	.3	2.2	0	6.0	↓
116	↓	.3	1.4	0	5.2	↓
118	↓	.6	1.2	.1	5.3	↓
120	↓	.7	1.2	.1	5.4	↓
122	↓	1.0	1.3	.1	5.8	↓
124	↓	1.0	1.3	.1	5.8	↓
126B	.7	.7	1.0	.6	2.6	18.3
128	↓	.4	.4	.4	1.7	↓
130	↓	.4	.3	.2	1.5	↓
132	↓	.4	.4	.2	1.5	↓
134	↓	.2	.7	.2	1.6	↓
136	↓	.2	1.0	.2	1.9	↓
138	.3	1.0	2.0	.2	3.3	18.2
140	↓	1.4	2.1	.3	3.8	↓
142	↓	.8	1.3	.3	2.4	↓
143	↓	.9	1.3	.2	2.5	↓
144	↓	1.1	1.3	.1	2.7	17.8

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 6/8/83
CHECKED BY: [signature] DATE: 6-8-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
145	.3	.3	1.4	.1	2.0	17.8
146	.3	.6	3.2	.1	4.1	17.8
148	.1	1.0	3.3	.1	4.4	17.7
152	.1	.5	1.5	.1	2.1	14.1
156	3.5	.8	.5	.1	4.8	13.9
158		.9	2.5	.1	6.9	19.2
160		.7	2.9	0	7.1	
161		.7	2.9	.1	7.1	
162		.7	2.9	.1	7.1	
164		.5	2.5	0	6.5	
166		.5	1.5	.1	5.5	
168		.8	1.2	.1	5.5	
170		.9	1.3	.1	5.7	
172		1.2	1.5	.1	6.2	
174		1.2	1.5	.1	6.2	
176B	.7	.7	.7	.3	2.2	18.3
178		.6	.4	.2	1.7	
180		.3	.8	.5	1.9	
182		.3	1.3	.1	2.3	
184	.3	.9	2.5	.1	3.7	18.2

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DmD DATE: 6/8/83
CHECKED BY: [signature] DATE: 6-8-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
186	.3	1.3	2.5	.1	4.1	18.2
187		.9	1.2	.1	2.4	18.2
188		1.0	1.1	.1	2.4	17.8
192		.3	1.1	.1	1.7	17.8
190		.5	1.9	.1	2.7	17.8
195	.1	1.0	1.9	.1	3.0	17.7
196	.1	.6	1.1	.1	1.8	14.1
200	3.5	.8	.5	.1	4.8	13.9
202		.9	2.2	.1	6.6	19.2
204		.6	2.6	.1	6.7	
205		.6	2.6	.1	6.7	
206		.6	2.6	.1	6.7	
208		.3	2.3	.1	6.1	
210		.3	1.4	.1	5.2	
212		.7	1.1	.1	5.3	
214		.8	1.2	.1	5.5	
216		1.1	1.4	.1	6.0	
218		1.1	1.4	.1	6.0	
230B	1.9	3.2	9.5	3.1	15.1	17.9
286	1.9	6.4	6.3	1.3	14.7	17.6

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DHB DATE: 6/8/83
CHECKED BY: DHB DATE: 6-8-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
288	1.9	6.7	5.8	1.2	14.5	17.6
290	1.9	3.6	4.7	2.8	11.0	17.6
292	1.9	3.9	5.2	4.6	12.7	17.2
296	2.9	2.1	4.0	4.2	10.8	
298		1.4	3.5	3.4	9.2	
302		1.8	4.0	2.9	9.6	
304		2.5	3.8	2.4	9.9	
306		2.0	3.8	2.4	9.4	
308		1.7	4.0	1.7	8.9	
310		1.3	3.9	1.3	8.3	
312		3.2	3.4	4.0	11.3	
314		.9	2.6	1.5	6.8	
316		1.1	2.6	2.5	7.6	
318	4.1	5.6	1.9	2.3	12.7	
320R		4.3	1.4	1.9	10.8	19.2
320R		3.1	1.5	2.3	9.9	
322		3.3	1.6	2.0	10.0	
324		3.1	1.6	1.2	9.2	
325		3.1	1.6	1.2	9.2	
326		2.7	1.9	2.5	9.9	

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 6/8/83
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STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
328	4.1	2.5	1.7	2.3	9.5	17.2
330	4.1	2.4	1.7	2.1	9.2	19.2
332	4.1	2.6	2.1	2.1	9.7	↓
334	3.5	.8	.6	.6	5.1	↓
336	↓	.7	.7	.7	5.2	↓
284R	↓	.7	.6	.9	5.3	↓
284R	↓	.6	.8	.9	5.3	↓
338	↓	.4	.9	.4	4.9	↓
339	↓	.6	1.1	.7	5.4	↓
340	↓	.7	1.2	1.2	5.9	↓
342	↓	.8	1.1	1.2	5.9	↓
240B	1.9	1.3	6.9	1.9	10.4	17.6
241	↓	1.3	5.4	1.4	8.8	↓
402	↓	3.5	4.0	1.5	9.7	↓
404	↓	4.7	5.3	1.5	12.1	↓
344	↓	3.5	4.7	1.8	10.4	↓
346	↓	.9	4.0	4.8	9.0	17.2
350	2.9	.7	3.1	2.8	7.8	↓
352	2.9	.9	2.7	3.6	8.3	↓
356	2.9	.4	3.1	4.7	8.9	↓

Technical Report
TR-5364-2
[illegible]ision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMB DATE: 6/8/83
CHECKED BY: DMB DATE: 6-8-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
320 B	2.9	3.1	4.0	3.7	11.4	19.2

6.1.5 Equation B-3 Stresses

TELEDYNE
ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DATE: 5-31-83
CHECKED BY: DATE: 5/31/83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE KSI	ALLOWABLE STRESS (KSI)
2	.2	27.6
4	2.1	
6	2.3	
7	.8	
8	.9	
10	2.4	
12	2.5	
14	.9	
16	1.0	
18	2.7	
20	2.7	
21	1.0	
24	1.0	
26	1.8	27.7
28	1.7	
32	.6	
33	1.7	
34	2.0	
36	2.2	
38	2.3	

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 5-31-83
CHECKED BY: DMD DATE: 5/31/83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE KSI	ALLOWABLE STRESS (KSI)
40	2.3	27.7
42	2.3	↓
44	2.6	↓
46	3.2	↓
48	1.4	↓
49	1.4	↓
50	1.3	↓
51	.7	↓
52	.6	↓
54	.5	↓
56	.5	↓
58	.4	↓
60	.2	↓
62	.4	↓
64	.5	↓
66	.7	↓
68	1.0	↓
70	1.0	↓
71	1.6	↓
72 R	3.6	↓

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 5-31-83
CHECKED BY: [signature] DATE: 5/31/83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE KSI	ALLOWABLE STRESS (KSI)
72R	3.8	27.7
73	1.7	
126R	2.6	
126R	3.3	
127	1.1	
176R	1.3	
176R	2.4	
219	2.7	
222	18.3	27.2
224	5.0	
226	6.8	
228	2.8	
230R	4.0	
230R	6.1	
232	8.8	
234	8.7	
236	6.0	
238	7.3	27.1
240R	8.2	
240R	6.9	

TELEDYNE
ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 5-31-83
CHECKED BY: [illegible] DATE: 5/31/83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE KSI	ALLOWABLE STRESS (KSI)
242	8.0	27.1
244	5.9	
246	2.8	
248	2.4	
250	4.3	
252	4.9	
258	3.0	
259	2.8	
257	5.0	
260	4.4	
262	2.3	27.0
266	1.4	
268	2.0	
272	2.6	
274	3.1	
276	3.4	
278	3.3	
279	3.3	
280	1.9	
282	1.5	

TELEDYNE
ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 5-31-83
CHECKED BY: [illegible] DATE: 5/31/83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE KSI	ALLOWABLE STRESS (KSI)
284 B	1.2	27.0
72 B	4.1	27.3
74	2.6	
76	5.6	
78	6.8	
80	5.8	
82	2.6	
84	3.6	27.2
86	2.8	
88	5.0	
90	4.3	
92	1.8	
97	1.5	27.1
94	2.2	
100	2.3	
96	5.1	
98	5.8	
103	2.6	26.4
107	1.1	26.4
108	.7	27.4

TELEDYNE
ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 5-31-83
CHECKED BY: [signature] DATE: 5/31/83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE KSI	ALLOWABLE STRESS (KSI)
110	.7	27.4
111	.6	
112	.7	
114	.8	
116	1.1	
118	1.2	
120	1.2	
122	1.2	
124	1.1	
126 B	4.3	27.3
128	2.4	
130	2.1	
132	1.7	
134	1.1	
136	.8	
138	1.9	27.2
140	2.2	
142	.9	
143	.7	
144	.5	

TELEDYNE
ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DATE: 5-31-83
CHECKED BY: DATE: 5/31/83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE KSI	ALLOWABLE STRESS (KSI)
145	.5	27.1
146	1.4	
148	1.0	
152	.3	26.4
156	.3	26.4
158	.5	27.4
160	.6	
161	.5	
162	.6	
164	.6	
166	.5	
168	.4	
170	.4	
172	.4	
174	.3	
176B	6.3	27.3
178	3.3	
180	2.4	
182	1.3	
184	2.3	27.2

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DWB DATE: 5-31-83
CHECKED BY: DmD DATE: 5/31/83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE KSI	ALLOWABLE STRESS (KSI)
186	2.0	27.2
187	.6	27.2
188	.7	27.1
192	.7	↓
190	1.6	↓
195	2.5	↓
196	1.1	26.4
200	.7	26.4
202	.7	27.4
204	.8	↓
205	.7	↓
206	.8	↓
208	1.0	↓
210	1.1	↓
212	1.0	↓
214	1.0	↓
216	.9	↓
218	.8	↓
230 B	8.0	27.2
286	3.5	27.1

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: LMB DATE: 5-31-83
CHECKED BY: DMD DATE: 5/31/83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE KSI	ALLOWABLE STRESS (KSI)
288	5.5	27.1
290	3.0	27.1
292	2.9	27.0
296	1.6	↓
298	1.7	↓
302	1.8	↓
304	1.9	↓
306	2.1	↓
308	2.4	↓
310	2.0	↓
312	2.3	↓
314	1.0	↓
316	1.9	↓
318	1.8	↓
320 R	.8	27.4
320 R	2.7	↓
322	1.3	↓
324	3.9	↓
325	3.2	↓
326	6.1	↓

TELEDYNE
ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 5-31-83
CHECKED BY: DMD DATE: 5/31/83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE KSI	ALLOWABLE STRESS (KSI)
328	6.2	27.4
330	5.4	↓
332	6.0	↓
334	2.0	↓
336	2.4	↓
284 R	2.3	↓
284 R	2.3	↓
338	4.0	↓
339	5.5	↓
340	5.9	↓
342	5.4	↓
240 B	20.0	27.1
241	2.3	↓
402	5.8	↓
404	10.4	↓
344	18.9	↓
346	9.7	27.0
350	4.6	↓
352	3.6	↓
356	3.2	↓

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMS DATE: 5-31-83
CHECKED BY: Smd DATE: 5/31/83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE KSI	ALLOWABLE STRESS (KSI)
320 B	3.9	27.4

6.1.6 Equation C-1 Stresses

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SMD DATE: 5/5/83
CHECKED BY: JWB DATE: 5-5-83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
2	0	0	0	0	29.2
4		.3	.3	.6 XY	
6		.4	.1	.5 XY	
7		.2	.1	.3 XY	
8		.3	0	.3 XY	
10		.7	.1	.8 XY	
12		1.0	.1	1.1 XY	
14		.5	.1	.6 XY	
16		.6	.1	.7 XY	
18		1.1	.2	1.3 XY	
20		1.5	.3	1.8 YZ	
21		.8	.1	.9 YZ	
24		.8	.1	.9 YZ	
26		.8	.5	1.3 YZ	30.1
28		.9	.4	1.3 YZ	
32		.5	.1	.6 XY	
33		.9	.3	1.2 XY	
34		1.0	.3	1.3 XY	
36		1.0	.3	1.3 XY	
38		.9	.3	1.2 XY	30.0

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: Dmb DATE: 5/5/83
CHECKED BY: JWB DATE: 5-5-83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
40	0	.4	.4	.8 XY	30.0
42	↓	.3	.5	.8 XY	↓
44		.9	.4	1.3 YZ	
46		1.3	.3	1.6 XY	
48		.6	.5	1.1 YZ	
49		.6	.4	1.0 YZ	
50		.6	.3	.9 XY	
51		.4	.5	.9 XY	
52		.4	.3	.7 XY	29.8
54		.2	.3	.5 YZ	↓
56		.4	.2	.6 YZ	
58		.6	.4	1.0 XY	
60		.3	.2	.5 XY	
62		.6	.4	1.0 XY	
64		.4	.4	.8 XY	
66		.3	.3	.6 XY	
68		.3	.4	.7 XY	
70		.2	.5	.7 YZ	
71		.3	.7	1.0 YZ	
72R		.4	1.2	1.6 YZ	29.9

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/5/83
CHECKED BY: TMB DATE: 5-6-83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
72R	0	.6	1.3	1.9 YZ	29.9
73	↓	.4	.9	1.3 YZ	↓
126R	↓	.6	1.2	1.8 YZ	↓
126R	↓	.6	1.4	2.0 YZ	↓
127	↓	.4	.8	1.2 YZ	↓
176R	↓	.3	.8	1.1 YZ	↓
176R	↓	.2	.6	.8 YZ	↓
219	↓	.4	1.8	2.2 YZ	↓
222	↓	1.5	4.4	5.9 YZ	27.1
224	↓	2.9	3.2	6.1 YZ	↓
226	↓	2.6	3.9	6.5 YZ	↓
228	↓	1.3	3.0	4.3 YZ	26.8
230R	↓	.9	3.8	4.7 YZ	↓
230R	↓	1.6	1.8	3.4 YZ	↓
232	↓	3.0	3.6	6.6 YZ	↓
234	↓	2.9	3.6	6.5 YZ	↓
236	↓	2.0	3.4	5.4 YZ	↓
238	↓	1.3	6.3	7.6 XY	26.3
240R	↓	1.1	6.9	8.0 XY	↓
240R	↓	1.3	4.4	5.7 YZ	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SMD DATE: 5/5/83
CHECKED BY: AMB DATE: 5-6-83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
242	0	2.0	5.4	7.4 YZ	26.3
244	↓	1.6	4.0	5.6 YZ	↓
246	↓	1.2	4.1	5.3 YZ	↓
248	↓	1.1	6.0	7.1 YZ	↓
250	↓	1.5	7.9	9.4 YZ	↓
252	↓	1.8	11.4	13.2 YZ	↓
258	↓	1.7	12.7	14.4 YZ	↓
259	↓	1.5	11.3	12.8 YZ	↓
257	↓	2.6	15.1	17.7 YZ	↓
260	↓	1.3	11.6	12.9 YZ	↓
262	↓	2.9	8.2	11.1 YZ	25.7
266	2.9	3.0	3.1	9.0 YZ	↓
268	↓	3.6	3.7	10.2 YZ	↓
272	↓	3.5	4.6	11.0 YZ	↓
274	↓	2.7	4.2	9.8 YZ	↓
276	↓	3.1	4.1	10.1 YZ	↓
278	↓	3.4	4.3	10.6 YZ	↓
279	↓	3.4	4.3	10.6 YZ	↓
280	↓	2.2	6.9	12.0 YZ	↓
282	↓	1.6	7.5	12.0 YZ	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/5/83
CHECKED BY: DMB DATE: 5-6-83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
284B	2.9	.9	10.0	13.8 YZ	25.7
72B	0	2.0	1.9	3.9 XY	27.5
74	↓	1.0	1.2	2.2 XY	↓
76	↓	.6	.8	1.4 XY	↓
78	↓	.3	.7	1.0 XY	↓
80	↓	.3	.4	.7 XY	↓
82	↓	.4	.6	1.0 YZ	↓
84	↓	.4	1.0	1.4 YZ	27.2
86	↓	.3	1.1	1.4 YZ	↓
88	↓	1.2	2.2	3.4 YZ	↓
90	↓	1.5	2.4	3.9 YZ	↓
92	↓	.9	1.5	2.4 YZ	↓
97	↓	1.0	1.7	2.7 YZ	26.7
94	↓	1.2	2.2	3.4 YZ	26.7
100	↓	.3	2.3	2.6 YZ	26.7
96	↓	.5	4.1	4.6 YZ	26.7
98	↓	.8	4.2	5.0 YZ	26.5
103	↓	.5	2.5	3.0 YZ	21.1
107	3.5	.7	.7	4.9 XY	21.0
108	3.5	.8	3.8	8.1 YZ	28.8

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/5/83
CHECKED BY: DWB DATE: 5-6-83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
110	3.5	.6	44	8.5 YZ	28.8
111		.6	4.4	8.5 YZ	
112		.6	4.4	8.5 YZ	
114		.3	3.9	7.7 YZ	
116		.3	2.4	6.2 YZ	
118		.6	2.0	6.1 YZ	
120		.7	2.0	6.2 YZ	
122		1.0	2.2	6.7 XY	
124		1.0	2.2	6.7 XY	
126B	0	.7	1.7	2.4 XY	27.5
128		.4	.7	1.1 XY	
130		.4	.5	.9 YZ	
132		.4	.7	1.1 XY	
134		.2	1.2	1.4 XY	
136		.2	1.8	2.0 XY	
138		1.0	3.4	4.4 XY	27.2
140		1.4	3.6	5.0 XY	
142		.8	2.2	3.0 XY	
143		.9	2.2	3.1 XY	
144		1.1	2.3	3.4 XY	26.7

Technical Report
TR-5364-2
vision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SmS DATE: 5/5/83
CHECKED BY: [illegible] DATE: 5-6-83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)		ALLOWABLE STRESS (KSI)
145	0	.3	2.4	2.7	XY	26.7
146	↓	.6	5.6	6.2	XY	26.7
148	↓	1.0	5.7	6.7	XY	26.5
152	↓	.5	2.6	3.1	XY	21.1
156	3.5	.8	.8	5.1	YZ	20.9
158	↓	.9	4.2	8.6	XY	28.8
160	↓	.7	5.0	9.2	XY	↓
161	↓	.7	5.0	9.2	XY	↓
162	↓	.7	5.0	9.2	XY	↓
164	↓	.5	4.4	8.4	XY	↓
166	↓	.5	2.7	6.7	XY	↓
168	↓	.8	2.0	6.3	XY	↓
170	↓	.9	2.1	6.5	YZ	↓
172	↓	1.2	2.5	7.2	YZ	↓
174	↓	1.2	2.5	7.2	YZ	↓
176B	0	.7	1.2	1.9	YZ	27.5
178	↓	.6	.7	1.3	YZ	↓
180	↓	.3	1.4	1.7	YZ	↓
182	↓	.3	2.2	2.5	YZ	↓
184	↓	.9	4.2	5.1	YZ	27.2

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/5/83
CHECKED BY: DMB DATE: 5-6-83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
186	0	1.3	4.3	5.6 YZ	27.2
187		.9	2.1	3.0 YZ	27.2
188		1.0	1.9	2.9 YZ	26.7
192		.3	1.8	2.1 YZ	26.7
190		.5	3.2	3.7 YZ	26.7
195		1.0	3.1	4.1 YZ	26.5
196		.6	1.9	2.5 YZ	21.1
200	3.5	.8	.8	5.1 XY	20.9
202		.9	3.8	8.2 YZ	28.8
204		.6	4.4	8.5 YZ	
205		.6	4.4	8.5 YZ	
206		.6	4.4	8.5 YZ	
208		.3	3.9	7.7 YZ	
210		.3	2.4	6.2 YZ	
212		.7	1.9	6.1 YZ	
214		.8	2.0	6.3 XY	
216		1.1	2.3	6.9 XY	
218		1.1	2.3	6.9 XY	
230 B	0	3.2	15.0	18.2 YZ	26.8
286	0	6.4	10.1	16.5 YZ	26.3

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/5/83
CHECKED BY: [illegible] DATE: 5-6-83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
288	0	6.7	9.2	15.9 YZ	26.3
290	0	3.6	7.5	11.1 YZ	26.3
292	0	3.9	8.3	12.2 YZ	25.7
296	2.9	2.1	6.3	11.3 YZ	↓
298	↓	1.4	5.6	9.9 YZ	↓
302	↓	1.8	6.3	11.0 YZ	↓
304	↓	2.5	6.1	11.5 YZ	↓
306	↓	2.0	6.1	11.0 YZ	↓
308	↓	1.7	6.4	11.0 YZ	↓
310	↓	1.3	6.2	10.4 YZ	↓
312	↓	3.2	5.3	11.4 YZ	↓
314	↓	.9	4.2	8.0 YZ	↓
316	↓	1.1	4.1	8.1 YZ	↓
318	4.1	5.6	3.3	13.0 XY	↓
320R	↓	4.3	2.4	10.8 XY	28.8
320R	↓	3.1	2.4	9.6 YZ	↓
322	↓	3.3	2.6	10.0 YZ	↓
324	↓	3.1	2.5	9.7 YZ	↓
325	↓	3.1	2.5	9.7 YZ	↓
326	↓	2.7	2.9	9.7 YZ	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: Smd DATE: 5/5/83
CHECKED BY: [illegible] DATE: 5-6-83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
328	4.1	2.5	2.7	9.3 YZ	28.8
330	↓	2.4	2.5	9.1 YZ	↓
332	↓	2.6	3.3	10.0 YZ	↓
334	3.5	.8	1.0	5.3 YZ	↓
336	↓	.7	1.1	5.3 YZ	↓
284 A	↓	.7	.9	5.1 YZ	28.8
284 A	↓	.6	1.3	5.4 YZ	↓
338	↓	.4	1.3	5.2 YZ	↓
339	↓	.6	1.7	5.8 YZ	↓
340	↓	.7	1.8	6.0 YZ	↓
342	↓	.8	1.7	6.0 YZ	↓
240 B	0	1.3	11.8	13.1 XY	26.3
241	↓	1.3	9.1	10.4 XY	↓
402	↓	3.5	7.0	10.5 XY	↓
404	↓	4.7	9.2	13.9 XY	↓
344	↓	3.5	8.1	11.6 XY	↓
346	↓	.9	6.9	7.8 XY	25.7
350	2.9	.7	5.4	9.0 XY	↓
352	↓	.9	4.7	8.5 XY	↓
356	↓	.4	5.3	8.6 XY	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 5/5/83
CHECKED BY: [signature] DATE: 5-6-83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
320B	2.9	3.1	7.0	13.0 xy	28.8

6.1.7 Equation C-2 Stresses

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DWB DATE: 5-18-83
CHECKED BY: DMS DATE: 5/18/83

STRESS SUMMARY - EQUATION C2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	SV TRANSIENT SHOCK STRESS (KSI)	EQUATION C2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
2	.4	0	5.4	5.8	29.2
4	↓	.3	39.7	40.4	↓
6	↓	.4	20.3	21.1	↓
7	↓	.2	10.0	10.6	↓
8	↓	.3	6.9	7.6	↓
10	↓	.7	16.7	17.8	↓
12	↓	1.0	18.8	20.2	↓
14	↓	.5	13.1	14.0	↓
16	↓	.6	28.1	29.1	↓
18	↓	1.1	56.8	58.3	↓
20	↓	1.5	32.9	34.8	↓
21	↓	.8	16.2	17.4	↓
24	.7	.8	16.8	18.3	30.1
26	↓	.8	77.5	79.0	↓
28	↓	.9	55.9	57.5	↓
32	↓	.5	19.8	21.0	↓
33	↓	.9	40.	41.6	↓
34	↓	1.0	40.4	42.1	↓
36	↓	1.0	41.1	42.8	↓
38	.8	.9	59.6	61.3	30.0

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DHB DATE: 5-18-83
CHECKED BY: SMD DATE: May 18 '83

STRESS SUMMARY - EQUATION C2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	SV TRANSIENT SHOCK STRESS (KSI)	EQUATION C2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
40	.8	.4	56.3	57.5	30.0
42		.3	55.3	56.4	
44		.9	54.3	56.0	
46		1.3	48.7	50.8	
48		.6	59.2	60.6	
49		.6	51.2	52.6	
50		.6	44.4	45.8	
51		.4	64.3	65.5	
52	1.0	.4	93.6	95.0	29.8
54		.2	59.1	60.3	
56		.4	24.2	25.6	
58		.6	51.2	52.8	
60		.3	28.2	29.5	
62		.6	54.0	55.6	
64		.4	40.6	42.0	
66		.3	27.8	29.1	
68		.3	37.5	38.8	
70		.2	32.9	34.1	
71		.3	15.6	16.9	
72R	.9	.4	36.3	37.6	29.9

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: ________ DATE: 5-18-83
CHECKED BY: ________ DATE: 5/18/83

STRESS SUMMARY - EQUATION C2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	SV TRANSIENT SHOCK STRESS (KSI)	EQUATION C2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
72B	.7	2.0	74.	76.7	27.5
74		1.0	48.3	50.0	
76		.6	106.1	107.4	
78		.3	194.4	195.4	
80		.3	146.9	147.9	
82		.4	201.3	202.4	
84	.9	.4	53.4	54.7	27.2
86		.3	49.0	50.2	
88		1.2	49.1	51.2	
90		1.5	97.3	99.7	
92		.9	75.0	76.8	
97	1.8	1.0	69.0	71.8	26.7
94		1.2	59.5	62.5	
100		.3	62.5	64.6	
96		.5	101.5	103.8	
98	2.4	.8	114.2	117.4	26.5
103	2.4	.5	67.2	70.1	21.1
107	3.5	.7	32.5	36.7	21.0
108	3.5	.8	23.5	27.8	28.8
110	3.5	.6	30.9	35.0	28.8

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 5-18-83
CHECKED BY: [signature] DATE: 5/18/83

STRESS SUMMARY - EQUATION C2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	SV TRANSIENT SHOCK STRESS (KSI)	EQUATION C2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
111	3.5	.6	30.9	35.0	28.8
112		.6	30.9	35.0	
114		.3	26.1	29.9	
116		.3	47.7	51.5	
118		.6	83.6	87.7	
120		.7	87.1	91.3	
122		1.0	89.9	94.4	
124		1.0	89.9	94.4	

6.1.8 Equation C-3 Stresses

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 5/4/83
CHECKED BY: [signature] DATE: 5-4-83

STRESS SUMMARY - EQUATION C3

NODE #	SV TRANSIENT THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
2	.2	27.6
4	1.9	
6	2.1	
7	.8	
8	.8	
10	2.1	
12	2.1	
14	.8	
16	.9	
18	2.5	
20	2.4	
21	.9	
24	.9	
26	1.8	27.7
28	1.6	
32	.6	
33	1.6	
34	1.8	
36	2.1	
38	2.1	

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DHD DATE: 5/4/83
CHECKED BY: RMB DATE: 5-4-83

STRESS SUMMARY - EQUATION C3

NODE #	SV TRANSIENT THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
40	1.9	27.7
42	1.9	↓
44	2.1	
46	2.7	
48	1.4	
49	1.3	
50	1.3	
51	.7	
52	.8	
54	.7	
56	.7	
58	.6	
60	.2	
62	.6	
64	.7	
66	.9	
68	1.1	
70	.9	
71	1.4	
72R	3.2	↓

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DmD DATE: 5/4/83
CHECKED BY: [illegible] DATE: 5-4-83

STRESS SUMMARY - EQUATION C3

NODE #	SV TRANSIENT THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
72B	4.1	27.3
74	2.1	
76	5.0	
78	6.1	
80	5.3	
82	2.3	
84	3.0	27.2
86	2.2	
88	3.9	
90	3.2	
92	1.4	
97	1.3	27.1
94	2.2	
100	2.2	
96	5.1	
98	5.6	
103	2.5	26.4
107	1.0	26.4
108	.6	27.4
110	.6	27.4

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SmD DATE: 5/4/83
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STRESS SUMMARY - EQUATION C3

NODE #	SV TRANSIENT THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
111	.5	27.4
112	.6	↓
114	.7	↓
116	.9	↓
118	1.0	↓
120	1.1	↓
122	1.1	↓
124	1.0	↓

6.2 Support Loads

Support loads are given for each support on the pressurizer relief line piping. Support load combinations were calculated in accordance with Table II, Reference 2. Combination E2 was only considered for those supports that are part of the quarter model. Thermal-1 refers to the normal thermal operating case and thermal-2 refers to the PORV transient thermal loading and thermal-3 refers to SV transient thermal condition.

The support load combinations considered are as follows:

D1 = deadweight + normal thermal +/- OBE

D2 = deadweight + PORV transient thermal +/- $\left[(OBE)^2 + (\text{PORV transient shock})^2\right]^{1/2}$

E1 = deadweight + normal thermal +/- DBE

E2 = deadweight + SV transient thermal +/- SV transient shock

Technical Report
TR-5364-2
Revision 0

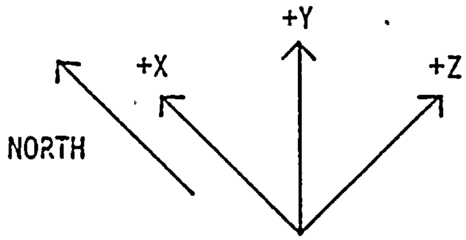
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 6-9-83
CHECKED BY: [illegible] DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-R-585
NODE NUMBER 16

DESIGN LOADINGS	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1		.019	.001	-20					
THERMAL-1		-.161	.027	-1860					
THERMAL-2		-.035	-.377	350					
THERMAL-3		-.029	-.377	493					
SEISMIC-OBE		±.001	±.001	±202					
SEISMIC-DBE		±.002	±.002	±351					
BLOWDOWN-SRV		+.266 -.264	+.292 -.464	±76790					
BLOWDOWN-PORV		±.001	±.002	±377					

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET	+758 -2032		
EMERGENCY	+77263 -76317		

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)	4132		
DESIGN (-)	347		

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

For normal/upset conditions TES combined loads are less for +FX and greater for -FX. For the emergency condition TES loads are greater.

Technical Report
TR-5364-2
Revision 0

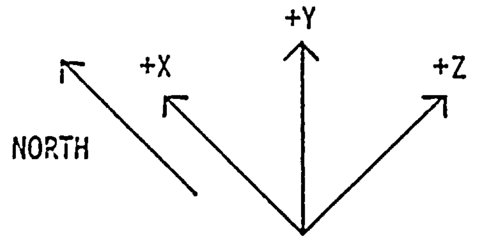
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 6-9-83
CHECKED BY: [illegible] DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-R-586
NODE NUMBER 24

	DESIGN LOADINGS								
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.003		.006		-1170				
THERMAL-1	-.034		.067		1700				
THERMAL-2	-.061		-.400		241				
THERMAL-3	-.051		-.362		139				
SEISMIC-OBE	±.001		0		±111				
SEISMIC-DBE	±.001		0		±201				
BLOWDOWN-SRV	+.261 -.373		+.064 -.062		±25780				
BLOWDOWN-PORV	±.002		±0		±110				

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET		+641 -1281	
EMERGENCY		+24749 -26811	

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)		3890	
DESIGN (-)		479	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

For normal/upset conditions TES combined loads are less for +FY and greater for -FY. For the emergency condition TES combined loads are greater.

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

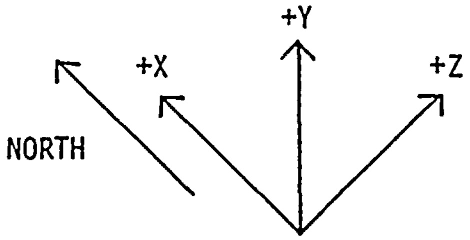
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SJIB DATE: 6-9-83

CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-587

NODE NUMBER 32

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.036	-.129	.028						
THERMAL-1	.226	1.01	.276						
THERMAL-2	-.203	.370	-.330						
THERMAL-3	-.186	.330	-.330						
SEISMIC-OBE	±.004	0	±.007		±134				
SEISMIC-OBE	±.007	0	±.011		±237				
BLOWDOWN-SRV	+1.307 -1.491	0	+1.522 -1.398		±51450				
BLOWDOWN-PORV	±.007 .008	0	+.014 -.012		±257				

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET		±290	
EMERGENCY		±51450	

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)		1037	
DESIGN (-)		1037	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING FOR THE NORMAL/UPSET CONDITIONS AND GREATER FOR THE EMERGENCY CONDITION.

Technical Report
TR-5364-2
Revision 0

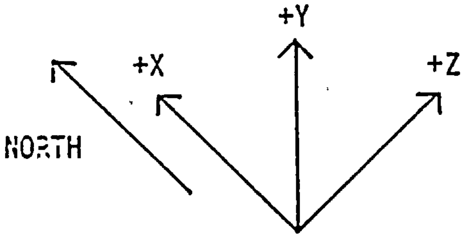
TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 6-9-83
CHECKED BY: [illegible] DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-R-589
NODE NUMBER 48

DESIGN LOADINGS	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1		.004		-30		20			
THERMAL-1		2.27		1150		-770			
THERMAL-2		.985		-399		246			
THERMAL-3		.904		-501		333			
SEISMIC-OBE		±.007		±254		±380			
SEISMIC-DBE		±.011		±427		±662			
BLOWDOWN-SRV		+.758 -.786		±45110		±75580			
BLOWDOWN-PORV		+.006 -.005		±170		±537			

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET	+1374 -735		+924 -1130
EMERGENCY	+44579 -45641		+75933 -75227

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)	615		5682
DESIGN (-)	3236		4144

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING FOR THE NORMAL/UPSET CONDITIONS AND GREATER FOR THE EMERGENCY CONDITION.

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

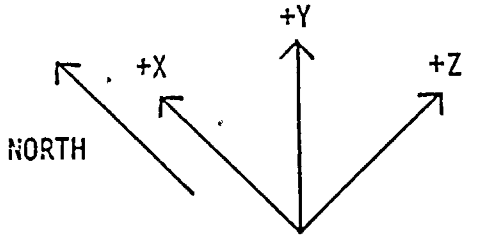
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 6-9-83

CHECKED BY: [illegible] DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-C-590

NODE NUMBER 50

DESIGN LOADINGS	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.001	.004	-.010		3281				
THERMAL-1	.024	2.27	-.023						
THERMAL-2	.018	1.06	-.017						
THERMAL-3	.019	.980	-.017						
SEISMIC-OBE	±.004	±.011	±.003						
SEISMIC-DBE	±.007	±.004	±.005						
BLOWDOWN-SRV	+.341 -.314	+.752 -.784	+.712 -.573						
BLOWDOWN-PORV	±.002	+.006 -.005	+.006 -.007						

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET		+3281	
EMERGENCY		+3281	

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)		3281	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE ______ THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

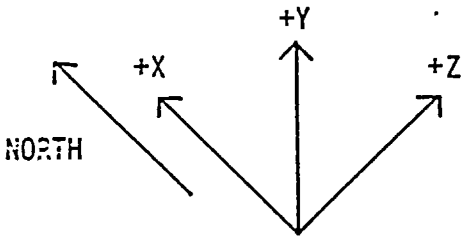
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 6-9-83
CHECKED BY: [illegible] DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-R-591
NODE NUMBER 60

	DESIGN LOADINGS								
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1		-.001		30		-70			
THERMAL-1		2.31		180		-500			
THERMAL-2		1.76		-219		-211			
THERMAL-3		1.72		-171		-238			
SEISMIC-OBE		±.007		±272		±247			
SEISMIC-DBE		±.011		±447		±417			
BLOWDOWN-SRV		+.405 -.526		±39540		±73540			
BLOWDOWN-PORV		+.004 -.005		±392		±764			

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET	+482 -666		+522 -1084
EMERGENCY	+39399 -39681		+73232 -73848

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)	972		657
DESIGN (-)	1566		1044

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING FOR THE NORMAL/UPSET CONDITIONS AND GREATER FOR THE EMERGENCY CONDITION.

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

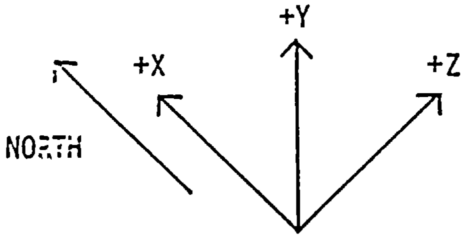
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SDMB DATE: 6-9-83

CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-592

NODE NUMBER 101

	DESIGN LOADINGS								
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.036	.024	-.023						
THERMAL-1	.224	2.82	-.116						
THERMAL-2	.263	2.79	-.152						
THERMAL-3	.269	2.79	-.151						
SEISMIC-OBE	±.101	0	±.144		±800				
SEISMIC-DBE	±.176	0	±.250		±1324				
BLOWDOWN-SRV	+.455 -.369	0	+.409 -.461		±55600				
BLOWDOWN-PORV	±.001	0	±.001		± 95				

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET		±806	
EMERGENCY		±55600	

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)		5301	
DESIGN (-)		5301	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING FOR THE NORMAL/UPSET CONDITION AND GREATER FOR THE EMERGENCY CONDITION.

TELEDYNE ENGINEERING SERVICES

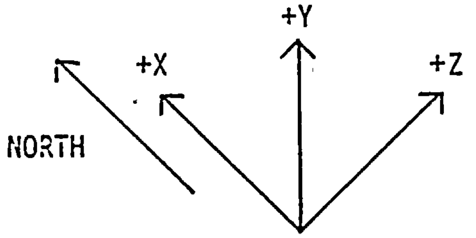
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMB DATE: 6-9-83

CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-C-593

NODE NUMBER 99

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.035	.038	-.019		1054				
THERMAL-1	.215	2.80	-.107						
THERMAL-2	.290	2.74	-.161						
THERMAL-3	.309	2.73	-.146						
SEISMIC-OBE	±.104	±.004	±.148						
SEISMIC-DBE	±.182	±.007	±.258						
BLOWDOWN-SRV	+.760 -.617	+.308 -.299	+.499 -.728						
BLOWDOWN-PORV	±.001	±.001	+.002 -.001						

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET		+1054	
EMERGENCY		+1054	

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)		1054	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE ——— THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

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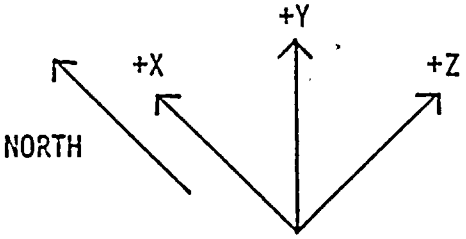
DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SDB DATE: 6-9-83
CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-594
NODE NUMBER 149

	DESIGN LOADINGS								
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.023	.027	-.047						
THERMAL-1	.160	2.81	.166						
THERMAL-2	.206	2.81	.154						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.192	0	±.047		±1100				
SEISMIC-DBE	±.332	0	±.078		±1820				
BLOWDOWN-SRV	—	—	—		—				
BLOWDOWN-PORV	±.002	0	±.002		±142				

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET		±1109	
EMERGENCY		±1820	

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)		4479	
DESIGN (-)		4479	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

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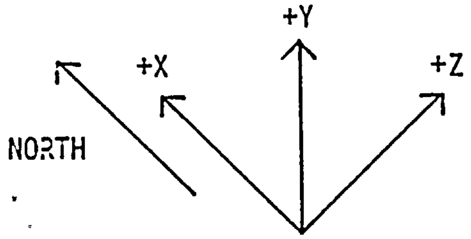
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMB DATE: 6-9-83
CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-C-595
NODE NUMBER 147

	DESIGN LOADINGS								
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.012	.045	-.035		1072				
THERMAL-1	.135	2.79	.142						
THERMAL-2	.206	2.79	.176						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.173	±.007	±.040						
SEISMIC-DBE	±.299	±.012	±.068						
BLOWDOWN-SRV	—	—	—						
BLOWDOWN-PORV	±.002	±.001	±.002						

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET		+1072	
EMERGENCY		+1072	

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)		1072	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE ——— THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

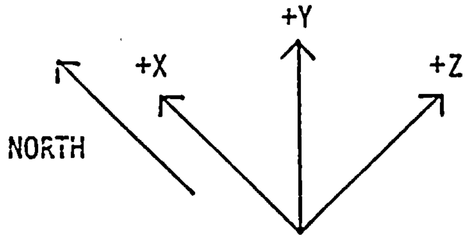
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 6-9-83
CHECKED BY: [signature] DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-596
NODE NUMBER 193

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.045	.024	-.003						
THERMAL-1	-.177	2.76	.187						
THERMAL-2	-.081	2.80	.248						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.045	0	±.167		±997				
SEISMIC-DBE	±.075	0	±.286		±1646				
BLOWDOWN-SRV	—	—	—		—				
BLOWDOWN-PORV	±.001	0	+.002 -.003		±93				

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET		±1001	
EMERGENCY		±1646	

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)		4218	
DESIGN (-)		4218	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

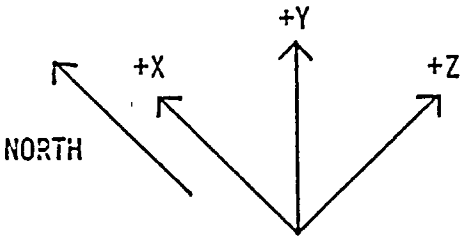
TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 6-9-83
CHECKED BY: [illegible] DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-C-597
NODE NUMBER 189

DESIGN LOADINGS	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.041	.044	-.005		983				
THERMAL-1	-.175	2.72	.145						
THERMAL-2	-.104	2.75	.247						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.044	±.009	±.167						
SEISMIC-DBE	±.072	±.015	±.285						
BLOWDOWN-SRV	—	—	—						
BLOWDOWN-PORV	±.001	±.001	+.002 -.004						

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET		+983	
EMERGENCY		+983	

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)		983	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE — THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

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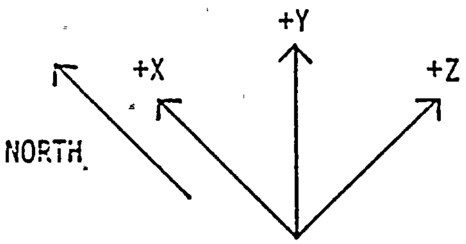
DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 6-9-83
CHECKED BY: [signature] DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-598
NODE NUMBER 95

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.016	.030	.002						
THERMAL-1	.085	2.81	-.131						
THERMAL-2	-.103	2.59	-.445						
THERMAL-3	-.096	2.44	-.435						
SEISMIC-OBE	±.007	±.003	±.006	±121	±131	±191			
SEISMIC-OBE	±.012	±.005	±.011	±209	±226	±330			
BLOWDOWN-SRV	+3.39 −3.28	+.166 −.173	+1.99 −1.98	±34425	±37195	±54455			
BLOWDOWN-PORV	±.004	±.001	+.003 −.002	±45	±49	±72			

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET	±129	±140	±204
EMERGENCY	±34425	±37195	±54455

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)	731	823	1223
DESIGN (-)	731	823	1223

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING FOR THE NORMAL/UPSET CONDITIONS AND GREATER FOR THE EMERGENCY CONDITION.

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
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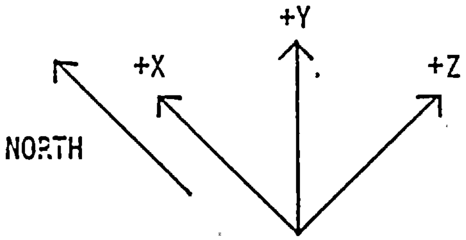
BY: [illegible] DATE: 6-9-83
CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-599
NODE NUMBER 141

DESIGN LOADINGS	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.020	.028	.042						
THERMAL-1	.114	2.80	.039						
THERMAL-2	.301	2.64	.142						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.010	±.006	±.004	±85	±42	±62			
SEISMIC-DBE	±.017	±.011	±.007	±145	±73	±106			
BLOWDOWN-SRV	—	—	—	—	—	—			
BLOWDOWN-PORV	±.002	±.001	+.001 -.002	±68	±34	±50			

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET	±109	±54	±80
EMERGENCY	±145	±73	±106

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)	422		573
DESIGN (-)	422		573

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
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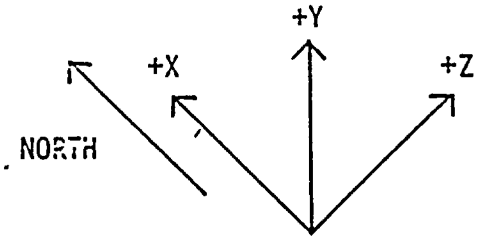
GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-R-600
NODE NUMBER 73

DESIGN LOADINGS	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1		-.002		-180		-170			
THERMAL-1		2.35		2060		2030			
THERMAL-2		2.32		1742		252			
THERMAL-3		—		—		—			
SEISMIC-OBE		±.005		±362		±517			
SEISMIC-DBE		±.008		±573		±872			
BLOWDOWN-SRV		—		—		—			
BLOWDOWN-PORV		+.003 -.002		±327		±1006			

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET	+2242 -542		+2377 -1049
EMERGENCY	+2453 -753		+2732 -1042

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)	2395		1997
DESIGN (-)	981		3659

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE GREATER (+Fx, +Fz) / LESS (-Fx, -Fz) THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

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ENGINEERING SERVICES

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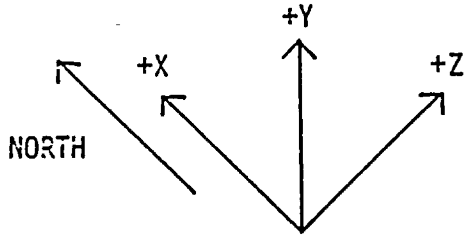
DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DHB DATE: 6-9-83

CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-R-601

NODE NUMBER 222

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1		-.002		530		370			
THERMAL-1		2.37		-1769		-2000			
THERMAL-2		2.62		-5054		-2181			
THERMAL-3		—		—		—			
SEISMIC-OBE		±.006		±701		±392			
SEISMIC-DBE		±.009		±1092		±632			
BLOWDOWN-SRV		—		—		—			
BLOWDOWN-PORV		+.003 -.002		±352		±254			

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET	+1231 -5308		+762 -2278
EMERGENCY	+1622 -2331		+1002 -2262

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)	1223		1106
DESIGN (-)	8757		2740

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS * THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

* EXCEPT IN + FX.

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

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DONALD C. COOK
UNIT #2
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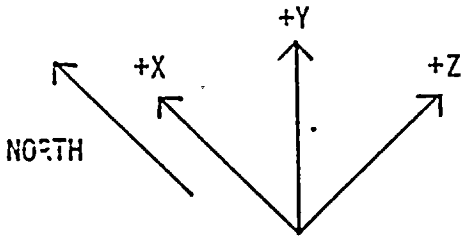
BY: [signature] DATE: 6-9-83

CHECKED BY: DmD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-C-602

NODE NUMBER 290

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.030	.077	.056		798				
THERMAL-1	-.523	2.71	-.508						
THERMAL-2	-.574	3.15	-.502						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.077	±.010	±.147						
SEISMIC-DBE	±.123	.016	.234						
BLOWDOWN-SRV	—	—	—						
BLOWDOWN-PORV	+.017 -.024	+.011 -.009	+.025 -.017						

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET		+798	-
EMERGENCY		+798	

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)		798	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE — THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

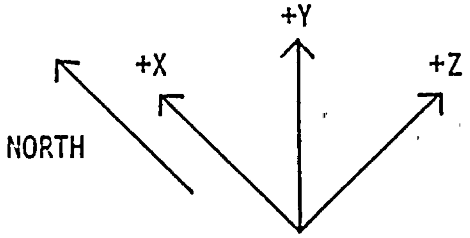
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 6-9-83

CHECKED BY: D.M.D DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-R-605

NODE NUMBER 326

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1		.120		170		-30			
THERMAL-1		3.36		-2220		3530			
THERMAL-2		3.36		-1381		3692			
THERMAL-3		—		—		—			
SEISMIC-OBE		±.013		±714		±1095			
SEISMIC-DBE		±.012		±1117		±1718			
BLOWDOWN-SRV		—		—		—			
BLOWDOWN-PORV		+.014 −.012		±2305		±1683			

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET	+1202 −3624		+5670 −1125
EMERGENCY	+1287 −3167		+5218 −1748

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)	1313		5851
DESIGN (-)	2972		2412

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

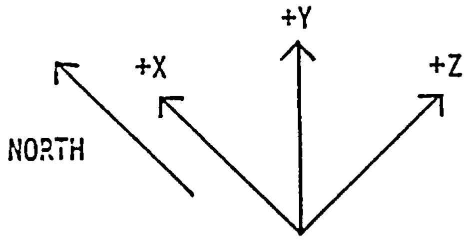
TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 6-9-83
CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-C-606
NODE NUMBER 316

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.023	.235	.021		634				
THERMAL-1	.076	3.67	-.282						
THERMAL-2	.093	3.66	-.253						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.032	±.064	±.051						
SEISMIC-DBE	±.050	±.102	±.080						
BLOWDOWN-SRV	—	—	—						
BLOWDOWN-PORV	+.015 -.018	+.046 -.031	+.029 -.035						

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET		+634	
EMERGENCY		+634	

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)		634	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE ______ THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

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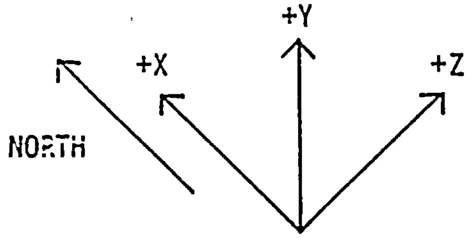
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 6-9-83
CHECKED BY: KMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-R-607
NODE NUMBER 312

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.002	.452	.031	-1069		-36			
THERMAL-1	.023	3.69	-.582	3205		109			
THERMAL-2	.020	3.73	-.559	1095		37			
THERMAL-3	—	—	—	—		—			
SEISMIC-OBE	±.001	±.049	±.041	±950		± 32			
SEISMIC-OBE	±.001	±.077	±.064	±1470		± 50			
BLOWDOWN-SRV	—	—	—	—		—			
BLOWDOWN-PORV	±.001	+.047 -.020	+.026 -.029	±1617		± 55			

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET	+3086 -2019		+105 -68
EMERGENCY	+3606 -2539		+123 -86

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)	5245		720
DESIGN (-)	2146		340

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

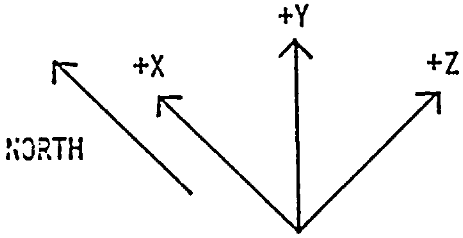
SUPPORT LOAD SUMMARY SHEET

BY: SIIB DATE: 6-9-83

CHECKED BY: DMD DATE: 6/9/83

DONALD C. COOK
UNIT #2
PROJECT 5364

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-C-608

NODE NUMBER 304

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.026	.361	.047		858				
THERMAL-1	-.185	3.30	-.669						
THERMAL-2	-.242	3.50	-.628						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.051	±.004	±.082						
SEISMIC-DBE	±.081	±.006	±.130						
BLOWDOWN-SRV	—	—	—						
BLOWDOWN-PORV	+.021 -.022	+.008 -.010	+.022 -.018						

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET		+858	
EMERGENCY		+353	

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)		858	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE —
THAN THE LOAD SHOWN
ON THE SUPPORT DRAWING

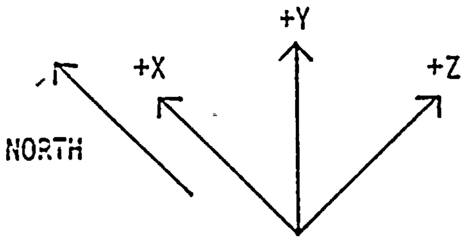
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 6-9-83
CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-609
NODE NUMBER 306

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.024	.420	.042						
THERMAL-1	-.114	3.42	-.693						
THERMAL-2	-.170	3.57	-.652						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.043	0	±.064		±333				
SEISMIC-DBE	±.069	0	±.101		±516				
BLOWDOWN-SRV	—	—	—		—				
BLOWDOWN-PORV	±.021	0	+.024 -.021		±687				

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET		±763	
EMERGENCY		±516	

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)		560	
DESIGN (-)		560	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE GREATER THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

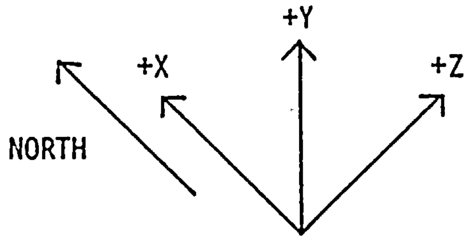
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 6-9-83
CHECKED BY: [illegible] DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-C-610
NODE NUMBER 274

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.031	.029	-.041		637				
THERMAL-1	-.430	3.23	.187						
THERMAL-2	-.390	3.27	-.078						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.108	±.011	±.281						
SEISMIC-DBE	±.160	±.019	±.417						
BLOWDOWN-SRV	—	—	—						
BLOWDOWN-PORV	+.026 -.027	+.021 -.023	+.046 -.045						

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET		+637	
EMERGENCY		+637	

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)		637	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE — THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
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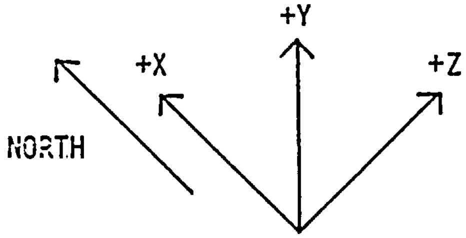
BY: DMB DATE: 6-9-83
CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-611
NODE NUMBER 248

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.045	.340	.050						
THERMAL-1	.093	3.36	-.193						
THERMAL-2	.070	3.61	.014						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.010	±.016	±.049	±26	±184	±62			
SEISMIC-OBE	±.016	±.023	±.073	±41	±286	±96			
BLOWDOWN-SRV	—	—	—	—	—	—			
BLOWDOWN-PORV	+.021 -.018	+.008 -.009	+.016 -.017	±160	±1124	±376			

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET	±162	±1139	±381
EMERGENCY	±41	±286	±96

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)	79	550	184
DESIGN (-)	79	550	184

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE GREATER THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

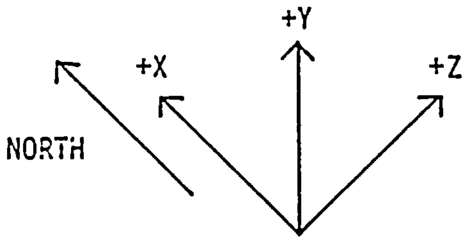
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: *[signature]* DATE: *6-9-83*
CHECKED BY: *[signature]* DATE: *6/9/83*

GLOBAL COORDINATE SYSTEM



MARK NUMBER *2-GRC-R-612*
NODE NUMBER *258*

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1		.341		-2[illegible]		30			
THERMAL-1		3.30		162[illegible]		-2820			
THERMAL-2		3.65		-33[illegible]		-152			
THERMAL-3		—		—		—			
SEISMIC-OBE		±.023		±60[illegible]		±1211			
SEISMIC-OBE		±.035		±910		±1792			
BLOWDOWN-SRV		—		—		—			
BLOWDOWN-PORV		+.010 -.009		±873		±669			

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET	+2024 -1610		+1262 -4001
EMERGENCY	+2329 -1120		+1822 -4582

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)	1105		1768
DESIGN (-)	3141		4894

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE *LESS* THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

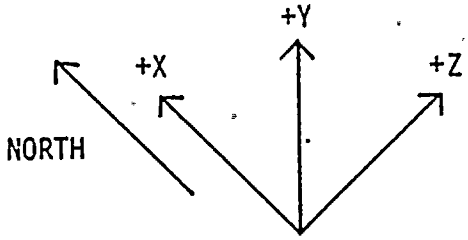
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 6-9-83
CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-C-613
NODE NUMBER 261

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.014	.233	-.015		720				
THERMAL-1	-.037	3.29	.057						
THERMAL-2	-.028	3.65	-.011						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.006	±.022	±.022						
SEISMIC-DBE	±.009	±.033	±.032						
BLOWDOWN-SRV	—	—	—						
BLOWDOWN-PORV	+.007 −.009	+.010 −.007	±.005						

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET		+720	
EMERGENCY		+720	

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)		720	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE — THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
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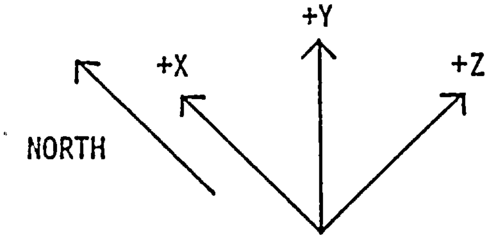
BY: DMB DATE: 6-9-83
CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-R-614

NODE NUMBER 238

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.018	.198	.041	371.		-157			
THERMAL-1	-.118	3.34	-.437	-2147		912			
THERMAL-2	-.183	3.42	-.440	3293		-1393			
THERMAL-3	—	—	—	—		—			
SEISMIC-OBE	±.015	±.004	±.038	±720		±306			
SEISMIC-DBE	±.023	±.006	±.057	±1076		±457			
BLOWDOWN-SRV	—	—	—	—		—			
BLOWDOWN-PORV	+.010 -.014	±.002	+.024 -.031	±670		±284			

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET	+4648 -2496		+1061 -1972
EMERGENCY	+1447 -2852		+1212 -614

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)	9331		538
DESIGN (-)	1264		3962

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

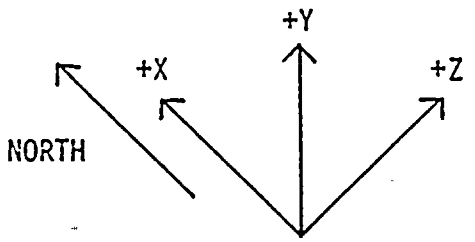
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: SMB DATE: 6-9-83

CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-R-616

NODE NUMBER 129

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.004	0	.001		-276				
THERMAL-1	.012	2.35	-.006		-558				
THERMAL-2	.063	2.35	.041		-8				
THERMAL-3	—	—	—		—				
SEISMIC-OBE	±.002		±.005		±1753				
SEISMIC-OBE	±.003		±.008		±2789				
BLOWDOWN-SRV	—		—		—				
BLOWDOWN-PORV	±.003		±.002		±754				

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET		+1624 -2587	
EMERGENCY		+2513 -3623	

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)		37502	
DESIGN (-)		36947	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

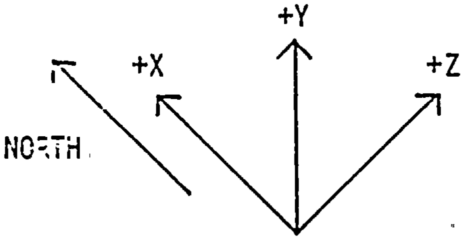
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 6-9-83
CHECKED BY: [illegible] DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-624
NODE NUMBER 22

DESIGN LOADINGS	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.008	-.003	.006						
THERMAL-1	-.069	-.003	.065						
THERMAL-2	-.074	-.009	-.429						
THERMAL-3	-.059	-.009	-.387						
SEISMIC-OBE	±.001	0	0	±7		±75			
SEISMIC-DBE	±.002	±.001	0	±11		±122			
BLOWDOWN-SRV	+.437 -.675	+.088 -.084	+.065 -.063	±40292		±3572			
BLOWDOWN-PORV	±.003	0	±0	±18		±199			

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET	±19		±213
EMERGENCY	±40292		±3572

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)			1429
DESIGN (-)			1429

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING FOR THE NORMAL/UPSET CONDITIONS AND GREATER FOR THE EMERGENCY CONDITION.

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

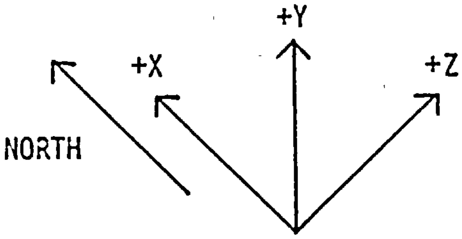
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMB DATE: 6-9-83

CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-626

NODE NUMBER 402

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.017	.210	.013						
THERMAL-1	-.270	3.39	-.599						
THERMAL-2	-.171	3.51	-.575						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.048	0	±.039		±291				
SEISMIC-DBE	±.082	0	±.060		±503				
BLOWDOWN-SRV	—	—	—		—				
BLOWDOWN-PORV	+.016 -.020	0	+.018 -.026		±1396				

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET		±1426	
EMERGENCY		±503	

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)		945	
DESIGN (-)		945	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE GREATER THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
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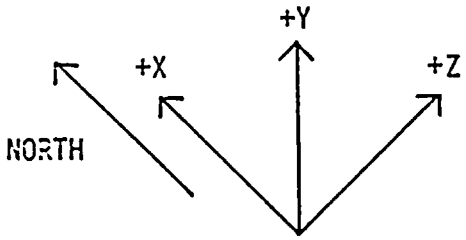
BY: [signature] DATE: 6-9-83
CHECKED BY: DMD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-C-627
NODE NUMBER 400

DESIGN LOADINGS	DISPLACEMENTS X	DISPLACEMENTS Y	DISPLACEMENTS Z	FORCES FX	FORCES FY	FORCES FZ	MOMENTS MX	MOMENTS MY	MOMENTS MZ
DEADWEIGHT-1	-.005	.202	.022		732				
THERMAL-1	-.238	3.38	-.530						
THERMAL-2	-.183	.351	-.494						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.032	±.014	±.037						
SEISMIC-DBE	±.053	±.024	±.057						
BLOWDOWN-SRV	—	—	—						
BLOWDOWN-PORV	+.012 -.018	±.004	+.022 -.028						

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET		+732	
EMERGENCY		+732	

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)		732	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE — THAN THE LOAD SHOWN ON THE SUPPORT DRAWING.

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

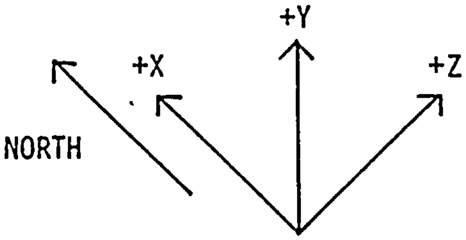
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 6-9-83

CHECKED BY: DmD DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-629

NODE NUMBER 228

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.018	.013	.036						
THERMAL-1	-.279	2.47	-.252						
THERMAL-2	-.500	2.91	-.309						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.044		±.084		±1766				
SEISMIC-DBE	±.068		±.133		±2808				
BLOWDOWN-SRV	—		—		—				
BLOWDOWN-PORV	+.015 -.022		+.025 -.019		±1025				

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET		±2042	
EMERGENCY		±2808	

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)		5943	
DESIGN (-)		5943	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

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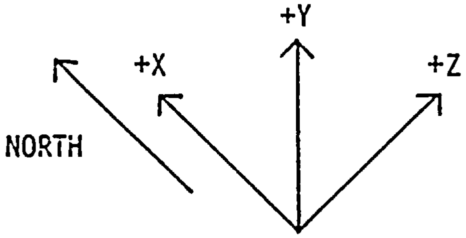
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [signature] DATE: 6-9-83
CHECKED BY: [signature] DATE: 6/9/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-630
NODE NUMBER 182

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.028	.030	.005						
THERMAL-1	.003	2.65	.030						
THERMAL-2	.072	2.55	.280						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.008	±.009	±.005	±56		±88			
SEISMIC-DBE	±.013	±.014	±.008	±95		±150			
BLOWDOWN-SRV	—	—	—	—		—			
BLOWDOWN-PORV	+.005 -.007	±.002	+.003 -.005	±98		±155			

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET	±113		±178
EMERGENCY	±95		±150

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)	339		404
DESIGN (-)	339		404

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

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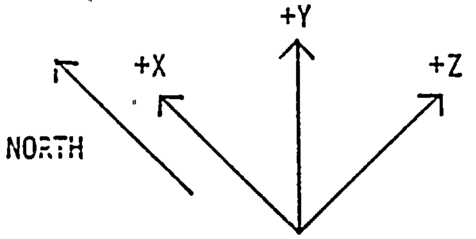
GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-631
NODE NUMBER 132

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.023	-.005	.002						
THERMAL-1	.080	2.48	.009						
THERMAL-2	.080	2.40	.230						
THERMAL-3	—	—	—						
SEISMIC-OBE	±.002	±.025	±.002	±107		±84			
SEISMIC-DBE	±.003	±.043	±.003	±184		±146			
BLOWDOWN-SRV	—	—	—						
BLOWDOWN-PORV	+.001 -.002	+.021 -.020	+.001 -.002	±183		±145			

TES COMBINED LOADS			
	FX	FY	FZ
NORMAL/UPSET	±212		±168
EMERGENCY	±184		±146

SUPPORT DRAWING LOADS			
	FX	FY	FZ
DESIGN (+)	681		811
DESIGN (-)	681		811

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: [illegible] DATE: 6-9-83
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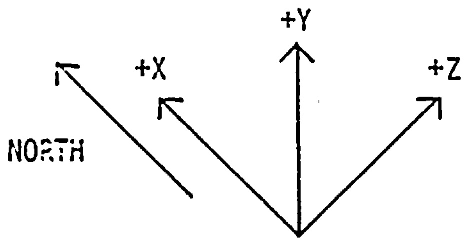
GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-S-632
NODE NUMBER 78

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.001	-.058	-.001						
THERMAL-1	.084	2.43	.002						
THERMAL-2	.093	2.27	.197						
THERMAL-3	.035	2.25	.182						
SEISMIC-OBE	±.002	±.038	±.002	±224		±184			
SEISMIC-OBE	±.002	±.065	±.003	±384		±316			
BLOWDOWN-SRV	+.268 -.312	+1.14 -1.24	+.384 -.441	±128356		±105579			
BLOWDOWN-PORV	±.002	+.009 -.006	±.002	±168		±138			

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET	±280		±230
EMERGENCY	±128356		±105579

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)	2500		3167
DESIGN (-)	2500		3167

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING FOR THE NORMAL/UPSET CONDITIONS AND GREATER FOR THE EMERGENCY CONDITION.

TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

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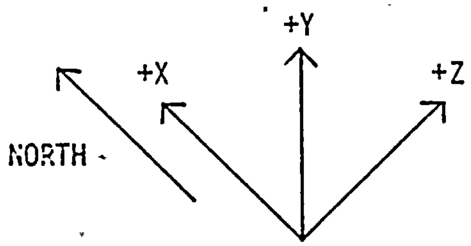
GLOBAL COORDINATE SYSTEM



MARK NUMBER 2-GRC-R-633

NODE NUMBER 84

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.003	-.051	-.003	46		40			
THERMAL-1	.106	2.68	-.120	73		64			
THERMAL-2	.276	2.32	-.312	1207		1060			
THERMAL-3	.213	2.20	-.240	1136		998			
SEISMIC-OBE	±.002	±.053	±.003	±284		±249			
SEISMIC-DBE	±.004	±.085	±.005	±488		±429			
BLOWDOWN-SRV	+1.43 -1.63	+.890 -.883	+2.02 -1.82	±102123		±89665			
BLOWDOWN-PORV	±.002	+.008 -.006	+.003 -.002	±96		±84			

TES COMBINED LOADS	FX	FY	FZ
NORMAL/UPSET	+1553 -238		+1363 -209
EMERGENCY	+103305 -100941		+90703 -88627

SUPPORT DRAWING LOADS	FX	FY	FZ
DESIGN (+)	4210		3173
DESIGN (-)	1984		1495

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING FOR THE NORMAL/UPSET CONDITIONS AND GREATER FOR THE EMERGENCY CONDITION.

6.3 Valve Accelerations

Valve accelerations were calculated for all valves due to the DBE seismic condition and the PORV transient shock condition. In addition, the acceleration of valve SV-45C was calculated for the SV transient shock condition since this valve is part of the quarter model. The horizontal allowable was taken as 3g and the vertical allowable as 2g based on the attachments to AEP letter dated September 16, 1982 from Mr. J. L. Williams of AEP to Mr. L. B. Semprucci of TES (Reference 12). For the seismic accelerations, the resultant horizontal acceleration was compared against the 3g allowable. Weights for valves NMO-151, 152 and 153 were taken as 352 pounds, in determining the seismic acceleration, since this is the value used in the seismic analysis, see Section 5.0.

For the PORV transient shock accelerations, the updated valve weight of 400 pounds was used in both the analysis and the acceleration calculations. It should be noted that valves NRV-151, NRV-152, NRV-153, NMO-151, NMO-152 and NMO-153 all fail the vertical acceleration criteria of 2g and valves NMO-151, 152 and 153 exceed the horizontal acceleration criteria of 3g. These values are considered acceptable per reference 7 (see Section 2.0).

The acceleration of valve SV-45C for the SV transient shock condition exceeds all criteria by a large margin, which further indicates the failure of the system during emergency conditions.

6.3.1 DBE Seismic Valve Accelerations

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/12/83
CHECKED BY: [illegible] DATE: 5-12-83

VALVE NO.		SV-45A			SV-45B			SV-45C		
NODE NO.		1980			1540			105		
		ACCELERATION			ACCELERATION			ACCELERATION		
		A_x	A_y	A_z	A_x	A_y	A_z	A_x	A_y	A_z
SHOCK DIRECTION	X	1.02	.16	.41	1.47	.19	.34	.82	.12	.80
	Y	.04	.02	.05	.06	.03	.05	.06	.03	.06
	Z	.42	.20	1.34	.34	.16	1.07	.81	.14	1.05
SRSS RESULTS	A_{xT}	1.10 g			1.51 g			1.15 g		
	A_{yT}	.26 g			.25 g			.19 g		
	A_{zT}	1.40 g			1.12 g			1.32 g		

	ACCEL.	ALLOWABLE	ACCEL.	ALLOWABLE	ACCEL.	ALLOWABLE
VERTICAL A_{yT}	.26 g	2 g	.25 g	2 g	.19 g	2 g
HORIZONTAL *	1.78 g	3 g	1.88 g	3 g	1.75 g	3 g

* HORIZONTAL ACCELERATION = $\sqrt{(A_{xT})^2 + (A_{zT})^2}$

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DHD DATE: 5/12/83
CHECKED BY: [illegible] DATE: 5-12-83

VALVE NO.		NMO-151			NMO-152			NMO-153		
NODE NO.		301			355			271		
		ACCELERATION			ACCELERATION			ACCELERATION		
		A_x	A_y	A_z	A_x	A_y	A_z	A_x	A_y	A_z
SHOCK DIRECTION	X	.35	.17	.39	.78	.35	.40	.54	.39	.90
	Y	.17	.09	.11	.16	.16	.08	.11	.12	.19
	Z	.50	.24	.91	.49	.26	.35	.51	.19	1.14
SRSS RESULTS	A_{xT}	.63 g			.93 g			.75 g		
	A_{yT}	.32 g			.46 g			.45 g		
	A_{zT}	1.00 g			.54 g			1.46 g		

	ACCEL.	ALLOWABLE	ACCEL.	ALLOWABLE	ACCEL.	ALLOWABLE
VERTICAL A_{yT}	.32 g	2 g	.46 g	2 g	.45 g	2 g
HORIZONTAL *	1.18 g	3 g	1.07 g	3 g	1.65 g	3 g

$$* \text{ HORIZONTAL ACCELERATION} = \sqrt{(A_{xT})^2 + (A_{zT})^2}$$

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 5/12/83
CHECKED BY: [illegible] DATE: 5-12-83

VALVE NO.		NRV-151			NRV-152			NRV-153		
NODE NO.		295			347			365		
		ACCELERATION			ACCELERATION			ACCELERATION		
		A_x	A_y	A_z	A_x	A_y	A_z	A_x	A_y	A_z
SHOCK DIRECTION	X	.54	.18	.61	1.40	.19	.75	.62	.31	.91
	Y	.13	.23	.12	.12	.09	.10	.22	.10	.13
	Z	.86	.22	1.53	.72	.14	.53	.47	.18	1.26
SRSS RESULTS	A_{xT}	1.02 g			1.58 g			.82 g		
	A_{yT}	.30 g			.25 g			.37 g		
	A_{zT}	1.69 g			.94 g			1.56 g		

	NRV-151 ACCEL.	NRV-151 ALLOWABLE	NRV-152 ACCEL.	NRV-152 ALLOWABLE	NRV-153 ACCEL.	NRV-153 ALLOWABLE
VERTICAL A_{yT}	.30 g	2 g	.25 g	2 g	.37 g	2 g
HORIZONTAL *	1.97 g	3 g	1.84 g	3 g	1.76 g	3 g

* HORIZONTAL ACCELERATION = $\sqrt{(A_{xT})^2 + (A_{zT})^2}$

6.3.2 PORV Transient Shock and SV Transient Shock Valve Accelerations

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 8 June 83
CHECKED BY: [illegible] DATE: 8 June 83

VALVE ACCELERATIONS

VALVE	SV-45A			SV-45B		
NODE NUMBER	1980			1540		
VALVE WEIGHT	685 LBS			685 LBS		
DIRECTION	X	Y	Z	X	Y	Z
FORCE (LBS)	36	56	49	41	47	53
ACCELERATION	.05g	.08g	.07g	.06g	.07g	.08g
ALLOWABLE	3 g	2 g	3 g	3 g	2 g	3 g

VALVE	SV-45C			SV-45C *		
NODE NUMBER	105			105		
VALVE WEIGHT	685 LBS			685 LBS		
DIRECTION	X	Y	Z	X	Y	Z
FORCE (LBS)	27	34	21	19469	21145	8192
ACCELERATION	.04g	.05g	.03g	28.4g	30.9g	12.0g
ALLOWABLE	3 g	2 g	3 g	3g	2g	3g

* ACCELERATIONS ARE THE RESULTS OF THE SV TRANSIENT SHOCK CONDITION FROM THE QUARTER MODEL ANALYSIS. ALL OTHER VALVE ACCELERATIONS IN THIS SECTION RESULT FROM THE PORV TRANSIENT SHOCK CONDITION.

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 8 JUNE 83
CHECKED BY: AMB DATE: 8 June 83

VALVE ACCELERATIONS

VALVE	NMO-151			NMO-152		
NODE NUMBER	301			355		
VALVE WEIGHT	400 LBS			400 LBS		
DIRECTION	X	Y	Z	X	Y	Z
FORCE (LBS)	1413	891	633	636	1248	1498
ACCELERATION	3.53g	2.23g	1.58g	1.59g	3.12g	3.75g
ALLOWABLE	3g	2g	3g	3g	2g	3g

VALVE	NMO-153					
NODE NUMBER	271					
VALVE WEIGHT	400 LBS					
DIRECTION	X	Y	Z	X	Y	Z
FORCE (LBS)	1554	1156	632			
ACCELERATION	3.89g	2.89g	1.58g			
ALLOWABLE	3g	2g	3g			

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 8 JUNE 83
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VALVE ACCELERATIONS

VALVE	NRV-151			NRV-152		
NODE NUMBER	295			349		
VALVE WEIGHT	480 LBS			480 LBS		
DIRECTION	X	Y	Z	X	Y	Z
FORCE (LBS)	597	1003	234	346	1754	647
ACCELERATION	1.24g	2.09g	.49g	.72g	3.65g	1.35g
ALLOWABLE	3g	2g	3g	3g	2g	3g

VALVE	NRV-153					
NODE NUMBER	265					
VALVE WEIGHT	480 LBS					
DIRECTION	X	Y	Z	X	Y	Z
FORCE (LBS)	555	1123	222			
ACCELERATION	1.16g	2.34g	.46g			
ALLOWABLE	3g	2g	3g			

6.4 Nozzle Loads

Forces and Moments for the four pressurizer nozzles and the quench tank nozzles are given in this section for each loading condition analyzed.

TELEDYNE ENGINEERING SERVICES

NOZZLE LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 6/8/83

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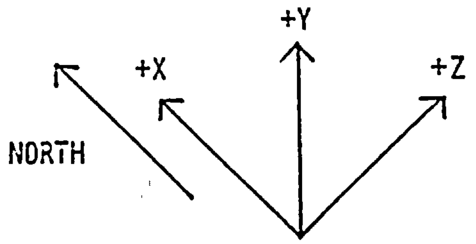
GLOBAL COORDINATE SYSTEM



NODE NUMBER 2

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	—	—	—	70	-950	50	-2580	-3220	-6470
THERMAL-1	—	—	—	460	590	1150	53470	-41790	-117040
THERMAL-2	—	—	—	-120	180	-110	-310	23990	-27730
THERMAL-3	—	—	—	-160	170	-200	-2360	25980	-22200
SEISMIC-OBE	—	—	—	±36	±94	±50	±795	±1565	±4116
SEISMIC-DBE	—	—	—	±58	±166	±85	±1329	±2599	±7133
BLOWDOWN-SRV	—	—	—	±32019	±19725	±27766	±351784	±858752	±973166
BLOWDOWN-PORV	—	—	—	±351	±117	±104	±1569	±3272	±5446

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TELEDYNE ENGINEERING SERVICES

NOZZLE LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 6/8/83

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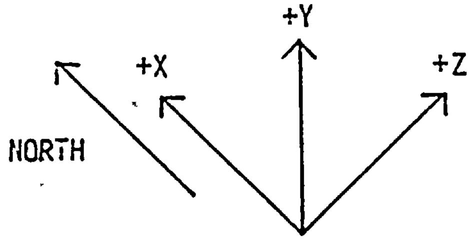

NODE NUMBER 124

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	—	—	—	-60	-980	0	-19300	-1010	-2569
THERMAL-1	—	—	—	-180	-320	150	-160	-5150	-13550
THERMAL-2	—	—	—	-230	-200	-40	7220	11740	-16410
THERMAL-3	—	—	—	-200	-100	-80	6990	11450	-13570
SEISMIC-OBE	—	—	—	±591	±852	±701	±16243	±13095	±17376
SEISMIC-DBE	—	—	—	±1003	±1406	±1213	±28151	±21905	±28949
BLOWDOWN-SRV	—	—	—	±14971	±33325	±52119	±1674445	±559538	±419711
BLOWDOWN-PORV	—	—	—	±29	±55	±45	±1716	±823	±766

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

NOZZLE LOAD SUMMARY SHEET

BY: DMD DATE: 6/8/83

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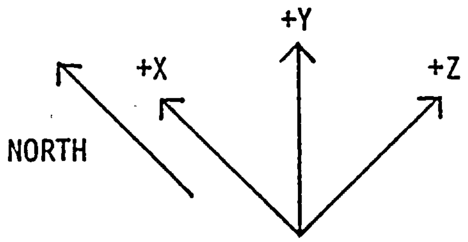
DONALD C. COOK
UNIT #2
PROJECT 5364

GLOBAL COORDINATE SYSTEM



NODE NUMBER 174

	DESIGN LOADINGS								
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	—	—	—	0	-910	-40	-7530	-800	-20980
THERMAL-1	—	—	—	-380	-490	-110	16750	-10960	-7250
THERMAL-2	—	—	—	-70	-270	20	6460	-950	790
SEISMIC-OBE	—	—	—	±891	±1210	±790	±15309	±16045	±22664
SEISMIC-OBE	—	—	—	±1542	±1991	±1300	±25318	±26549	±39163
BLOWDOWN-SRV	—	—	—	—	—	—	—	—	—
BLOWDOWN-PORV	—	—	—	±57	±78	±56	±1212	±1081	±2519

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

Technical Report
TR-5364-2
Revision 0

TELEDYNE
ENGINEERING SERVICES

NOZZLE LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 6/8/83
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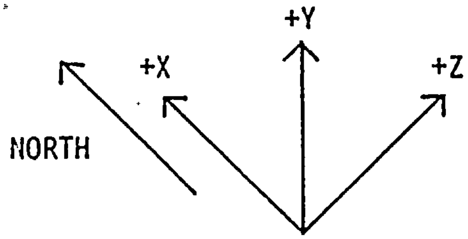

NODE NUMBER 218

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	—	—	—	40	-989	-10	15160	-250	-13760
THERMAL-1	—	—	—	-270	-860	-579	21990	-21679	24070
THERMAL-2	—	—	—	90	-400	-60	4940	-970	15200
SEISMIC-OBE	—	—	—	±740	±1100	±780	±22610	±14193	±7406
SEISMIC-DBE	—	—	—	±1221	±1821	±1331	±37426	±23445	±12649
BLOWDOWN-SRV	—	—	—	—	—	—	—	—	—
BLOWDOWN-PORV	—	—	—	±57	±86	±56	±1725	±1000	±1503

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

NOZZLE LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMD DATE: 6/8/83
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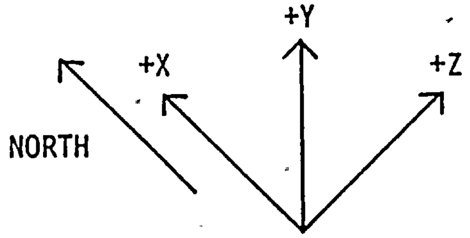


NODE NUMBER 342

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	—	—	—	310	-170	10	1330	4320	-13070
THERMAL-1	—	—	—	70	-60	-1150	-87270	33800	29390
THERMAL-2	—	—	—	40	450	-1159	-97290	31640	26650
SEISMIC-OBE	—	—	—	±182	±284	±241	±15557	±12931	±10248
SEISMIC-DBE	—	—	—	±294	±477	±393	±23938	±19320	±15538
BLOWDOWN-SRV	—	—	—	—	—	—	—	—	—
BLOWDOWN-PORV	—	—	—	±650	±6248	±554	±19815	±5301	±17464

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

6.5 Valve Loads

Section 6.5 gives the moments on each end of all valves in the piping system for each loading condition analyzed.

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

VALVE END MOMENTS

BY: AMB DATE: 6-8-83
CHECKED BY: DmD DATE: 6/8/83

VALVE NUMBER SV-45A

NODE NUMBER	196			200		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	2532	938	4853	3242	1046	14021
THERMAL 1	-22224	2773	4017	-12742	12244	-14350
THERMAL 2	2172	1696	-9635	2836	2570	-14309
SEISMIC OBE	±8522	±3675	±1779	±2077	±1291	±8896
SEISMIC DBE	±14573	±6280	±2978	±3497	±2148	±14684
BLOWDOWN PORV	±882	±285	±597	±917	±730	±854

VALVE NUMBER ______________________

NODE NUMBER						
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT						
THERMAL 1						
THERMAL 2						
SEISMIC OBE						
SEISMIC DBE						
BLOWDOWN PORV						

UNITS: INCH-POUNDS

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

DONALD C. COOK
UNIT #2
PROJECT 5364

VALVE END MOMENTS

BY: DMB DATE: 6-8-83
CHECKED BY: DMD DATE: 6/8/83

VALVE NUMBER SV-45B

NODE NUMBER	152			156		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	3963	1343	99	13948	1588	5144
THERMAL 1	-6572	1225	14663	-11581	7505	4517
THERMAL 2	2055	-1423	-1573	-2199	-544	-4628
THERMAL-3	—	—	—	—	—	—
SEISMIC OBE	±3762	±3713	±12031	±6927	±906	±6495
SEISMIC DBE	±6504	±6423	±20814	±11460	±1507	±10755
BLOWDOWN PORV	±375	±196	±419	±872	±685	±460

VALVE NUMBER SV-45C

NODE NUMBER	103			107		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	1798	819	-3676	7708	1492	-10836
THERMAL 1	5555	299	9505	-650	3946	9948
THERMAL 2	-8372	-10721	18035	-9908	-8612	16182
THERMAL-3	-9678	-9073	17487	-9336	-7745	14976
SEISMIC OBE	±9863	±2919	±7704	±7041	±746	±4154
SEISMIC DBE	±17131	±5077	±13374	±11679	±1244	±6881
BLOWDOWN PORV	±620	±130	±564	±750	±557	±706
BLOWDOWN SRV	±433358	±84761	±502148	±391070	±255572	±578093

UNITS: INCH-POUNDS

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

VALVE END MOMENTS

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMB DATE: 5-27-83
CHECKED BY: DMD DATE: 5/27/83

VALVE NUMBER NRV-151

NODE NUMBER	292			296		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	1305	1338	6933	1460	1690	6549
THERMAL 1	6579	1741	-6163	6375	-2570	-5656
THERMAL 2	4729	213	-2379	4594	-1096	-2044
SEISMIC OBE	±7008	±6142	±1983	±7941	±7814	±6151
SEISMIC DBE	±11146	±9772	±3029	±12646	±12433	±9834
BLOWDOWN PORV	±3576	±1129	±7671	±7647	±2661	±13478

VALVE NUMBER NMO-151

NODE NUMBER	298			302		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	2967	2084	2817	4660	2428	-2677
THERMAL 1	6141	-7464	-5077	5941	-11682	-4531
THERMAL 2	4439	-2581	-1662	4307	-3862	-1334
SEISMIC OBE	±8219	±6296	±4674	±11359	±3878	±4451
SEISMIC DBE	±13090	±10021	±7504	±18076	±6171	±7087
BLOWDOWN PORV	±8087	±5021	±10421	±4703	±5603	±8713

UNITS: INCH-POUNDS

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

VALVE END MOMENTS

DONALD C. COOK
UNIT #2
PROJECT 5364

BY: DMB DATE: 5-27-83
CHECKED BY: DMD DATE: 5/27/83

VALVE NUMBER NRV-152

NODE NUMBER	346			350		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	809	-275	1382	-2492	-389	54
THERMAL 1	11080	5888	4243	10447	1662	3988
THERMAL 2	15352	1300	9007	12609	-1039	7899
SEISMIC OBE	±3106	±4196	±5116	±4329	±5260	±7278
SEISMIC DBE	±5275	±7312	±8915	±7257	±9160	±12551
BLOWDOWN PORV	±7740	±1096	±4492	±8822	±2339	±7346

VALVE NUMBER NMO-152

NODE NUMBER	352			356		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	-3004	-546	-157	-1051	-660	109
THERMAL 1	9575	-4166	3635	8954	-3322	3385
THERMAL 2	8824	-4264	6371	6133	-6576	5286
SEISMIC OBE	±3712	±3372	±7236	±3792	±1538	±9170
SEISMIC DBE	±6252	±5827	±12497	±6515	±2534	±15906
BLOWDOWN PORV	±10489	±5586	±5966	±14880	±6371	±6195

UNITS: INCH-POUNDS

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 0

VALVE END MOMENTS

BY: [signature] DATE: 5-27-83
CHECKED BY: [signature] DATE: 5/27/83

DONALD C. COOK
UNIT #2
PROJECT 5364

VALVE NUMBER NRV-153

NODE NUMBER	262			266		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	3490	-224	-3953	5265	-41	-8350
THERMAL 1	-9400	-7895	-3140	-10151	-6228	-6280
THERMAL 2	1198	-3818	-996	2002	-2637	-2988
SEISMIC OBE	±9149	±770	±4255	±4528	±2963	±4959
SEISMIC DBE	±13560	±1221	±6318	±7296	±4435	±8120
BLOWDOWN PORV	±2573	±1296	±7121	±6328	±1946	±13676

VALVE NUMBER NMO-153

NODE NUMBER	268			272		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	6007	180	-10184	6196	360	-9360
THERMAL 1	-11065	-4200	-4020	-11800	-2566	-2196
THERMAL 2	2981	-1202	-5409	3768	-42	-7363
SEISMIC OBE	±3722	±6476	±2187	±7515	±6167	±2910
SEISMIC DBE	±5692	±9605	±3625	±11152	±9150	±4402
BLOWDOWN PORV	±5957	±2541	±11249	±4781	±2193	±12104

UNITS: INCH-POUNDS

6.6 Miscellaneous Calculations

6.6.1 Thermal Boundary Displacements

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

BY DMD DATE 4/12/83 | CHKD. BY [illegible] DATE 4-12-83

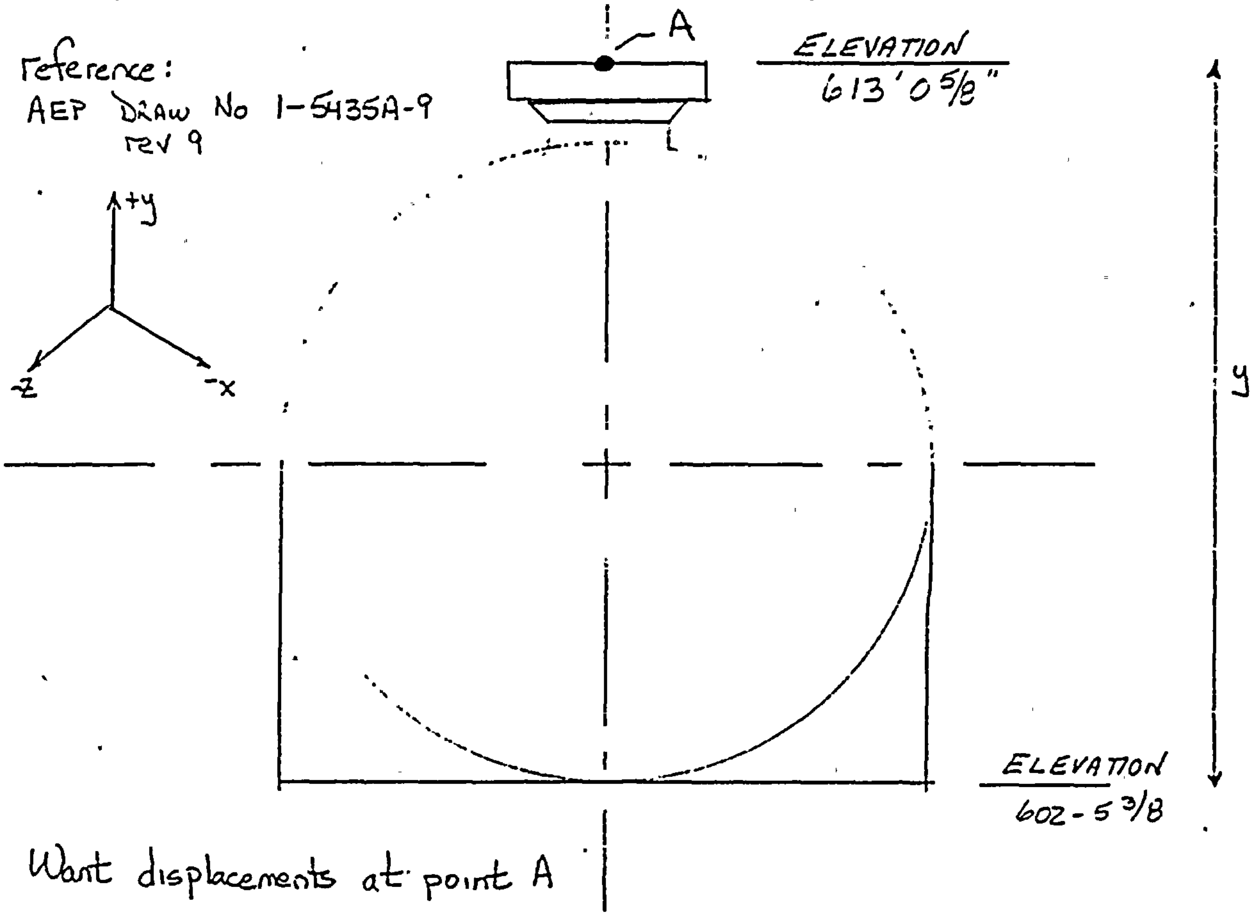
THERMAL BOUNDARY DISPLACEMENTS
NORMAL THERMAL CONDITION

SHEET NO. 1 OF ___ | PROJ. NO. 5364

UNITS 1 & 2

Temperature @ Quench Tank = 85°F (per AEP letter dated 11/29/82)

reference:
AEP DRAW No 1-5435A-9
rev 9



Want displacements at point A

y = 613'-0 5/8"
−602-5 3/8'
10'-7 1/4 = 10.604'

x movement = z movement = 0 since nozzle is at ℄ of Q-tank

y movement = $\alpha \Delta t \ell$

$\alpha = 6.135 \times 10^{-6}$ in/in/°F (for ferritic carbon steel)
$\Delta t = 15°F$ (85-70)
$\ell = 10.604' = 127.248"$

$\Delta y = 6.135 \times 10^{-6} \times 15 \times 127.248 = .0117"$

Summary $\Delta x = 0$ $\Delta y = +.0117"$ $\Delta z = 0$

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

BY DMD DATE 4/12/83 SHEET NO. 1 OF
CHKD. BY [illegible] DATE 4/[illegible] PROJ. NO. 5364

α, ΔT Values Units 1 & 2

temperature ⇒ 653°F

$\Delta T = 653 - 70 = 583$

for austentic stainless steel $\alpha_{650} = 9.87 \times 10^{-6}$

$\alpha_{700} = 9.93 \times 10^{-6}$

$\alpha_{700} - \alpha_{650} = 9.93 - 9.87 = .06$

$\frac{.06}{50^\circ} = \frac{x}{3^\circ} \quad x = .0036$

$\alpha_{653} = 9.87 + .0036 = 9.8736 \times 10^{-6}$

temperature = 85°

$\Delta T = 85 - 70 = 15^\circ$

for austentic stainless steel $\alpha_{70} = 9.11 \times 10^{-6}$

$\alpha_{100} = 9.16 \times 10^{-6}$

$\alpha_{100} - \alpha_{70} = 9.16 - 9.11 = .05$

$\frac{.05}{30} = \frac{x}{15} \Rightarrow x = .025$

$\alpha_{85} = 9.11 + .025 = 9.135 \times 10^{-6}$

Temperature of Pressurizer = 653° F (per AEP letter dated 11/29/82)

references ① AEP Draw No 1-5435-8 rev 8
② Ⓦ Draw No 1097 J56 sheet 1 of 2
③ AEP Draw No 1-5436-8

per reference ② dimension from base of pressurizer to SRV & PORV nozzles is:

$$635.5 - (52.00 - 35.06) = 618.56''$$

Δy will be same for all four nozzles since the elevations are the same.

$\alpha_{583^\circ} = 7.3366 \times 10^{-6}$ in/in/°F for carbon steel @ 653°

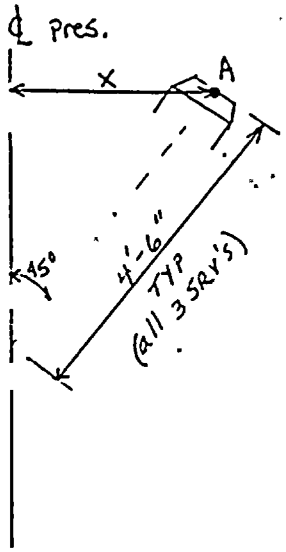
$l = 618.56''$

$\Delta t = 653 - 70 = 583$

$$\Delta y = +\alpha \Delta t l = 7.3366 \times 10^{-6} \times 618.56'' \times 583°F = 2.6457''$$

radial growth

per section "G-7" of ref 3



$$\frac{\sin 90}{4.5} = \frac{\sin 45}{x}$$

$$x = 3.182' = 38.1838''$$

note: this page of calculations is the same for both units since the pressurizer & nozzle dimensions are essentially identical

Technical Report
TR-5364-2
Rivsion 0

TELEDYNE ENGINEERING SERVICES

BY: DMD DATE 4/13/83
CHKD. BY: AMB DATE 4-13-83

Thermal Boundary Displacements
NORMAL THERMAL CONDITION

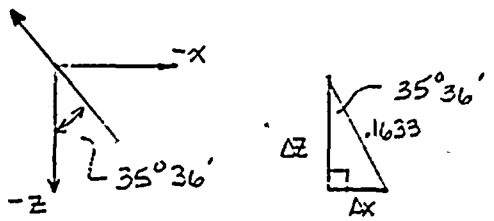
SHEET NO. 3 OF ____
PROJ. NO. 5364

UNIT 2

radial $\Delta = 7.3366 \times 10^{-6} \times 583 \times 38.1838 = .1633''$

determine X & Z Components for radial Δ for each SRV valve nozzle

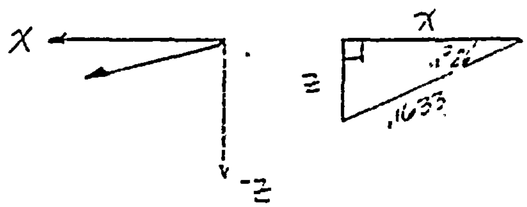
Valve SV-45A



$$\frac{\sin 90}{.1633} = \frac{\sin 35°36'}{\Delta X} = \frac{\cos 35°36'}{\Delta Z}$$

$\Delta X = {}^{+}.0951$
$\Delta Z = {}^{+}.1328$

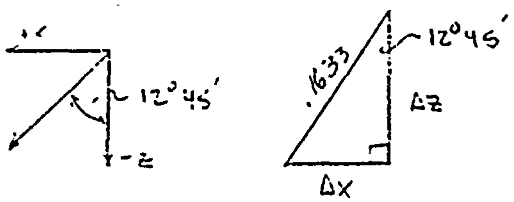
Valve SV-45B



$$\frac{\sin 90}{.1633} = \frac{\sin 11°26'}{-\Delta Z} = \frac{\cos 11°26'}{\Delta X}$$

$\Delta X = +.1601$
$\Delta Z = {}^{-}.0324$

Valve SV-45C



$$\frac{\sin 90}{.1633} = \frac{\sin 12°45'}{\Delta X} = \frac{\cos 12°45'}{-\Delta Z}$$

$\Delta X = {}^{+}.0360$
$\Delta Z = {}^{-}.1593$

Technical Report
TR-5364-2
Revision 0

TELEDYNE ENGINEERING SERVICES

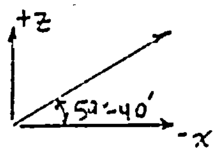
BY DMD DATE 4/13/83
CHKD. BY [illegible] DATE 4-13-83

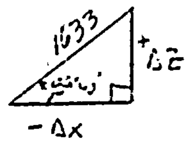
Thermal Boundary Displacements
NORMAL THERMAL CONDITION

SHEET NO. 4 OF
PROJ. NO. 5364

UNIT 2

PORV Relief Line





$$\frac{\sin 90}{.1633} = \frac{\sin 59°40'}{+\Delta Z} = \frac{\cos 59°40'}{-\Delta X}$$

$\Delta X = -.0825$
$\Delta Z = +.1409$

for the 4 pressurizer nozzles the following displacements will be inserted.

node 218 (Valve SV-45A)
$\Delta x = +.0951''$
$\Delta y = +2.6457''$
$\Delta z = +.1328''$

node 174 (SV-45 B)
$\Delta X = +.1601''$
$\Delta y = +2.6457''$
$\Delta z = -.0324''$

node 124 (SV-45C)
$\Delta x = +.0360''$
$\Delta y = +2.6457''$
$\Delta Z = -.1593''$

node 342 (PORV Relief)
$\Delta X = -.0825''$
$\Delta y = +2.6457''$
$\Delta Z = +.1409''$

6.6.2 OBE Spectra

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-2
Revision 1

BY BMD DATE 4/8/83
CHKD. BY BMB DATE 4/8/83

Response Spectra

SHEET NO. 1 OF
PROJ. NO. 5364

OBE Analysis

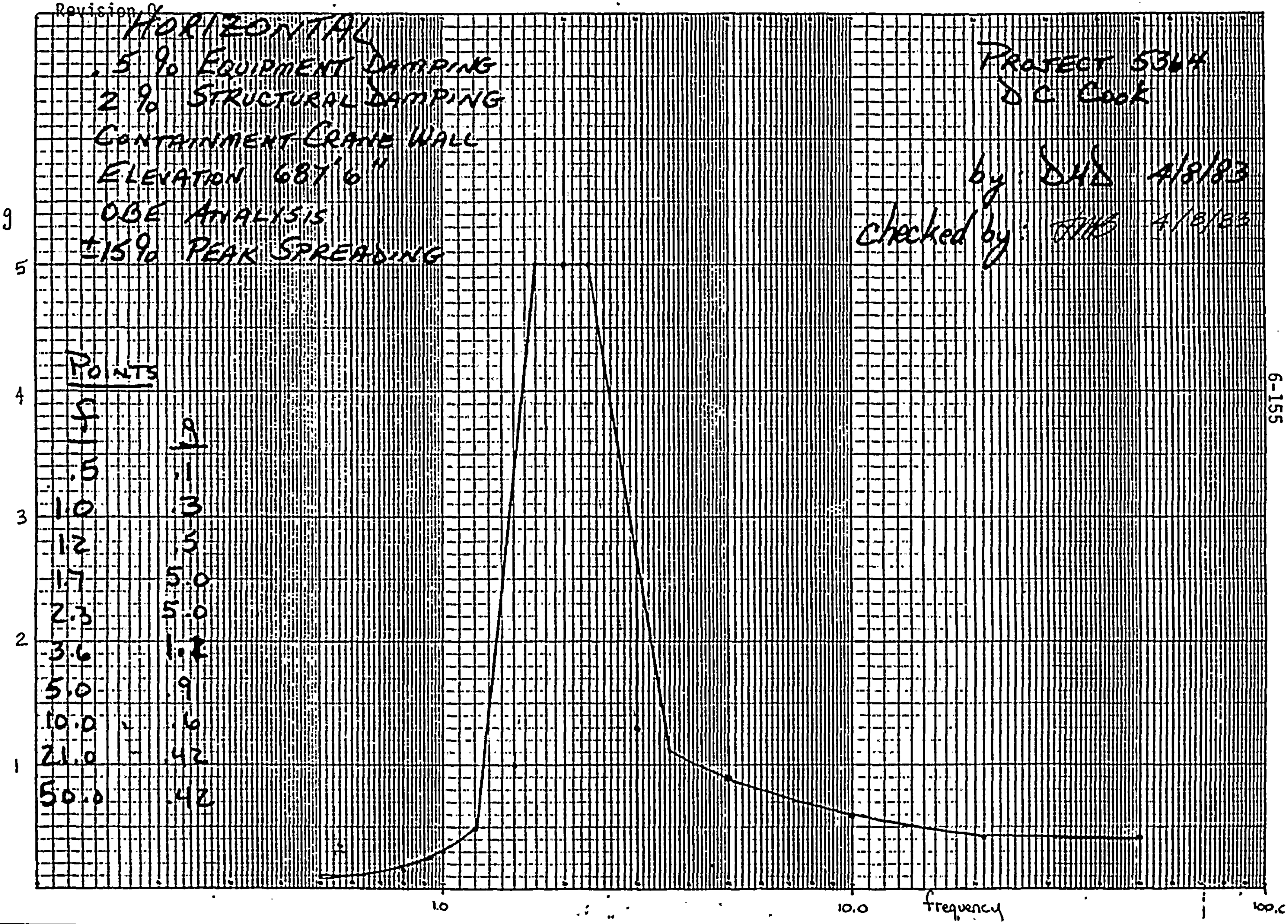
for both Units 1 & 2 the attached spectra curves indicate that Containment CRANE WALL elevation 687'-6" governs for all frequencies. Therefore the horizontal (X & Z) response spectra for OBE analysis is

f	g
.5	.10
1.0	.30
1.2	.50
1.7	5.0
2.3	5.0
3.6	1.10
5.0	.90
10.0	.60
21.0	.42
50.0	.42

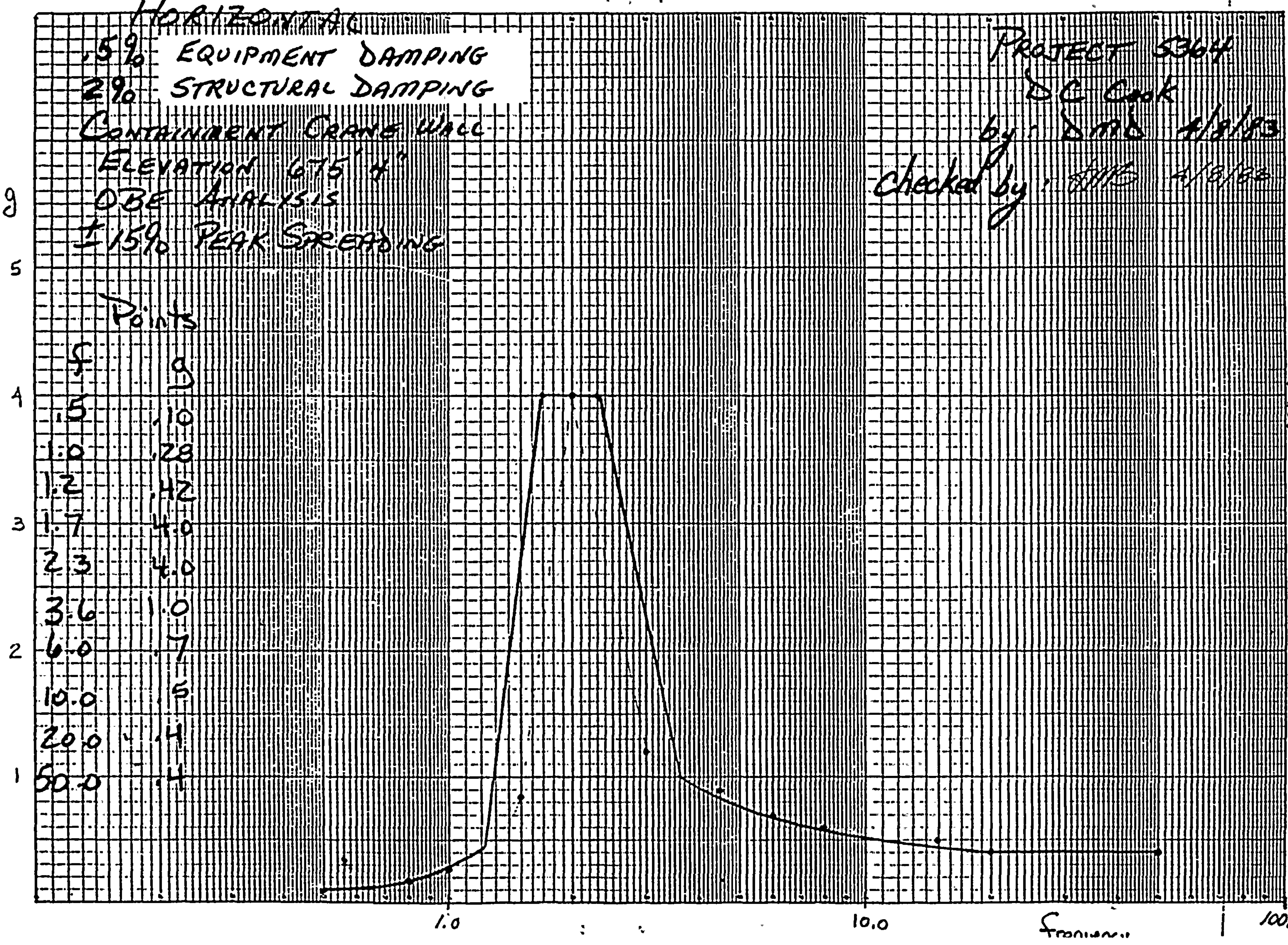
VERTICAL

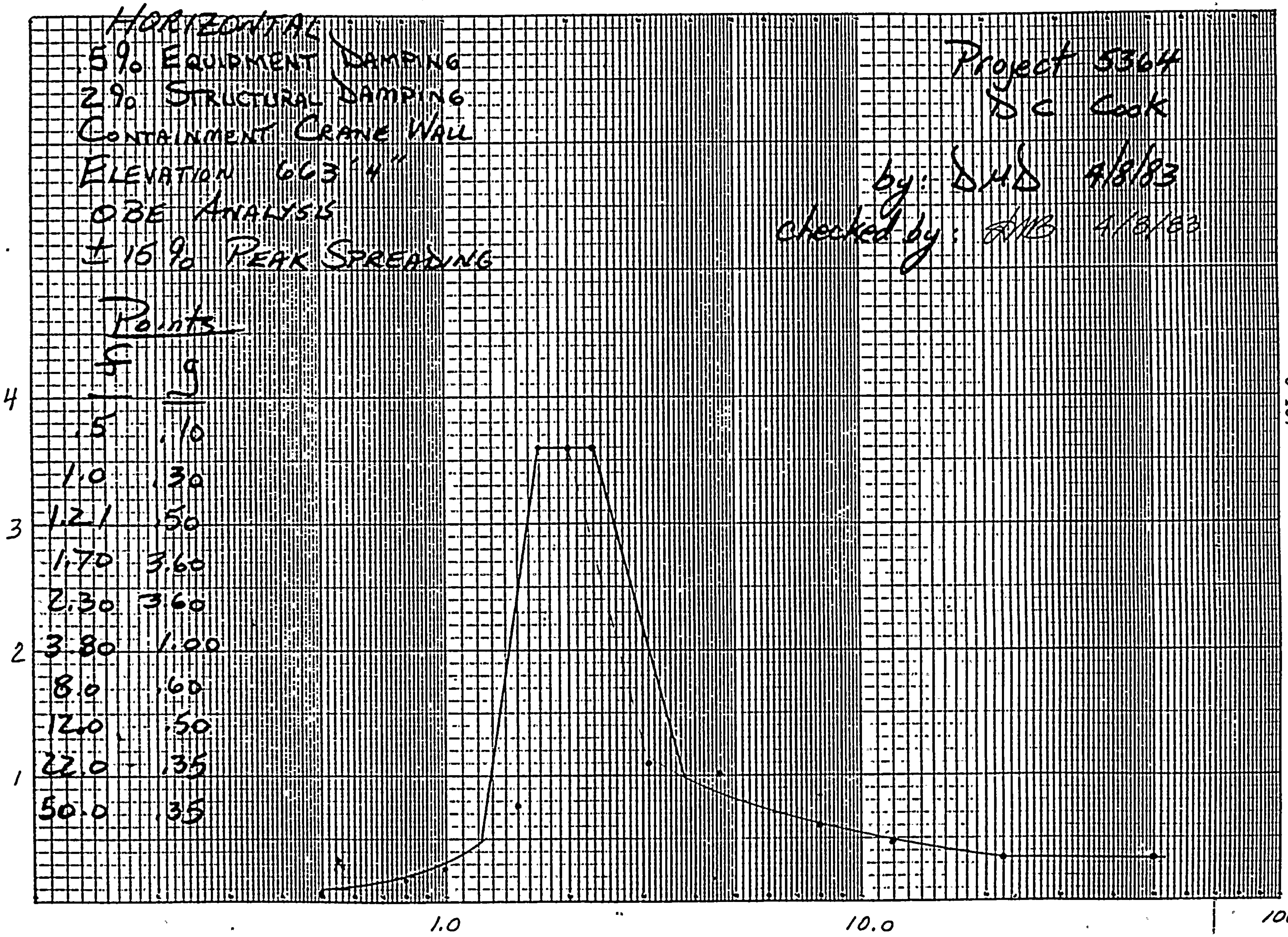
The vertical, OBE response, per the attached spectra, is:

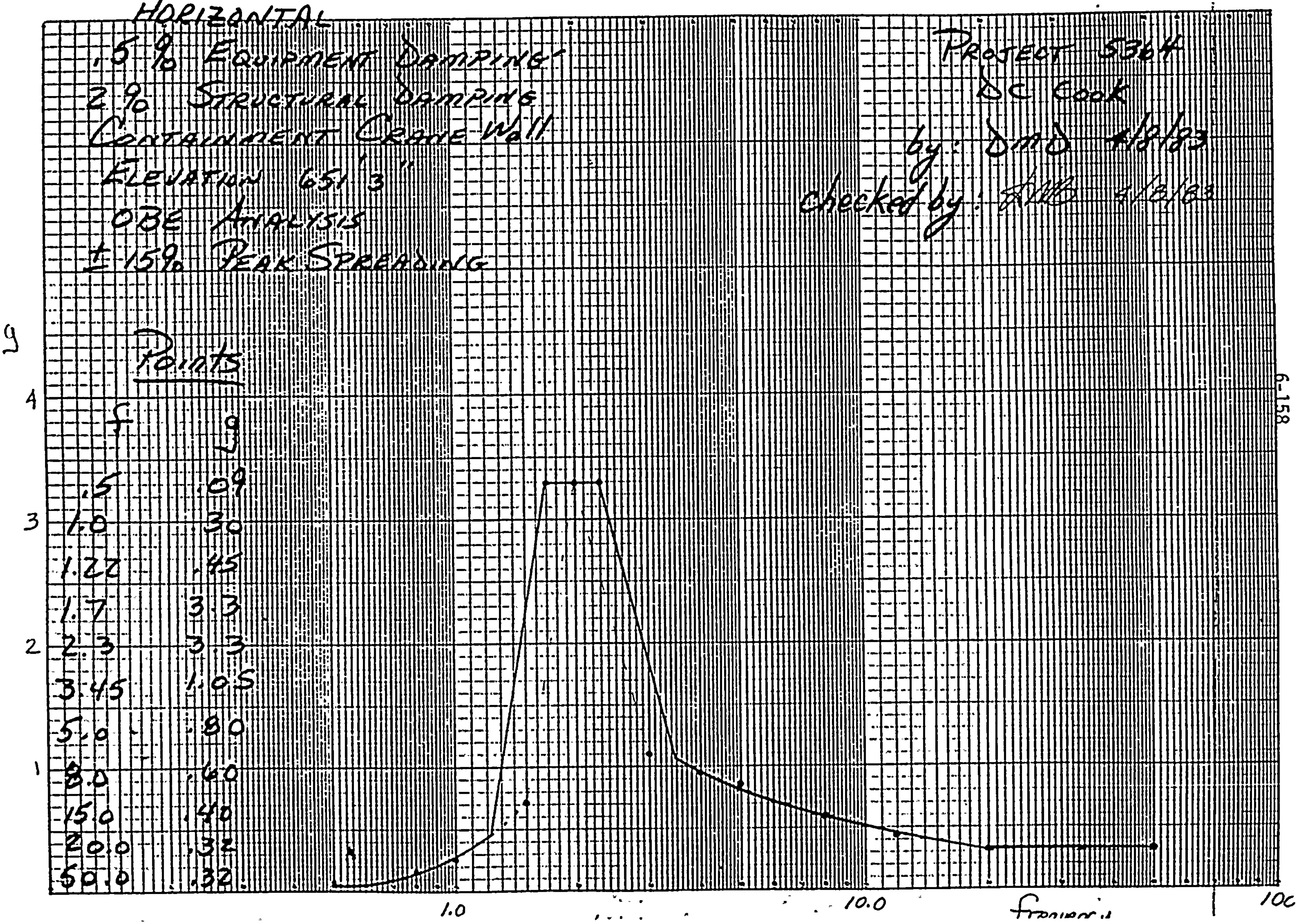
f	g
.5	.04
1.0	.13
1.22	.20
1.70	1.33
2.30	1.33
3.10	.62
5.00	.62
10.0	.23
22.0	.12
50.0	.12


HORIZONTAL
.5 % EQUIPMENT DAMPING
2 % STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 687'6"
OBE ANALYSIS
±15% PEAK SPREADING
PROJECT 5364
D C COOK
by DHS 4/8/83
checked by 4/8/83
g
5
4
3
2
1
POINTS
f g
.5 .1
1.0 .3
1.2 .5
1.7 5.0
2.3 5.0
3.6 1.
5.0 .9
10.0 .6
21.0 .42
50.0 .42
1.0
10.0
frequency
100.0

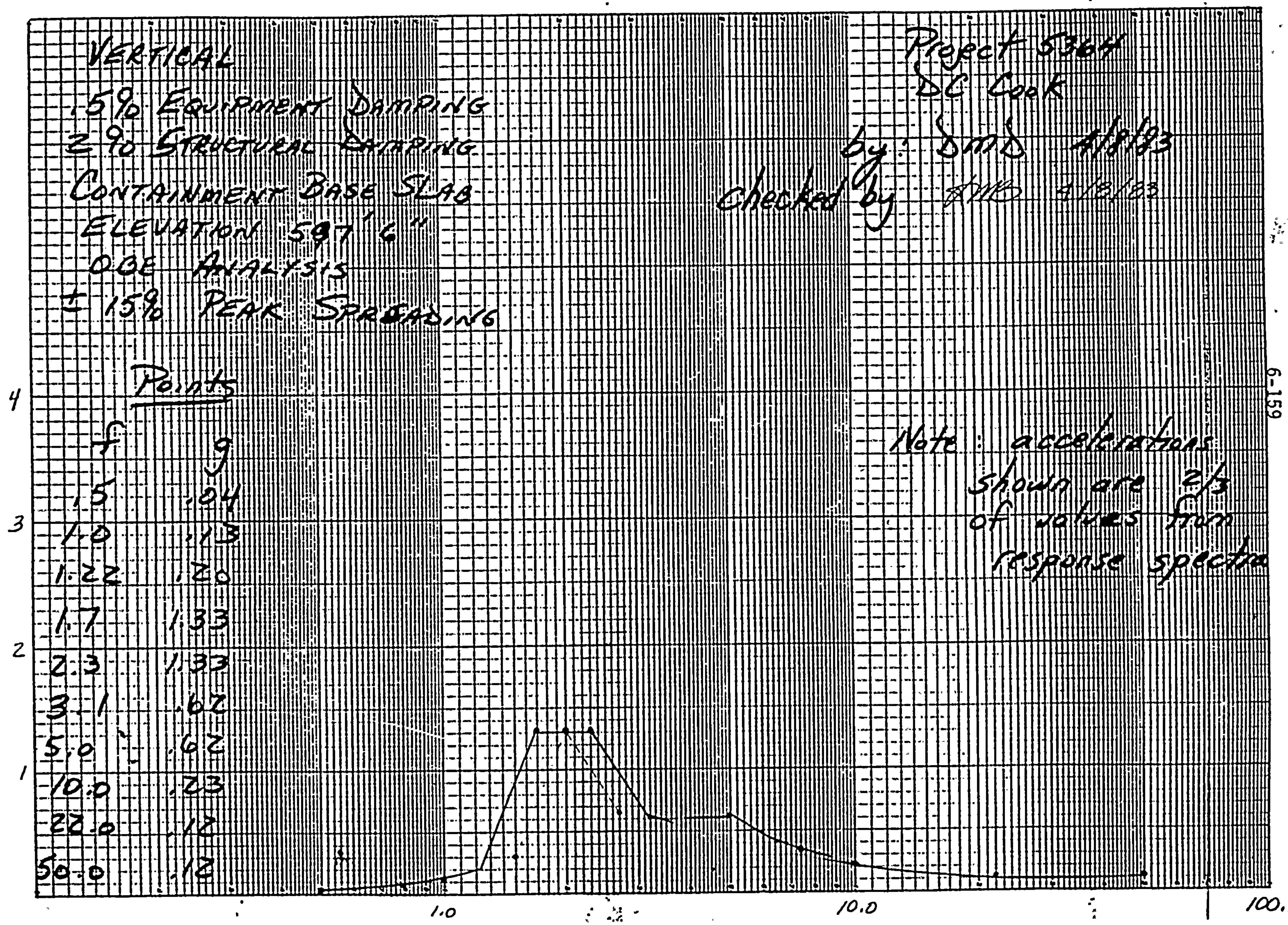
[illegible]


HORIZONTAL
.5% EQUIPMENT DAMPING
2% STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 675' 4"
OBE ANALYSIS
±15% PEAK SPREADING
PROJECT 5364
DC Cook
by: DMD 4/8/83
Checked by: 4/8/83
Points
f g
.5 .10
1.0 .28
1.2 .42
1.7 4.0
2.3 4.0
3.6 1.0
6.0 .7
10.0 .5
20.0 .4
50.0 .4
g
5
4
3
2
1
1.0
10.0
100.0
Frequency


HORIZONTAL
5% EQUIPMENT DAMPING
2% STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 663' 4"
OBE ANALYSIS
± 16% PEAK SPREADING
Project 5364
D C Cook
by: DMD 4/8/83
checked by: RMB 4/8/83
Points
f g
.5 .10
1.0 .30
1.21 .50
1.70 3.60
2.30 3.60
3.80 1.00
8.0 .60
12.0 .50
22.0 .35
50.0 .35
4
3
2
1
1.0
10.0
100


HORIZONTAL
.5 % EQUIPMENT DAMPING
2 % STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 651' 3"
OBE ANALYSIS
± 15% PEAK SPREADING
PROJECT 5364
DC COOK
by: DMD 4/8/83
checked by: [illegible] 4/8/83
Points
f g
.5 .09
1.0 .30
1.22 .45
1.7 3.3
2.3 3.3
3.45 1.05
5.0 .80
8.0 .60
15.0 .40
20.0 .32
50.0 .32
g
4
3
2
1
1.0
10.0
100
Frequency

[illegible]


VERTICAL
.5% EQUIPMENT DAMPING
2% STRUCTURAL DAMPING
CONTAINMENT BASE SLAB
ELEVATION 597'6"
OBE ANALYSIS
± 15% PEAK SPREADING
Points
f g
.5 .04
1.0 .13
1.22 .20
1.7 1.33
2.3 1.33
3.1 .62
5.0 .62
10.0 .23
22.0 .12
50.0 .12
Project 5364
DC Cook
by: DMD 4/8/83
Checked by: [illegible] 4/8/83
Note: accelerations shown are 2/3 of values from response spectra
4
3
2
1
1.0
10.0
100.

[illegible]

6.6.3 DBE Spectra

TELEDYNE ENGINEERING SERVICES

BY DMD DATE 4/11/83
CHKD. BY [illegible] DATE 4-13-83

RESPONSE SPECTRA

SHEET NO. 1 OF
PROJ. NO. 5364

DBE Analysis

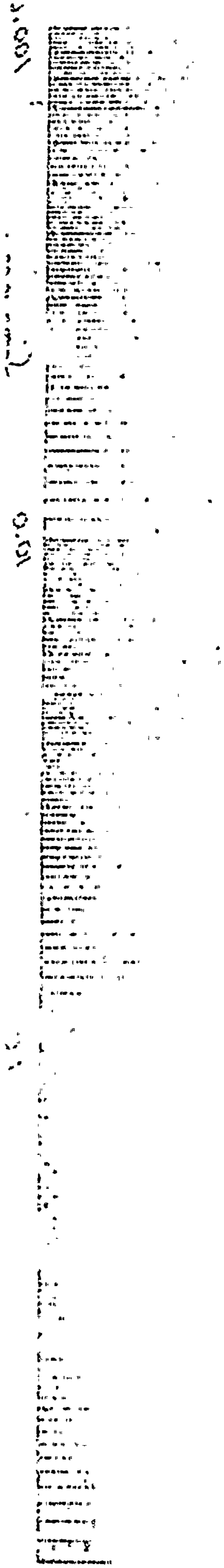
per the attached figures, enveloping CONTAINMENT CRANE WALL ELEVATIONS 651.3, 663.3, 675.3 & 687.5 results in the following DBE horizontal spectra for both Units 1 & 2

freq	g
.5	.19
1.0	.50
1.18	.70
1.7	5.2
2.3	5.2
3.15	2.6
3.65	1.46
6.0	1.40
7.0	1.15
10.0	1.0
17.0	.72
50.0	.72

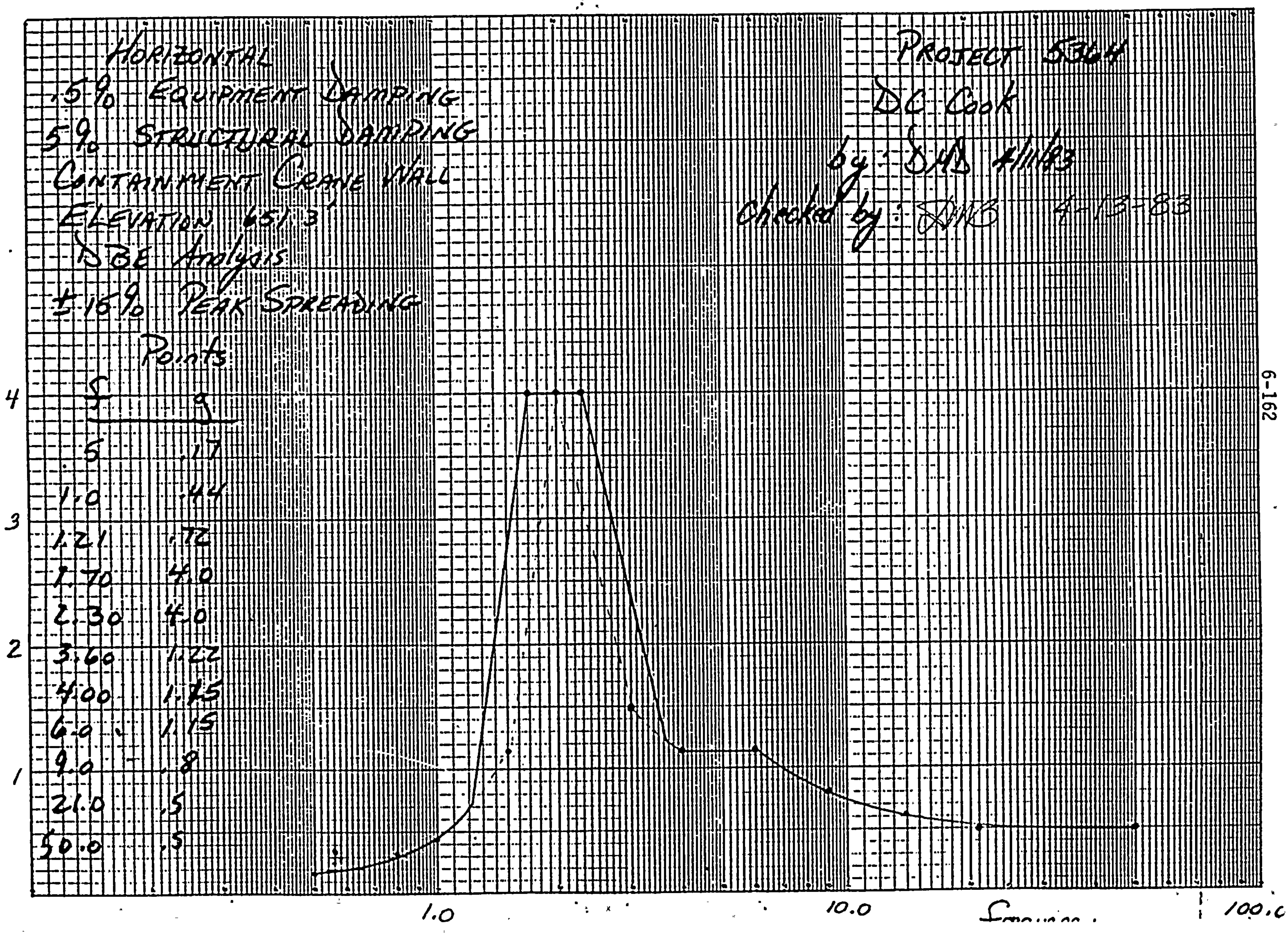
VERTICAL

The Vertical DBE response for Units 1 & 2, per the attached spectra, is:

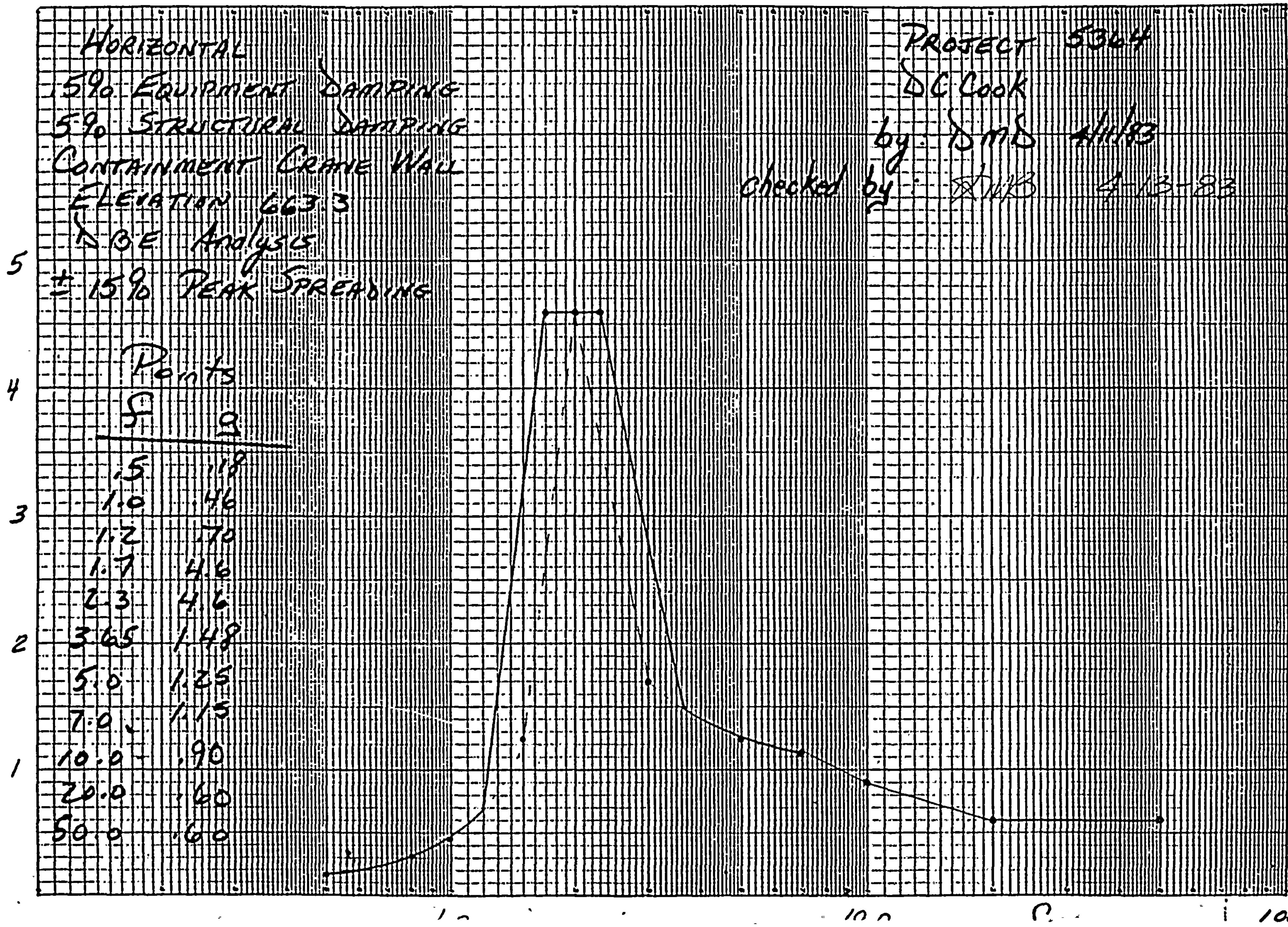
f	g
.5	.11
1.0	.25
1.18	.33
1.70	1.40
2.30	1.40
3.42	.80
6.00	.80
10.0	.43
15.0	.28
25.0	.20
50.0	.20

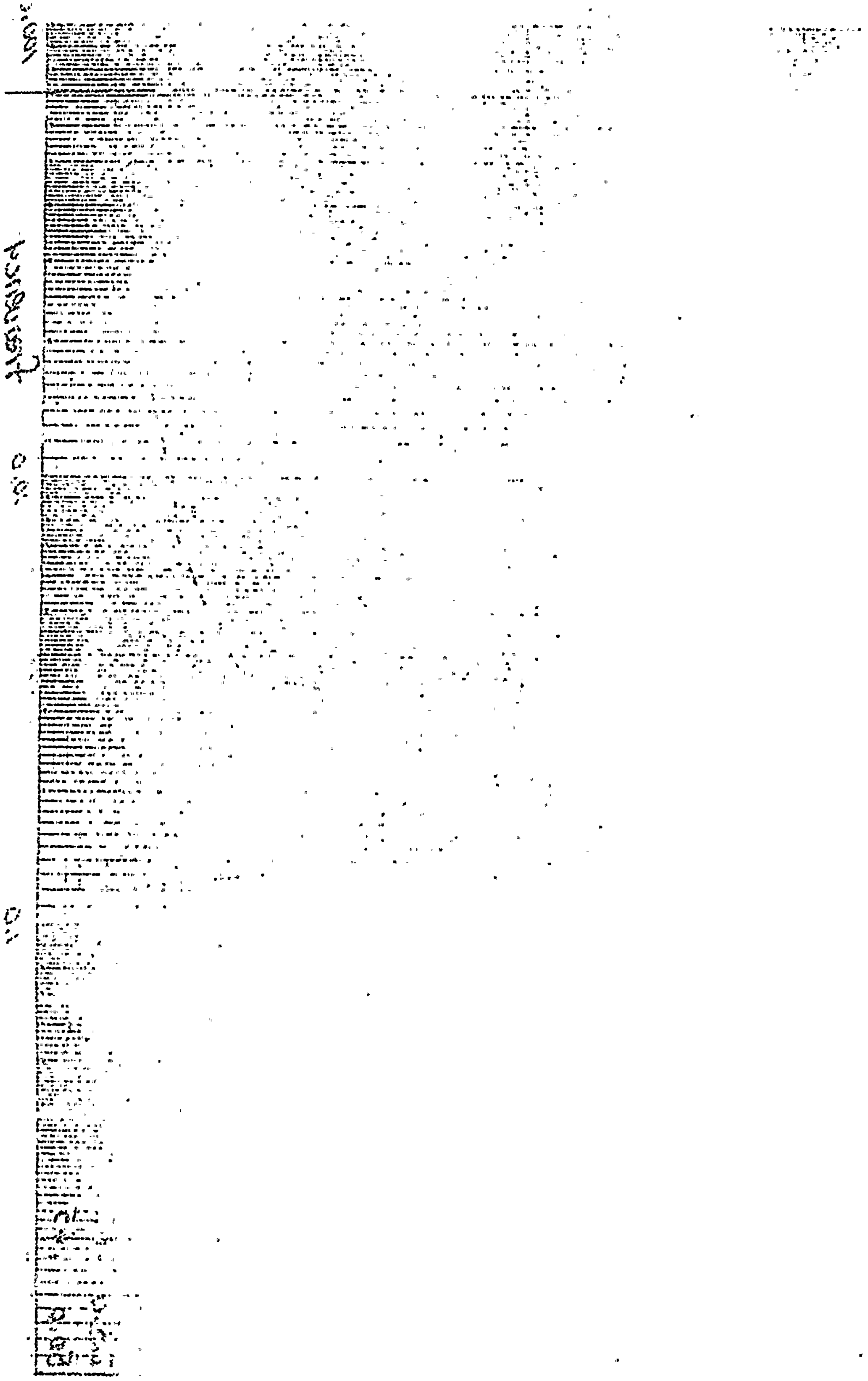


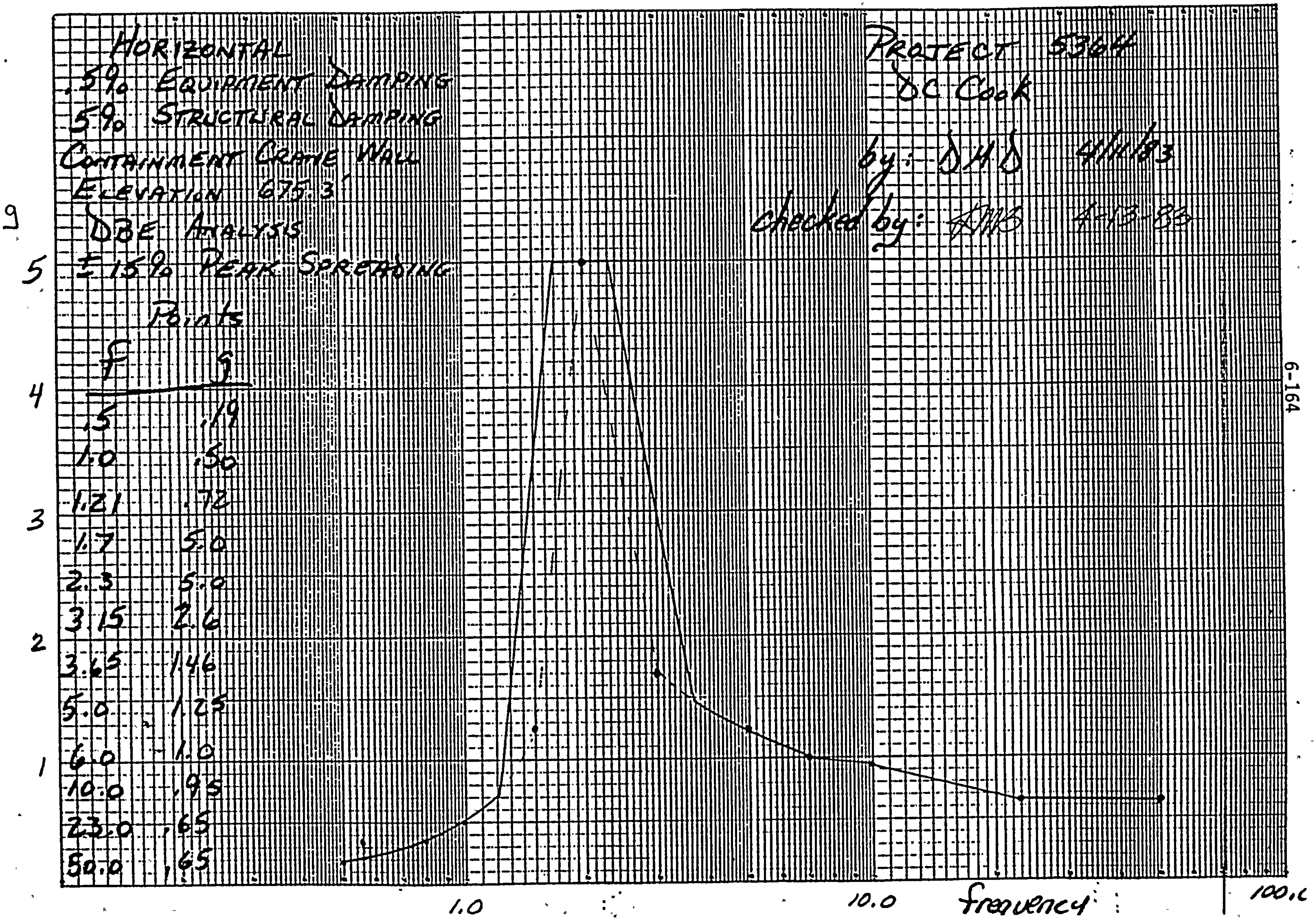
Technical Report
TR-53[illegible]
Revision 0



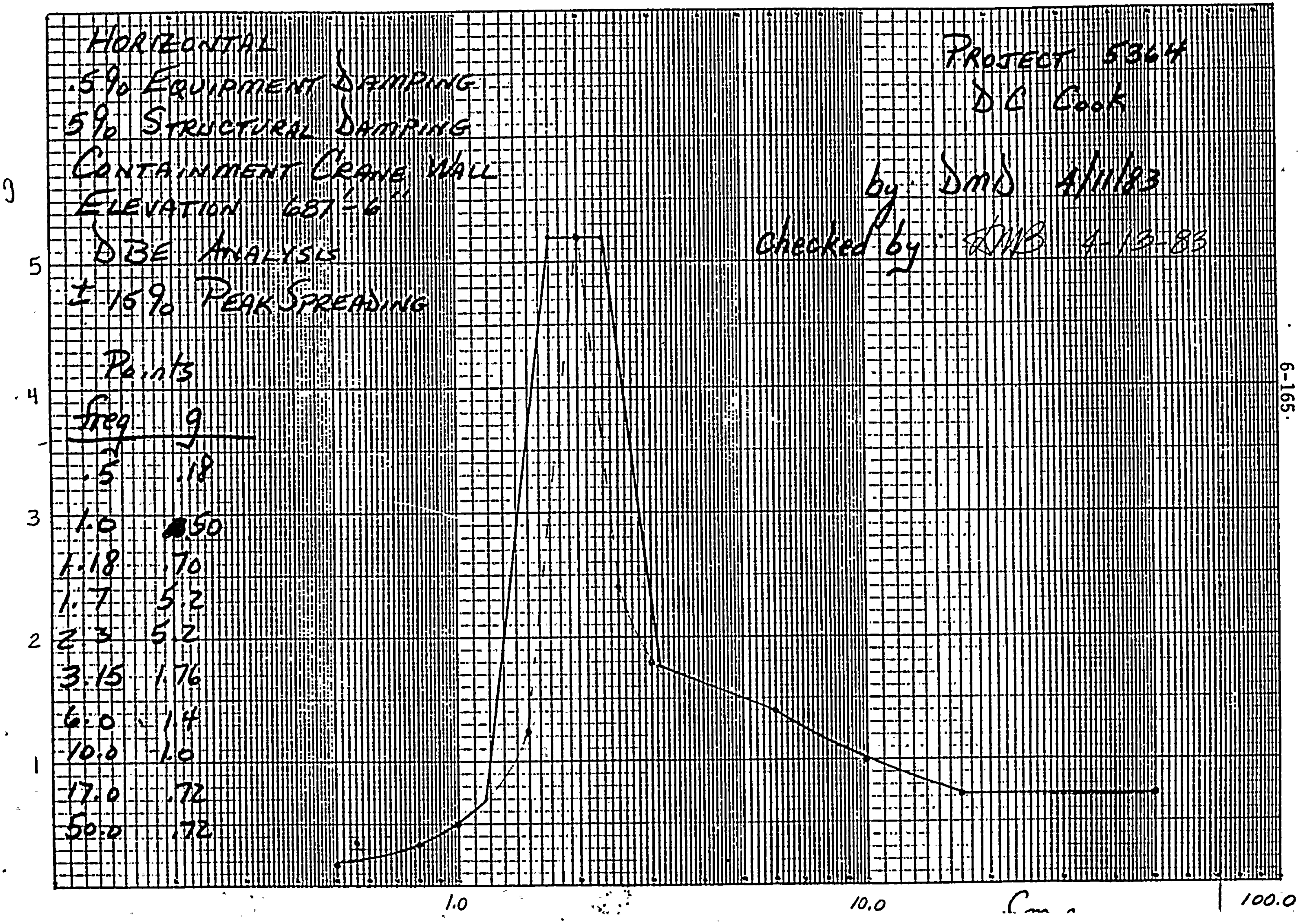
[illegible]

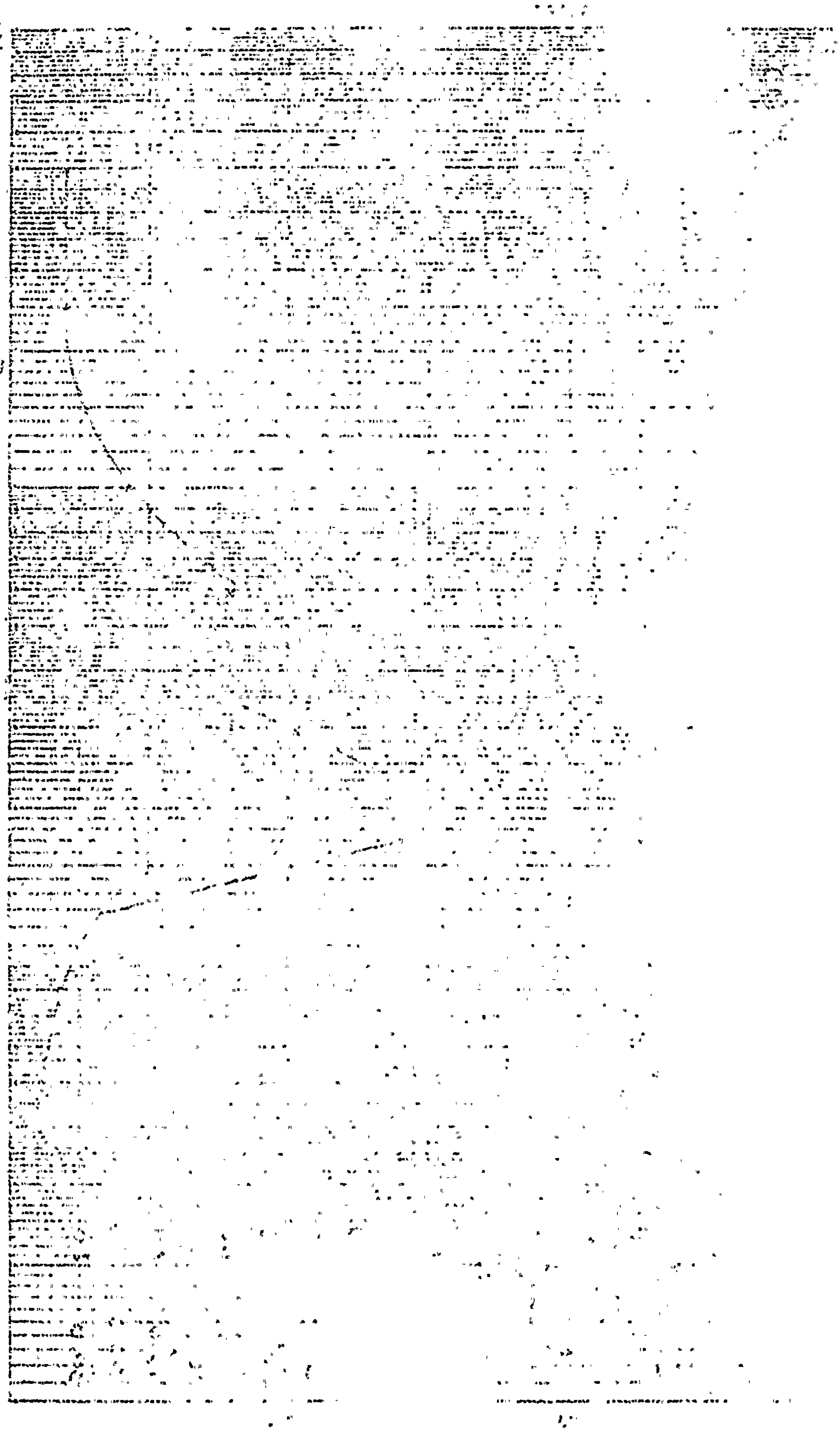

HORIZONTAL
5% EQUIPMENT DAMPING
5% STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 663 3
DBE Analysis
± 15% PEAK SPREADING
PROJECT 5364
DC Cook
by DMD 4/11/83
checked by
4-13-83
Points
f g
.5 .18
1.0 .46
1.2 .70
1.7 4.6
2.3 4.6
3.65 1.48
5.0 1.25
7.0 1.15
10.0 .90
20.0 .60
50.0 .60
g
5
4
3
2
1
1.0
10.0
100.

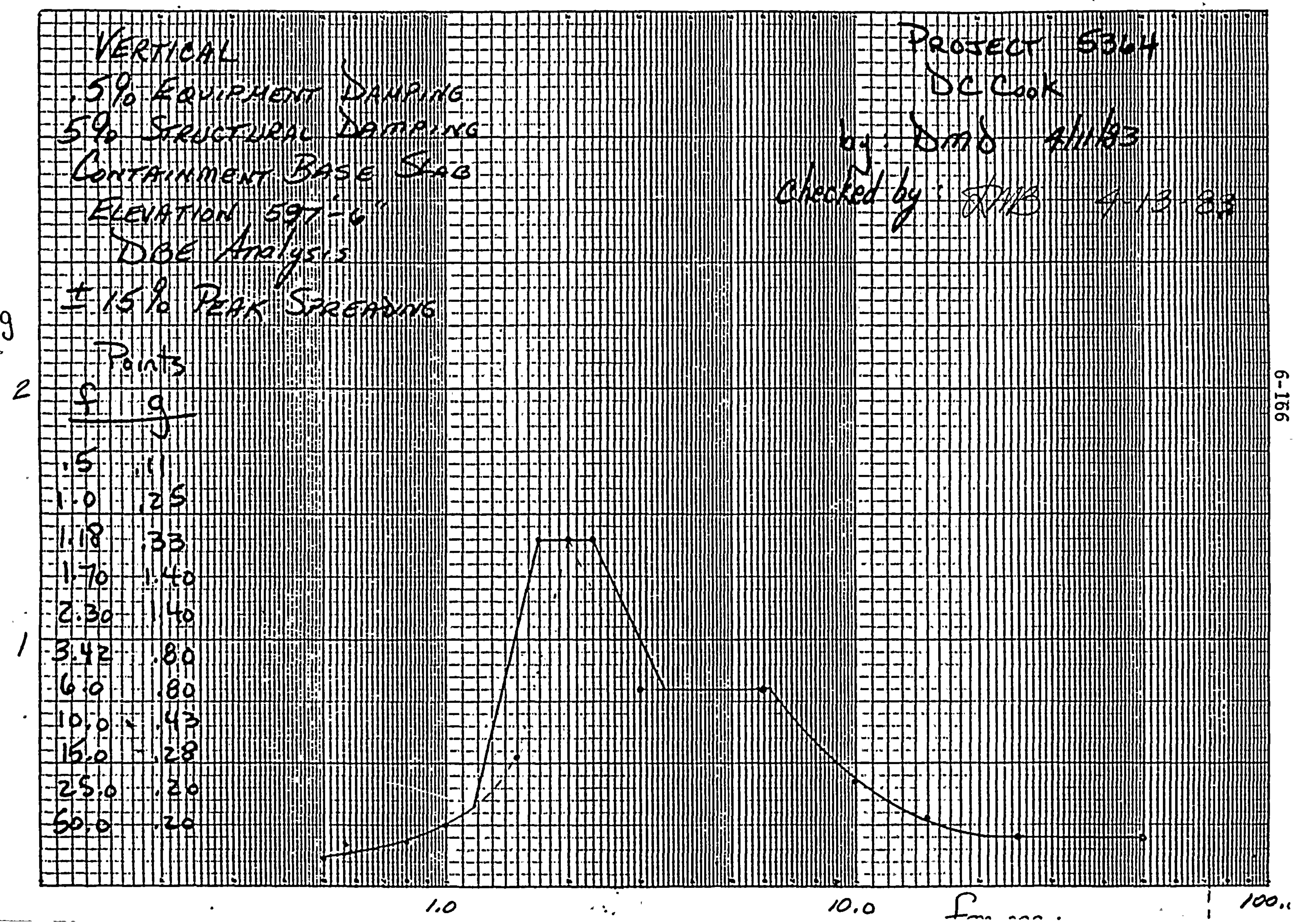



HORIZONTAL
.5% EQUIPMENT DAMPING
5% STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 675.3'
DBE ANALYSIS
±15% PEAK SPREADING
Points
f g
.5 .19
1.0 .50
1.21 .72
1.7 5.0
2.3 5.0
3.15 2.6
3.65 1.46
5.0 1.25
6.0 1.0
10.0 .95
23.0 .65
50.0 .65
PROJECT 5364
DC Cook
by: DHD 4/11/83
checked by: AMB 4-13-83
g
5
4
3
2
1
1.0
10.0
frequency
100.0

[illegible]


HORIZONTAL
.5% EQUIPMENT DAMPING
5% STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 687'-6"
DBE ANALYSIS
± 15% PEAK SPREADING
PROJECT 5364
DC Cook
by DMD 4/11/83
Checked by 4-13-83
Points
freq g
.5 .18
1.0 .50
1.18 .70
1.7 5.2
2.3 5.2
3.15 1.76
6.0 1.4
10.0 1.0
17.0 .72
50.0 .72
5
4
3
2
1
1.0
10.0
100.0




VERTICAL
5% EQUIPMENT DAMPING
5% STRUCTURAL DAMPING
CONTAINMENT BASE SLAB
ELEVATION 597'-6"
DBE Analysis
± 15% PEAK SPREADING
PROJECT 5364
DC COOK
by DMD 4/11/83
Checked by 4-13-83
Points
f g
.5 .11
1.0 .25
1.18 .33
1.70 1.40
2.30 1.40
3.42 .80
6.0 .80
10.0 .43
15.0 .28
25.0 .20
50.0 .20
g
2
1
1.0
10.0
100.

7.0 DRAWINGS

8.0 REFERENCES

1. Teledyne Engineering Services Technical Proposal PR-5653, dated May 14, 1981.

2. Letter from Mr. S. Ulan of AEP to Mr. L.B. Semprucci of TES, dated November 29, 1983.

3. Letter from Mr. S. Ulan of AEP to Mr. P. D. Harrison of TES, dated March 15, 1983.

4. RELAP5 MOD1 - Version 2.11 - A five equation Thermal-Hydrodynamic Analysis computer program including non-condensibles.

5. TMRPIPE - A system of Computer Programs for the Complete Analysis of Nuclear Piping.

6. TES Technical Report TR-5364-1, Donald C. Cook Nuclear Generating Station, "Analysis of Pressurizer Safety Valves/Relief Valves Discharge Piping Systems per NUREG 0737, II.D.1, Unit 1.

7. Letter from Mr. S. Ulan of AEP to Mr. P. D. Harrison of TES, dated May 26, 1983.

8. TES letter 5364-21, dated February 2, 1983 from Mr. P. D. Harrison of TES to Mr. Sam Ulan of AEP.

9. TES letter 5364-25, dated February 14, 1983 from Mr. P. D. Harrison of TES to Mr. Sam Ulan of AEP.

10. TES letter 5364-33, dated April 8, 1983 from Mr. P. D. Harrison of TES to Mr. Sam Ulan of AEP.

TELEDYNE ENGINEERING SERVICES

8.0 REFERENCES (Continued)

11. 1967 Edition of USAS B31.1 Power Piping Code.

12. Letter from Mr. J. L. Williams of AEP to Mr. L. B. Semprucci of TES dated September 16, 1982.

13. Crosby Valve Drawing and Gage Company Drawing No. H-51688, Revision A.

14. Masoneilan International, Inc. Control Valve Model No. 38-20721, Drawing No. CP1-18-55, Revision H.

15. Westinghouse Electric Company, Drawing No. 110E272.

16. EPRI Safety and Relief Valve Test Report, Research Project V102 Interim Report, April 1982.

17. ASME Code NB7000, Section III.

18. ITI Report, "Evaluation of RELAP5/MOD1 for Calculation of Safety and Relief Valve Discharge Piping Hydrodynamic Loads," February 1982. Prepared by Intermountain Technologies.

19. Technical Paper #410 by Crane.

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DATE 6.13.86

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TELEDYNE ENGINEERING SERVICES

TECHNICAL REPORT

TECHNICAL REPORT TR-5364-2
REVISION 0

BOOK 3 OF 10

DONALD C. COOK NUCLEAR GENERATING PLANT

ANALYSIS OF PRESSURIZER SAFETY/RELIEF VALVES
DISCHARGE PIPING SYSTEM PER NUREG 0737, II.D.1,
UNIT 2

8608060048

JUNE 10, 1983

AMERICAN ELECTRIC POWER SERVICE CORPORATION
2 BROADWAY
NEW YORK, NEW YORK 10004

TECHNICAL REPORT TR-5364-2
REVISION 0

BOOK 3 OF 10

DONALD C. COOK NUCLEAR GENERATING STATION

ANALYSIS OF PRESSURIZER SAFETY/RELIEF VALVES DISCHARGE PIPING SYSTEM PER NUREG 0737, II. D.1, UNIT 2

JUNE 10, 1983

TELEDYNE ENGINEERING SERVICES

130 SECOND AVENUE
WALTHAM, MASSACHUSETTS 02254
617-890-3350

TABLE OF CONTENTS

TELEDYNE ENGINEERING SERVICES

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

Section 9.1.1

RELAP Input

9.1.1.1 PORV Solid 400 Liquid

LISTING OF INPUT DATA FOR CASE 1

```
=AEP UNIT2  1 LINE  RELAP5
*
*
*
*
*
*             ******************************************
*             ******************************************
*             **                                      **
*             **       UNIT 2 PORV MODEL,  SOLID CASE **
*             **                                      **
*             ******************************************
*             ******************************************
*
*
*
*
*
*
*  AEP  D.C. COOK UNIT2
*  DISCHRAGE PIPING
*  THIS IS THE NUMBERING SYSTEM FOR UNIT2S' RELAP MODEL
*  WHERE COMPONENTS NUMBERED IN THE:
*         100'S ARE VALVE SV-45C AND ARC 1 LEVEL  669'-2"
*         200'S ARE VALVE SV-45B AND ARC 2 LEVEL  670'-10"
*         300'S ARE VALVE SV-45A ARN ARC 3 LEVEL  672'-6"
*         400'S ARE PORV NRV-151 AND ARC "A"
*         500'S ARE PORV NRV-153 AND ARC "B"
*         600'S ARE PORV NRV-152 AND ARC "C"
*         700'S ARE 6" DISCHARGE PIPING
*         800'S ARE 12" DISCH.
*         900'S QUENCH TANK PORTION
*         999  ATMOSPHERE
100 NEW TRANSNT
101 RUN
102 BRITISH BRITISH
104 NOACTION
*
*************************************
*         TIME STEP CONTROL         *
*************************************
*
201  0.400  1.0-7  2.0-4  11001  5  50  250
*
*************************************
*            MINOR EDITS            *
*************************************
*
301  MFLOWJ  415000000
302  MFLOWJ  490000000
303  MFLOWJ  493000000
304  MFLOWJ  388000000
305  MFLOWJ  811140000
306  MFLOWJ  811790000
307  MFLOWJ  307000000
308  MFLOWJ  207000000
```

BY KJG DATE 5-17-83
CHKD. BY [illegible] DATE 6-2-83

TELEDYNE ENGINEERING SERVICES

114
113
112
111
110 [illegible] [illegible]

[illegible]

```
309  MFLOWJ  107000000
*
310  QUALS  400010000
311  QUALS  500010000
312  QUALS  600010000
313  QUALS  410210000
314  QUALS  485270000
315  QUALS  492110000
316  QUALS  389010000
317  QUALS  811140000
318  QUALS  811790000
319  QUALS  106010000
320  QUALS  106390000
321  QUALS  206010000
322  QUALS  206330000
323  QUALS  306010000
324  QUALS  306250000
*
325  P       400010000
326  P       500010000
327  P       600010000
328  P       410210000
329  P       485270000
330  P       492110000
331  P       389010000
332  P       811140000
333  P       811790000
334  P       106010000
335  P       106390000
336  P       206010000
337  P       206330000
338  P       306010000
339  P       306250000
*
*
*
*
*
**************************************************
**                                              **
**          FORCE  CARDS  FOR  REPIPE           **
**                                              **
**************************************************
*
*    *******   ARC 2, ELEVATION 670' 10",  SV-45B   ******
*
2001    5,151
2002    206010000,206020000,206030000,206040000,206050000
2003    206060000,206070000,206080000,206090000,206100000
2004    206110000,206120000,206130000,206140000,206150000
2005    206160000,206170000,206180000,206190000,206200000
2006    206210000,206220000,206230000,206240000,206250000
2007    206260000,206270000,206280000,206290000,206300000
2008    206310000,206320000,206330000
*
*
*
*
```

TELEDYNE
ENGINEERING SERVICES

```
*       ****   FIRST C.V. DOWNSTREAM OF THE ARC    ****
*
*
2010    805010000
*
*
*
*
*        *****  12 INCH DISCHARGE DOWN TO THE QUENCH TANK   *****
*
*
2020    811190000,811200000,811210000,811220000,811230000
2021    811240000,811250000,811260000,811270000,811280000
2022    811290000,811300000,811310000,811320000,811330000
2023    811340000,811350000,811360000,811370000,811380000
2024    811390000,811400000,811410000,811420000,811430000
2025    811440000,811450000,811460000,811470000,811480000
2026    811490000,811500000,811510000,811520000,811530000
2027    811540000,811550000,811560000,811570000,811580000
2028    811590000,811600000,811610000,811620000,811630000
2029    811640000,811650000,811660000,811670000,811680000
2030    811690000,811700000,811710000,811720000,811730000
2031    811740000,811750000,811760000,811770000,811780000
2032    811790000,811800000,811810000,811820000,811830000
2033    811840000,811850000,811860000,811870000,811880000
2034    811890000,811900000,811910000,811920000,811930000
2035    811940000,811950000,811960000,811970000,811980000
2036    811990000,811180000
*
2040    813010000,813020000,813030000,813040000,813050000
2041    813060000,813070000,813080000,813090000,813100000
2042    813110000,813120000,813130000,813140000,813150000
2043    813160000,813170000,813180000,813190000,813200000
2044    813210000,813220000,813230000,813240000,813250000
2045    813260000,813270000,813280000,813290000,813300000
*
*
*
*       ******   PIPE DOWN INTO THE QUENCH TANK   ****
*
*
2050    901010000,901020000,903010000,903020000
2051    903030000
*
*
*
*
*
*
*
*
*
*       *****   PIPING UPSTREAM OF PORV NRV - 153   *****
*
*
*
*
*
```

```
*
*
*
*
*
************************************
*             TRIPS                *
************************************
*
501  P  907010000  GT  NULL  0  114.7  L  *QUENCH TANK BLOW OUT PATCH
502  TIME  0  GT NULL 0  1.5  L  * JOB TERMINATION TRIP
503  TIME  0  GE NULL 0  0.0    L  *  VALVE OPEN
504  TIME  0  GE  NULL  0  5.0  L  *  VALVE CLOSED
600  502
*
***************************************************
*           **************************            *
*           * HYDRODYNAMIC COMPONENTS *           *
*           **************************            *
***************************************************
*
3850000  "PRESS4"  TMDPVOL
3850101  0.0  20.0  500.0   0.0  0.0  0.0  0.00005  0.0  11
3850200  3
3850201  0.0  2349.7  400.0  0.8  2420.0  400.0  1.2  2498.7  400.0
*
*        ***********************************
*        *   PORV UPSTREAM PIPING          *
*        ***********************************
*
*
3860000  "NOZ"  SNGLJUN
3860101  385000000  387000000  0.0  0.0  0.0  1100
3860201  1  0.0  0.0  0.0
*
*    6 INCH SCH.  160 PIPE
*
3870000  "PORVU"  PIPE
3870001  12
3870101  0.14653  12
3870301  0.328  1
3870302  0.5227  12
3870401  0.0  12
3870601  42.733  1
3870602  90.0  12
3870801  0.000151  0.0  12
3870901  0.0964  0.0964  1
3870902  0.0  0.0  11
3871001  00  12
3871101  1000  11
3871201  3  2349.7  400.0  0.0  0.0  12
3871300  1
3871301  0.0  0.0  0.0  11
*
3880000  "PORVU"  SNGLJUN
3880101  387010000  389000000  0.0  0.0  0.0  1000
3880201  1  0.0  0.0  0.0
*
```

```
*   6 X 6 X 3 INCH REDUCING TEE
*
3890000  "PORVU"  BRANCH
3890001  0
3890101  0.14653  0.25  0.0  0.0  90.0  0.25  0.000151  0.0  00
3890200  3  2349.7  400.0  0.0  0.0  0.0
*
4980000  "PORVU"  SNGLJUN
4980101  389010000  410000000  0.0  0.1836  0.1836  1000
4980201  1  0.0  0.0  0.0
*
*   3 INCH SCH. 160 PIPING
*
4100000  "PORV"  PIPE
4100001  21
4100101  0.03757  17
4100102  0.03387  18
4100103  0.0265  19
4100104  0.01912  20
4100105  0.01175  21
4100301  0.5  5
4100302  0.5278  11
4100303  0.5313  17
4100304  0.2657  21
4100401  0.0  21
4100601  0.0  5
4100602  90.0  11
4100603  0.0  21
4100801  0.000153  0.0  21
4100901  0.0  0.0  4
4100902  0.2172  0.2172  5
4100903  0.0  0.0  10
4100904  0.2172  0.2172  11
4100905  0.0  0.0  20
4101001  00  21
4101101  1000  20
4101201  3  2349.7  400.0  0.0  0.0  21
4101300  1
4101301  0.0  0.0  0.0  20
*
*   PORV VALVE NRV - 153
*
4150000  "PORV153"  VALVE
4150101  410010000  500000000  0.00806  0.0  0.0  0100
4150201  1  0.0  0.0  0.0
4150300  MTRVLV
4150301  503  504  1.0  0.0
*
4200000  "PORV"  SNGLJUN
4200101  389010000  425000000  0.0  0.0  0.0  1000
4200201  1  0.0  0.0  0.0
*
*     6  INCH  SCH.  160  PIPING
*
4250000  "PORV"  PIPE
4250001  5
4250101  0.1465  5
4250301  0.3889  3
```

```
4250302  0.375  5
4250401  0.0  5
4250601  90.0  3
4250602  0.0  5
4250801  0.000151  0.0  5
4250901  0.0  0.0  2
4250902  0.1836  0.1836  3
4250903  0.0  0.0  4
4251001  00  5
4251101  1000  4
4251201  3  2349.7  400.0  0.0  0.0  5
4251300  1
4251301  0.0  0.0  0.0  4
*
4300000  "PORV"  SNGLJUN
4300101  425010000  435000000  0.0  0.0  0.0  1000
4300201  1  0.0  0.0  0.0
*
*     6 INCH   X 4 INCH    REDUCER
*
4350000  "PORV"  PIPE
4350001  2
4350101  0.1465  1
4350102  0.0716  2
4350301  0.2292  2
4350401  0.0  2
4350601  0.0  2
4350801  0.000151  0.0  1
4350802  0.000133  0.0  2
4350901  0.0577  0.0961  1
4351001  00  2
4351101  1000  1
4351201  3  2349.7  400.0  0.0  0.0  2
4351300  1
4351301  0.0  0.0  0.0  1

*
4400000  "PORV"  SNGLJUN
4400101  435010000  445000000  0.0  0.0  0.0  1000
4400201  1  0.0  0.0  0.0
*
*    4  INCH  SCH.  120  PIPING
*
4450000  "PORV"  PIPE
4450001  10
4450101  0.0716  10
4450301  0.35833  5
4450302  0.5  10
4450401  0.0  10
4450601  0.0  5
4450602  90.0  9
4450603  0.0  10
4450801  0.000133  0.0  10
4450901  0.0  0.0  4
4450902  0.1944  0.1944  5
4450903  0.0  0.0  8
4450904  0.1944  0.1944  9
4451001  00  10
```

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```
4451101  1000  9
4451201  3  2349.7  400.0  0.0  0.0  10
4451300  1
4451301  0.0  0.0  0.0  9
*
4500000  "PORV"  SNGLJUN
4500101  445010000  455000000  0.0  0.0  0.0  1000
4500201  1  0.0  0.0  0.0
*
*     4 X 4 X 3  INCH REDUCING BRANCH
*
4550000  "PORV"  BRANCH
4550001  0
4550101  0.0716  0.5  0.0  0.0  0.0  0.0  0.000133  0.0  00
4550200  3  2349.7  400.0  0.0  0.0  0.0
*
4600000   "PORV"   SNGLJUN
4600101  455010000  465000000  0.0  0.0  0.0  1000
4600201  1  0.0  0.0  0.0
*
*    4  INCH  SCH.  120  PIPING
*
4650000  "PORV"  PIPE
4650001  3
4650101  0.0716    3
4650301  0.25  3
4650401  0.0  3
4650601  0.0  3
4650801  0.000133  0.0  3
4650901  0.0  0.0  2
4651001  00  3
4651101  1000  2
4651201  3  2349.7  400.0  0.0  0.0  3
4651300  1
4651301  0.0  0.0  0.0  2
*
4700000  "PORV"  SNGLJUN
4700101  465010000  475000000  0.0  0.0  0.0  1000
4700201  1  0.0  0.0  0.0
*
*    4 INCH  X  3 INCH   REDUCER
*
4750000  "PORV"  PIPE
4750001  2
4750101  0.0716  1
4750102  0.0376  2
4750301  0.1667  2
4750401  0.0  2
4750601  0.0  2
4750801  0.000133  0.0  1
4750802  0.000153  0.0  2
4750901  0.0472  0.0730  1
4751001  00  2
4751101  1000  1
4751201  3  2349.7  400.0  0.0  0.0  2
4751301  0.0  0.0  0.0  1
*
4800000  "PORV"  SNGLJUN
```

```
4800101  475010000  485000000  0.0  0.0  0.0  1000
4800201  1  0.0  0.0  0.0
*
*   3  INCH  SCH.  160  PIPING
*
4850000  "PORV"  PIPE
4850001  27
4850101  0.0376  23
4850102  0.0339  24
4850103  0.0266  25
4850104  0.0192  26
4850105  0.0118  27
4850301  0.4375  4
4850302  0.4690  12
4850303  0.500  15
4850304  0.368  16
4850305   0.367   17
4850306   0.5405  23
4850307   0.41937  27
4850401  0.0  27
4850601  0.0  27
4850801  0.000153  0.0  27
4850901  0.0  0.0  26
4851001  00  27
4851101  1000  26
4851201  3  2349.7  400.0  0.0  0.0  27
4851300  1
4851301  0.0  0.0  0.0  26
*
*    PORV  VALVE  NRV - 151
*
4900000  "PORV"  VALVE
4900101  485010000  400000000  0.00806  0.0  0.0  0100
4900201  1  0.0  0.0  0.0
4900300  MTRVLV
4900301  503  504  1.0  0.0
*
4910000  "PORV"  SNGLJUN
4910101  455010000  492000000  0.0  0.095  0.095  1000
4910201  1  0.0  0.0  0.0
*
*   3  INCH  SCH.  160  PIPING
*
4920000  "PORV"  PIPE
4920001  11
4920101  0.0376  7
4920102  0.0339  8
4920103  0.0266  9
4920104  0.0192  10
4920105  0.0118  11
4920301  0.4881  7
4920302  0.4792  11
4920401  0.0  11
4920601  0.0  11
4920801  0.000153  0.0  11
4920901  0.0  0.0  10
4921001  00  11
4921101  1000  10
```

```
4921201  3  2349.7  400.0  0.0  0.0  11
4921300  1
4921301  0.0  0.0  0.0  10
*
*   PORV  VALVE  NRV - 152
*
4930000  "PORV"  VALVE
4930101  492010000  600000000  0.00806  0.0  0.0  0100
4930201  1  0.0  0.0  0.0
4930300  MTRVLV
4930301  503  504  1.0  0.0
*
*
*********************************************
*    SAFETY VALVES DISCHARGE SECTION        *
*********************************************
*
*
*
****************************************************************
*    SAFETY VALVE-45C  DISCHARGING AT ELEV. 669'-2"  ARC  1   *
****************************************************************
*
*
**
*  DISCHARGE PIPING
*
*  6  INCH  SCH.  40  PIPING
**
1060000  "DISCHA1"  PIPE
1060001  39
1060101  0.20069  39
1060301  0.526  4
1060302  1.094  14
* ARC STARTS HERE LEVEL 669-2"
1060303  1.000   20
1060304  0.8994  29
1060305  0.7436  35
* ARC ENDS
1060306  0.7980  39
1060401  0.0  39
1060601  0.0  4
1060602  -90.0  14
1060603  0.0  39
1060801  0.000152  0.0  39
1060901  0.0  0.0  3
1060902  0.1800  0.1800  4
1060903  0.0  0.0  13
1060904  0.1800  0.1800  14
1060905  0.0  0.0  38
1061001  00  39
1061101  1000  38
1061201  4  17.7  120.0  0.9284  0.0  39
1061300  1
1061301  0.0  0.0  0.0  38
*
1070000  "DISCHA1"  SNGLJUN
1070101  106010000  809000000  0.0  0.1560  0.1560  1000  *LOSSES FOR A 12 IN ELBOW
```

TELEDYNE ENGINEERING SERVICES

[illegible]

```
1070201  1  0.0  0.0  0.0
*
*
*
*****************************************************
*        MAIN DISCHARGE  12" HEADER TO QUENCH TANK      *
*****************************************************
*
*
*    12  X  12  X  6  INCH  REDUCING TEE
*
*    CONNECTS  SRV  PIPING  TO  MAIN  DISCHARGE
*
*
8090000  "DISCHA1"  BRANCH
8090001  0
8090101  0.77708  0.5  0.0  0.0  -90.0  -0.5  0.000169  0.0  00
8090200  4  17.7  120.0  0.9284
*
8100000  "DISCHA1"  SNGLJUN
8100101  809010000  811000000  0.0  0.0  0.0  1000
8100201  1  0.0  0.0  0.0
*
*    12   INCH  SCH.  40  DISCHARGE PIPING
*
8110000  "DISCH1A"  PIPE
8110001  99
8110101  0.7771  99
8110301  1.039  14
8110302  0.53025  18
8110303  0.5  22
8110304  0.53025  26
8110305  0.9875  56
8110306  0.475  66
8110307  0.49359  79
8110308  0.46875  87
8110309  0.50  95
8110310  0.875  99
8110401  0.0  99
8110601  -90.0  14
8110602  -45.0  18
8110603  -90.0  22
8110604  -45.0  26
8110605  -90.0  56
8110606  0.0  87
8110607  -90.0  95
8110608  0.0  99
8110801  0.000169  0.0  99
8110901  0.0  0.0  13
8110902  0.078  0.078  14
8110903  0.0  0.0  17
8110904  0.078  0.078  18
8110905  0.0  0.0  21
8110906  0.078  0.078  22
8110907  0.0  0.0  25
8110908  0.078  0.078  26
8110909  0.0  0.0  55
8110910  0.158  0.158  56
```

```
8110911  0.0  0.0  65
8110912  0.026  0.026  66
8110913  0.0  0.0  78
8110914  0.13  0.13  79
8110915  0.0  0.0  86
8110916  0.156  0.156  87
8110917  0.0  0.0  94
8110918  0.156  0.156  95
8110919  0.0  0.0  98
8111001  00  99
8111101  1000  98
8111201  4  17.7  120.0  0.9284  0.0  99
8111300  1
8111301  0.0  0.0  0.0  98
*
8120000  "DISCHA1"  SNGLJUN
8120101  811010000  813000000  0.0  0.0  0.0  1000
8120201  1  0.0  0.0  0.0
*
*     12  INCH  SCH.  40  DISCHARGE  PIPING
*
8130000  "DISCHA1" PIPE
8130001  30
8130101  0.7771  30
8130301  0.875  6
8130302  1.0  20
8130303  0.5  30
8130401  0.0  30
8130601  0.0  30
8130801  0.000169  0.0  30
8130901  0.0  0.0  5
8130902  0.156  0.156  6
8130903  0.0  0.0  19
8130904  0.156  0.156  20
8130905  0.0  0.0  29
8131001  00  30
8131101  1000  29
8131201  4  17.7  120.0  0.9284  0.0  30
8131300  1
8131301  0.0  0.0  0.0  29
*
*
*
******************************************************
*        SAFETY VALVE 458 AT ELEV. 670'-10" ARC 2    *
******************************************************
*
*
*
**
*   DISCHARGE  PIPING
*
*  6  INCH  SCH.  40  PIPING
**
2060000   "DISCHA2"  PIPE
2060001   33
2060101   0.20069   33
2060301   0.4635    4
```

```
2060302   0.927       14
*ARC  STARTS  LEVEL  670'-10"
2060303   0.955       23
2060304   0.727       29
2060308   0.7980      33
2060401   0.0         33
2060601   0.0          4
2060602   -90.        14
2060603   0.0         33
2060801   0.000152  0.0    33
2060901   0.0  0.0  3
2060902  0.1800  0.1800     4
2060903   0.0  0.0  13
2060904  0.1800  0.1800     14
2060905   0.0  0.0  32
2061001     00        33
2061101    1000    32
2061201    4  17.7  120.0  0.9284  0.0  33
2061300    1
2061301    0.0  0.0  0.0  32
*
*************************************************
*    SAFETY VALVE 45A AT ELEV. 672'-6" ARC 3    *
*************************************************
*
*
*
**
*   DISCHARGE PIPING
*
*    6  INCH  SCH.  40  PIPING
**
3060000    "DISCHA3"  PIPE
3060001    25
3060101    0.20069  25
3060301    0.526     4
3060302    0.969     12
*   ARC   STARTS  LEVEL  672'-6"
3060303    0.635     15
3060304    0.991     18
3060305    0.991     21
3060306    0.799     25
*   ARC ENDS
3060401    0.0   25
3060601    0.0       4
3060602    -90.0    12
3060603    0.0      25
3060801    0.000152  0.0  25
3060901    0.0  0.0   3
3060902   0.1800  0.1800    4
3060903    0.0  0.0  11
3060904   0.1800  0.1800    12
3060905    0.0  0.0  24
3061001    00  25
3061101   1000  24
3061201    4  17.7  120.0  0.9284  0.0  25
3061300    1
3061301    0.0  0.0 0.0  24
```

TELEDYNE
ENGINEERING SERVICES

```
*
*
*
*
******************************************
*           PORV  PIPING                 *
******************************************
*
*
*   PIPING  DOWNSTREAM  OF  VALVE  NRV - 153
*
*   3  INCH  SCH.  40  PIPING
*
*
5000000    "PORVB"    PIPE
5000001    16
5000101    0.05132  16   *  3 IN  SCH40S
5000301    0.497  3
5000302    0.556  6
     *   ARC  STARTS  LEVEL  684'-9"
5000303    0.365     7  *
5000304    0.6448  13
5000305     0.5892   16
5000401    0.0  16
5000601    0.0    3
5000602    -90.0  6
5000603    0.0    16
5000801    0.000153  0.0  16
5000901    0.0       0.0      2
5000902    0.2088  0.2088   3
5000903    0.0       0.0      5
5000904    0.2088  0.2088   6
5000905    0.0       0.0     15
5001001    00  16
5001101     1000  15
5001201    4  17.7  120.0  0.9284  0.0  16
5001300    1
5001301    0.0  0.0  0.0  15
*
5010000    "PORVB"  SNGLJUN   *  THIS JUNCTION IS ON ARC B
5010101    500010000  502000000  0.0  0.0  0.0  1000
5010201    1  0.0 0.0 0.0
*
*   4  INCH  X  3  INCH  DIFFUSER
*
5020000    "PORVB"   PIPE  * REDUCER ON ARC B 3IN X4IN
5020001    2
5020101    0.05132    1   *  3IN SCH40S
5020102    0.08840    2   *  4IN SCH40S
5020301    0.3385    2
5020401    0.0  2
5020601    0.0  2
5020801    0.000153  0.0  1
5020802    0.000134  0.0  2
5020901    0.0399  0.0544  1
5021001    00  2
5021101     1000  1
5021201    4  17.7  120.0 0.9284  0.0  2
```

TELEDYNE ENGINEERING SERVICES

```
5021300   1
5021301   0.0  0.0  0.0  1
*
*
5030000   "PORVB"  SNGLJUN  * ON ARC B
5030101   502010000  504000000  0.0  0.0  0.0  1000
5030201   1  0.0  0.0  0.0
*
*   4  X  4  X  3  INCH  BRANCH
*
5040000   "PORVB"  BRANCH  *  ON ARC B @ 242
5040001   0
5040101   0.0884  0.361 0.0  0.0  0.0  0.0  0.000134  0.0  00
5040200   4  17.7  120.0  0.9284  0.0  0.0
*
5050000   "PORVB"  SNGLJUN   * ON ARC B
5050101   504010000  506000000  0.0  0.0  0.0  1000
5050201   1  0.0  0.0  0.0
*
*   4  INCH  SCH.  40  PIPING
*
5060000   "PORVB" PIPE   *  ON ARC B
5060001   9
5060101   0.0884   9
5060301   0.6211   8
5060302   0.7607    9
5060401   0.0  9
5060601   0.0  9
5060801   0.000134  0.0  9
5060901   0.0  0.0  8
5061001   00  9
5061101   1000  8
5061201   4  17.7  120.0  0.9284  0.0  9
5061300   1
5061301   0.0  0.0  0.0  8
*
5070000   "PORVB"  SNGLJUN
5070101   506010000  508000000  0.0  0.0  0.0  1000
5070201   1  0.0  0.0  0.0
*
*   4  INCH  X  6  INCH  DIFFUSER
*
5080000   "PORVB" PIPE
5080001   2
5080101   0.0884   1
5080102   0.20069   2
5080301   0.5792  2
5080401   0.0  2
5080601   0.0  2
5080801   0.000134  0.0  1
5080802   0.000152  0.0  2
5080901   0.1483  0.0815  1
5081001   00  2
5081101   1000  1
5081201   4  17.7  120.0  0.9284  0.0  2
5081300   1
5081301   0.0  0.0  0.0  1
*
```

TELEDYNE ENGINEERING SERVICES

```
5090000   "PORVB" SNGLJUN   * ON ARC B
5090101   508010000  510000000  0.0  0.0  0.0 1000
5090201   1  0.0  0.0  0.0
*
*   6  X  6  X  3  INCH REDUCING  TEE
*
5100000   "PORVB" BRANCH   * ON ARC B @ 232
5100001   0
5100101   0.20069 0.25  0.0  0.0  0.0  0.0  0.000152  0.0  00
5100200   4  17.7  120.0  0.9284  0.0  0.0
*
5110000   "PORVB" SNGLJUN   *  ON ARC B
5110101   510010000  700000000    0.0  0.0 0.0  1000
5110201   1  0.0  0.0  0.0
*
*    PIPING  DOWNSTREAM  OF  VALVE  NRV - 151
*
*    3  INCH  SCH.  40  PIPING
*
4000000   "PORVA"  PIPE
4000001   8
4000101   0.05132  8
4000301   0.4141   4
4000302   0.4375   8
4000401   0.0  8
4000601   0.0  4
4000602   -90.0 8
4000801   0.000153  0.0  8
4000901   0.0  0.0  3
4000902   0.2088  0.2088  4
4000903  0.0  0.0  7
4001001   00  8
4001101   1000  7
4001201   4  17.7  120.0  0.9284  0.0  8
4001300   1
4001301   0.0  0.0  0.0   7
*
4010000   "PORVAB" SNGLJUN
4010101   400010000  510000000   0.0  0.1800  0.1800  1000
4010201   1  0.0  0.0  0.0
*
*    DOWNSTREAM  PIPING  FROM  VALVE  NRV - 152
*
*    3  INCH  SCH.  40  PIPING
*
6000000   "PORVC"  PIPE
6000001   7
6000101   0.05132 7
6000301   0.4722    3
6000302   0.4375    7
6000401   0.0  7
6000601   0.0  3
6000602   -90.0  7
6000801   0.000153  0.0  7
6000901   0.0  0.0  2
6000902   0.2088  0.2088  3
6000903   0.0  0.0  8
6001001   00  7
```

TELEDYNE ENGINEERING SERVICES

```
6001101   1000  6
6001201   4  17.7  120.0  0.9284  0.0  7
6001300   1
6001301   0.0  0.0  0.0  6
*
6010000   "PORVBC" SNGLJUN
6010101   600010000  504000000  0.0  0.1932  0.1932  1000
6010201   1  0.0  0.0  0.0
*
*    MAIN  HEADER  DOWNSTREAM  OF  PORV  PIPING
*
7000000   "PORVBD"  PIPE
7000001   12
7000101   0.20069  12
7000301   0.75  2
7000302   1.075  12
7000401   0.0  12
7000601   0.0   2
7000602   -90.  12
7000801   0.000152  0.0  12
7000901    0.0    0.0    1
7000902   0.1800  0.1800  2
7000903   0.0     0.0     11
7001001   00  12
7001101   1000  11
7001201   4  17.7  120.0  0.9284  0.0  12
7001300   1
7001301   0.0  0.0  0.0  11
*
7010000   "PORVD"  SNGLJUN
7010101   700010000  702000000  0.0  0.0  0.0  1000
7010201   1  0.0  0.0  0.0
*
*
*
*
*
*********************************************************
**                                                     **
**          MAIN ARC CONNECTIONS                       **
**                                                     **
*********************************************************
*
*
*
*    12 INCH  X  6 INCH   DIFFUSER ABOVE SRV ARCS ON MAIN DISCHARGE
*
*
*
7020000   "PORVD"  PIPE
7020001   3
7020101   0.20069  1
7020102   .77708   3
7020301   0.75  1
7020302   0.375  3
7020401   0.0  3
7020601   -90.0  3
7020801   0.000152  0.0  1
```

```
7020802   0.000169  0.0  3
7020901   0.4930  0.2045  1
7020902   0.0     0.0     2
7021001   00  3
7021101   1000  2
7021201   4  17.7  120.0  0.9284  0.0  3
7021300   1
7021301   0.0  0.0  0.0  2
*
8000000   "PORVD"  SNGLJUN
8000101   702010000  801000000  0.0  0.0  0.0  1000
8000201   1  0.0  0.0  0.0
*
3070000   "PORVD3"  SNGLJUN
3070101   306010000  801000000  0.0  0.156  0.156  1000 * 12 IN ELBOW LOSSES
3070201   1  0.0  0.0  0.0
*
*   12  X  12  X  6  INCH REDUCING TEE CONNECTS ARC WITH DISCHARGE
*
8010000   "PORVD"  BRANCH
8010001   0
8010101   0.77708  0.5  0.0  0.0  -90.  -0.5  0.000169  0.0  00
8010200   4  17.7  120.0  0.9284  0.0 0.0
*
8020000   "PORVD"  SNGLJUN
8020101   801010000  803000000  0.0  0.0  0.0  1000
8020201   1  0.0  0.0 0.0
*
8030000   "PORVD"  SNGLVOL
8030101   0.77708  1.1667  0.0  0.0 -90.  -1.1667  0.000169  0.0  00
8030200   4  17.7  120.0 0.9284  0.0  0.0
*
8040000   "PORVD"  SNGLJUN
8040101   803010000  805000000  0.0  0.0  0.0 1000
8040201   1  0.0  0.0  0.0
*
2070000   "PORVD"  SNGLJUN
2070101   206010000  805000000  0.0  0.156  0.156  1000 * 12 IN ELBOW LOSSES
2070201   1  0.0  0.0  0.0
*
*  12 X12 X 6 INCH REDUCING TEE. CONNECTS SRV ARC WITH DISCHARGE PIPING.
*
8050000   "PORVD"  BRANCH
8050001   0
8050101   0.77708  0.5  0.0  0.0  -90.  -0.5  0.000169 0.0 00
8050200   4  17.7  120.0  0.9284  0.0  0.0
*
8060000   "PORVD"  SNGLJUN
8060101   805010000  807000000   0.0  0.0  0.0  1000
8060201   1  0.0  0.0  0.0
*
8070000   "PORVD"  SNGLVOL
8070101   0.77708  1.1667 0.0 0.0 -90. -1.1667 0.000169 0.0 00
8070200   4  17.7  120.0  0.9284  0.0  0.0
*
8080000   "PORVD"  SNGLJUN
8080101   807010000  809000000  0.0  0.0  0.0  1000
8080201   1  0.0  0.0  0.0
```

```
*
9000000  "QTANKD"  SNGLJUN
9000101  813010000  901000000  0.0  0.1560  0.1560  1000
9000201  1  0.0  0.0  0.0
*
9010000  "QTANKD"  PIPE
9010001  2
9010101  0.77708  2
9010301  1.0833  2
9010401  0.0  2
9010601  -90.0  2
9010801  0.000169  0.0  2
9010901  0.0  0.0  1
9011001  00  2
9011101  1000  1
9011201  4  17.7  120.0  0.9284  0.0  2
9011300  1
9011301  0.0  0.0  0.0  1
*
*************************
**                     **
**    QUENCH   TANK    **
**                     **
*************************
*
9020000   "QTANK-IN"  SNGLJUN
9020101   901010000  903000000  0.  0.  0.   1000
9020201   1    0.  0.   0.
**
*    SPARGER  12 IN SCH40  PIPE
**
9030000   "SPARGER"  PIPE
*    NO OF VOLUMES
9030001   18
*    FLOW AREA
9030101   0.7773     18
*    VOL. LENGTHS
9030301   1.125      2
9030302   1.1333     7
9030303   1.0        18
*    VOL. VOLS.
9030401   0.0        18
*
*    VERTICAL ANGLES
9030601  -90.        7
9030602   0.0        18
*    PIPE  ROUGHNESS
9030801   1.69-4     0.0       18
*    JUNCTION  LOSS COEFF.
9030901   0.0        0.0       6
9030902   0.156      0.156     7
9030903   0.0        0.0       17
*    VOL. CONTROL FLAG
9031001   00         18
*    JUN. CONTROL FLAG
9031101   1000       17
*    INITIAL COND.
9031201   4     17.7    120.    0.9284    0.    2
```

```
9031202   3     17.7    120.     0.0        0.    18
*         JUN.  INITIAL COND.
9031300   1
9031301   0.0   0.0   0.0        17
**
*    SPARGER   EXIT
**
9040000 "EXIT" SNGLJUN
9040101   903010000   905000000    0.0    1.0    1.0     0100
9040201   1     0.     0.     0.
**
*         WATER  VOL.
**
9050000   "QT. WATER" SNGLVOL
9050101   260.4706   5.6667   0.0    0.0   90.   5.6667  0.003  0.0   01
9050200   3     17.7       120.
**
*         INTERFACE
**
9060000   "INTERFACE"  SNGLJUN
9060101   905010000  907000000    0.0     0.0     0.0     1000
9060201   1     0.0  0.0  0.0
**
*         AIR  VOLUME
**
9070000   "QT.AIR"  SNGLVOL
9070101   260.4706  1.2439    0.0    0.0    90.    1.2439  0.003  0.0  01
9070200   4     17.7    120.     0.9284
**
*         RUPTURE DISC
**
9080000   "RUP.DISC"  VALVE
9080101   907010000   999000000     1.77  0.   0.    1100
9080201   1     0.     0.    0.
9080300   TRPVLV
9080301   501        *     VALVE OPENING TRIP
**
*    PIPE  OUTSIDE  ENVIRONMENT
**
9990000   "ATMOSPHERE"    TMDPVOL
9990101   10000.     10000.    0.0  0.0  0.0  0.0  .00001  0.0   11
9990200   4
9990201   0.0   17.7   120.  0.9284
.END OF CASE
```

TELEDYNE
ENGINEERING SERVICES

9.1.1.2 <u>PORV Solid 400 Liquid Restart</u>

LISTING OF INPUT DATA FOR CASE 1

```
=THIS RESTARS RELAP 3 PORVS OPENING ON SOLID WATER UNIT2 RED
*
100 RESTART TRANSNT
101 RUN
*
103 2000
104 NOACTION
201 0.600  1.-7 2.-4 11001 5 50 250
*
*
* MINOR EDITS
*
301  MFLOWJ  415000000
302  MFLOWJ  490000000
303  MFLOWJ  493000000
304  MFLOWJ  388000000
305  MFLOWJ  811140000
306  MFLOWJ  811790000
307  MFLOWJ  307000000
308  MFLOWJ  207000000
309  MFLOWJ  107000000
*
310  QUALS  400010000
311  QUALS  500010000
312  QUALS  600010000
313  QUALS  410210000
314  QUALS  485270000
315  QUALS  492110000
316  QUALS  389010000
317  QUALS  811140000
318  QUALS  811790000
319  QUALS  106010000
320  QUALS  106390000
321  QUALS  206010000
322  QUALS  206330000
323  QUALS  306010000
324  QUALS  306250000
*
325  P        400010000
326  P        500010000
327  P        600010000
328  P        410210000
329  P        485270000
330  P        492110000
331  P        389010000
332  P        811140000
333  P        811790000
334  P        106010000
335  P        106390000
336  P        206010000
337  P        206330000
338  P        306010000
339  P        306250000
*
2001    5,151
2002    206010000,206020000,206030000,206040000,206050000
```

BY KJG DATE 5-20-83
CHKD. BY [illegible] DATE 6-2-83

TELEDYNE ENGINEERING SERVICES

```
2003      206060000,206070000,206080000,206090000,206100000
2004      206110000,206120000,206130000,206140000,206150000
2005      206160000,206170000,206180000,206190000,206200000
2006      206210000,206220000,206230000,206240000,206250000
2007      206260000,206270000,206280000,206290000,206300000
2008      206310000,206320000,206330000
*
*
*
*
*        ****   FIRST C.V. DOWNSTREAM OF THE ARC    ****
*
*
2010      805010000
*
*
*
*
*         *****  12 INCH DISCHARGE DOWN TO THE QUENCH TANK   *****
*
*
2020      811190000,811200000,811210000,811220000,811230000
2021      811240000,811250000,811260000,811270000,811280000
2022      811290000,811300000,811310000,811320000,811330000
2023      811340000,811350000,811360000,811370000,811380000
2024      811390000,811400000,811410000,811420000,811430000
2025      811440000,811450000,811460000,811470000,811480000
2026      811490000,811500000,811510000,811520000,811530000
2027      811540000,811550000,811560000,811570000,811580000
2028      811590000,811600000,811610000,811620000,811630000
2029      811640000,811650000,811660000,811670000,811680000
2030      811690000,811700000,811710000,811720000,811730000
2031      811740000,811750000,811760000,811770000,811780000
2032      811790000,811800000,811810000,811820000,811830000
2033      811840000,811850000,811860000,811870000,811880000
2034      811890000,811900000,811910000,811920000,811930000
2035      811940000,811950000,811960000,811970000,811980000
2036      811990000,811180000
*
2040      813010000,813020000,813030000,813040000,813050000
2041      813060000,813070000,813080000,813090000,813100000
2042      813110000,813120000,813130000,813140000,813150000
2043      813160000,813170000,813180000,813190000,813200000
2044      813210000,813220000,813230000,813240000,813250000
2045      813260000,813270000,813280000,813290000,813300000
*
*
*
*        ******   PIPE DOWN INTO THE QUENCH TANK  ****
*
*
2050      901010000,901020000,903010000,903020000
2051      903030000
*
*
*
3880000  "PORVU"  SNGLJUN
3880101  387010000  389000000  0.0  0.0  0.0  1000
```

```
3880201   1   0.0  0.0  0.0
20300100   MFLOWJ   415000000
20300200   MFLOWJ   493000000
20300300   MFLOWJ   490000000
20300400   MFLOWJ   388000000
20300500   MFLOWJ   811140000
20300600   MFLOWJ   811790000
20300700   MFLOWJ   307000000
20300800   MFLOWJ   207000000
20300900   MFLOWJ   107000000
*
20301000   QUALS   400010000
20301100   QUALS   500010000
20301200   QUALS   600010000
20301300   QUALS   410210000
20301400   QUALS   485270000
20301500   QUALS   492110000
20301600   QUALS   389010000
20301700   QUALS   811140000
20301800   QUALS   811790000
20301900   QUALS   106010000
20302000   QUALS   106390000
20302100   QUALS   206010000
20302200   QUALS   206330000
20302300   QUALS   306010000
20302400   QUALS   306250000
*
20302500   P         400010000
20302600   P         500010000
20302700   P         600010000
20302800   P         410210000
20302900   P         485270000
20303000   P         492110000
20303100   P         389010000
20303200   P         811140000
20303300   P         811790000
20303400   P         106010000
20303500   P         106390000
20303600   P         206010000
20303700   P         206330000
20303800   P         306010000
20303900   P         306250000
*
.END
```

9.1.1.3 SV Cold Loop Seal (Quarter Model)

LISTING OF INPUT DATA FOR CASE 1

```
*AEP UNIT2  1 LINE  RELAP5
100 NEW TRANSNT
101 RUN
102 BRITISH BRITISH
104 NOACTION
* TIME STEP CONTROL
*
201  0.6000  1.0-7  2.0-4  11001  5  25  250
* MINOR EDITS
*
301  QUALS  007010000
302  QUALS  005200000
303  QUALS  013200000
304  P      005200000
305  P      007010000
306  P      007380000
307  MFLOWJ 006000000
308  MFLOWJ 005070000
309  MFLOWJ 014000000
310  P      007140000
311  P      011560000
312  P      013300000
313  MFLOWJ 007140000
314  MFLOWJ 007380000
315  MFLOWJ 011560000
*
*
2001   5,192,001010000,003010000,005010000
2002   005020000,005030000,005040000,005050000,005060000
2003   005070000,005080000,005090000,005100000,005110000
2004   005120000,005130000,005140000,005150000,005160000
2005   005170000,005180000,005190000,005200000,007010000
2006   007020000,007030000,007040000,007050000,007060000,007070000
2007   007080000,007090000,007100000,007110000,007120000
2008   007130000,007140000,007150000,007160000,007170000
2009   007180000,007190000,007200000,007210000,007220000
2010   007230000,007240000,007250000,007260000,007270000
2011   007280000,007290000,007300000,007310000,007320000
2012   007330000,007340000,007350000,007360000,007370000
2013   007380000,007390000,009010000,011010000,011020000
2014   011030000,011040000,011050000,011060000,011070000
2015   011080000,011090000,011100000,011110000,011120000
2016   011130000,011140000,011150000,011160000,011170000
2017   011180000,011190000,011200000,011210000,011220000
2018   011230000,011240000,011250000,011260000,011270000
2019   011280000,011290000,011300000,011310000,011320000
2020   011330000,011340000,011350000,011360000,011370000
2021   011380000,011390000,011400000,011410000,011420000
2022   011430000,011440000,011450000,011460000,011470000
2023   011480000,011490000,011500000,011510000,011520000
2024   011530000,011540000,011550000,011560000,011570000
2025   011580000,011590000,011600000,011610000,011620000
2026   011630000,011640000,011650000,011660000,011670000
2027   011680000,011690000,011700000,011710000,011720000
2028   011730000,011740000,011750000,011760000,011770000
2029   011780000,011790000,011800000,011810000,011820000
```

BY CMM DATE 2-9-83
CHKD. BY LOS DATE 2-9-83

```
2030  011830000,011840000,011850000,011860000,011870000
2031  011880000,011890000,011900000,011910000,011920000
2032  011930000,011940000,011950000,011960000,011970000
2033  011980000,011990000,013010000,013020000,013030000
2034  013040000,013050000,013060000,013070000,013080000
2035  013090000,013100000,013110000,013120000,013130000
2036  013140000,013150000,013160000,013170000,013180000
2037  013190000,013200000,013210000,013220000,013230000
2038  013240000,013250000,013260000,013270000,013280000
2039  013290000,013300000,015010000
*
*TRIPS
*
502  TIME  0  GT NULL 0  1.500  L  * JOB TERMINATION TRIP
503  TIME  0  GE NULL 0  0.0    L  *  VALVE OPEN
504  TIME  0  GE  NULL  0  5.0  L  *  VALVE CLOSED
600  502
*
*  HYDRODYNAMIC COMPONENTS
*
*
* PRESSURIZER
*
0010000  "PRESS1"  TMDPVOL
0010101  0.0  20.0  500.0  0.0  0.0  0.0  0.00005  0.0  11
0010200  2
0010201  0.0  2500.0  1.0  0.1  2514.0  1.0  0.3  2555.0  1.0  0.5  2600.0  1.0
0010202  0.7  2687.0  1.0  0.9  2700.0  1.0  1.1  2740.0  1.0  1.3  2745.0  1.0
0010203  1.5  2747.0  1.0  1.7  2748.0  1.0  1.9  2750.0  1.0  2.0  2750.0  1.0
0010204  2.5  2750.0  1.0
*
*  LOOP SEAL GEOMETRY
*
0020000  "LPSL"  SNGLJUN
0020101  001000000  003000000  0.0  0.0  0.0  1000  * THIS IS A SHORT RADIUS ELBOW LEAVING
0020201  1  0.0  0.0  0.0
*
0030000  "LPSL" SNGLVOL
0030101  0.1465  1.0  0.0  90.0  0.0  0.0  0.000151  0.0  00
0030200    2  2500.0  1.0
*
0040000  "LPSL"  SNGLJUN
0040101  003010000  005000000  0.0  0.1838  0.1838  1000
0040201  1  0.0  0.0  0.0
*
0050000  "LPSL"  PIPE
0050001  20
0050101  0.1465  20
0050301  0.50  10
0050302  0.574  20
0050401  0.0  20
0050601  -90.0  7
0050602  0.0  10
0050603  90.0  20
0050801  0.000151  0.0  20
0050901  0.0  0.0  8
```

TELEDYNE ENGINEERING SERVICES

```
0050904  0.1838  0.1838  10
0050905  0.0  0.0  19
0051001  00  20
0051101  1000  19
0051201  3  2500.0  584.4  0.0  0.0  1
0051202  3  2500.0  451.1  0.0  0.0  2
0051203  3  2500.0  352.1  0.0  0.0  3
0051204  3  2500.0  276.8  0.0  0.0  4
0051205  3  2500.0  218.1  0.0  0.0  5
0051206  3  2500.0  169.3  0.0  0.0  6
0051207  3  2500.0  141.1  0.0  0.0  20
0051300  1
0051301  0.0  0.0  0.0  19
*
******************************
*  VALVE  6M6  CROSBY SAFETY
******************************
0060000  "SRV"  VALVE
0060101  005010000  007000000  0.022  0.0  0.0  0100
0060201  1  0.0  0.0  0.0
0060300  MTRVLV
0060301  503  504  100.0  0.0  *  CROSBY 6M6  OPENING IN 10 MSEC
*
*  DISCHARGE PIPING
0070000  "DISCHA1"  PIPE
0070001  39
0070101  0.20069  39
0070301  0.526  4
0070302  1.094  14
* ARC STARTS HERE LEVEL 689-2"
0070303  0.94187  17
0070304  0.942  20
0070305  0.8425  23
0070306  0.844  26
0070307  0.8433  29
0070308  0.8333  32
0070309  0.8333  35
* ARC ENDS
0070310  0.91750  39
0070401  0.0  39
0070601  0.0  4
0070602  -90.0  14
0070603  0.0  39
0070801  0.000152  0.0  39
0070901  0.0  0.0  3
0070902  0.1800  0.1800  4
0070903  0.0  0.0  13
0070904  0.1800  0.1800  14
0070905  0.0  0.0  38
0071001  00  39
0071101  1000  38
0071201  4  14.7  120.0  0.9284  0.0  39
0071300  1
0071301  0.0  0.0  0.0  38
*
0080000  "DISCHA1"  SNGLJUN
0080101  007010000  009000000  0.0  0.1560  0.1560  1000  *LOSSES FOR A 12 IN ELBOW
```

```
*
* INPUT A BRANCH HERE FOR A COMPLETE MODEL
*
0090000  "DISCHA1"  SNGLVOL
0090101  0.7771  0.5  0.0  0.0  -90.0  -0.5  0.000169  0.0  00
0090200  4  14.7  120.0  0.9284
*
0100000  "DISCHA1"  SNGLJUN
0100101  009010000  011000000  0.0  0.0  0.0  1000
0100201  1  0.0  0.0  0.0
*
0110000  "DISCH1A"  PIPE
0110001  99
0110101  0.7771  99
0110301  1.039  14
0110302  0.53025  18
0110303  0.5  22
0110304  0.53025  26
0110305  0.9875  58
0110306  0.475  66
0110307  0.49359  79
0110308  0.46875  87
0110309  0.51172  95
0110310  0.95  99
0110401  0.0  99
0110601  -90.0  14
0110602  -45.0  18
0110603  -90.0  22
0110604  -45.0  26
0110605  -90.0  58
0110606  0.0  87
0110607  -90.0  95
0110608  0.0  99
0110801  0.000169  0.0  99
0110901  0.0  0.0  13
0110902  0.078  0.078  14
0110903  0.0  0.0  17
0110904  0.078  0.078  18
0110905  0.0  0.0  21
0110906  0.078  0.078  22
0110907  0.0  0.0  25
0110908  0.078  0.078  26
0110909  0.0  0.0  55
0110910  0.156  0.156  58
0110911  0.0  0.0  65
0110912  0.156  0.156  66
0110913  0.0  0.0  78
0110914  0.156  0.156  79
0110915  0.0  0.0  86
0110916  0.156  0.156  87
0110917  0.0  0.0  94
0110918  0.156  0.156  95
0110919  0.0  0.0  98
0111001  00  99
0111101  1000  98
0111201  4  14.7  120.0  0.9284  0.0  99
0111300  1
```

```
*
0120000  "DISCHA1"  SNGLJUN
0120101  011010000  013000000  0.0  0.0  0.0  1000
0120201  1  0.0  0.0  0.0
*
0130000  "DISCHA1" PIPE
0130001  30
0130101  0.7771  30
0130301  0.95  6
0130302  1.0  20
0130303  0.5  30
0130401  0.0  30
0130601  0.0  30
0130801  0.000169  0.0  30
0130901  0.0  0.0  5
0130902  0.156  0.156  6
0130903  0.0  0.0  19
0130904  0.156  0.156  20
0130905  0.0  0.0  29
0131001  00  30
0131101  1000  29
0131201  4  14.7  120.0  0.9284  0.0  30
0131300  1
0131301  0.0  0.0  0.0  29
*
0140000  "DISCH1A"  SNGLJUN
0140101  013010000  015000000  0.0  0.0  0.0  0100
0140201  1  0.0  0.0  0.0
*
0150000  "ATMOS"  TMDPVOL
0150101  10000.0  10000.0  0.0  0.0  0.0  0.0  0.00001  0.0  11
0150200  4
0150201  0.0  14.7  120.0  0.9284
*
* PLOT CARDS
*
20300100  QUALS  007010000
20300200  QUALS  005200000
20300300  QUALS  013200000
20300400  P      005200000
20300500  P      007010000
20300600  P      007380000
20300700  MFLOWJ 006000000
20300800  MFLOWJ 005070000
20300900  MFLOWJ 014000000
20301000  P      007140000
20301100  P      011560000
20301200  P      013300000
20301300  MFLOWJ  007140000
20301400  MFLOWJ  007380000
20301500  MFLOWJ  011560000
.END OF CASE
```

Section 9.1.2

REPIPE Input

9.1.2.1 <u>Unit 2 - Model Section A</u>

```
$PIPES
INLINE=3,KBLOCK=200,KPIPE=10,KPLOT(1)=1,KWAVE=1,
KPRINT=-1,KPNV=1,KSTEP=3,
NDROPV=385010000,206330000,811190000$
342     386000000    -0.3710    0.6786    0.6340/
340    -387010000    -0.3710    0.6786    0.6340/
339     387010000     0.0   1.0    0.0/
339     387020000     0.0   1.0    0.0/
339     387030000     0.0   1.0    0.0/
339     387040000     0.0   1.0    0.0/
339     387050000   0.0    1.0    0.0/
339     387060000   0.0    1.0    0.0/
339     387070000   0.0    1.0    0.0/
339     387080000   0.0    1.0    0.0/
339     387090000   0.0    1.0    0.0/
339     387100000   0.0    1.0    0.0/
339     387110000   0.0    1.0    0.0/
339     388000000   0.0    1.0    0.0/
339     420000000   0.0    1.0    0.0/
339     425010000   0.0    1.0    0.0/
339     425020000   0.0    1.0    0.0/
336    -387020000   0.0    1.0    0.0/
336    -387030000   0.0    1.0    0.0/
336    -387040000   0.0    1.0    0.0/
336    -387050000   0.0    1.0    0.0/
336    -387060000   0.0    1.0    0.0/
336    -387070000   0.0    1.0    0.0/
336    -387080000   0.0    1.0    0.0/
336    -387090000   0.0    1.0    0.0/
336    -387100000   0.0    1.0    0.0/
336    -387110000  0.0   1.0   0.0/
336    -388000000   0.0    1.0    0.0/
336    -420000000   0.0    1.0    0.0/
336   -498000000  0.0  1.0  0.0/
336    -425010000   0.0    1.0    0.0/
336    -425020000   0.0    1.0    0.0/
336    -425030000   0.0    1.0    0.0/
334     425030000   0.7844     0.0     0.6202/
334     425040000   0.7844     0.0     0.6202/
334     430000000   0.7844     0.0     0.6202/
330    -425040000   0.7844     0.0     0.6202/
330    -430000000   0.7844     0.0     0.6202/
330    -435010000   0.7844     0.0     0.6202/
334    435010000   0.7844     0.0     0.6202/
334    440000000   0.7844     0.0     0.6202/
334    445010000   0.7844     0.0     0.6202/
334    445020000   0.7844     0.0     0.6202/
334    445030000   0.7844     0.0     0.6202/
334    445040000   0.7844     0.0     0.6202/
330    -440000000   0.7844     0.0     0.6202/
330    -445010000   0.7844     0.0     0.6202/
330    -445020000   0.7844     0.0     0.6202/
330    -445030000   0.7844     0.0     0.6202/
330    -445040000   0.7844     0.0     0.6202/
330    -445050000   0.7844     0.0     0.6202/
328     445050000   0.0    1.0    0.0/
328     445060000   0.0    1.0    0.0/
328     445070000   0.0    1.0    0.0/
328     445080000   0.0    1.0    0.0/
```

BY KJG DATE 5-21-83
CHKD. BY MR DATE 5/26/83

TELEDYNE
ENGINEERING SERVICES

324	-445060000	0.0	1.0	0.0/
324	-445070000	0.0	1.0	0.0/
324	-445080000	0.0	1.0	0.0/
324	-445090000	0.0	1.0	0.0/
322	445090000	0.9138	0.0	-0.4062/
322	450000000	0.9138	0.0	-0.4062/
322	460000000	0.9138	0.0	-0.4062/
322	465010000	0.9138	0.0	-0.4062/
322	465020000	0.9138	0.0	-0.4062/
322	470000000	0.9138	0.0	-0.4062/
318	-450000000	0.9138	0.0	-0.4062/
318	-460000000	0.9138	0.0	-0.4062/
318	-491000000	0.9138	0.0	-0.4062/
318	-465010000	0.9138	0.0	-0.4062/
318	-465020000	0.9138	0.0	-0.4062/
318	-470000000	0.9138	0.0	-0.4062/
318	-475010000	0.9138	0.0	-0.4062/
3181	475010000	0.8212	0.0	-0.5707/
3181	480000000	0.8212	0.0	-0.5707/
3181	485010000	0.8212	0.0	-0.5707/
3181	485020000	0.8212	0.0	-0.5707/
3181	485030000	0.8212	0.0	-0.5707/
316	-480000000	0.8212	0.0	-0.5707/
316	-485010000	0.8212	0.0	-0.5707/
316	-485020000	0.8212	0.0	-0.5707/
316	-485030000	0.8212	0.0	-0.5707/
316	-485040000	0.8212	0 0	-0.5707/
3161	485040000	0.5557	0.0	-0.8314/
3161	485050000	0.5557	0.0	-0.8314/
3161	485060000	0.5557	0.0	-0.8314/
3161	485070000	0.5557	0.0	-0.8314/
314	-485050000	0.5557	0.0	-0.8314/
314	-485060000	0.5557	0.0	-0.8314/
314	-485070000	0.5557	0.0	-0.8314/
314	-485080000	0.5557	0.0	-0.8314/
3141	485080000	0.2178	0.0	-0.9760/
3141	485090000	0.2178	0.0	-0.9760/
3141	485100000	0.2178	0.0	-0.9760/
3141	485110000	0.2178	0.0	-0.9760/
312	-485090000	0.2178	0.0	-0.9760/
312	-485100000	0.2178	0.0	-0.9760/
312	-485110000	0.2178	0.0	-0.9760/
312	-485120000	0.2178	0.0	-0.9760/
3121	485120000	-0.1543	0.0	-0.9880/
3121	485130000	-0.1543	0.0	-0.9880/
3121	485140000	-0.1543	0.0	-0.9880/
3121	485150000	-0.1543	0.0	-0.9880/
310	-485130000	-0.1543	0.0	-0.9880/
310	-485140000	-0.1543	0.0	-0.9880/
310	-485150000	-0.1543	0.0	-0.9880/
310	-485160000	-0.1543	0.0	-0.9880/
3101	485160000	-0.9272	-0.0262	-0.3745/
308	485170000	-0.9272	-0.0262	-0.3745/
308	485180000	-0.9272	-0.0262	-0.3745/
308	485190000	-0.9272	-0.0262	-0.3745/
308	485200000	-0.9272	-0.0262	-0.3745/
308	485210000	-0.9272	-0.0262	-0.3745/
308	485220000	-0.9272	-0.0262	-0.3745/
308	485230000	-0.9272	-0.0262	-0.3745/
[illegible]	[illegible]	-0.9272	-0.0262	-0.3745/

308	485250000	-0.9272	-0.0262	-0.3745/
308	485260000	-0.9272	-0.0262	-0.3745/
3081	-485170000	-0.9272	-0.0262	-0.3745/
294	-485180000	-0.9272	-0.0262	-0.3745/
294	-485190000	-0.9272	-0.0262	-0.3745/
294	-485200000	-0.9272	-0.0262	-0.3745/
294	-485210000	-0.9272	-0.0262	-0.3745/
294	-485220000	-0.9272	-0.0262	-0.3745/
294	-485230000	-0.9272	-0.0262	-0.3745/
294	-485240000	-0.9272	-0.0262	-0.3745/
294	-485250000	-0.9272	-0.0262	-0.3745/
294	-485260000	-0.9272	-0.0262	-0.3745/
294	-490000000	-0.9272	-0.0262	-0.3745/
292	490000000	-0.9272	-0.0262	-0.3745/
292	400010000	-0.9272	-0.0262	-0.3745/
292	400020000	-0.9272	-0.0262	-0.3745/
292	400030000	-0.9272	-0.0262	-0.3745/
288	-400010000	-0.9272	-0.0262	-0.3745/
288	-400020000	-0.9272	-0.0262	-0.3745/
288	-400030000	-0.9272	-0.0262	-0.3745/
288	-400040000	-0.9272	-0.0262	-0.3745/
286	400040000	0.0	-1.0	0.0/
286	400050000	0.0	-1.0	0.0/
286	400060000	0.0	-1.0	0.0/
286	400070000	0.0	-1.0	0.0/
230	-400050000	0.0	-1.0	0.0/
230	-400060000	0.0	-1.0	0.0/
230	-400070000	0.0	-1.0	0.0/
230	-401000000	0.0	-1.0	0.0/
320	491000000	0.3746	0.0185	-0.9272/
320	492010000	0.3746	0.0185	-0.9272/
320	492020000	0.3746	0.0185	-0.9272/
320	492030000	0.3746	0.0185	-0.9272/
320	492040000	0.3746	0.0185	-0.9272/
320	492050000	0.3746	0.0185	-0.9272/
320	492060000	0.3746	0.0185	-0.9272/
320	492070000	0.3746	0.0185	-0.9272/
320	492080000	0.3746	0.0185	-0.9272/
320	492090000	0.3746	0.0185	-0.9272/
320	492100000	0.3746	0.0185	-0.9272/
348	-492010000	0.3746	0.0185	-0.9272/
348	-492020000	0.3746	0.0185	-0.9272/
348	-492030000	0.3746	0.0185	-0.9272/
348	-492040000	0.3746	0.0185	-0.9272/
348	-492050000	0.3746	0.0185	-0.9272/
348	-492060000	0.3746	0.0185	-0.9272/
348	-492070000	0.3746	0.0185	-0.9272/
348	-492080000	0.3746	0.0185	-0.9272/
348	-492090000	0.3746	0.0185	-0.9272/
348	-492100000	0.3746	0.0185	-0.9272/
348	-493000000	0.3746	0.0185	-0.9272/
348	493000000	0.3746	0.0185	-0.9272/
346	600010000	0.3746	0.0185	-0.9272/
346	600020000	0.3746	0.0185	-0.9272/
344	-600010000	0.3746	0.0185	-0.9272/
344	-600020000	0.3746	0.0185	-0.9272/
344	-600030000	0.3746	0.0185	-0.9272/
404	600030000	0.0	-1.0	0.0/
404	600040000	0.0	-1.0	0.0/
404	600050000	0.0	-1.0	0.0/

404	600060000	0.0	-1.0	0.0/
240	-600040000	0.0	-1.0	0.0/
2402	-600050000	0.0	-1.0	0.0/
2402	-600060000	0.0	-1.0	0.0/
2402	-601000000	0.0	-1.0	0.0/
284	498000000	-0.9272	0.0	-0.3746/
284	410010000	-0.9272	0.0	-0.3746/
284	410020000	-0.9272	0.0	-0.3746/
284	410030000	-0.9272	0.0	-0.3746/
284	410040000	-0 9272	0.0	-0.3746/
282	-410010000	-0.9272	0.0	-0.3746/
282	-410020000	-0.9272	0.0	-0.3746/
282	-410030000	-0.9272	0.0	-0.3746/
282	-410040000	-0.9272	0.0	-0.3746/
282	-410050000	-0.9272	0.0	-0.3746/
280	410050000	0.0	1.0	0.0/
280	410060000	0.0	1.0	0.0/
280	410070000	0.0	1.0	0.0/
280	410080000	0.0	1.0	0.0/
280	410090000	0.0	1.0	0.0/
280	410100000	0.0	1.0	0.0/
278	-410060000	0.0	1.0	0.0/
278	-410070000	0.0	1.0	0.0/
278	-410080000	0.0	1.0	0.0/
278	-410090000	0.0	1.0	0.0/
278	-410100000	0.0	1.0	0.0/
278	-410110000	0.0	1.0	0.0/
276	410110000	0.9270	-0.0218	0.3745/
276	410120000	0.9270	-0.0218	0.3745/
276	410130000	0.9270	-0.0218	0.3745/
276	410140000	0.9270	-0.0218	0.3745/
276	410150000	0.9270	-0.0218	0.3745/
276	410160000	0.9270	-0.0218	0.3745/
276	410170000	0.9270	-0.0218	0.3745/
276	410180000	0.9270	-0.0218	0.3745/
276	410190000	0.9270	-0.0218	0.3745/
276	410200000	0.9270	-0.0218	0.3745/
264	-410120000	0.9270	-0.0218	0.3745/
264	-410130000	0.9270	-0.0218	0.3745/
264	-410140000	0.9270	-0.0218	0.3745/
264	-410150000	0.9270	-0.0218	0.3745/
264	-410160000	0.9270	-0.0218	0.3745/
264	-410170000	0.9270	-0.0218	0.3745/
264	-410180000	0.9270	-0.0218	0.3745/
264	-410190000	0.9270	-0.0218	0.3745/
264	-410200000	0.9270	-0.0218	0.3745/
264	-415000000	0.9270	-0.0218	0.3745/
262	415000000	0.9270	-0.0218	0.3745/
262	500010000	0.9270	-0 0218	0.3745/
262	500020000	0.9270	-0.0218	0.3745/
260	-500010000	0.9270	-0.0218	0.3745/
260	-500020000	0.9270	-0.0218	0.3745/
260	-500030000	0.9270	-0.0218	0.3745/
257	500030000	0.0	-1.0	0.0/
257	500040000	0.0	-1.0	0.0/
257	500050000	0.0	-1.0	0.0/
252	-500040000	0.0	-1.0	0.0/
252	-500050000	0.0	-1.0	0.0/
252	-500060000	0.0	-1.0	0.0/
250	500060000	0.7559	0.0	-0.6547/

248	-500070000	0.7559	0.0	-0.6547/
2481	500070000	0.7170	0.0	-0.6971/
2481	500080000	0.7170	0.0	-0.6971/
2481	500090000	0.7170	0.0	-0.6971/
246	-500080000	0.7170	0.0	-0.6971/
246	-500090000	0.7170	0.0	-0.6971/
246	-500100000	0.7170	0.0	-0.6971/
2461	500100000	0.3736	0.0	-0.9276/
2461	500110000	0.3736	0.0	-0.9276/
2461	500120000	0.3736	0.0	-0.9276/
244	-500110000	0.3736	0.0	-0.9276/
244	-500120000	0.3736	0.0	-0.9276/
244	-500130000	0.3736	0.0	-0.9276/
2441	500130000	0.0282	0.0	-0.9996/
2441	500140000	0.0282	0.0	-0.9996/
2441	500150000	0.0282	0.0	-0.9996/
2441	501000000	0.0282	0.0	-0.9996/
242	-500140000	0.0282	0.0	-0.9996/
242	-500150000	0.0282	0.0	-0.9996/
242	-501000000	0.0282	0.0	-0.9996/
242	-502010000	0.0282	0.0	-0.9996/
2421	502010000	-0.2531	0.0	-0.9674/
240	-503000000	-0.2531	0.0	-0.9674/
2401	503000000	-0.3508	0.0	-0.9364/
2401	601000000	-0.3508	0.0	-0.9364/
238	-505000000	-0.3508	0.0	-0.9364/
2381	505000000	-0.6395	0.0	-0.7688/
2381	506010000	-0.6395	0.0	-0.7688/
2381	506020000	-0.6395	0.0	-0.7688/
2381	506030000	-0.6395	0.0	-0.7688/
236	-506010000	-0.6395	0.0	-0.7688/
236	-506020000	-0.6395	0.0	-0.7688/
236	-506030000	-0.6395	0.0	-0.7688/
236	-506040000	-0.6395	0.0	-0.7688/
2361	506040000	-0.9576	0.0	-0.2882/
2361	506050000	-0.9576	0.0	-0.2882/
2361	506060000	-0.9576	0.0	-0.2882/
2361	506070000	-0.9576	0.0	-0.2882/
234	-506050000	-0.9576	0.0	-0.2882/
234	-506060000	-0.9576	0.0	-0.2882/
234	-506070000	-0.9576	0.0	-0.2882/
234	-506080000	-0.9576	0.0	-0.2882/
2341	506080000	-0.9998	0.0	-0.0175/
2341	507000000	-0.9998	0.0	-0.0175/
2341	508010000	-0.9998	0.0	-0.0175/
2341	509000000	-0.9998	0.0	-0.0175/
2341	511000000	-0.9998	0.0	-0.0175/
226	-507000000	-0.9998	0.0	-0.0175/
226	-508010000	-0.9998	0.0	-0.0175/
226	-509010000	-0.9998	0.0	-0.0175/
226	-511000000	-0.9998	0.0	-0.0175/
226	-700010000	-0.9998	0.0	-0.0175/
224	700010000	0.0	-1.0	0.0/
224	700020000	0.0	-1.0	0.0/
224	700030000	0.0	-1.0	0.0/
224	700040000	0.0	-1.0	0.0/
224	700050000	0.0	-1.0	0.0/
224	700060000	0.0	-1.0	0.0/
224	700070000	0.0	-1.0	0.0/
[illegible]	[illegible]	[illegible]	-1.0	0.0/

224	700090000	0.0	-1.0	0.0/
224	700100000	0.0	-1.0	0.0/
224	700110000	0.0	-1.0	0 0/
224	701000000	0.0	-1.0	0.0/
68	-700030000	0.0	-1.0	0.0/
68	-700040000	0.0	-1.0	0.0/
68	-700050000	0.0	-1.0	0.0/
68	-700060000	0.0	-1.0	0.0/
68	-700070000	0.0	-1.0	0.0/
68	-700080000	0.0	-1.0	0.0/
68	-700090000	0.0	-1.0	0.0/
68	-700100000	0.0	-1.0	0.0/
68	-700110000	0.0	-1.0	0.0/
68	-701000000	0.0	-1.0	0.0/
68	-702010000	0.0	-1.0	0.0/
224	702010000	0.0	-1.0	0.0/
224	702020000	0.0	-1.0	0.0/
224	800000000	0.0	-1.0	0.0/
224	307000000	0.0	-1.0	0.0/
224	802000000	0.0	-1.0	0.0/
224	804000000	0.0	-1.0	0.0/
224	207000000	0.0	-1.0	0.0/
224	806000000	0.0	-1.0	0.0/
224	808000000	0.0	-1.0	0.0/
224	107000000	0.0	-1.0	0.0/
224	810000000	0.0	-1.0	0.0/
224	811010000	0.0	-1.0	0.0/
224	811020000	0.0	-1.0	0.0/
224	811030000	0.0	-1.0	0.0/
224	811040000	0.0	-1.0	0.0/
224	811050000	0.0	-1.0	0.0/
224	811060000	0.0	-1.0	0.0/
224	811070000	0.0	-1.0	0.0/
224	811080000	0.0	-1.0	0.0/
224	811090000	0.0	-1.0	0.0/
224	811100000	0.0	-1.0	0.0/
224	811110000	0.0	-1.0	0.0/
224	811120000	0.0	-1.0	0.0/
224	811130000	0.0	-1.0	0.0/
68	-700020000	0.0	-1.0	0.0/
68	-800000000	0.0	-1.0	0.0/
68	-802000000	0.0	-1.0	0.0/
68	-804000000	0.0	-1.0	0.0/
68	-806000000	0.0	-1.0	0.0/
68	-808000000	0.0	-1.0	0.0/
68	-810000000	0.0	-1.0	0.0/
68	-811010000	0.0	-1.0	0 0/
68	-811020000	0.0	-1.0	0.0/
68	-811030000	0.0	-1.0	0.0/
68	-811040000	0.0	-1.0	0.0/
68	-811050000	0.0	-1.0	0.0/
68	-811060000	0.0	-1.0	0.0/
68	-811070000	0.0	-1.0	0.0/
68	-811080000	0.0	-1.0	0.0/
68	-811090000	0.0	-1.0	0.0/
68	-811100000	0.0	-1.0	0 0/
68	-811110000	0.0	-1.0	0.0/
68	-811120000	0.0	-1.0	0.0/
68	-811130000	0.0	-1.0	0 0/

104 [illegible]
104 [illegible]
[illegible]

66	811140000	-0.2356	-0.7071	0.6667/
66	811150000	-0.2356	-0.7071	0.6667/
66	811160000	-0.2356	-0.7071	0.6667/
66	811170000	-0.2356	-0.7071	0.6667/
64	-811150000	-0.2356	-0.7071	0.6667/
64	-811160000	-0.2356	-0.7071	0.6667/
64	-811170000	-0.2356	-0.7071	0.6667/
64	-811180000	-0.2356	-0.7071	0.6667/
198	305000000	-0.9975	0.0	0.0709/
198	306010000	-0.9975	0.0	0.0709/
198	306020000	-0.9975	0.0	0.0709/
198	306030000	-0.9975	0.0	0.0709/
195	-306010000	-0.9975	0.0	0.0709/
195	-306020000	-0.9975	0 0	0.0709/
195	-306030000	-0.9975	0 0	0.0709/
195	-306040000	-0.9975	0.0	0.0709/
190	306040000	0.0	-1.0	0.0/
190	306050000	0.0	-1.0	0.0/
190	306060000	0.0	-1.0	0.0/
190	306070000	0.0	-1.0	0.0/
190	306080000	0.0	-1.0	0.0/
190	306090000	0.0	-1.0	0.0/
190	306100000	0.0	-1.0	0.0/
190	306110000	0.0	-1.0	0.0/
186	-306050000	0.0	-1.0	0.0/
186	-306060000	0.0	-1.0	0.0/
186	-306070000	0.0	-1.0	0.0/
186	-306080000	0.0	-1.0	0.0/
186	-306090000	0.0	-1.0	0.0/
186	-306100000	0.0	-1.0	0.0/
186	-306110000	0.0	-1.0	0.0/
186	-306120000	0.0	-1.0	0.0/
184	306120000	-0.9359	0.0	-0.3523/
184	306130000	-0.9359	0.0	-0.3523/
184	306140000	-0.9359	0.0	-0.3523/
182	-306130000	-0.9359	0.0	-0.3523/
182	-306140000	-0.9359	0.0	-0.3523/
182	-306150000	-0.9359	0.0	-0.3523/
1821	306150000	-0.6354	0.0	-0.7722/
1821	306160000	-0.6354	0.0	-0.7722/
1821	306170000	-0.6354	0.0	-0.7722/
180	-306160000	-0.6354	0.0	-0.7722/
180	-306170000	-0.6354	0.0	-0.7722/
180	-306180000	-0.6354	0.0	-0.7722/
1801	306180000	-0.0516	0.0	-0.9987/
1801	306190000	-0.0516	0.0	-0.9987/
1801	306200000	-0.0516	0.0	-0.9987/
178	-306190000	-0.0516	0.0	-0.9987/
178	-306200000	-0.0516	0.0	-0.9987/
178	-306210000	-0.0516	0.0	-0.9987/
1781	306210000	0.2639	0.0	-0.9645/
1781	306220000	0.2639	0.0	-0.9645/
1781	306230000	0.2639	0.0	-0.9645/
1781	306240000	0.2639	0.0	-0.9645/
176	-306220000	0.2639	0.0	-0.9645/
176	-306230000	0.2639	0.0	-0.9645/
176	-306240000	0.2639	0.0	-0.9645/
176	-307000000	0.2639	0.0	-0.9645/
104	105000000	0.7169	0.0	0.6972/
104	106010000	0.7169	0.0	0.6972/

[illegible]

[illegible]

104	106020000	0.7169	0 0	0.6972/
104	106030000	0.7169	0.0	0.6972/
98	-106010000	0.7169	0.0	0.6972/
98	-106020000	0.7169	0.0	0.6972/
98	-106030000	0.7169	0.0	0.6972/
98	-106040000	0.7169	0.0	0.6972/
96	106040000	0.0	-1.0	0.0/
96	106050000	0.0	-1.0	0.0/
96	106060000	0.0	-1.0	0.0/
96	106070000	0.0	-1.0	0.0/
96	106080000	0.0	-1.0	0.0/
96	106090000	0.0	-1.0	0.0/
96	106100000	0.0	-1.0	0.0/
96	106110000	0.0	-1.0	0.0/
96	106120000	0.0	-1.0	0.0/
96	106130000	0.0	-1.0	0.0/
90	-106050000	0.0	-1.0	0.0/
90	-106060000	0.0	-1.0	0.0/
90	-106070000	0.0	-1.0	0.0/
90	-106080000	0.0	-1.0	0.0/
90	-106090000	0.0	-1.0	0.0/
90	-106100000	0.0	-1.0	0.0/
90	-106110000	0.0	-1.0	0.0/
90	-106120000	0.0	-1.0	0.0/
90	-106130000	0.0	-1.0	0.0/
90	-106140000	0.0	-1.0	0.0/
88	106140000	0.2657	0.0	0.9641/
88	106150000	0.2657	0 0	0.9641/
88	106160000	0.2657	0.0	0.9641/
86	-106150000	0.2657	0.0	0.9641/
86	-106160000	0.2657	0.0	0.9641/
86	-106170000	0.2657	0.0	0.9641/
861	106170000	-0.3889	0.0	0.9213/
861	106180000	-0.3889	0.0	0.9213/
861	106190000	-0.3889	0 0	0.9213/
84	-106180000	-0.3889	0.0	0.9213/
84	-106190000	-0.3889	0.0	0.9213/
84	-106200000	-0.3889	0 0	0.9213/
841	106200000	-0.8464	0.0	0.5326/
841	106210000	-0.8464	0.0	0.5326/
841	106220000	-0.8464	0.0	0.5326/
82	-106210000	-0.8464	0.0	0.5326/
82	-106220000	-0.8464	0.0	0.5326/
82	-106230000	-0.8464	0.0	0.5326/
821	106230000	-0.9999	0.0	0.0162/
821	106240000	-0.9999	0.0	0.0162/
821	106250000	-0.9999	0.0	0.0162/
80	-106240000	-0.9999	0.0	0.0162/
80	-106250000	-0.9999	0.0	0.0162/
80	-106260000	-0.9999	0.0	0.0162/
801	106260000	-0.8289	0.0	-0.5595/
801	106270000	-0.8289	0.0	-0.5595/
801	106280000	-0.8289	0.0	-0.5595/
78	-106270000	-0.8289	0.0	-0.5595/
78	-106280000	-0.8289	0.0	-0.5595/
78	-106290000	-0.8289	0.0	-0.5595/
781	106290000	-0 4813	0.0	-0.8766/
781	106300000	-0.4813	0.0	-0.8766/
781	106310000	-0 4813	0.0	-0.8766/
78	-106300000	-0.4813	0.0	-0.8766/

```
76      -106310000     -0.4813    0.0     -0.8766/
76      -106320000     -0.4813    0.0     -0.8766/
761      106320000     -0.2356   -0.7071    0.6667/
761      106330000     -0.2356   -0.7071    0.6667/
761      106340000     -0.2356   -0.7071    0.6667/
74      -106330000     -0.2356   -0.7071    0.6667/
74      -106340000     -0.2356   -0.7071    0.6667/
74      -106350000     -0.2356   -0.7071    0.6667/
741      106350000     0.2639    0.0     -0.9645/
741      106360000     0.2639    0.0     -0.9645/
741      106370000     0.2639    0.0     -0.9645/
741      106380000     0.2639    0.0     -0.9645/
72       -106360000     0.2639    0.0     -0.9645/
72       -106370000     0.2639    0.0     -0.9645/
72       -106380000     0.2639    0.0     -0.9645/
72       -107000000     0.2639    0.0     -0.9645/
99999/
 $STEPS TSTEP(1)=0.001,0.200,-1,-1$
```

9.1.2.2 Unit 2 - Model Section B

138 30028000[illegible] [illegible]
138 -3025'3000 0 [illegible]

```
$PIPES
INLINE=3,KBLOCK=200,KPIPE=10,KPLOT(1)=1,KWAVE=1,
KPRINT=-1,KPNV=1,KSTEP=3,
NDROPV=206010000,903030000,805010000,811180000$
154    206010000    -0.4181    0.0    0.9084/
154    206020000    -0.4181    0.0    0.9084/
154    206030000    -0.4181    0.0    0.9084/
148   -206020000    -0.4181    0.0    0.9084/
148   -206030000    -0.4181    0.0    0.9084/
148   -206040000    -0.4181    0.0    0.9084/
146    206040000    0.0    -1.0    0.0/
146    206050000    0.0    -1.0    0.0/
146    206060000    0.0    -1.0    0.0/
146    206070000    0.0    -1.0    0.0/
146    206080000    0.0    -1.0    0.0/
146    206090000    0.0    -1.0    0.0/
146    206100000    0.0    -1.0    0.0/
146    206110000    0.0    -1.0    0.0/
146    206120000    0.0    -1.0    0.0/
146    206130000    0.0    -1.0    0.0/
140   -206050000    0.0    -1.0    0.0/
140   -206060000    0.0    -1.0    0.0/
140   -206070000    0.0    -1.0    0.0/
140   -206080000    0.0    -1.0    0.0/
140   -206090000    0.0    -1.0    0.0/
140   -206100000    0.0    -1.0    0.0/
140   -206110000    0.0    -1.0    0.0/
140   -206120000    0.0    -1.0    0.0/
140   -206130000    0.0    -1.0    0.0/
140   -206140000    0.0    -1.0    0.0/
138    206140000    -0.8064    0.0    0.5913/
138    206150000    -0.8064    0.0    0.5913/
138    206160000    -0.8064    0.0    0.5913/
136   -206150000    -0.8064    0.0    0.5913/
136   -206160000    -0.8064    0.0    0.5913/
136   -206170000    -0.8064    0.0    0.5913/
1361   206170000    -0.9998    0.0    0.0191/
1361   206180000    -0.9998    0.0    0.0191/
1361   206190000    -0.9998    0.0    0.0191/
134   -206180000    -0.9998    0.0    0.0191/
134   -206190000    -0.9998    0.0    0.0191/
134   -206200000    -0.9998    0.0    0.0191/
1341   206200000    -0.8285    0.0    -0.5599/
1341   206210000    -0.8285    0.0    -0.5599/
1341   206220000    -0.8285    0.0    -0.5599/
132   -206210000    -0.8285    0.0    -0.5599/
132   -206220000    -0.8285    0.0    -0.5599/
132   -206230000    -0.8285    0.0    -0.5599/
1321   206230000    -0.4217    0.0    -0.9067/
1321   206240000    -0.4217    0.0    -0.9067/
1321   206250000    -0.4217    0.0    -0.9067/
130   -206240000    -0.4217    0.0    -0.9067/
130   -206250000    -0.4217    0.0    -0.9067/
130   -206260000    -0.4217    0.0    -0.9067/
1301   206260000    0.0323    0.0    -0.9995/
1301   206270000    0.0323    0.0    -0.9995/
1301   206280000    0.0323    0.0    -0.9995/
128   -206270000    0.0323    0.0    -0.9995/
128   -206280000    0.0323    0.0    -0.9995/
```

BY KJG DATE 5-21-83
CHKD. BY MJL DATE 5-26-83

TELEDYNE ENGINEERING SERVICES

4B -6113,0000 [illegible] [illegible] [illegible]
4B -81130000 [illegible] [illegible] [illegible]
4P

128	-206290000	0.0323	0.0	-0.9995/
1281	206290000	0.2639	0.0	-0.9645/
1281	206300000	0.2639	0.0	-0.9645/
1281	206310000	0.2639	0.0	-0.9645/
1231	206320000	0.2639	0.0	-0.9645/
126	-206300000	0.2639	0.0	-0.9645/
126	-206310000	0.2639	0.0	-0.9645/
126	-206320000	0.2639	0.0	-0.9645/
126	-207000000	0.2639	0.0	-0.9645/
62	811180000	0.0	-1.0	0.0/
62	811190000	0.0	-1.0	0.0/
62	811200000	0.0	-1.0	0.0/
62	811210000	0.0	-1.0	0.0/
58	-811190000	0.0	-1.0	0.0/
58	-811200000	0.0	-1.0	0.0/
58	-811210000	0.0	-1.0	0.0/
58	-811220000	0.0	-1.0	0.0/
56	811220000	0.2356	-0.7071	-0.6667/
56	811230000	0.2356	-0.7071	-0.6667/
56	811240000	0.2356	-0.7071	-0.6667/
56	811250000	0.2356	-0.7071	-0.6667/
54	-811230000	0.2356	-0.7071	-0.6667/
54	-811240000	0.2356	-0.7071	-0.6667/
54	-811250000	0.2356	-0.7071	-0.6667/
54	-811260000	0.2356	-0.7071	-0.6667/
52	811260000	0.0	-1.0	0.0/
52	811270000	0.0	-1.0	0.0/
52	811280000	0.0	-1.0	0.0/
52	811290000	0.0	-1.0	0.0/
52	811300000	0.0	-1.0	0.0/
52	811310000	0.0	-1.0	0.0/
52	811320000	0.0	-1.0	0.0/
52	811330000	0.0	-1.0	0.0/
52	811340000	0.0	-1.0	0.0/
52	811350000	0.0	-1.0	0.0/
52	811360000	0.0	-1.0	0.0/
52	811370000	0.0	-1.0	0.0/
52	811380000	0.0	-1.0	0.0/
52	811390000	0.0	-1.0	0.0/
52	811400000	0.0	-1.0	0.0/
52	811410000	0.0	-1.0	0.0/
52	811420000	0.0	-1.0	0.0/
52	811430000	0.0	-1.0	0.0/
52	811440000	0.0	-1.0	0.0/
52	811450000	0.0	-1.0	0.0/
52	811460000	0.0	-1.0	0.0/
52	811470000	0.0	-1.0	0.0/
52	811480000	0.0	-1.0	0.0/
52	811490000	0.0	-1.0	0.0/
52	811500000	0.0	-1.0	0.0/
52	811510000	0.0	-1.0	0.0/
52	811520000	0.0	-1.0	0.0/
52	811530000	0.0	-1.0	0.0/
52	811540000	0.0	-1.0	0.0/
52	811550000	0.0	-1.0	0.0/
46	-811270000	0.0	-1.0	0.0/
46	-811280000	0.0	-1.0	0.0/
46	-811290000	0.0	-1.0	0.0/
46	-811300000	0.0	-1.0	0.0/
46	-811310000	0.0	-1.0	0.0/

46	-811320000	0.0	-1.0	0.0/
46	-811330000	0.0	-1.0	0.0/
46	-811340000	0.0	-1.0	0.0/
46	-811350000	0.0	-1.0	0.0/
46	-811360000	0.0	-1.0	0.0/
46	-811370000	0.0	-1.0	0.0/
46	-811380000	0.0	-1.0	0.0/
46	-811390000	0.0	-1.0	0.0/
46	-811400000	0.0	-1.0	0.0/
46	-811410000	0.0	-1.0	0.0/
46	-811420000	0.0	-1.0	0.0/
46	-811430000	0.0	-1.0	0.0/
46	-811440000	0.0	-1.0	0.0/
46	-811450000	0.0	-1.0	0.0/
46	-811460000	0.0	-1.0	0.0/
46	-811470000	0.0	-1.0	0.0/
46	-811480000	0.0	-1.0	0.0/
46	-811490000	0.0	-1.0	0.0/
46	-811500000	0.0	-1.0	0.0/
46	-811510000	0.0	-1.0	0.0/
46	-811520000	0.0	-1.0	0.0/
46	-811530000	0.0	-1.0	0.0/
46	-811540000	0.0	-1.0	0.0/
46	-811550000	0.0	-1.0	0.0/
46	-811560000	0.0	-1.0	0.0/
44	811560000	0.0	0.0	-1.0/
44	811570000	0.0	0.0	-1.0/
44	811580000	0.0	0.0	-1.0/
44	811590000	0.0	0.0	-1.0/
44	811600000	0.0	0.0	-1.0/
44	811610000	0.0	0.0	-1.0/
44	811620000	0.0	0.0	-1.0/
44	811630000	0.0	0.0	-1.0/
44	811640000	0.0	0.0	-1.0/
44	811650000	0.0	0.0	-1.0/
42	-811570000	0.0	0.0	-1.0/
42	-811580000	0.0	0.0	-1.0/
42	-811590000	0.0	0.0	-1.0/
42	-811600000	0.0	0.0	-1.0/
42	-811610000	0.0	0.0	-1.0/
42	-811620000	0.0	0.0	-1.0/
42	-811630000	0.0	0.0	-1.0/
42	-811640000	0.0	0.0	-1.0/
42	-811650000	0.0	0.0	-1.0/
42	-811660000	0.0	0.0	-1.0/
40	811660000	0.2588	0.0	-0.9659/
40	811670000	0.2588	0.0	-0.9659/
40	811680000	0.2588	0.0	-0.9659/
40	811690000	0.2588	0.0	-0.9659/
40	811700000	0.2588	0.0	-0.9659/
40	811710000	0.2588	0.0	-0.9659/
40	811720000	0.2588	0.0	-0.9659/
40	811730000	0.2588	0.0	-0.9659/
40	811740000	0.2588	0.0	-0.9659/
40	811750000	0.2588	0.0	-0.9659/
40	811760000	0.2588	0.0	-0.9659/
40	811770000	0.2588	0.0	-0.9659/
40	811780000	0.2588	0.0	-0.9659/
38	-811670000	0.2588	0.0	-0.9659/
38	-811680000	0.2588	0.0	-0.9659/

30	-813030000	1.0	0.0	0.01
30	-813050000	1.0	0.0	0.01
30	-8130[illegible]			

38	-811690000	0.2588	0.0	-0.9659/
38	-811700000	0.2588	0.0	-0.9659/
38	-811710000	0.2588	0.0	-0.9659/
38	-811720000	0.2588	0.0	-0.9659/
38	-811730000	0.2588	0.0	-0.9659/
38	-811740000	0.2588	0.0	-0.9659/
38	-811750000	0.2588	0.0	-0.9659/
38	-811760000	0.2588	0.0	-0.8659/
38	-811770000	0.2588	0.0	-0.9658/
38	-811780000	0.2588	0.0	-0.9659/
38	-811790000	0.2588	0.0	-0.9659/
36	811790000	1.0	0.0	0.0/
36	811800000	1.0	0.0	0.0/
36	811810000	1.0	0.0	0.0/
36	811820000	1.0	0.0	0.0/
36	811830000	1.0	0.0	0.0/
36	811840000	1.0	0.0	0.0/
36	811850000	1.0	0.0	0.0/
36	811860000	1.0	0.0	0.0/
34	-811800000	1.0	0.0	0.0/
34	-811810000	1.0	0.0	0.0/
34	-811820000	1.0	0.0	0.0/
34	-811830000	1.0	0.0	0.0/
34	-811840000	1.0	0.0	0.0/
34	-811850000	1.0	0.0	0.0/
34	-811860000	1.0	0.0	0.0/
34	-811870000	1.0	0.0	0.0/
33	811870000	0.0	-1.0	0.0/
33	811880000	0.0	-1.0	0.0/
33	811890000	0.0	-1.0	0.0/
33	811900000	0.0	-1.0	0.0/
33	811910000	0.0	-1.0	0.0/
33	811920000	0.0	-1.0	0.0/
33	811930000	0.0	-1.0	0.0/
33	811940000	0.0	-1.0	0.0/
28	-811880000	0.0	-1.0	0.0/
28	-811890000	0.0	-1.0	0.0/
28	-811900000	0.0	-1.0	0.0/
28	-811910000	0.0	-1.0	0.0/
28	-811920000	0.0	-1.0	0.0/
28	-811930000	0.0	-1.0	0.0/
28	-811940000	0.0	-1.0	0.0/
28	-811950000	0.0	-1.0	0.0/
26	811950000	1.0	0.0	0.0/
26	811960000	1.0	0.0	0.0/
26	811970000	1.0	0.0	0.0/
26	811980000	1.0	0.0	0.0/
26	812000000	1.0	0.0	0.0/
26	813010000	1.0	0.0	0.0/
26	813020000	1.0	0.0	0.0/
26	813030000	1.0	0.0	0.0/
26	813040000	1.0	0.0	0.0/
26	813050000	1.0	0.0	0.0/
20	-811960000	1.0	0.0	0.0/
20	-811970000	1.0	0.0	0.0/
20	-811980000	1.0	0.0	0.0/
20	-812000000	1.0	0.0	0.0/
20	-813010000	1.0	0.0	0.0/
20	-813020000	1.0	0.0	0.0/
20	-813030000	1.0	0.0	0.0/

20	-813040000	1.0	0.0	0.0/
20	-813050000	1.0	0.0	0.0/
20	-813060000	1.0	0.0	0.0/
18	813060000	0.0	0.0	1.0/
18	813070000	0.0	0.0	1.0/
18	813080000	0.0	0.0	1.0/
18	813090000	0.0	0.0	1.0/
18	813100000	0.0	0.0	1.0/
18	813110000	0.0	0.0	1.0/
18	813120000	0.0	0.0	1.0/
18	813130000	0.0	0.0	1.0/
18	813140000	0.0	0.0	1.0/
18	813150000	0.0	0.0	1.0/
18	813160000	0.0	0.0	1.0/
18	813170000	0.0	0.0	1.0/
18	813180000	0.0	0.0	1.0/
18	813190000	0.0	0.0	1.0/
12	-813070000	0.0	0.0	1.0/
12	-813080000	0.0	0.0	1.0/
12	-813090000	0.0	0.0	1.0/
12	-813100000	0.0	0.0	1.0/
12	-813110000	0.0	0.0	1.0/
12	-813120000	0.0	0.0	1.0/
12	-813130000	0.0	0.0	1.0/
12	-813140000	0.0	0.0	1.0/
12	-813150000	0.0	0.0	1.0/
12	-813160000	0.0	0.0	1.0/
12	-813170000	0.0	0.0	1.0/
12	-813180000	0.0	0.0	1.0/
12	-813190000	0.0	0.0	1.0/
12	-813200000	0.0	0.0	1.0/
10	813200000	-1.0	0.0	0.0/
10	813210000	-1.0	0.0	0.0/
10	813220000	-1.0	0.0	0.0/
10	813230000	-1.0	0.0	0.0/
10	813240000	-1.0	0.0	0.0/
10	813250000	-1.0	0.0	0.0/
10	813260000	-1.0	0.0	0.0/
10	813270000	-1.0	0.0	0.0/
10	813280000	-1.0	0.0	0.0/
10	813290000	-1.0	0.0	0.0/
6	-813210000	-1.0	0.0	0.0/
6	-813220000	-1.0	0.0	0.0/
6	-813230000	-1.0	0.0	0.0/
6	-813240000	-1.0	0.0	0.0/
6	-813250000	-1.0	0.0	0.0/
6	-813260000	-1.0	0.0	0.0/
6	-813270000	-1.0	0.0	0.0/
6	-813280000	-1.0	0.0	0.0/
6	-813290000	-1.0	0.0	0.0/
6	-813300000	-1.0	0.0	0.0/
4	900000000	0.0	-1.0	0.0/
4	901010000	0.0	-1.0	0.0/
4	901020000	0.0	-1.0	0.0/
4	902000000	0.0	-1.0	0.0/
4	903010000	0.0	-1.0	0.0/
2	-901010000	0.0	-1.0	0.0/
2	-902000000	0.0	-1.0	0.0/
2	-903010000	0.0	-1.0	0.0/
2	-903020000	0.0	-1.0	0.0/

```
99999/
$STEPS TSTEP(1)=0.001,1.0,-1,-1$
```

9.1.2.3 Unit 2 - Quarter Model

```
$PIPES
INLINE=3,KBLOCK=601,KPIPE=0,KPLOT(1)=1,KWAVE=1,
KPRINT=-1,KPNV=1,KSTEP=3,NDROPV=1010000,15010000$
1    002000000  -1.0  0.0  0.0/
2   -004000000  -1.0  0.0  0.0/
3    004000000   0.0 -1.0  0.0/
3    005010000   0.0 -1.0  0.0/
3    005020000   0.0 -1.0  0 0/
3    005040000   0.0 -1.0  0.0/
3    005050000   0.0 -1.0  0.0/
3    005060000   0.0 -1.0  0.0/
4   -005010000   0.0 -1.0  0.0/
4   -005020000   0.0 -1.0  0.0/
4   -005030000   0.0 -1.0  0.0/
4   -005040000   0.0 -1.0  0.0/
4   -005050000   0.0 -1.0  0.0/
4   -005060000   0.0 -1.0  0.0/
4   -005070000   0.0 -1.0  0.0/
5    005070000  -1.0  0.0  0.0/
5    005080000  -1.0  0.0  0.0/
5    005090000  -1.0  0.0  0.0/
6   -005080000  -1.0  0.0  0.0/
6   -005090000  -1.0  0.0  0.0/
6   -005100000  -1.0  0.0  0.0/
7    005100000   0.0  1.0  0.0/
7    005110000   0.0  1.0  0.0/
7    005120000   0.0  1.0  0.0/
7    005130000   0.0  1.0  0.0/
7    005140000   0.0  1.0  0.0/
7    005150000   0.0  1.0  0.0/
7    005160000   0.0  1.0  0.0/
7    005170000   0.0  1.0  0.0/
7    005180000   0.0  1.0  0.0/
7    005190000   0.0  1.0  0.0/
8   -005110000   0.0  1.0  0.0/
8   -005120000   0.0  1.0  0.0/
8   -005130000   0.0  1.0  0.0/
8   -005140000   0.0  1.0  0.0/
8   -005150000   0.0  1.0  0.0/
8   -005160000   0.0  1.0  0.0/
8   -005170000   0.0  1.0  0.0/
8   -005180000   0.0  1.0  0.0/
8   -005190000   0.0  1.0  0.0/
8   -006000000   0.0  1.0  0.0/
9    006000000  -1.0  0.0  0.0/
9    007010000  -1.0  0.0  0.0/
9    007020000  -1.0  0.0  0.0/
9    007030000  -1.0  0.0  0.0/
10  -007010000  -1.0  0.0  0.0/
10  -007020000  -1.0  0.0  0.0/
10  -007030000  -1.0  0.0  0.0/
10  -007040000  -1.0  0.0  0.0/
11   007040000   0.0 -1.0  0.0/
11   007050000   0.0 -1.0  0.0/
11   007060000   0.0 -1.0  0.0/
11   007070000   0.0 -1.0  0.0/
11   007080000   0.0 -1.0  0.0/
11   007090000   0.0 -1.0  0.0/
```

BY CMM DATE 2-9-83

CHKD. BY LGS DATE 2-9-83

```
11   007120000   0.0 -1.0  0.0/
11   007130000   0.0 -1.0  0.0/
12  -007050000   0.0 -1.0  0.0/
12  -007060000   0.0 -1.0  0.0/
12  -007070000   0.0 -1.0  0.0/
12  -007080000   0.0 -1.0  0.0/
12  -007090000   0.0 -1.0  0.0/
12  -007100000   0.0 -1.0  0.0/
12  -007110000   0.0 -1.0  0.0/
12  -007120000   0.0 -1.0  0.0/
12  -007130000   0.0 -1.0  0.0/
12  -007140000   0.0 -1.0  0.0/
14    007140000   -.258  0.0 -.966/
14    007150000   -.258  0.0 -.966/
14    007160000   -.258  0.0 -.966/
15   -007150000   -.258  0.0 -.966/
15   -007160000   -.258  0.0 -.966/
15   -007170000   -.258  0.0 -.966/
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16    007180000    .337  0.0 -.942/
16    007190000    .337  0.0 -.942/
17   -007180000    .337  0.0 -.942/
17   -007190000    .337  0.0 -.942/
17   -007200000    .337  0.0 -.942/
18    007200000    .793  0.0 -.609/
18    007210000    .793  0.0 -.609/
18    007220000    .793  0.0 -.609/
19   -007210000    .793  0.0 -.609/
19   -007220000    .793  0.0 -.609/
19   -007230000    .793  0.0 -.609/
20    007230000    .994  0.0 -.1132/
20    007240000    .994  0.0 -.1132/
20    007250000    .994  0.0 -.1132/
21   -007240000    .994  0.0 -.1132/
21   -007250000    .994  0.0 -.1132/
21   -007260000    .994  0.0 -.1132/
22    007260000    .910  0.0  .415/
22    007270000    .910  0.0  .415/
22    007280000    .910  0.0  .415/
23   -007270000    .910  0.0  .415/
23   -007280000    .910  0.0  .415/
23   -007290000    .910  0.0  .415/
24    007290000    .555  0.0  .8321/
24    007300000    .555  0.0  .8321/
24    007310000    .555  0.0  .8321/
25   -007300000    .555  0.0  .8321/
25   -007310000    .555  0.0  .8321/
25   -007320000    .555  0.0  .8321/
26    007320000   .0183  0.0 .9998/
26    007330000   .0183  0.0 .9998/
26    007340000   .0183  0.0 .9998/
27   -007330000   .0183  0.0 .9998/
27   -007340000   .0183  0.0 .9998/
27   -007350000   .0183  0.0 .9998/
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28    007360000   -.264  0.0  .965/
28    007370000   -.264  0.0  .965/
28    007380000   -.264  0.0  .965/
29   -007360000   -.264  0.0  .965/
```

```
29   -007380000   -.264  0.0   .965/
29   -008000000   -.264  0.0   .965/
30    008000000   0.0 -1.0  0.0/
30    010000000   0.0 -1.0  0.0/
30    011010000   0.0 -1.0  0.0/
30    011020000   0.0 -1.0  0.0/
30    011030000   0.0 -1.0  0.0/
30    011040000   0.0 -1.0  0.0/
30    011050000   0.0 -1.0  0.0/
30    011060000   0.0 -1.0  0.0/
30    011070000   0.0 -1.0  0.0/
30    011080000   0.0 -1.0  0.0/
30    011090000   0.0 -1.0  0.0/
30    011100000   0.0 -1.0  0.0/
30    011110000   0.0 -1.0  0.0/
30    011120000   0.0 -1.0  0.0/
30    011130000   0.0 -1.0  0.0/
31   -010000000   0.0 -1.0  0.0/
31   -011010000   0.0 -1.0  0.0/
31   -011020000   0.0 -1.0  0.0/
31   -011030000   0.0 -1.0  0.0/
31   -011040000   0.0 -1.0  0.0/
31   -011050000   0.0 -1.0  0.0/
31   -011060000   0.0 -1.0  0.0/
31   -011070000   0.0 -1.0  0.0/
31   -011080000   0.0 -1.0  0.0/
31   -011090000   0.0 -1.0  0.0/
31   -011100000   0.0 -1.0  0.0/
31   -011110000   0.0 -1.0  0.0/
31   -011120000   0.0 -1.0  0.0/
31   -011130000   0.0 -1.0  0.0/
31   -011140000   0.0 -1.0  0.0/
32    011140000   .316 -.707 -.948/
32    011150000   .316 -.707 -.948/
32    011160000   .316 -.707 -.948/
32    011170000   .316 -.707 -.948/
33   -011150000   .316 -.707 -.948/
33   -011160000   .316 -.707 -.948/
33   -011170000   .316 -.707 -.948/
33   -011180000   .316 -.707 -.948/
34    011180000   0.0 -1.0  0.0/
34    011190000   0.0 -1.0  0.0/
34    011200000   0.0 -1.0  0.0/
34    011210000   0.0 -1.0  0.0/
35   -011200000   0.0 -1.0  0.0/
35   -011210000   0.0 -1.0  0.0/
35   -011220000   0.0 -1.0  0.0/
36    011220000  -.316 -.707  .948/
36    011230000  -.316 -.707  .948/
36    011240000  -.316 -.707  .948/
36    011250000  -.316 -.707  .948/
37   -011230000  -.316 -.707  .948/
37   -011240000  -.316 -.707  .948/
37   -011250000  -.316 -.707  .948/
37   -011260000  -.316 -.707  .948/
38    011260000   0.0 -1.0  0.0/
38    011270000   0.0 -1.0  0.0/
38    011280000   0.0 -1.0  0.0/
38    011290000   0.0 -1.0  0.0/
```

```
38   011310000   0.0 -1.0  0.0/
38   011320000   0.0 -1.0  0.0/
38   011330000   0.0 -1.0  0.0/
38   011340000   0.0 -1.0  0.0/
38   011350000   0.0 -1.0  0.0/
38   011360000   0.0 -1.0  0.0/
38   011370000   0.0 -1.0  0.0/
38   011380000   0.0 -1.0  0.0/
38   011390000   0.0 -1.0  0.0/
38   011400000   0.0 -1.0  0.0/
38   011410000   0.0 -1.0  0.0/
38   011420000   0.0 -1.0  0.0/
38   011430000   0.0 -1.0  0.0/
38   011440000   0.0 -1.0  0.0/
38   011450000   0.0 -1.0  0.0/
38   011460000   0.0 -1.0  0.0/
38   011470000   0.0 -1.0  0.0/
38   011480000   0.0 -1.0  0.0/
38   011490000   0.0 -1.0  0.0/
38   011500000   0.0 -1.0  0.0/
38   011510000   0.0 -1.0  0.0/
38   011520000   0.0 -1.0  0.0/
38   011530000   0.0 -1.0  0.0/
38   011540000   0.0 -1.0  0.0/
38   011550000   0.0 -1.0  0.0/
39  -011270000   0.0 -1.0  0.0/
39  -011280000   0.0 -1.0  0.0/
39  -011290000   0.0 -1.0  0.0/
39  -011300000   0.0 -1.0  0.0/
39  -011310000   0.0 -1.0  0.0/
39  -011320000   0.0 -1.0  0.0/
39  -011330000   0.0 -1.0  0.0/
39  -011340000   0.0 -1.0  0.0/
39  -011350000   0.0 -1.0  0.0/
39  -011360000   0.0 -1.0  0.0/
39  -011370000   0.0 -1.0  0.0/
39  -011380000   0.0 -1.0  0.0/
39  -011390000   0.0 -1.0  0.0/
39  -011400000   0.0 -1.0  0.0/
39  -011410000   0.0 -1.0  0.0/
39  -011420000   0.0 -1.0  0.0/
39  -011430000   0.0 -1.0  0.0/
39  -011440000   0.0 -1.0  0.0/
39  -011450000   0.0 -1.0  0.0/
39  -011460000   0.0 -1.0  0.0/
39  -011470000   0.0 -1.0  0.0/
39  -011480000   0.0 -1.0  0.0/
39  -011490000   0.0 -1.0  0.0/
39  -011500000   0.0 -1.0  0.0/
39  -011510000   0.0 -1.0  0.0/
39  -011520000   0.0 -1.0  0.0/
39  -011530000   0.0 -1.0  0.0/
39  -011540000   0.0 -1.0  0.0/
39  -011550000   0.0 -1.0  0.0/
39  -011560000   0.0 -1.0  0.0/
40   011560000   0.0  0.0 -1.0/
40   011570000   0.0  0.0 -1.0/
40   011580000   0.0  0.0 -1.0/
40   011590000   0.0  0.0 -1.0/
```

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40	011620000	0.0	0.0	-1.0/
40	011630000	0.0	0.0	-1.0/
40	011640000	0.0	0.0	-1.0/
40	011650000	0.0	0.0	-1.0/
41	-011570000	0.0	0.0	-1.0/
41	-011580000	0.0	0.0	-1.0/
41	-011590000	0.0	0.0	-1.0/
41	-011600000	0.0	0.0	-1.0/
41	-011610000	0.0	0.0	-1.0/
41	-011620000	0.0	0.0	-1.0/
41	-011630000	0.0	0.0	-1.0/
41	-011640000	0.0	0.0	-1.0/
41	-011650000	0.0	0.0	-1.0/
41	-011660000	0.0	0.0	-1.0/
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42	011670000	-.259	0.0	.966/
42	011680000	-.259	0.0	.966/
42	011690000	-.259	0.0	.966/
42	011700000	-.259	0.0	.966/
42	011710000	-.259	0.0	.966/
42	011720000	-.259	0.0	.966/
42	011730000	-.259	0.0	.966/
42	011740000	-.259	0.0	.966/
42	011750000	-.259	0.0	.966/
42	011760000	-.259	0.0	.966/
42	011770000	-.259	0.0	.966/
42	011780000	-.259	0.0	.966/
43	-011670000	-.259	0.0	.966/
43	-011680000	-.259	0.0	.966/
43	-011690000	-.259	0.0	.966/
43	-011700000	-.259	0.0	.966/
43	-011710000	-.259	0.0	.966/
43	-011720000	-.259	0.0	.966/
43	-011730000	-.259	0.0	.966/
43	-011740000	-.259	0.0	.966/
43	-011750000	-.259	0.0	.966/
43	-011760000	-.259	0.0	.966/
43	-011770000	-.259	0.0	.966/
43	-011780000	-.259	0.0	.966/
43	-011790000	-.259	0.0	.966/
44	011790000	-1.0	0.0	0.0/
44	011800000	-1.0	0.0	0.0/
44	011810000	-1.0	0.0	0.0/
44	011820000	-1.0	0.0	0.0/
44	011830000	-1.0	0.0	0.0/
44	011840000	-1.0	0.0	0.0/
44	011850000	-1.0	0.0	0.0/
44	011860000	-1.0	0.0	0.0/
45	-011800000	-1.0	0.0	0.0/
45	-011810000	-1.0	0.0	0.0/
45	-011820000	-1.0	0.0	0.0/
45	-011830000	-1.0	0.0	0.0/
45	-011840000	-1.0	0.0	0.0/
45	-011850000	-1.0	0.0	0.0/
45	-011860000	-1.0	0.0	0.0/
45	-011870000	-1.0	0.0	0.0/
46	011870000	0.0	-1.0	0.0/

46	011900000	0.0	-1.0	0.0/
46	011910000	0.0	-1.0	0.0/
46	011920000	0.0	-1.0	0.0/
46	011930000	0.0	-1.0	0.0/
46	011940000	0.0	-1.0	0.0/
47	-011880000	0.0	-1.0	0.0/
47	-011890000	0.0	-1.0	0.0/
47	-011900000	0.0	-1.0	0.0/
47	-011910000	0.0	-1.0	0.0/
47	-011920000	0.0	-1.0	0.0/
47	-011930000	0.0	-1.0	0.0/
47	-011940000	0.0	-1.0	0.0/
47	-011950000	0.0	-1.0	0.0/
48	011950000	-1.0	0.0	0.0/
48	011960000	-1.0	0.0	0.0/
48	011970000	-1.0	0.0	0.0/
48	011980000	-1.0	0.0	0.0/
48	011990000	-1.0	0.0	0.0/
48	012000000	-1.0	0.0	0.0/
48	013010000	-1.0	0.0	0.0/
48	013020000	-1.0	0.0	0.0/
48	013030000	-1.0	0.0	0.0/
48	013040000	-1.0	0.0	0.0/
48	013050000	-1.0	0.0	0.0/
49	-011960000	-1.0	0.0	0.0/
49	-011970000	-1.0	0.0	0.0/
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49	-011990000	-1.0	0.0	0.0/
49	-012000000	-1.0	0.0	0.0/
49	-013010000	-1.0	0.0	0.0/
49	-013020000	-1.0	0.0	0.0/
49	-013030000	-1.0	0.0	0.0/
49	-013040000	-1.0	0.0	0.0/
49	-013050000	-1.0	0.0	0.0/
49	-013060000	-1.0	0.0	0.0/
50	013060000	0.0	0.0	-1.0/
50	013070000	0.0	0.0	-1.0/
50	013080000	0.0	0.0	-1.0/
50	013090000	0.0	0.0	-1.0/
50	013100000	0.0	0.0	-1.0/
50	013110000	0.0	0.0	-1.0/
50	013120000	0.0	0.0	-1.0/
50	013130000	0.0	0.0	-1.0/
50	013140000	0.0	0.0	-1.0/
50	013150000	0.0	0.0	-1.0/
50	013160000	0.0	0.0	-1.0/
50	013170000	0.0	0.0	-1.0/
50	013180000	0.0	0.0	-1.0/
50	013190000	0.0	0.0	-1.0/
51	-013070000	0.0	0.0	-1.0/
51	-013080000	0.0	0.0	-1.0/
51	-013090000	0.0	0.0	-1.0/
51	-013100000	0.0	0.0	-1.0/
51	-013110000	0.0	0.0	-1.0/
51	-013120000	0.0	0.0	-1.0/
51	-013130000	0.0	0.0	-1.0/
51	-013140000	0.0	0.0	-1.0/
51	-013150000	0.0	0.0	-1.0/
51	-013160000	0.0	0.0	-1.0/

```
51  -013180000  0.0  0.0 -1.0/
51  -013190000  0.0  0.0 -1.0/
51  -013200000  0.0  0.0 -1.0/
52   013200000  1.0  0.0  0.0/
52   013210000  1.0  0.0  0.0/
52   013220000  1.0  0.0  0.0/
52   013230000  1.0  0.0  0.0/
52   013240000  1.0  0.0  0.0/
52   013250000  1.0  0.0  0.0/
52   013260000  1.0  0.0  0.0/
52   013270000  1.0  0.0  0.0/
52   013280000  1.0  0.0  0.0/
52   013290000  1.0  0.0  0.0/
53  -013210000  1.0  0.0  0.0/
53  -013220000  1.0  0.0  0.0/
53  -013230000  1.0  0.0  0.0/
53  -013240000  1.0  0.0  0.0/
53  -013250000  1.0  0.0  0.0/
53  -013260000  1.0  0.0  0.0/
53  -013270000  1.0  0.0  0.0/
53  -013280000  1.0  0.0  0.0/
53  -013290000  1.0  0.0  0.0/
53  -014000000  1.0  0.0  0.0/
99999/
 $STEPS TSTEP(1)=0.001,0.600$
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[illegible]

Control # 8608060048
Date 07-30-86 of Document

TECHNICAL REPORT TR-5364-1 M
REVISION 0

BOOK 2 OF 15

DONALD C. COOK NUCLEAR GENERATING PLANT

ANALYSIS OF PRESSURIZER SAFETY/RELIEF VALVES
DISCHARGE PIPING SYSTEM PER NUREG 0737, II.D.1,
UNIT 1

JUNE 6, 1983

AMERICAN ELECTRIC POWER SERVICE CORPORATION
2 BROADWAY
NEW YORK, NEW YORK 10004

TECHNICAL REPORT TR-5364-1
REVISION 0

BOOK 2 OF 15

DONALD C. COOK NUCLEAR GENERATING STATION

ANALYSIS OF PRESSURIZER SAFETY/RELIEF VALVES
DISCHARGE PIPING SYSTEM PER NUREG 0737, II. D.1,
UNIT 1

JUNE 6, 1983

TELEDYNE ENGINEERING SERVICES

130 SECOND AVENUE
WALTHAM, MASSACHUSETTS 02254
617-890-3350

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

[illegible]

TELEDYNE ENGINEERING SERVICES

TABLE OF CONTENTS
(Continued)

4.8 Force Time History Plots

The following are force versus time plots for each pipe segment at a node point described by the structural model. A drawing indicating force placement precedes each set (Unit 1, Unit 2). Since the force time histories were plotted after balancing and merging(i.e. SAP2SAP and MERGE), each plot is unbalanced force versus time from 0.0 to 0.6 seconds. The problem was run to 0.6 seconds because all significant forces in the area of concern (piping about the PORV's) had diminished in this time.

Unit 1 (PORV)	71 segments
Quarter Model	26 segments

Plot Set	Transient
4.8.1 Unit 1	Condensate/Steam Case (75% of model)
4.8.2 Unit 1	400° Solid Liquid Case
4.8.3 Quarter Model	Cold Loop Seal/Steam Case

[illegible]

4.8.1 Unit 1 - Condensate/Steam Case (75% of model)

BY RAM DATE 4-14-83
CHKD. BY LBS DATE 4-14-83

UNIT 1 STRUCTURAL NODE POINTS
PORV SECTION

SHEET NO. 1 OF 3
PROJ. NO. 5364

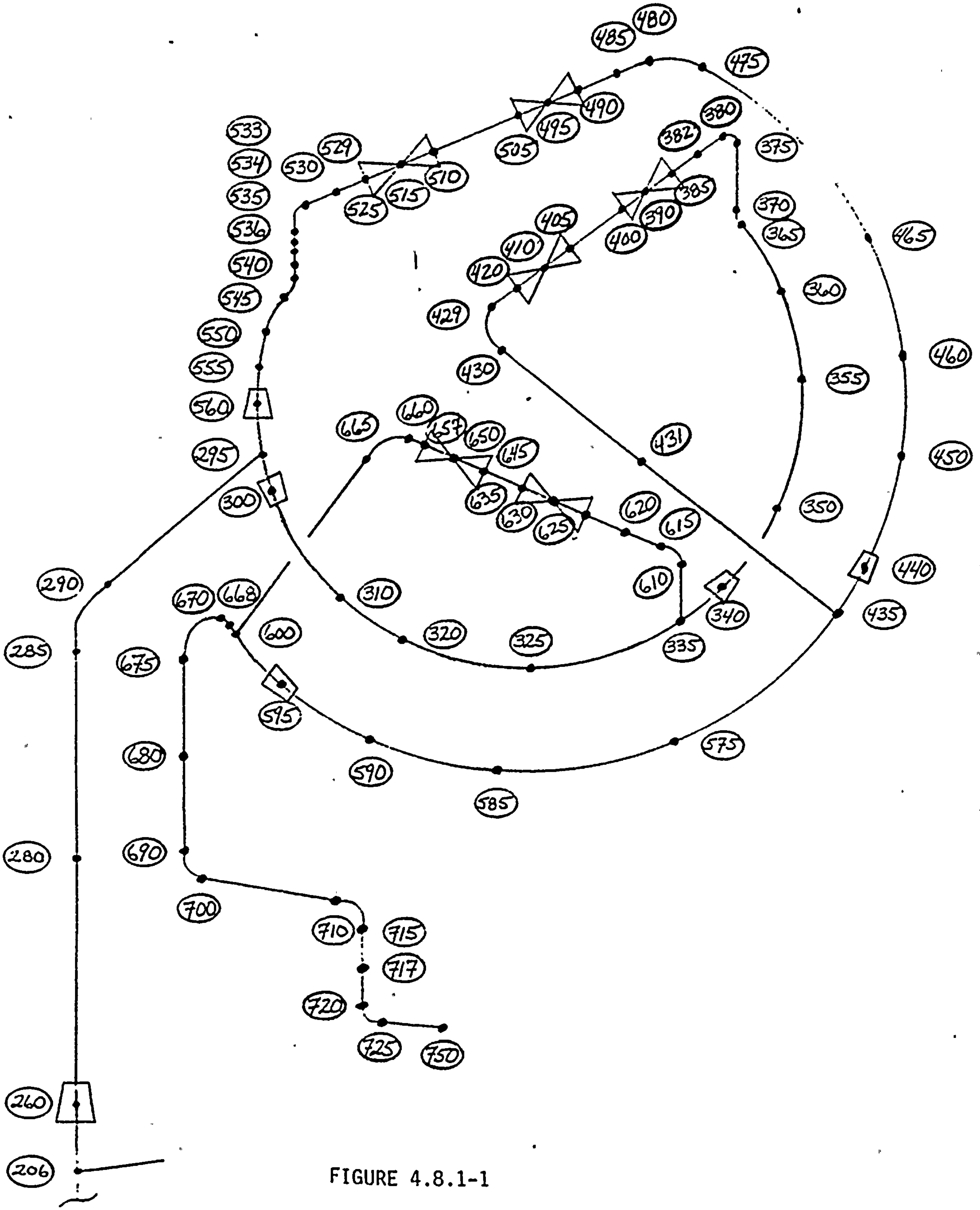


FIGURE 4.8.1-1

BY RAM DATE 4-14-83 | CHKD. BY LBS DATE 4-14-83

UNIT 1 STRUCTURAL NODES POINTS
MAIN ARCS

SHEET NO. 2 OF 3
PROJ. NO. 5364

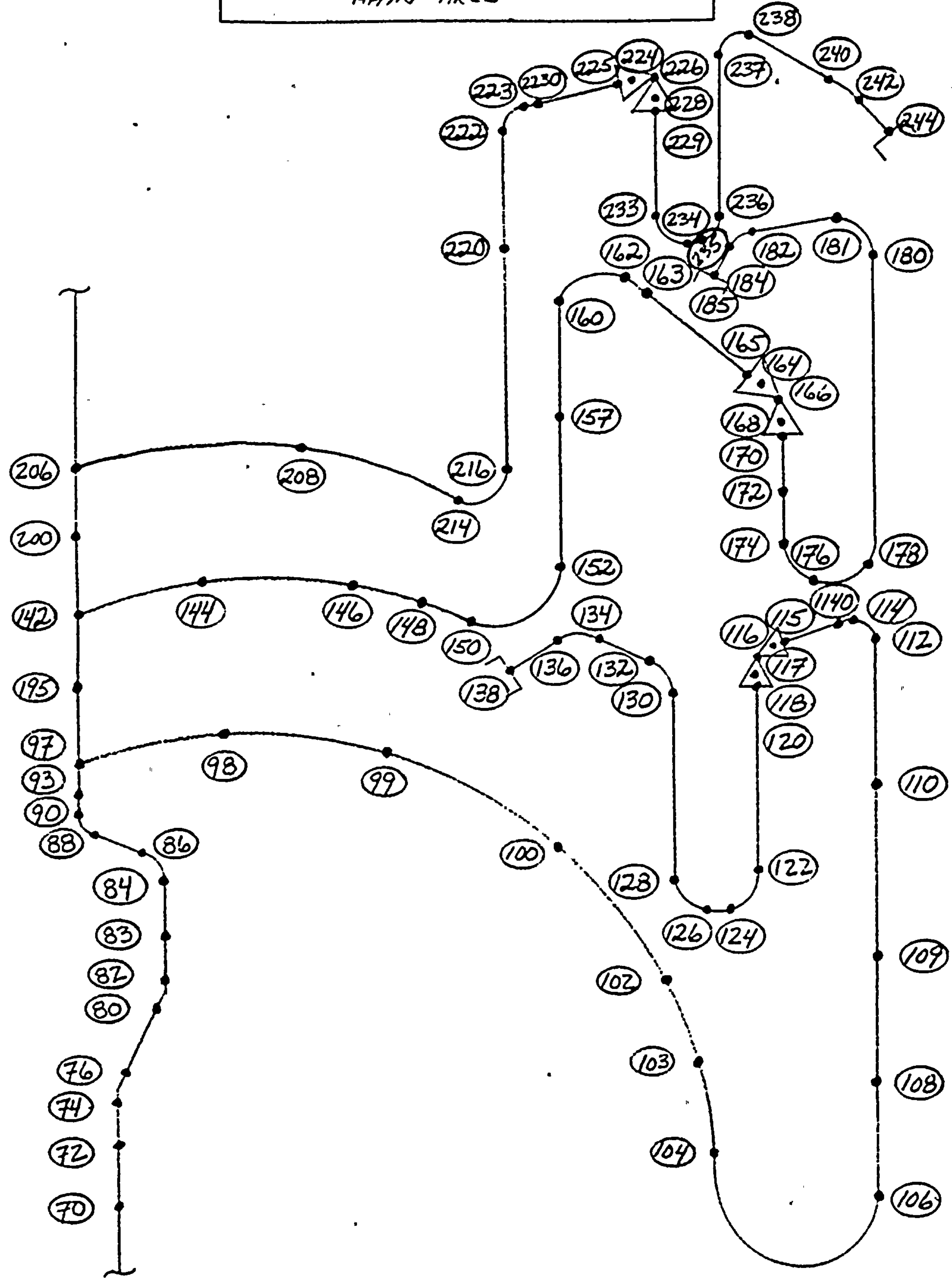


FIGURE 4.8.1-2

TELEDYNE ENGINEERING SERVICES

BY RAM DATE 4-14-83
CHKD. BY LBS DATE 4-14-83

UNIT 1 STRUCTURAL NODE POINTS
DOWNSTREAM (12 IN)

SHEET NO. 2 OF 3
PROJ. NO. 5364

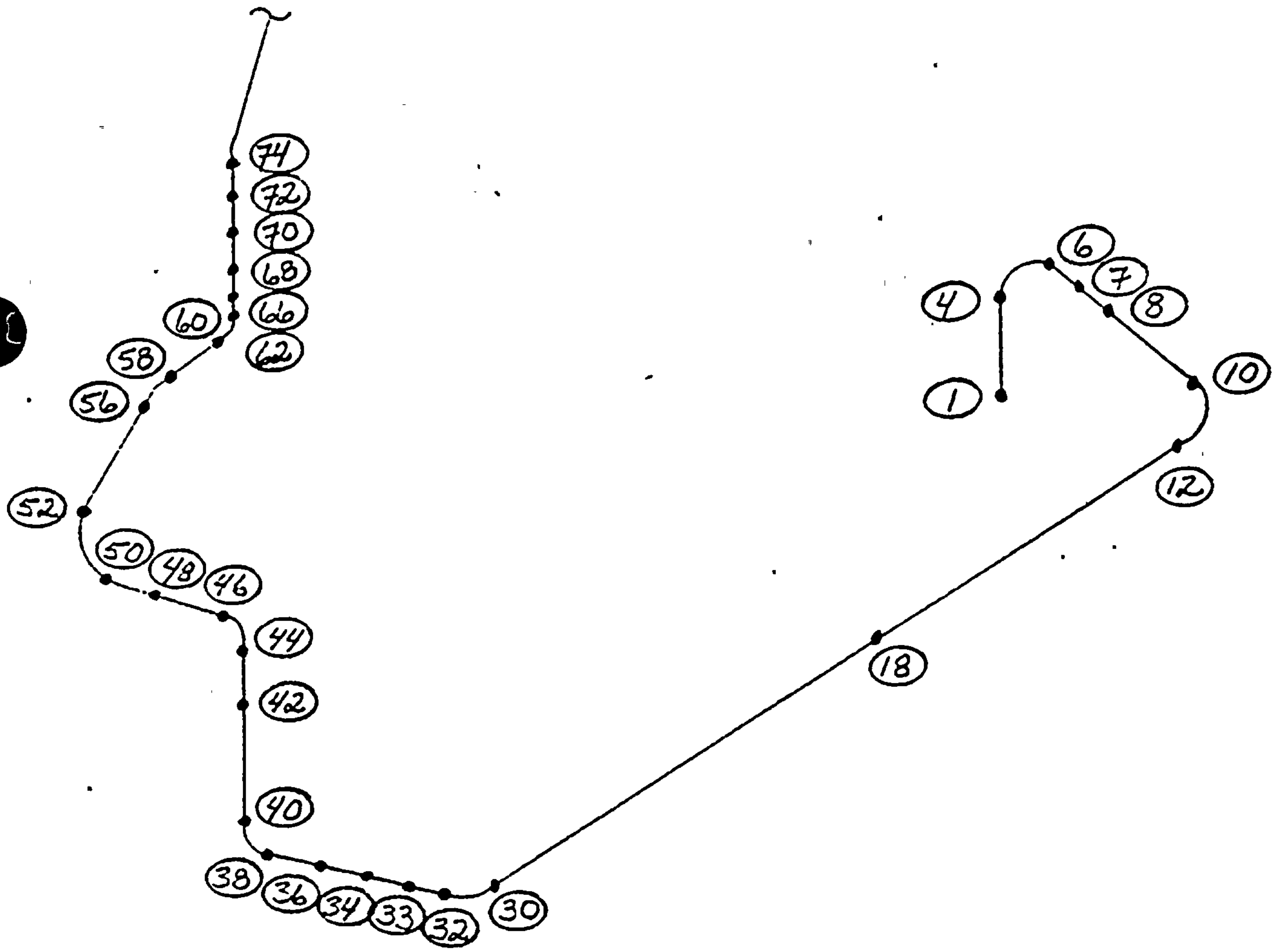
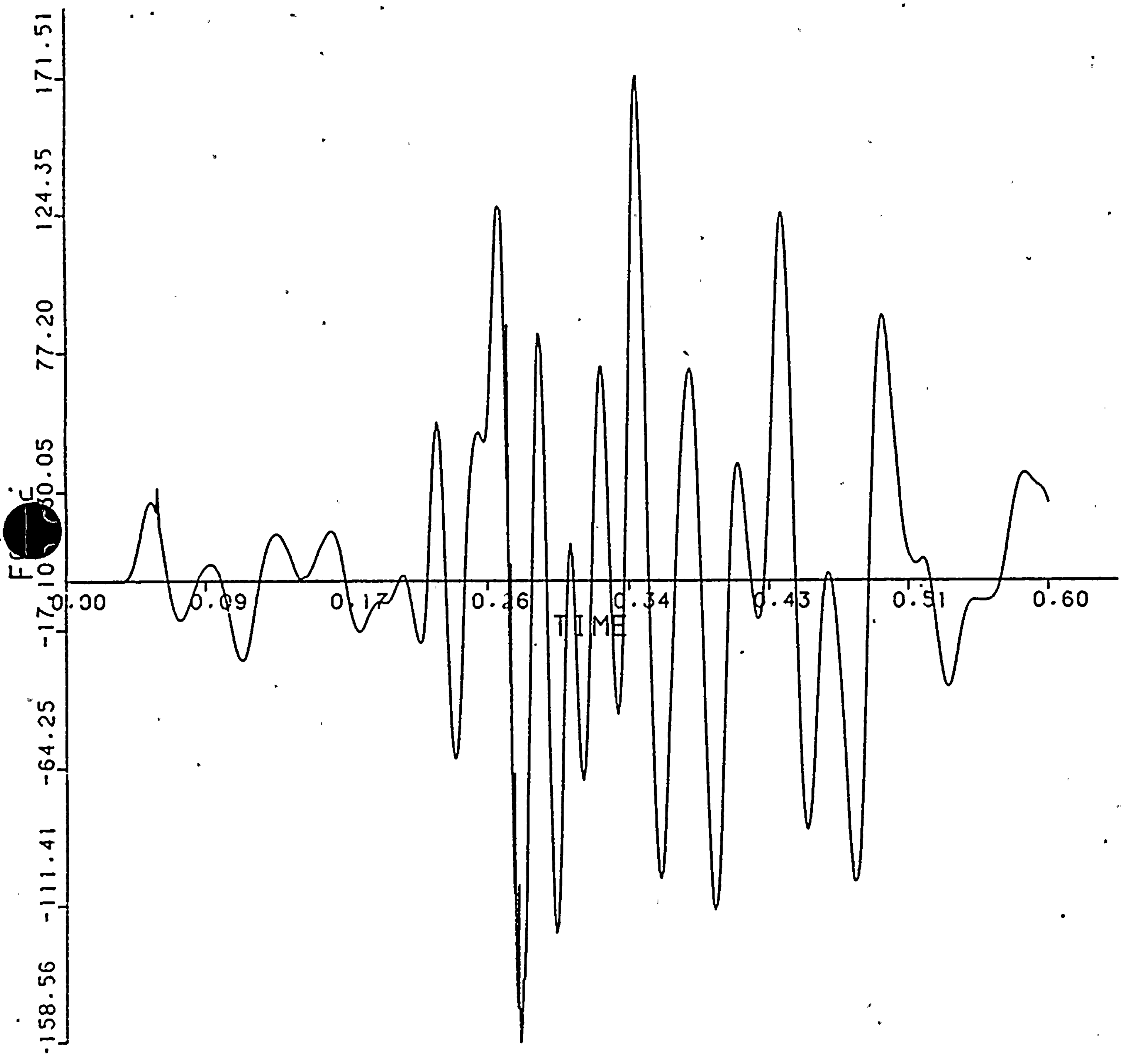


FIGURE 4.8.1-3

SAP2SAP VERIFICATION 5364 12-MAY-83

YELLOW LOOP SEAL - YELLPSL.TMP

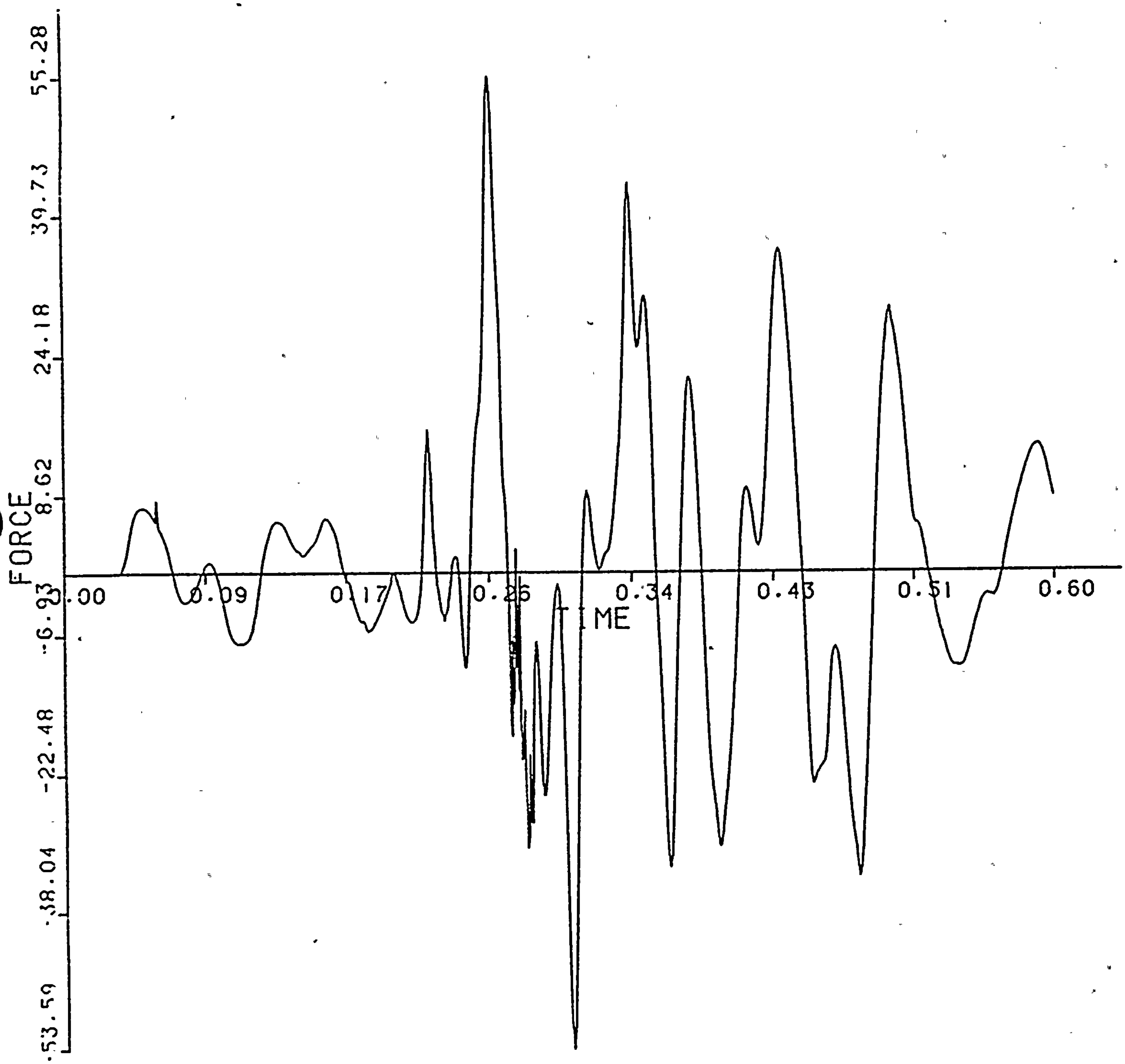
TIME/FORCE TABLE 1, MAGNITUDE AT NODE POINT 109



DONE BY: MK DATE: 5-12-83
CHKD BY: ULL DATE: 5-12-83

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 2, MAGNITUDE AT NODE POINT 104

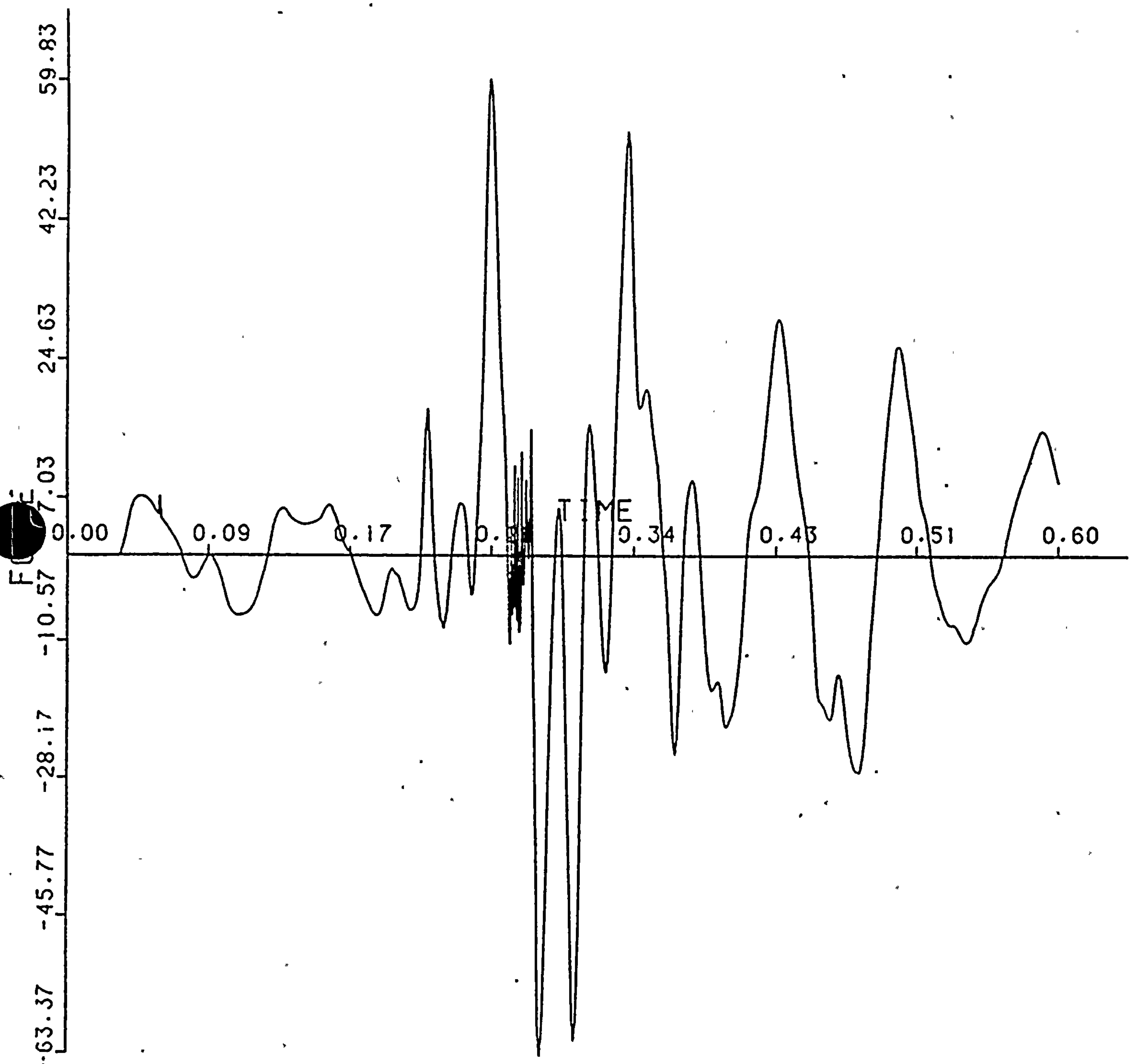


DONE BY: MK DATE: 5-12-83
CHKD BY: UU DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

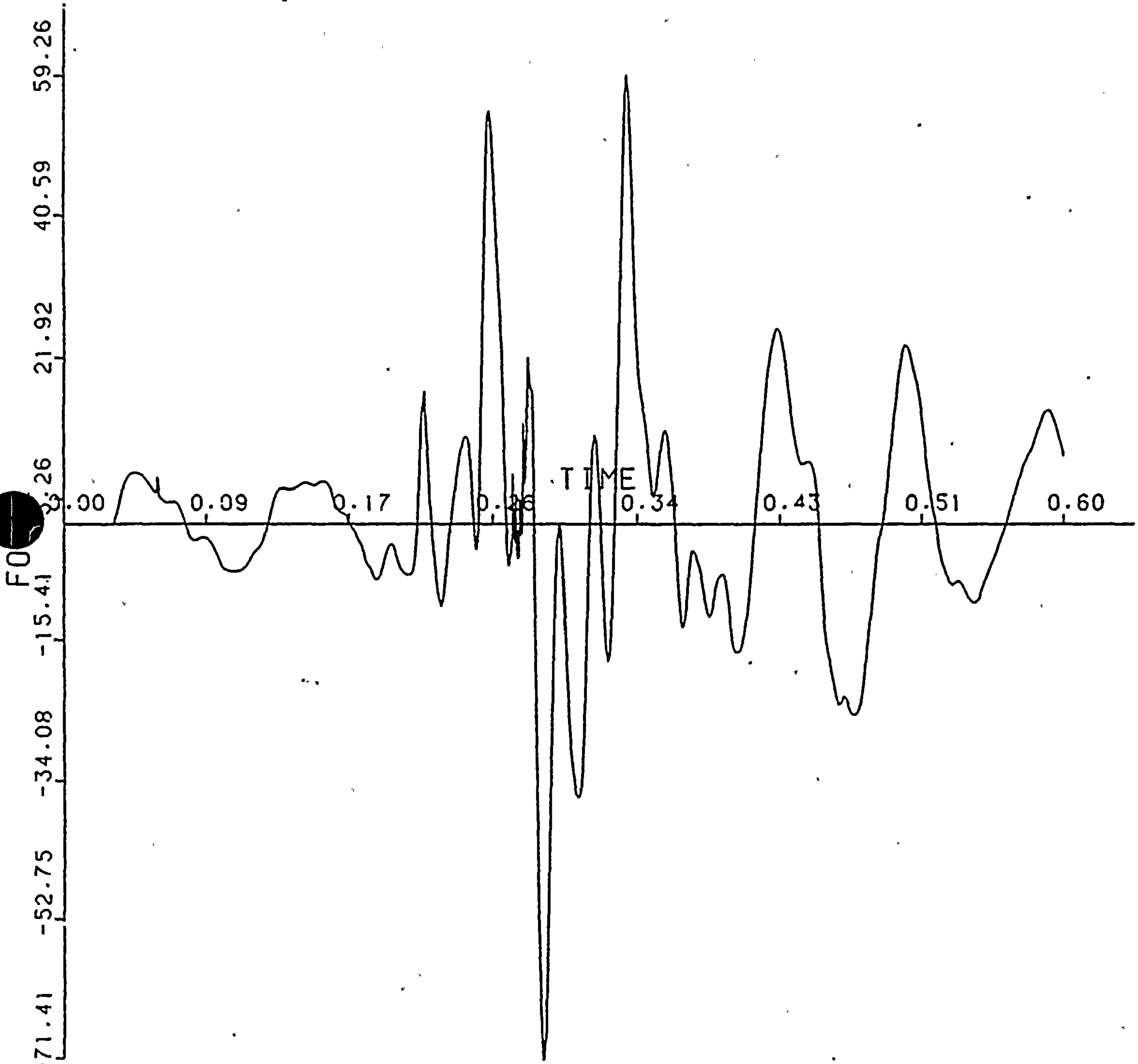
SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 3, MAGNITUDE AT NODE POINT 103



DONE BY: HK DATE: 5-12-83
CHKD BY: LL DATE: 5-12-83

 TELEDYNE ENGINEERING SERVICES

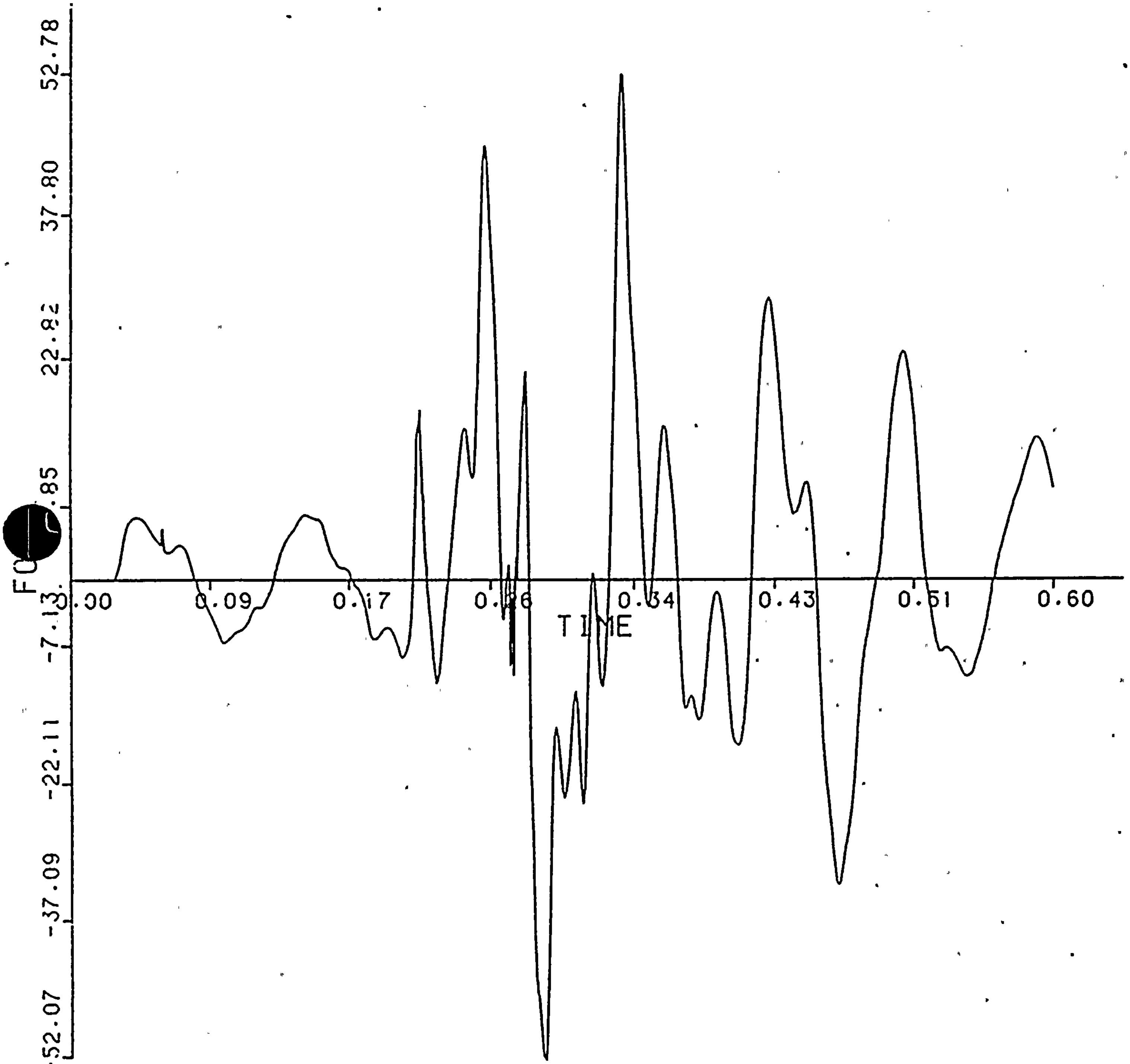
SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 4. MAGNITUDE AT NODE POINT 102



DONE BY: MR DATE: 5-12-83
CHKD BY: LL DATE: 5-12-83

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 5, MAGNITUDE AT NODE POINT 100



DONE BY: MR DATE: 5-12-83
CHKD BY: WL DATE: 5-12-83

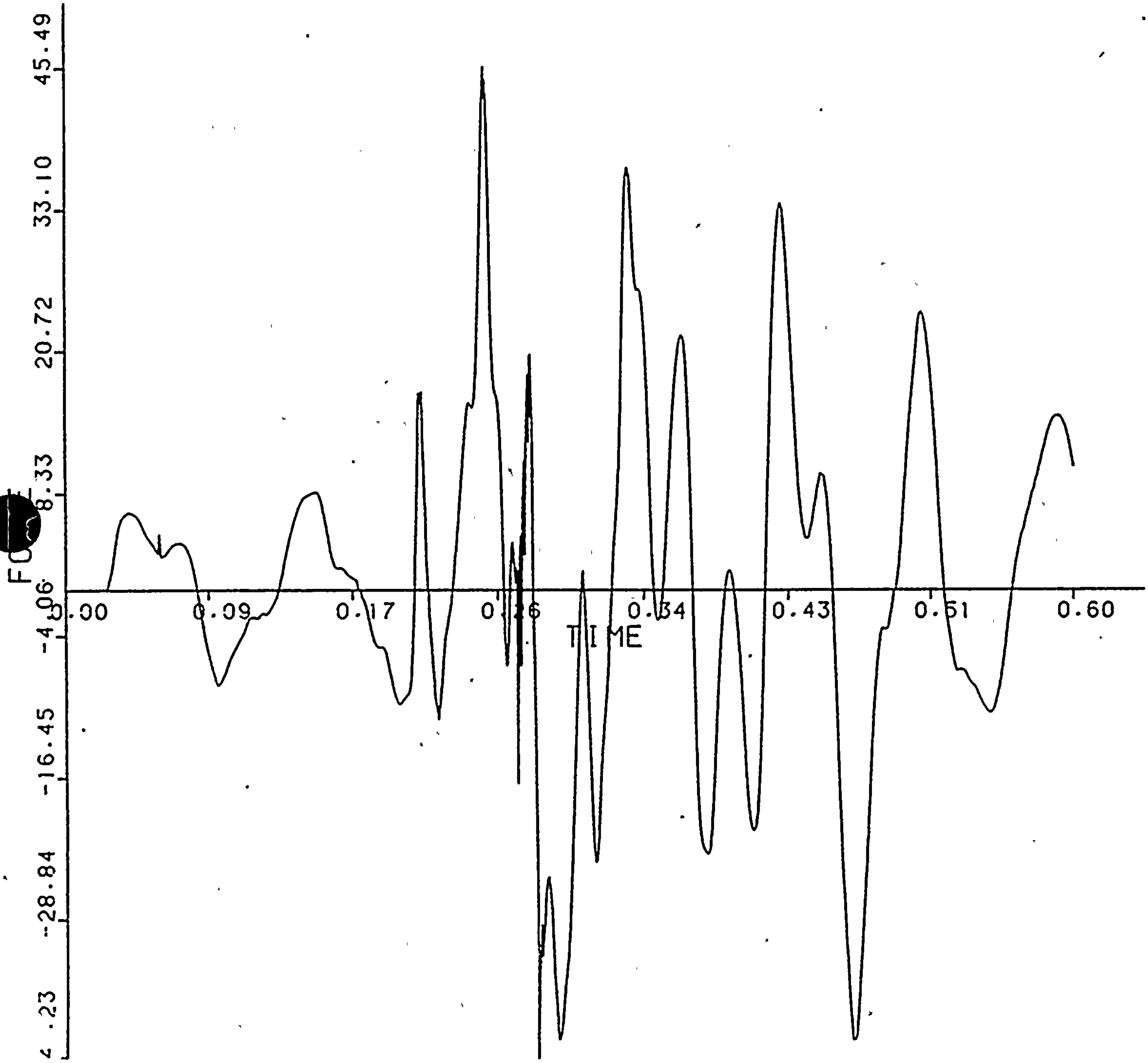
Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83

YELLOW LOOP SEAL - YELLPSL.TMP

TIME/FORCE TABLE 6, MAGNITUDE AT NODE POINT 99



DONE BY: MK DATE: 5-12-83

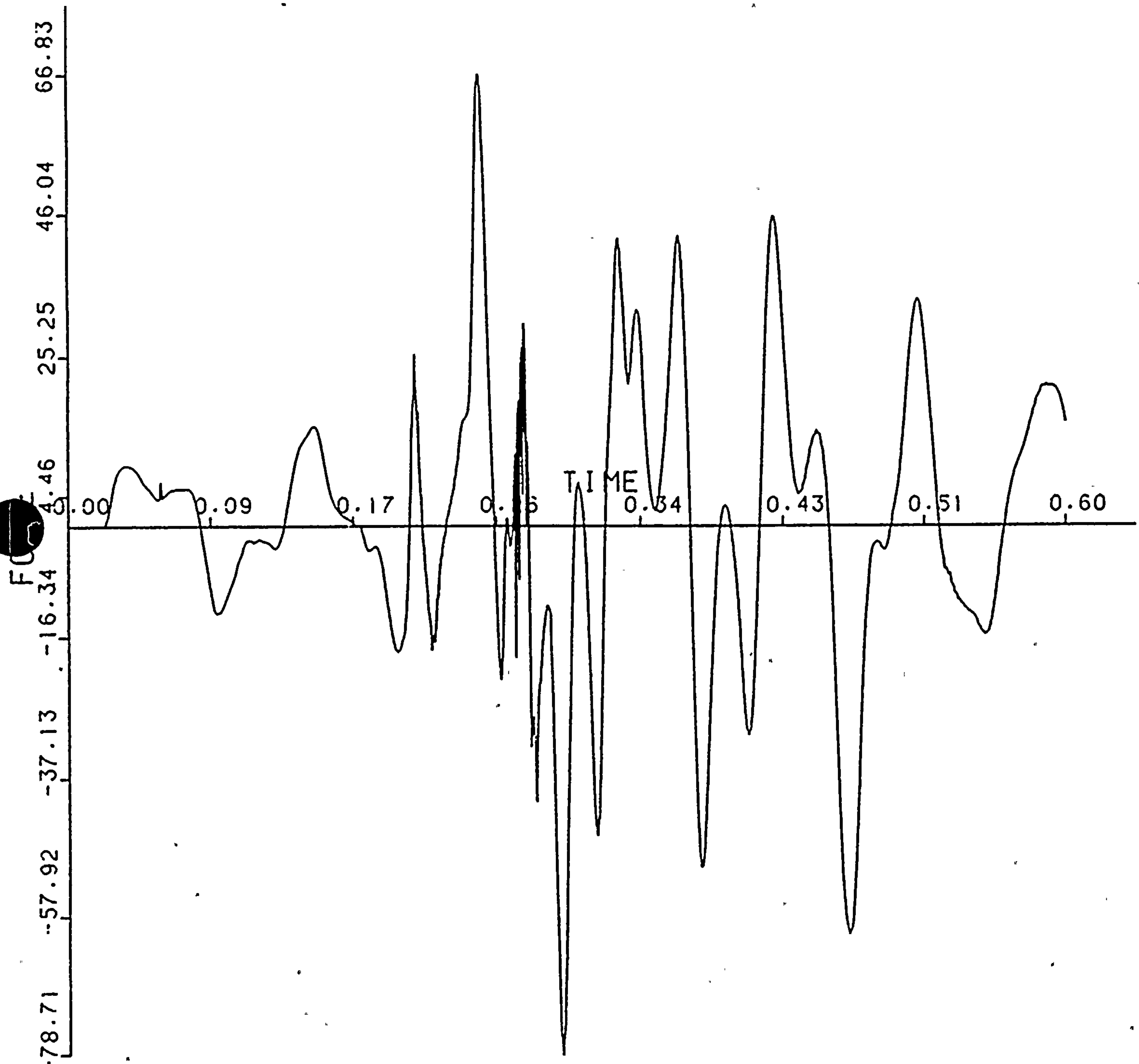
CHKD BY: LLL DATE: 5-12-83

TELEDYNE
ENGINEERING SERVICES

SAPSAP VERIFICATION 5364   12 MAY 83

YELLOW LOOP SEAL - YELLPSL.IMP

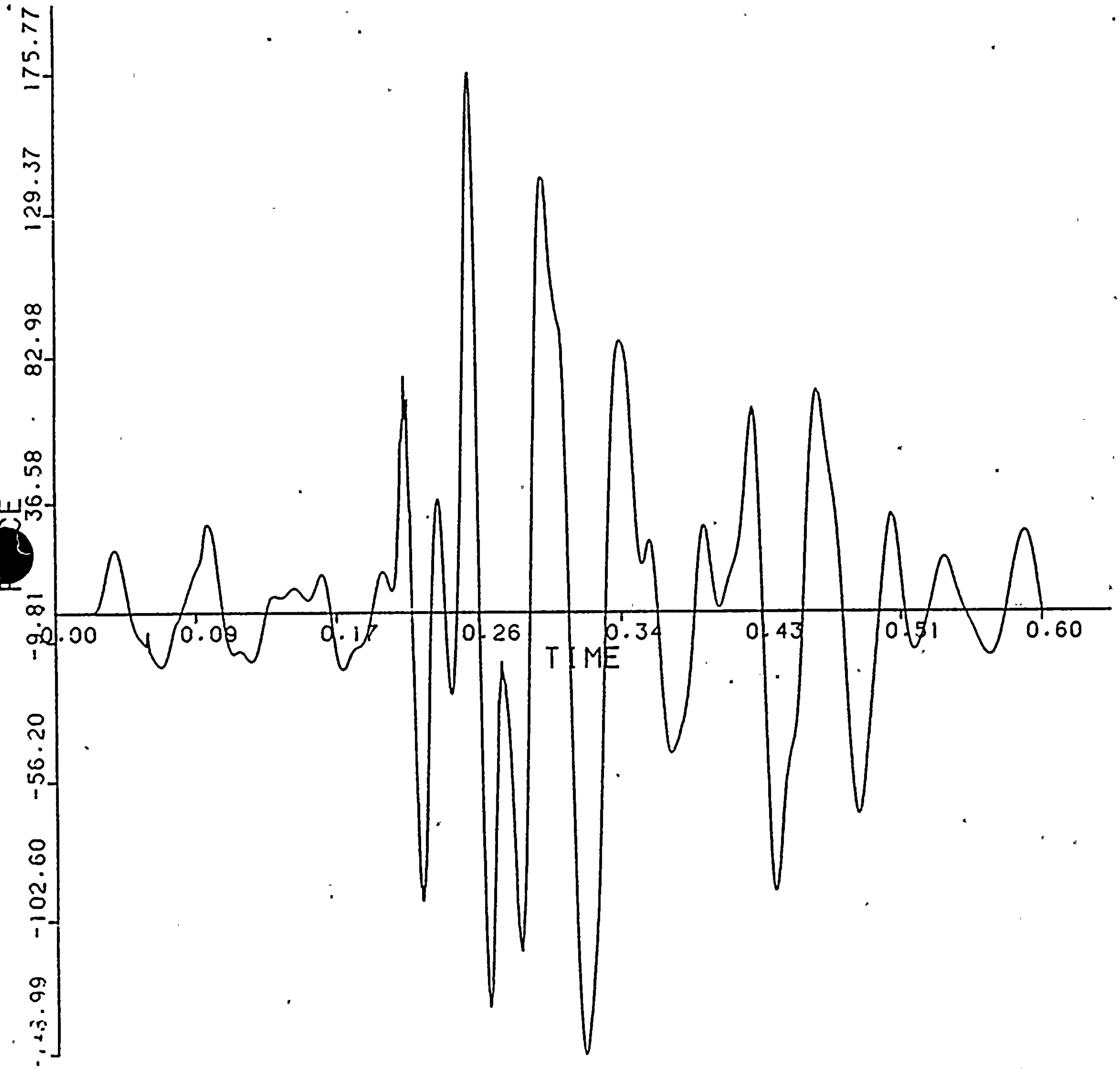
TIME/FORCE TABLE   7, MAGNITUDE AT NODE POINT   98



DONE BY: HK DATE: 5-12-83
CHKD BY: KL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 8. MAGNITUDE AT NODE POINT 216



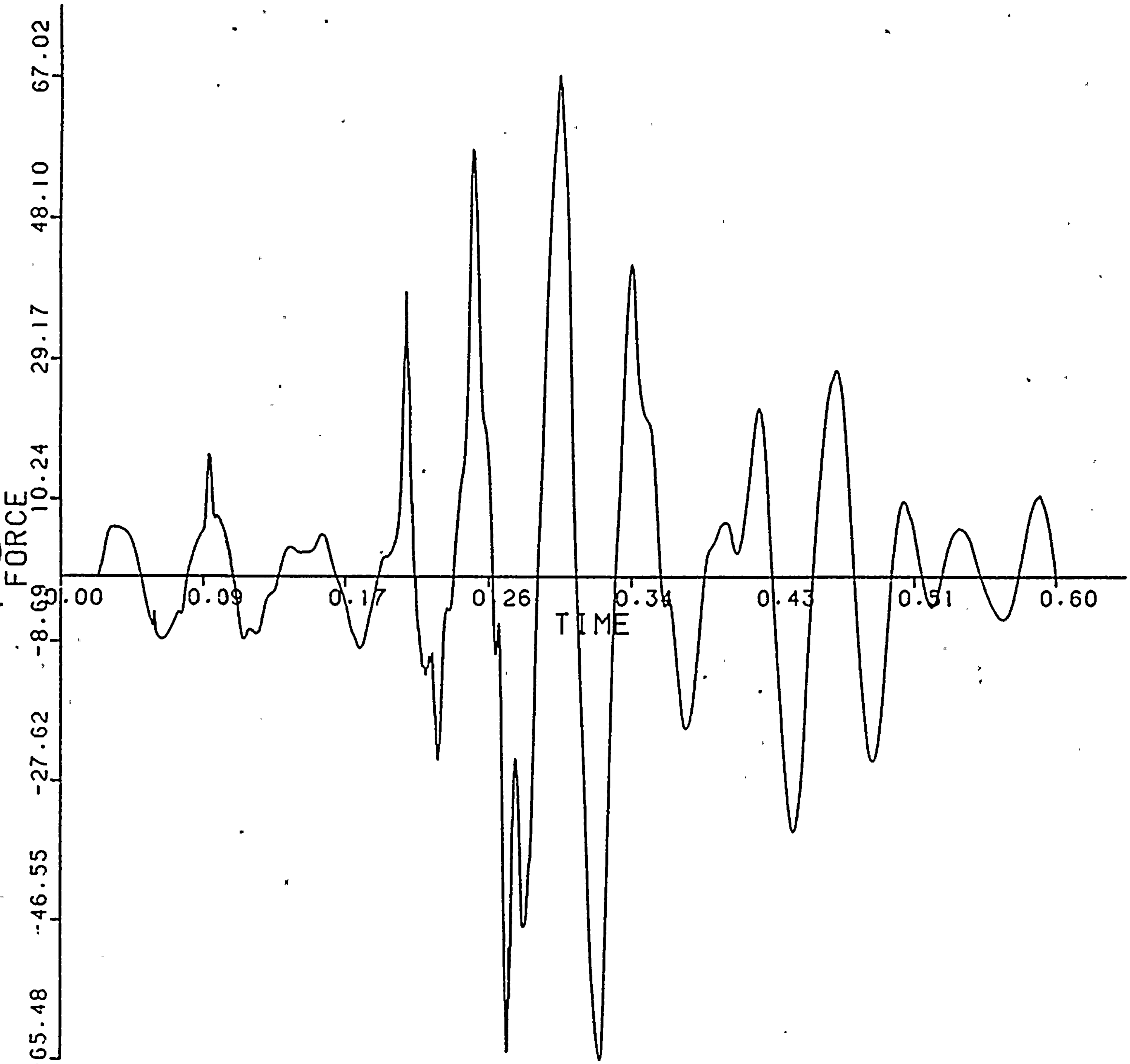
DONE BY: MK DATE: 5-12-83
CHKD BY: WL DATE: 5-12-83

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364   12-MAY-83

YELLOW LOOP SEAL - YELLPSL.TMP

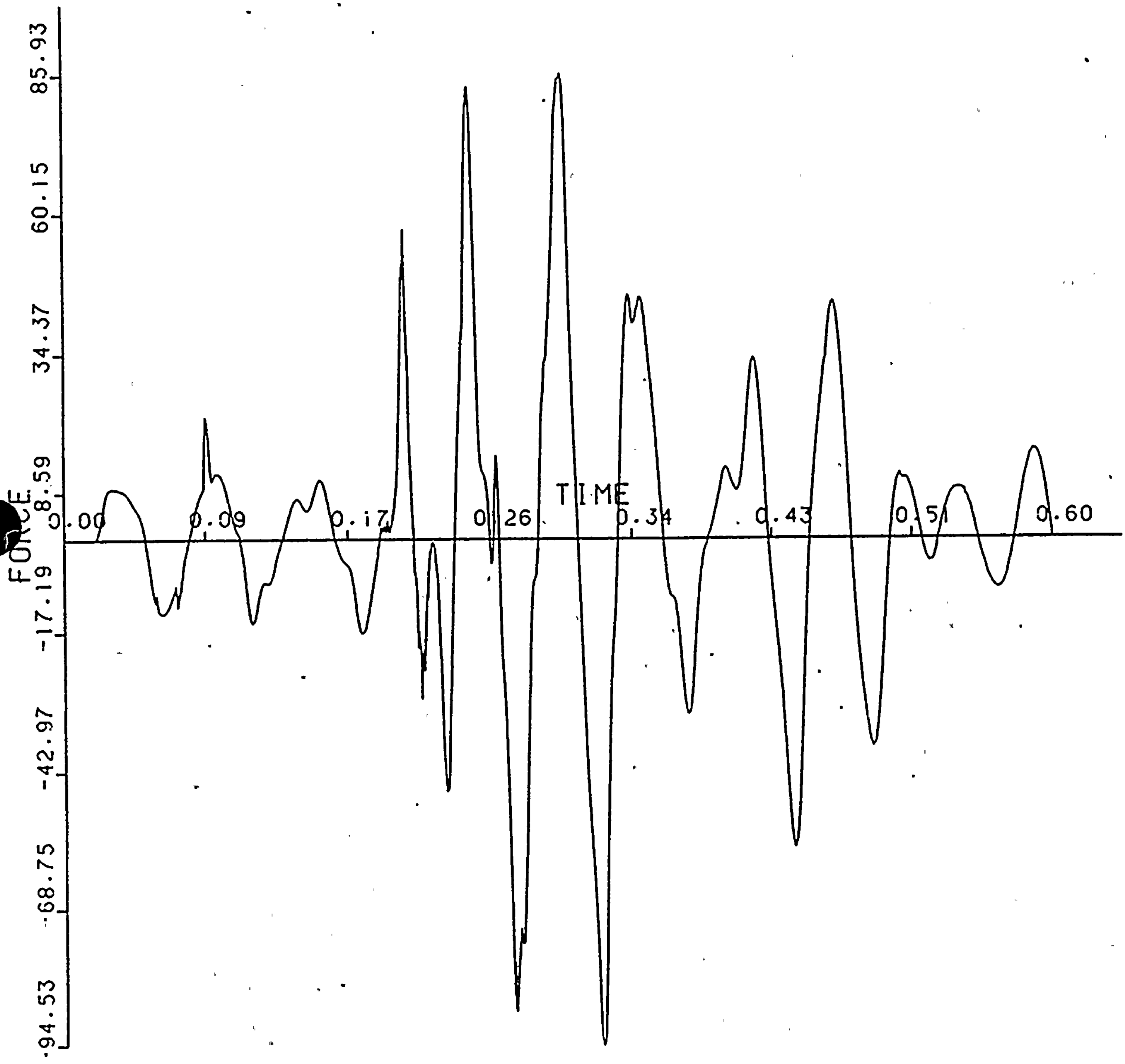
TIME/FORCE TABLE   9. MAGNITUDE AT NODE POINT   214



DONE BY: HK DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 10. MAGNITUDE AT NODE POINT 208

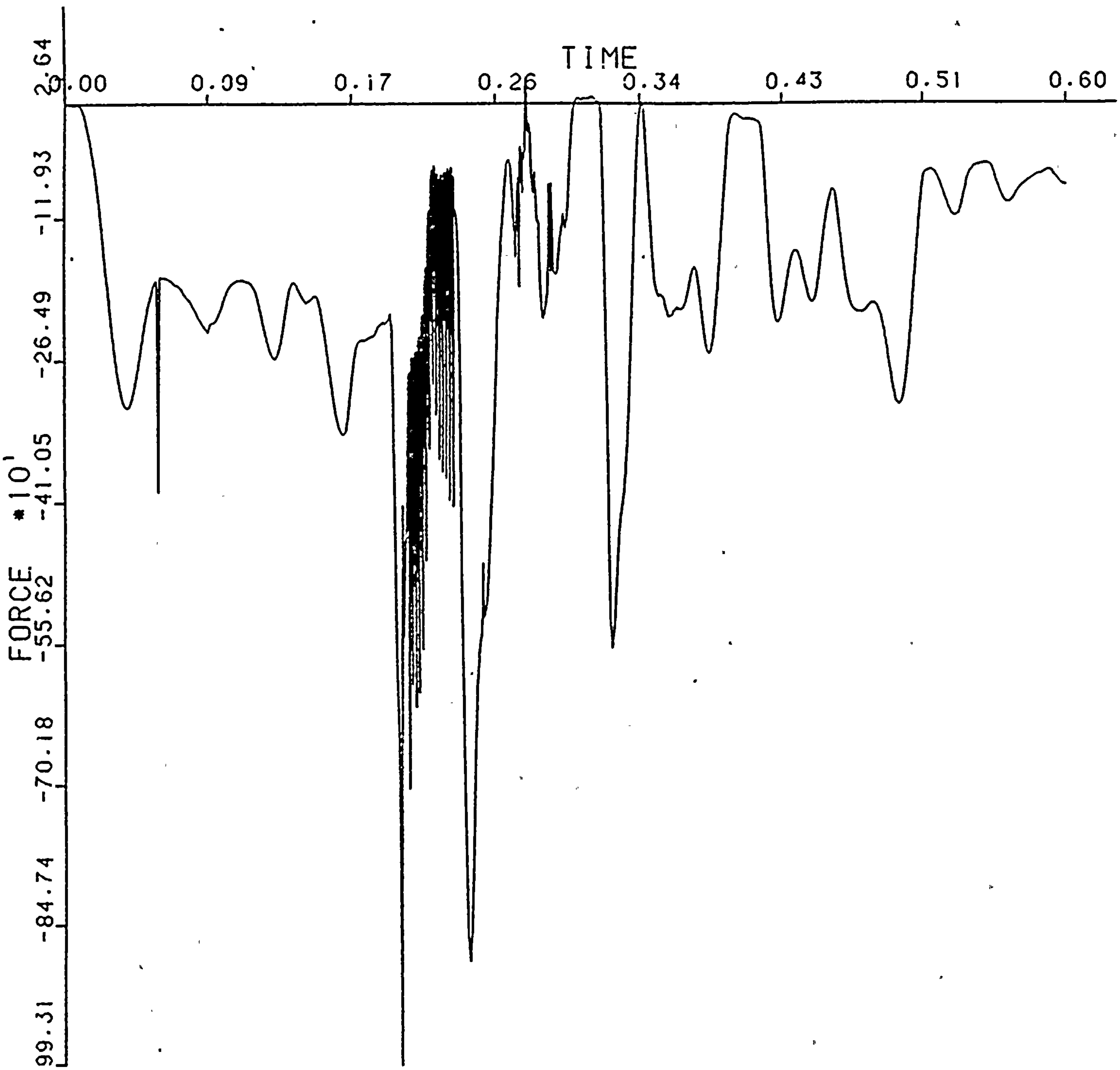


DONE BY: MR DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

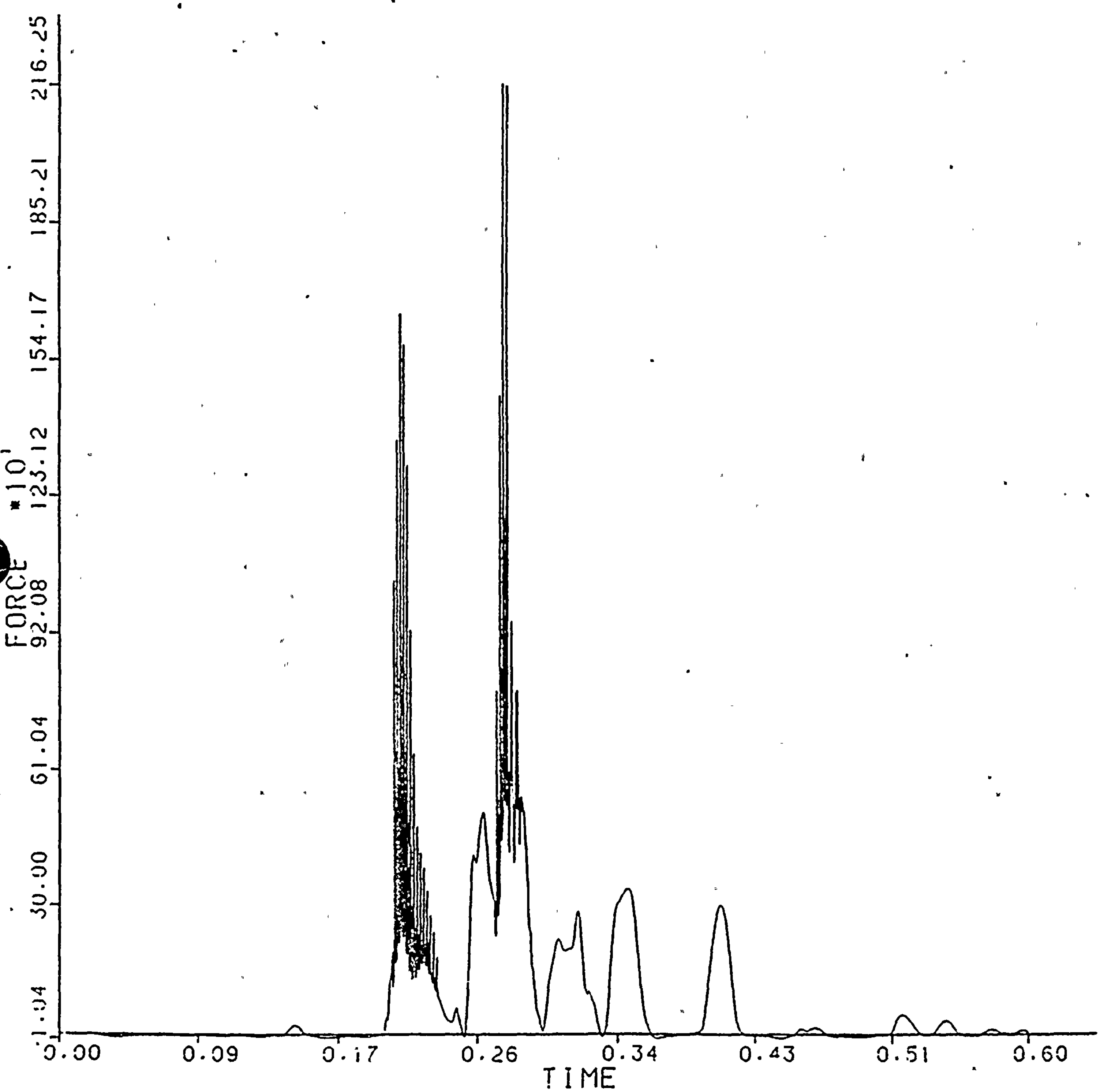
SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 11, MAGNITUDE AT NODE POINT 280



DONE BY: MK DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

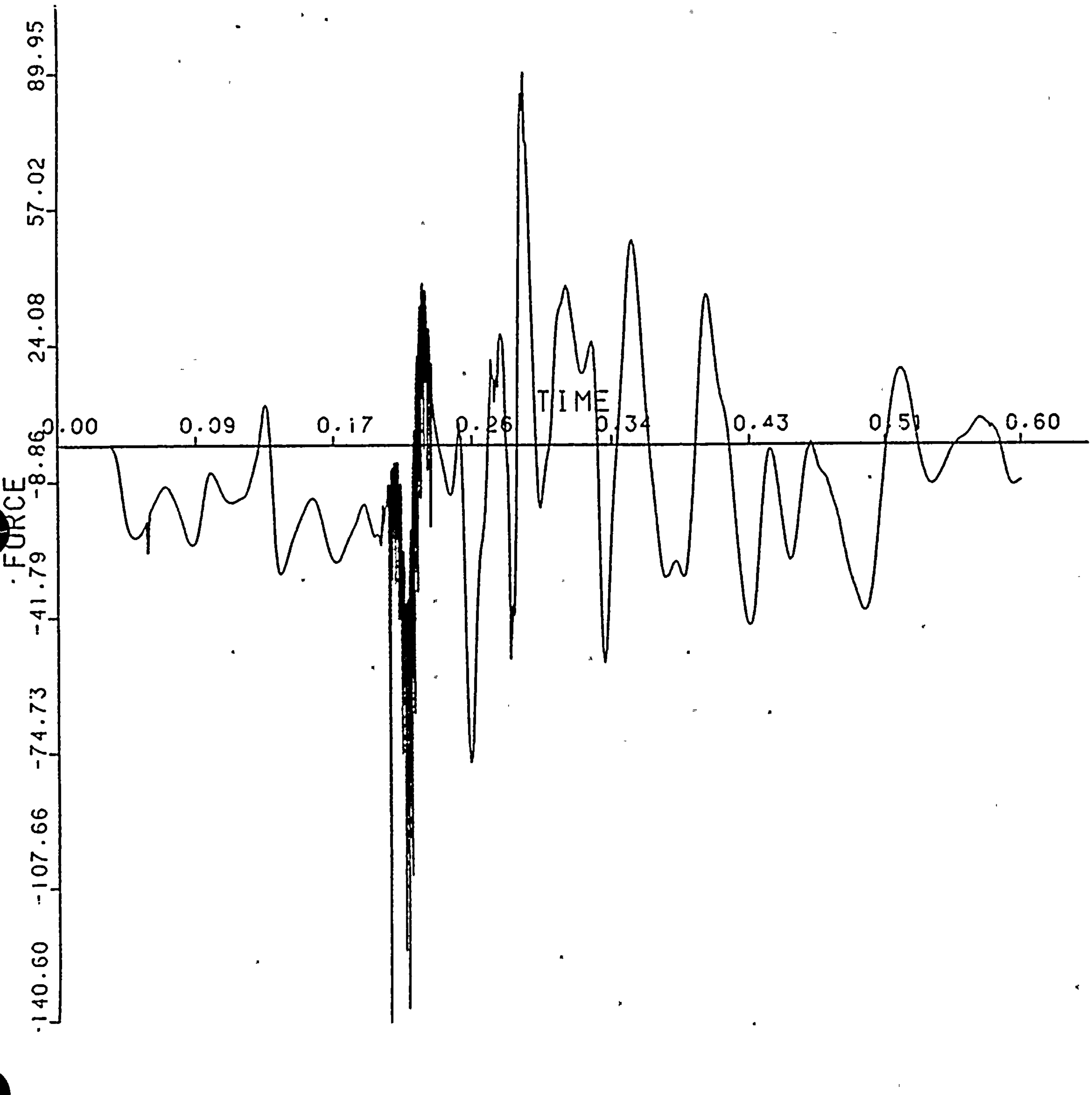
TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 12. MAGNITUDE AT NODE POINT 142



DONE BY: MK DATE: 5-12-83
CHKD BY: LL DATE: 5-12-83

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 13, MAGNITUDE AT NODE POINT 88



DONE BY: MK DATE: 5-12-83
CHKD BY: ULL DATE: 5-12-83

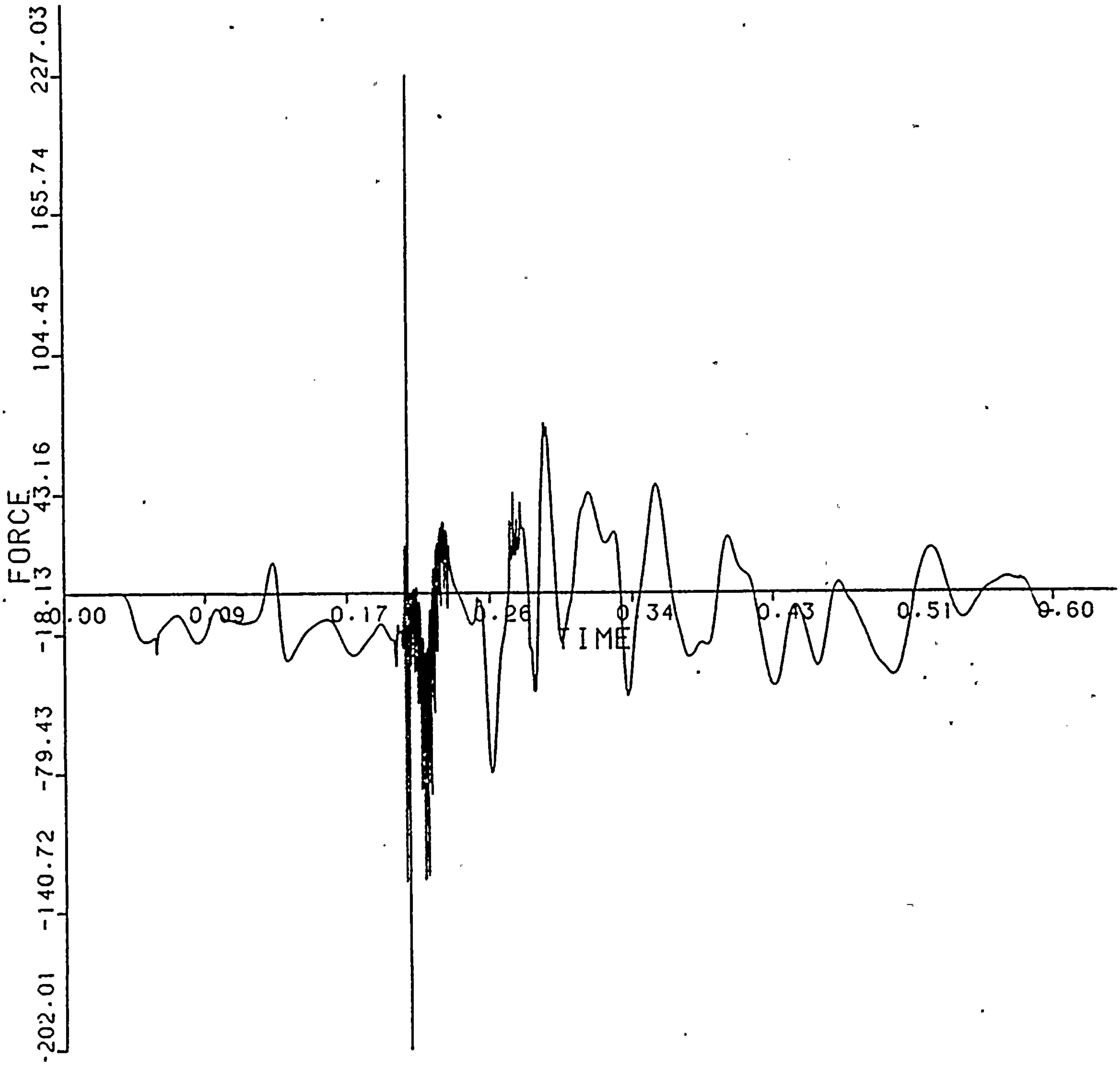
Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83

YELLOW LOOP SEAL - YELLPSL.TMP

TIME/FORCE TABLE 14, MAGNITUDE AT NODE POINT 83



DONE BY: AR DATE: 5-12-83

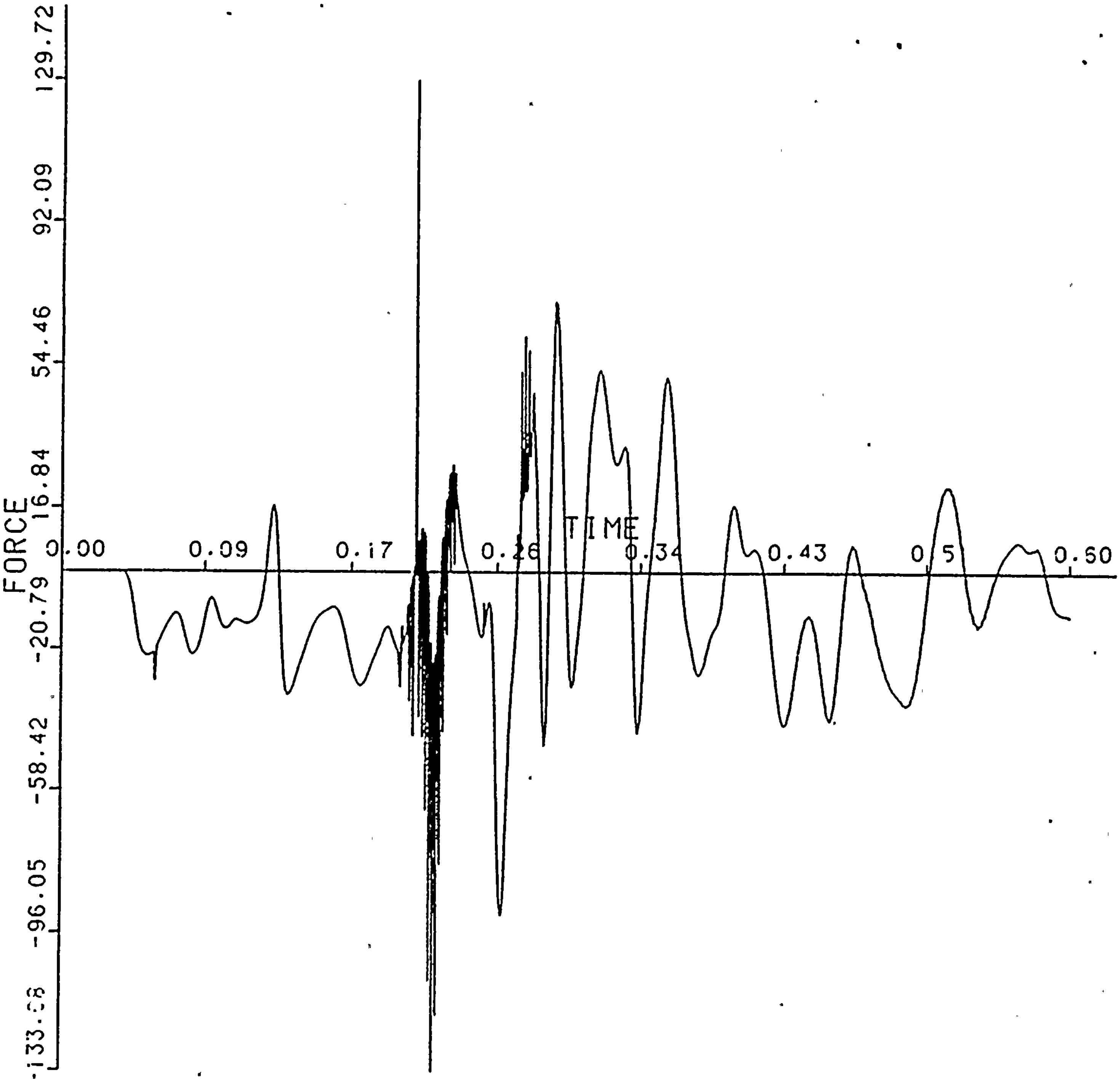
CHKD BY: WL DATE: 5-12-83

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83

YELLOW LOOP SEAL - YELLPSL.TMP

TIME/FORCE TABLE 15, MAGNITUDE AT NODE POINT 80

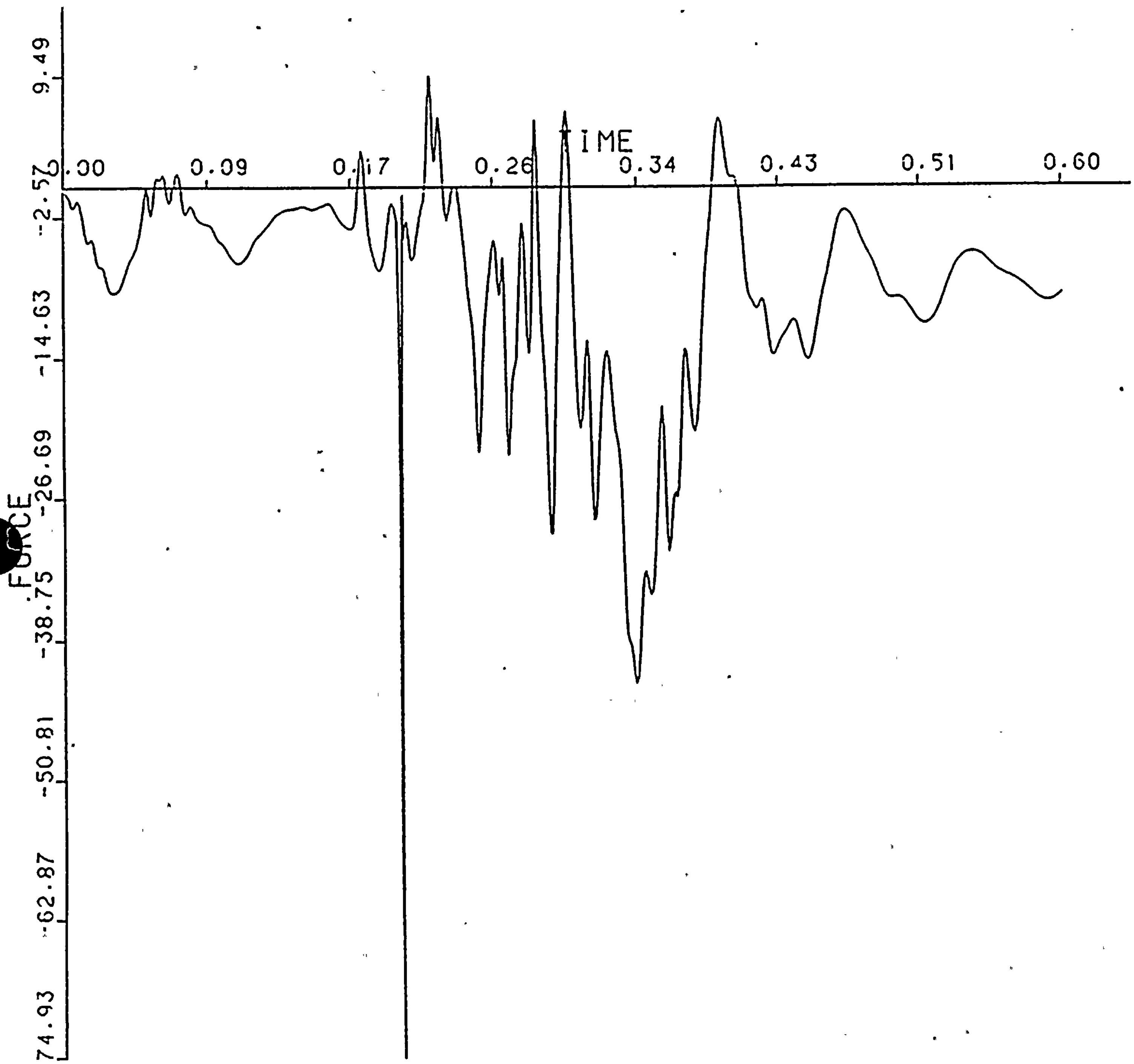


DONE BY: HK DATE: 5-12-83
CHKD BY: LL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

 TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 16, MAGNITUDE AT NODE POINT 725



DONE BY: MR DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

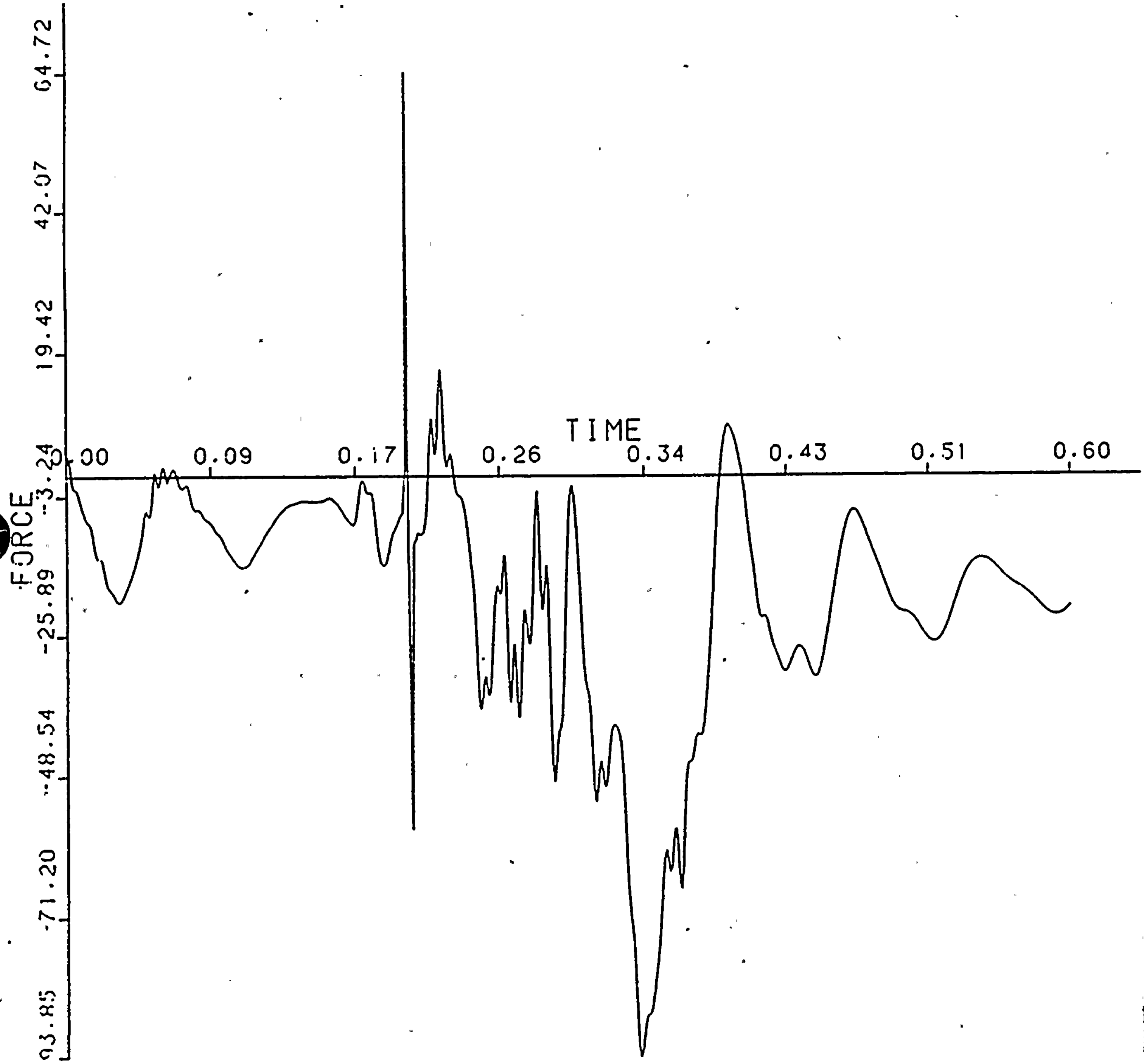
TELEDYNE ENGINEERING SERVICES

SAP/SAP VERIFICATION 5364   12 MAY 83

YELLOW LOOP SEAL   YELLPSL.TMP

[illegible]

717

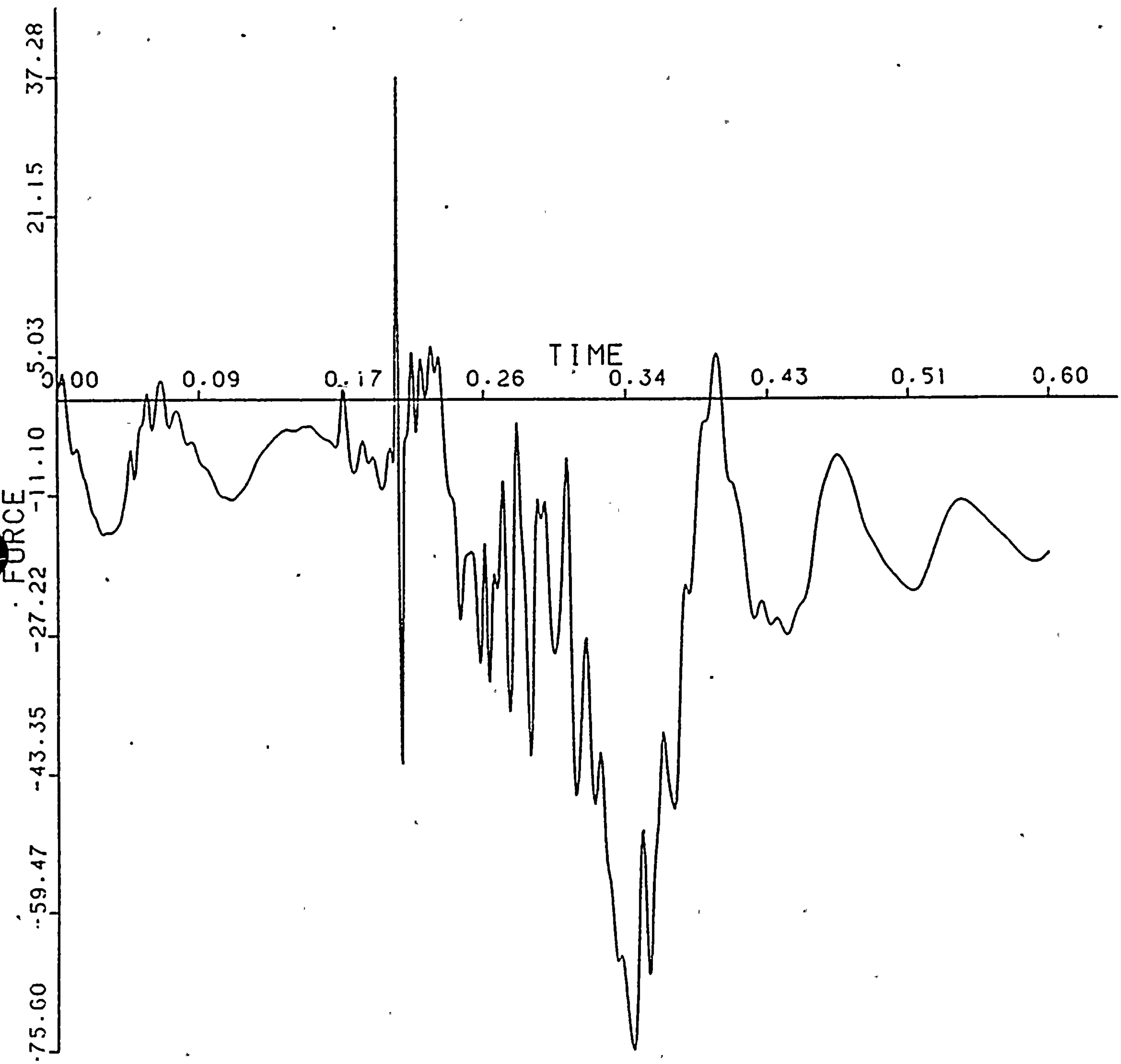


DONE BY: MK DATE: 5-12-83

CHKD BY: [illegible] DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 18. MAGNITUDE AT NODE POINT 710

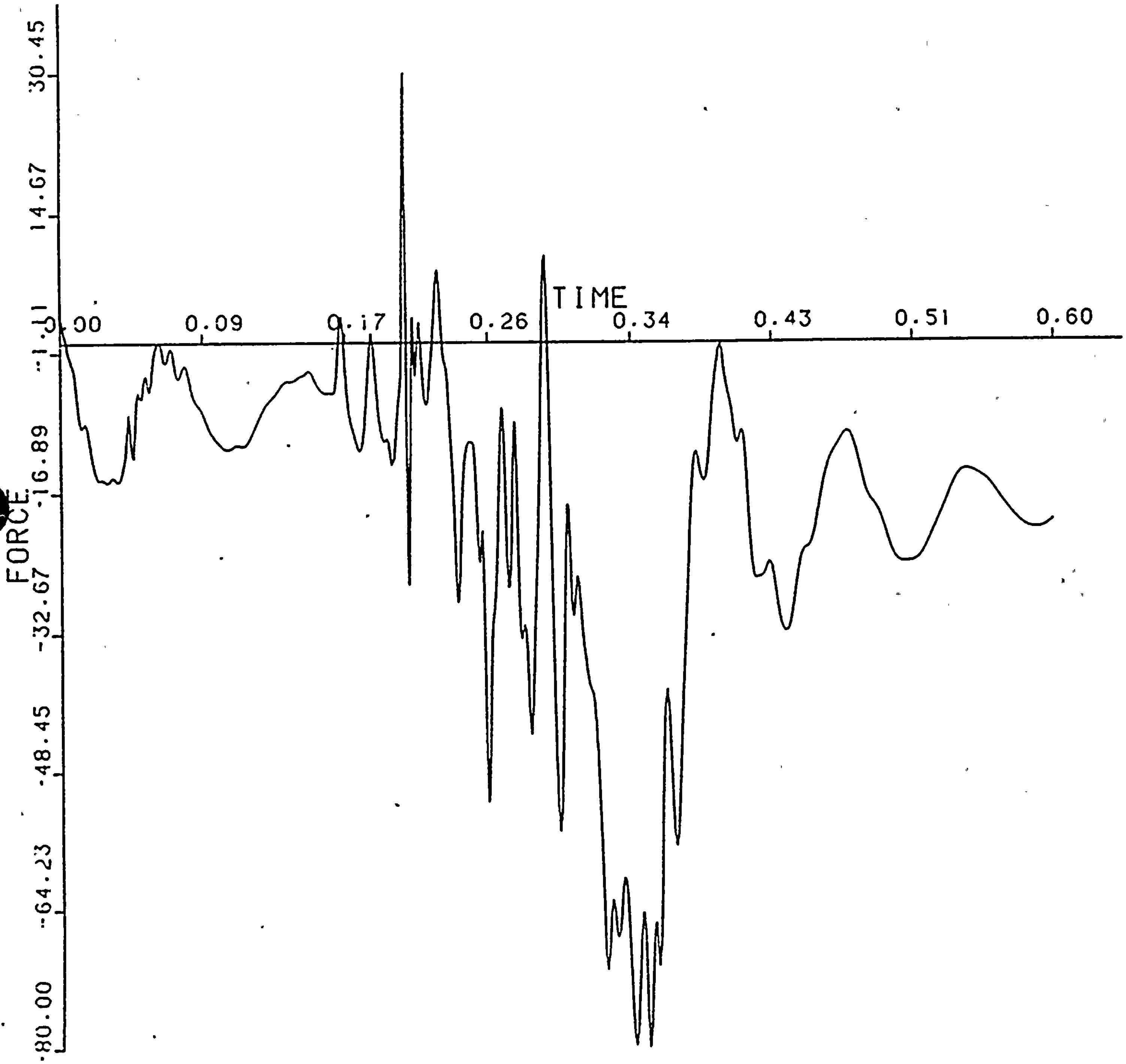


DONE BY: MZ DATE: 5-12-83
CHKD BY: LLC DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 19. MAGNITUDE AT NODE POINT 680

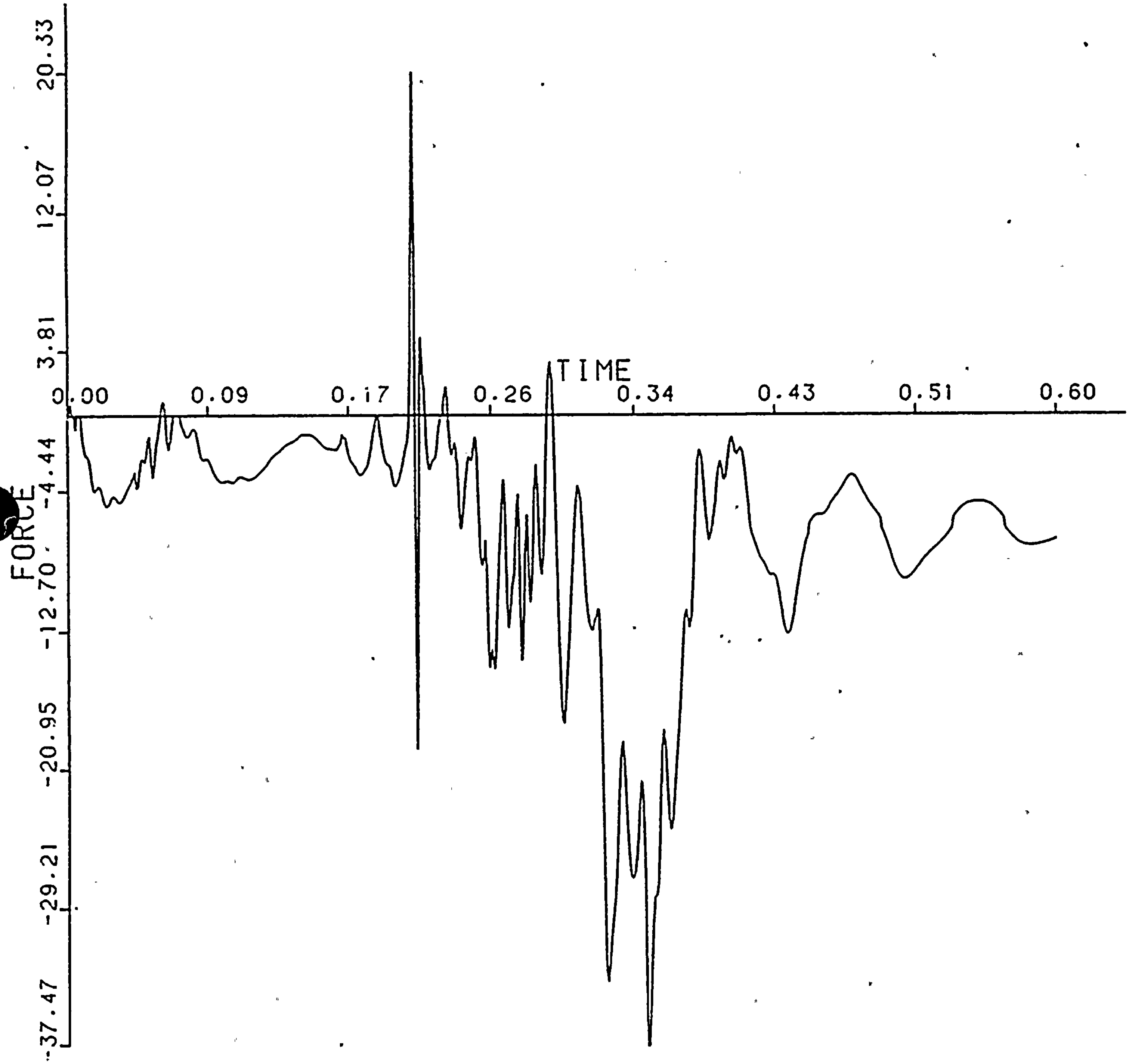


DONE BY: MR DATE: 5-12-83
CHKD BY: WL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

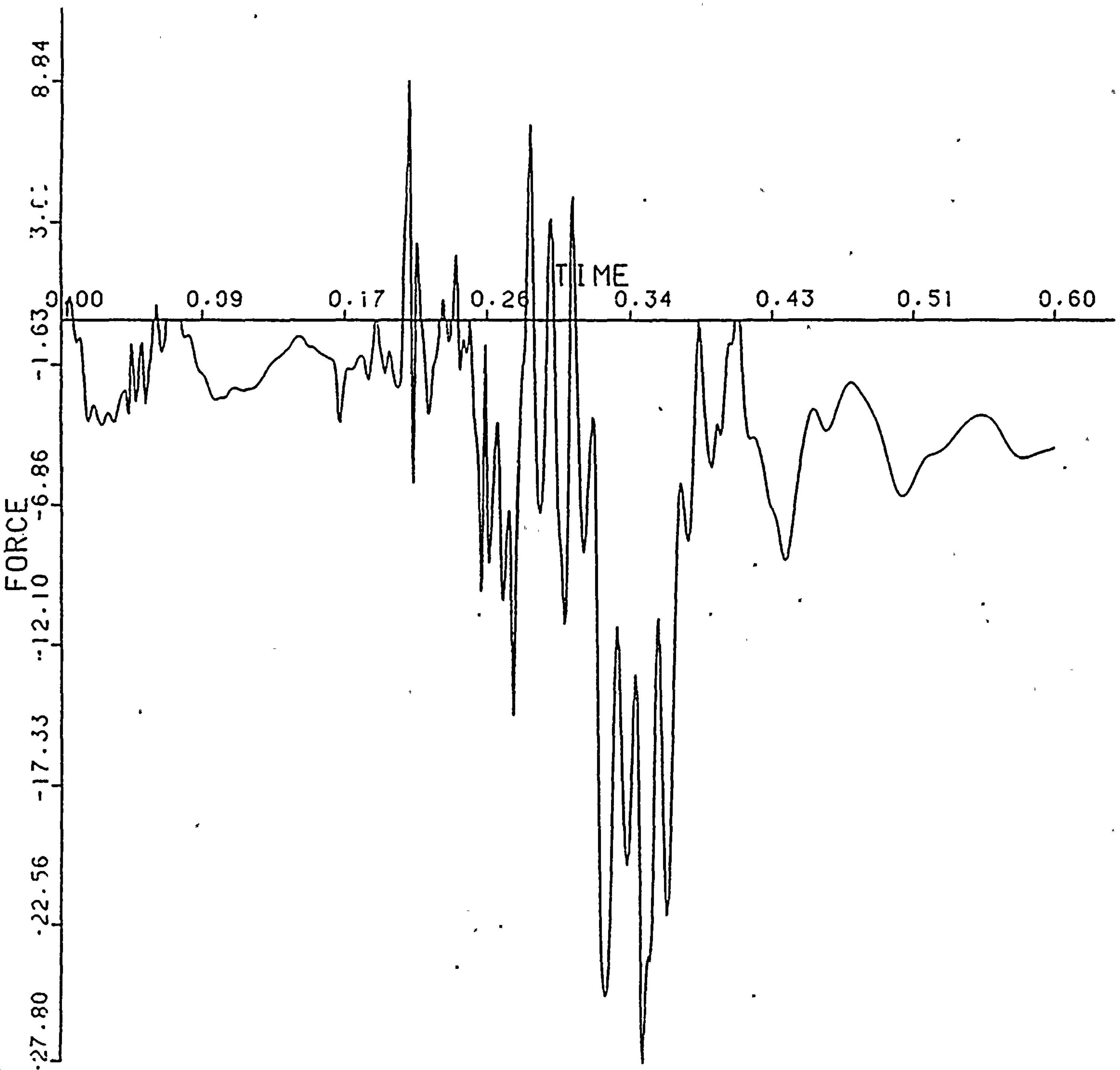
SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 20, MAGNITUDE AT NODE POINT 600



DONE BY: MR DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 21. MAGNITUDE AT NODE POINT 590

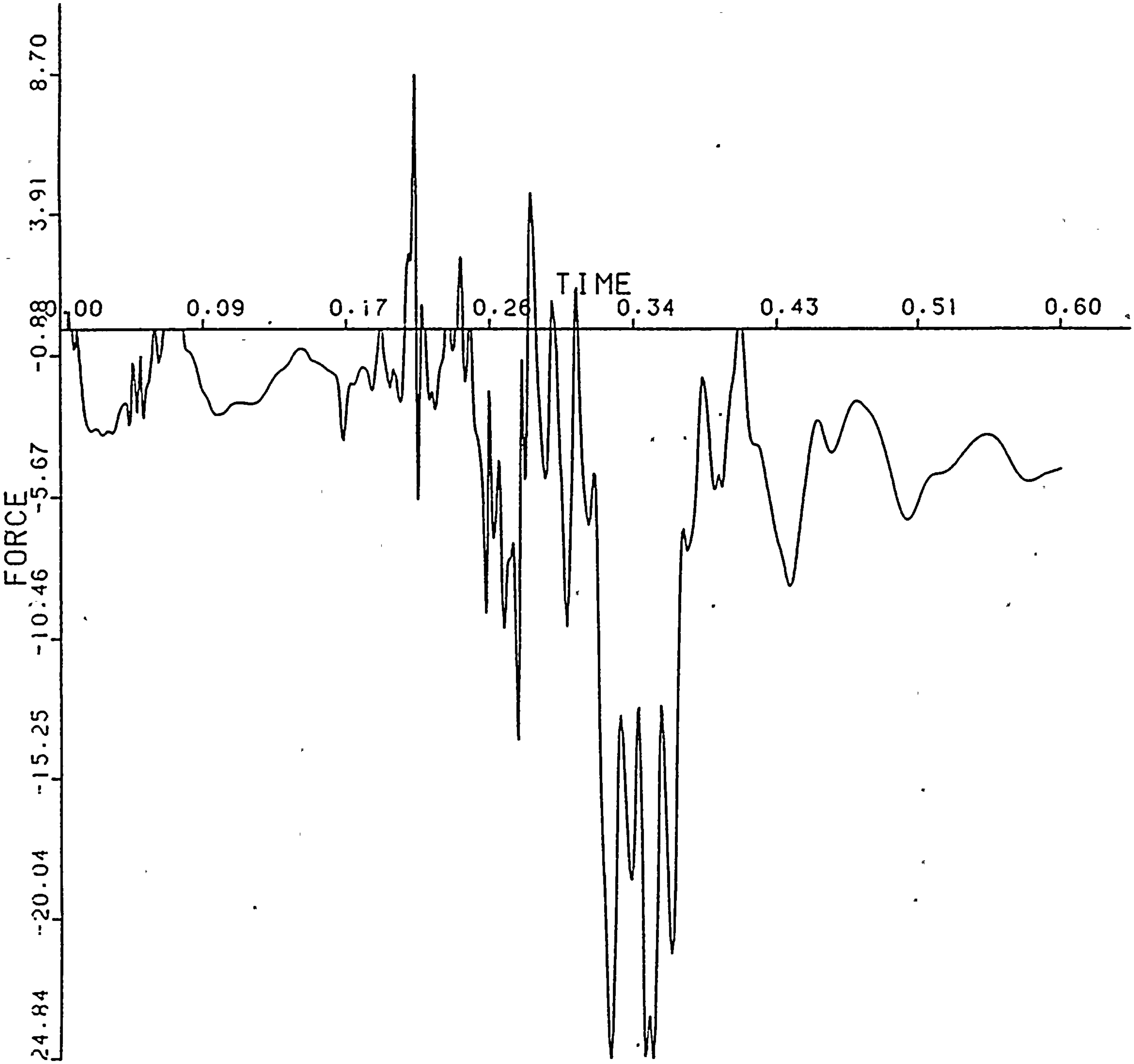


DONE BY: MR DATE: 5-12-83
CHKD BY: LL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 22. MAGNITUDE AT NODE POINT 585

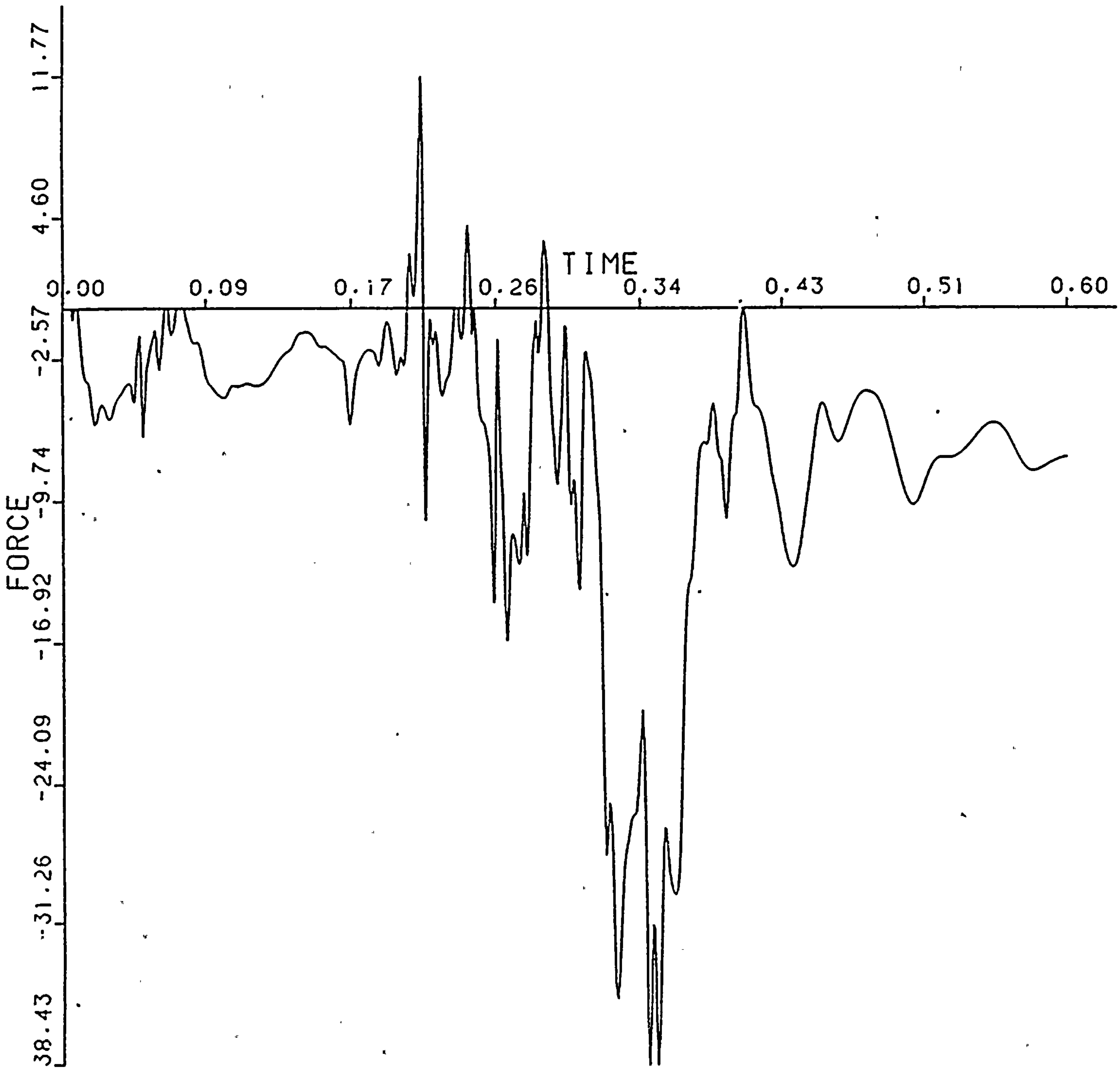


DONE BY: MK DATE: 5-12-83
CHKD BY: JJL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 23, MAGNITUDE AT NODE POINT 575

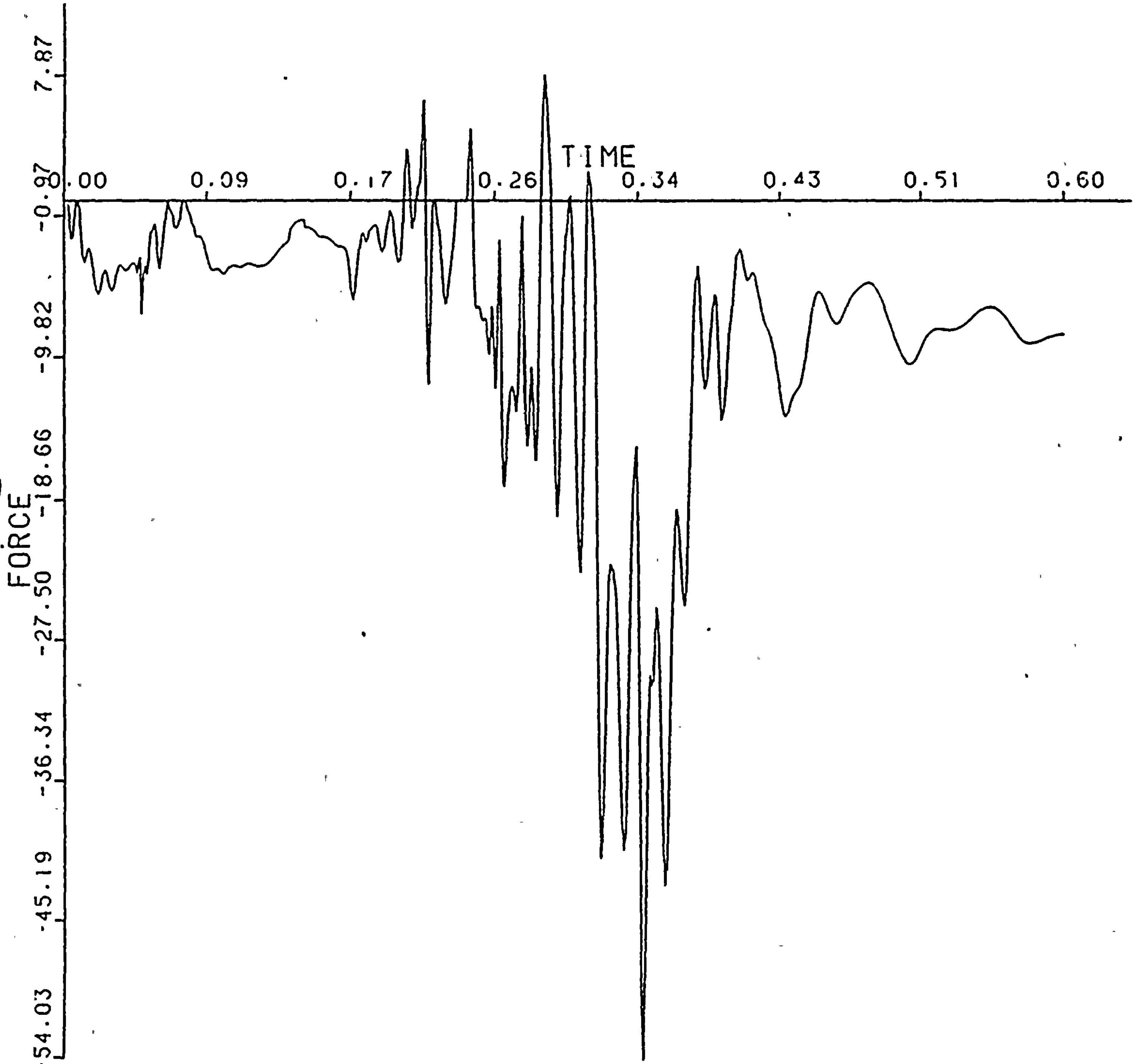


DONE BY: MK DATE: 5-12-83
CHKD BY: MM DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

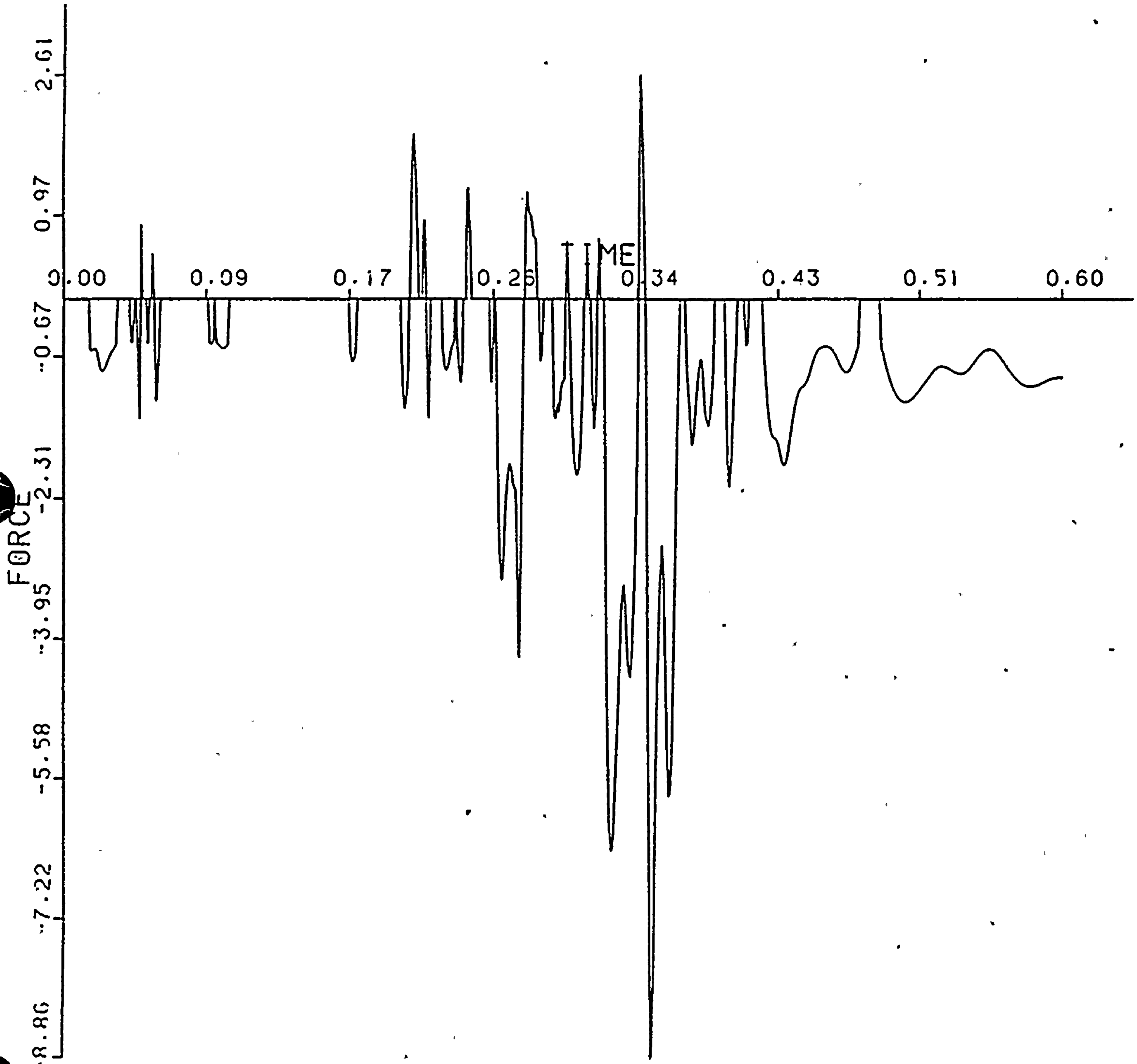
SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 24, MAGNITUDE AT NODE POINT 435



DONE BY: MR DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 25, MAGNITUDE AT NODE POINT 440

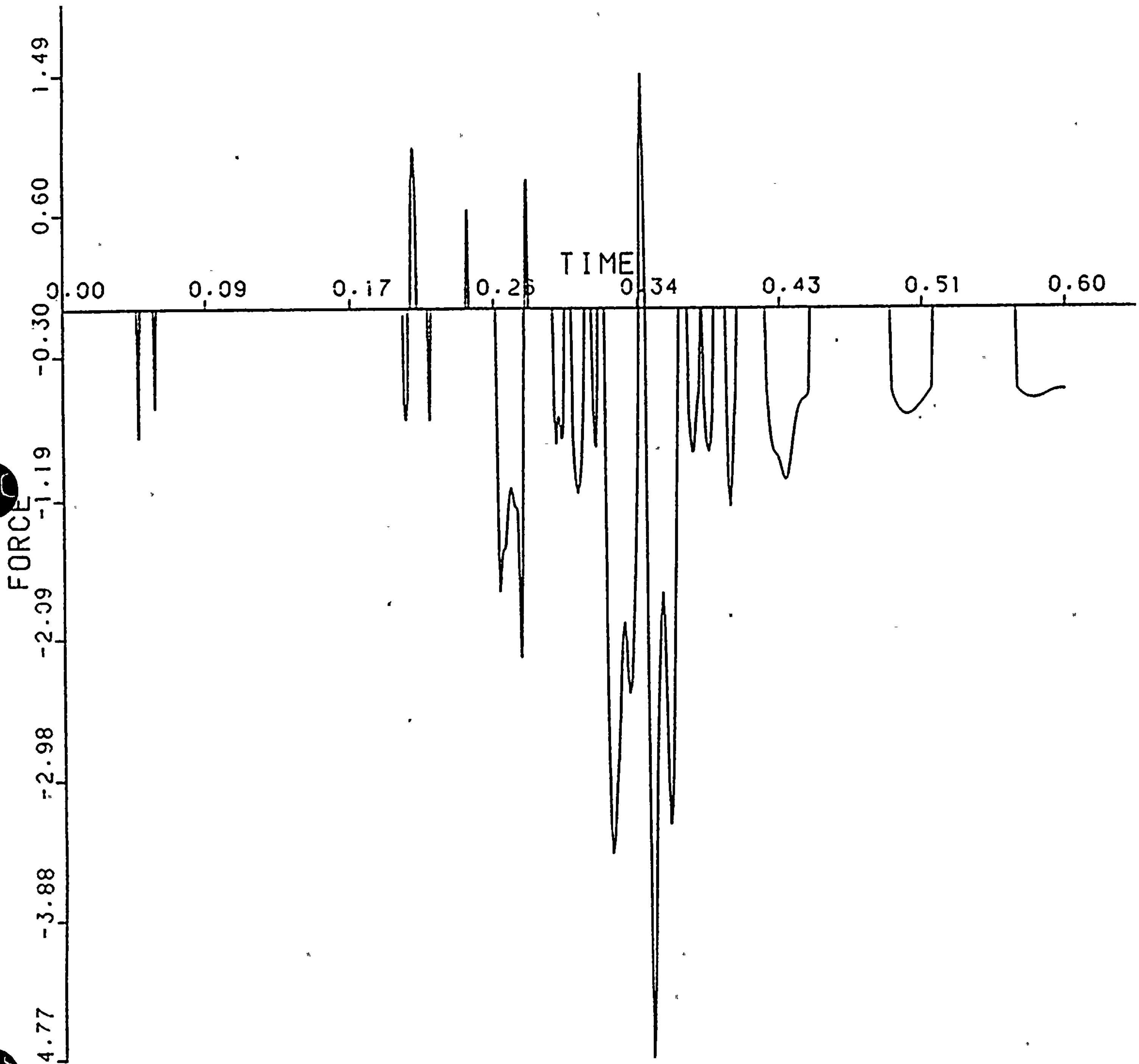


DONE BY: MK DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 26. MAGNITUDE AT NODE POINT 450

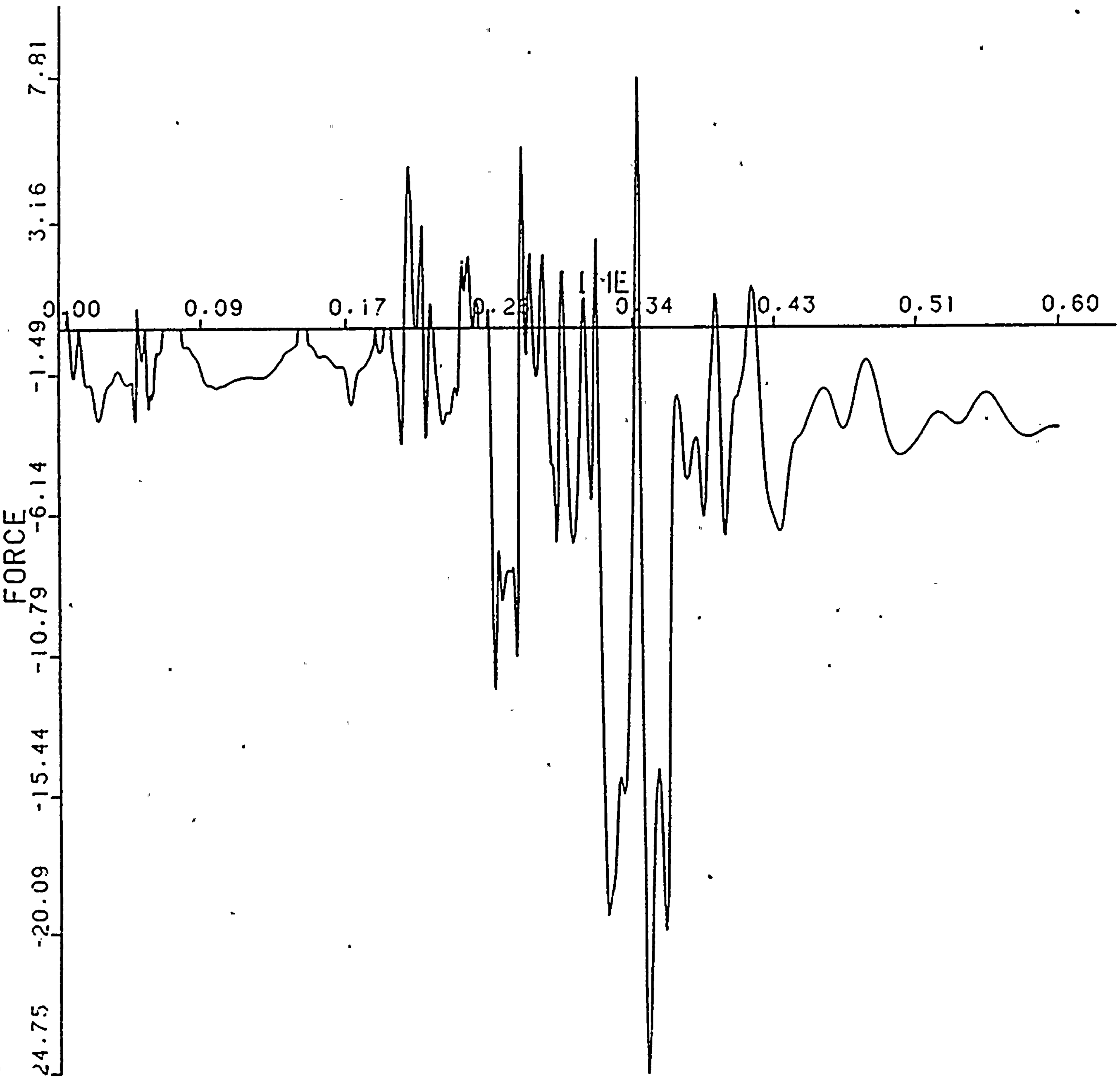


DONE BY: MK DATE: 5-12-83
CHKD BY: LL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 27. MAGNITUDE AT NODE POINT. 460



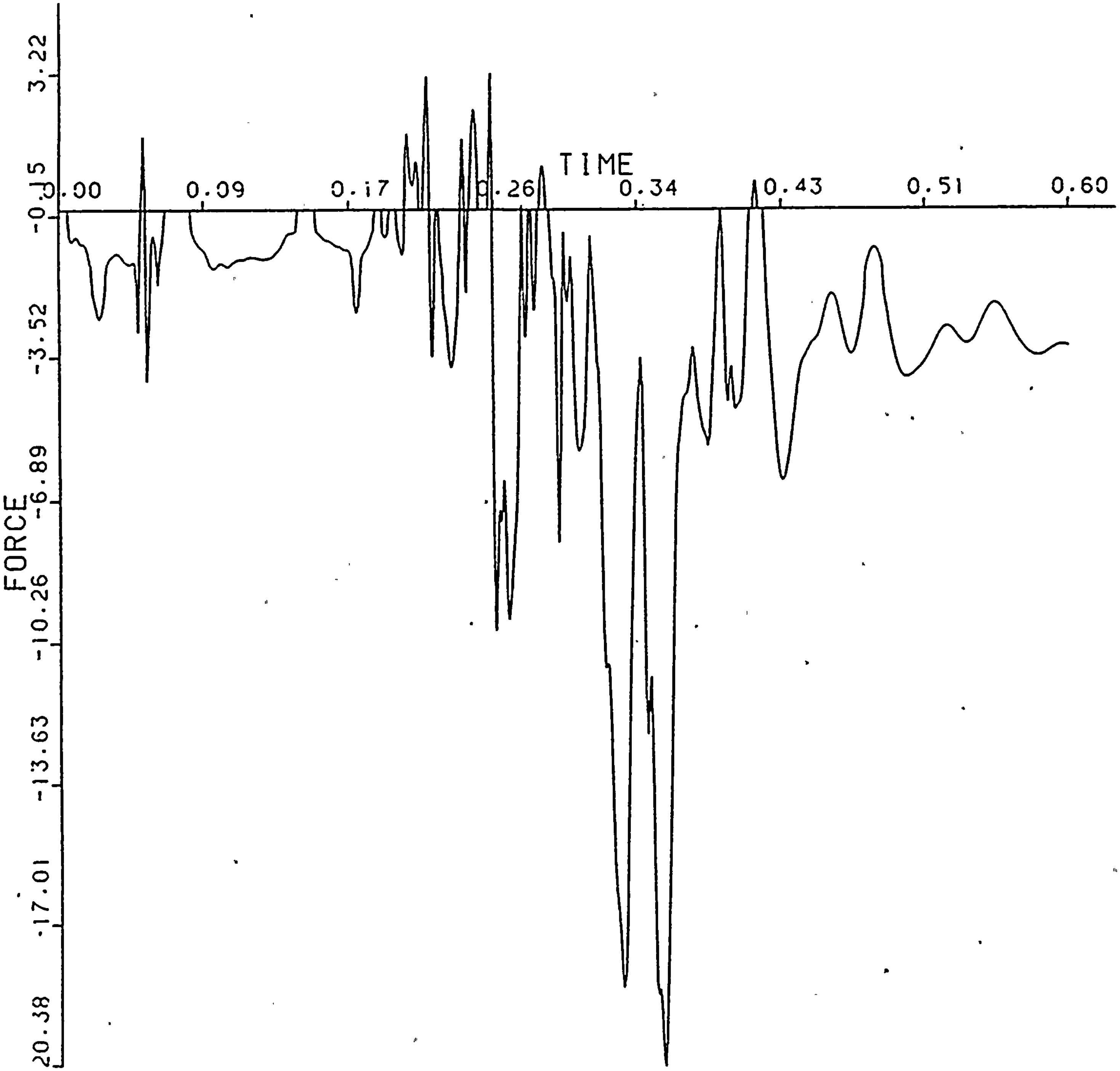
DONE BY: *MK* DATE: *5-12-83*
CHKD BY: *LL* DATE: *5-12-83*

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83

YELLOW LOOP SEAL - YELLPSL.TMP

TIME/FORCE TABLE 28. MAGNITUDE AT NODE POINT . 465

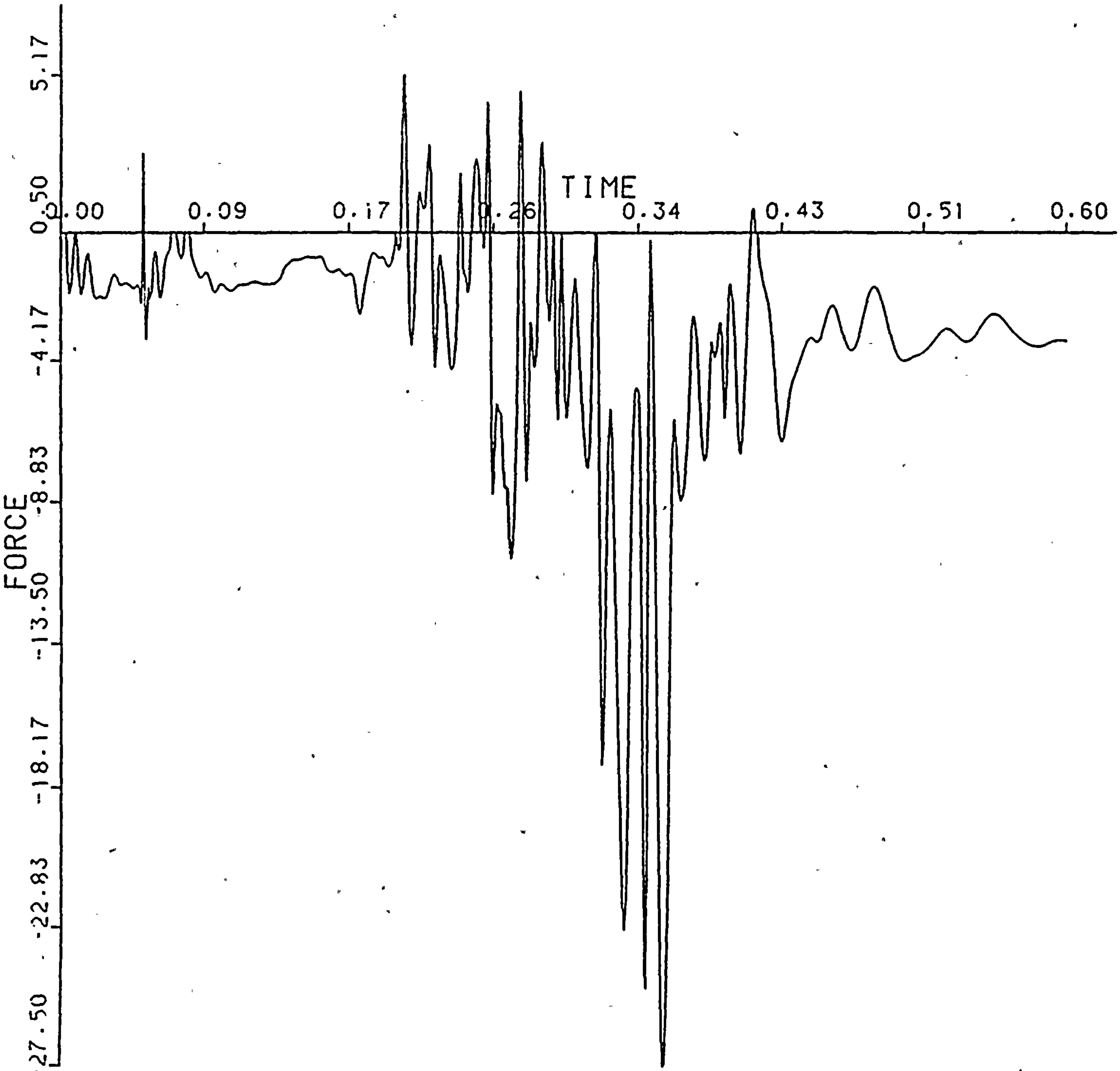


DONE BY: MR DATE: 5-12-83

CHKD BY: WW DATE: 5-12-83

TELEDYNE
ENGINEERING SERVICES

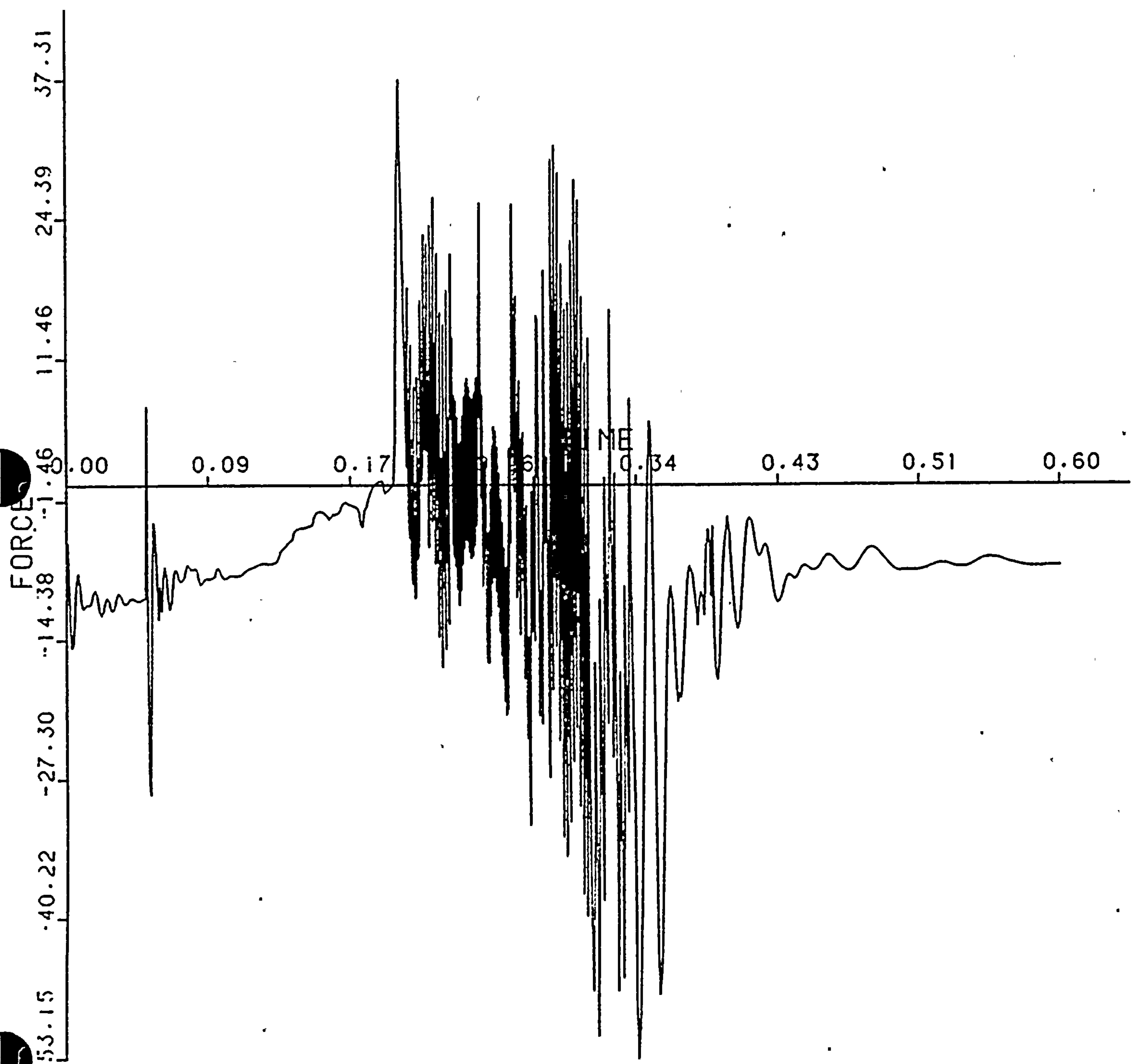
SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 29, MAGNITUDE AT NODE POINT 475



DONE BY: MK DATE: 5-12-83
CHKD BY: LL DATE: 5-12-83

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 30, MAGNITUDE AT NODE POINT 485

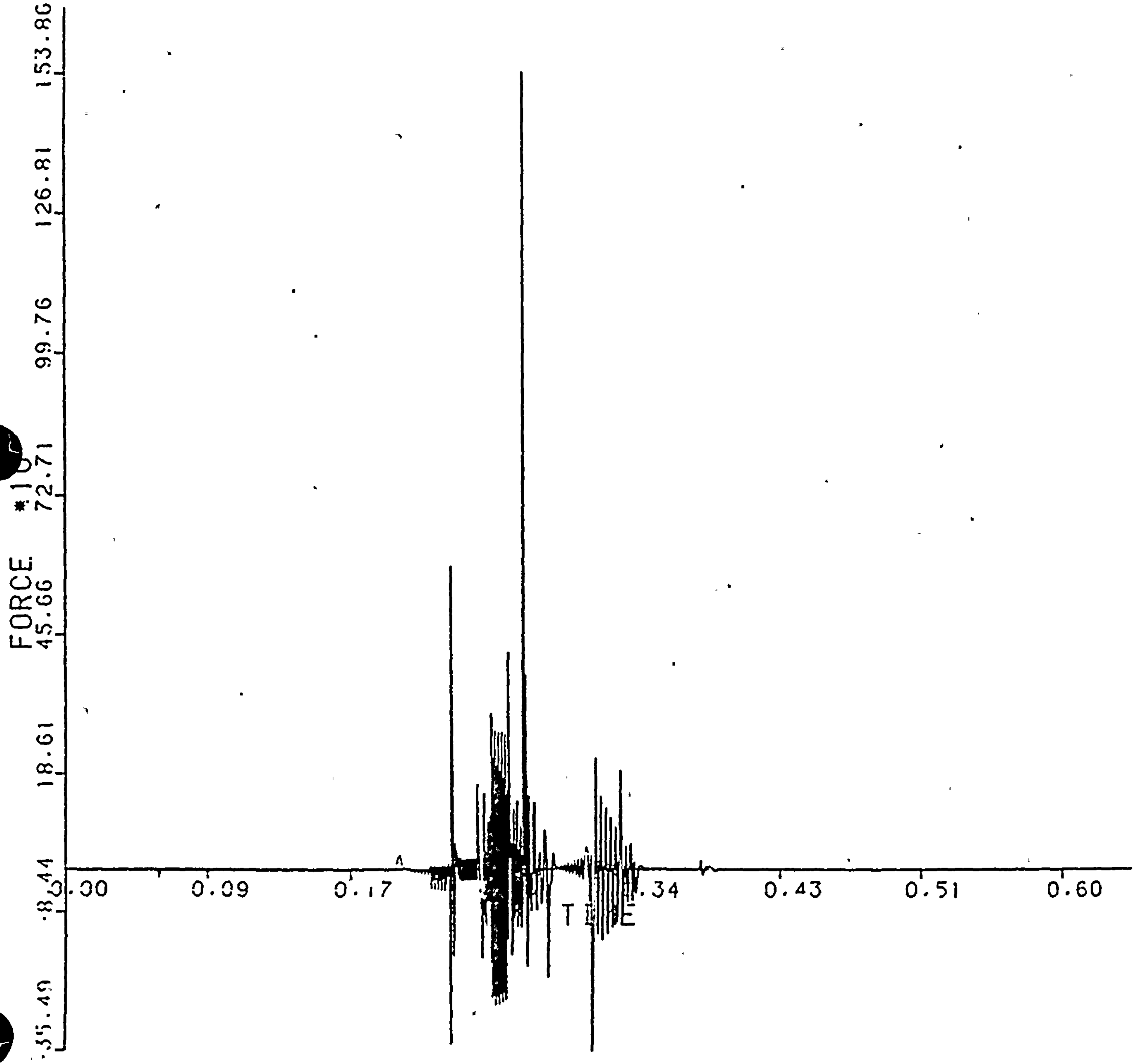


DONE BY: HK DATE: 5-12-83
CHKD BY: LL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

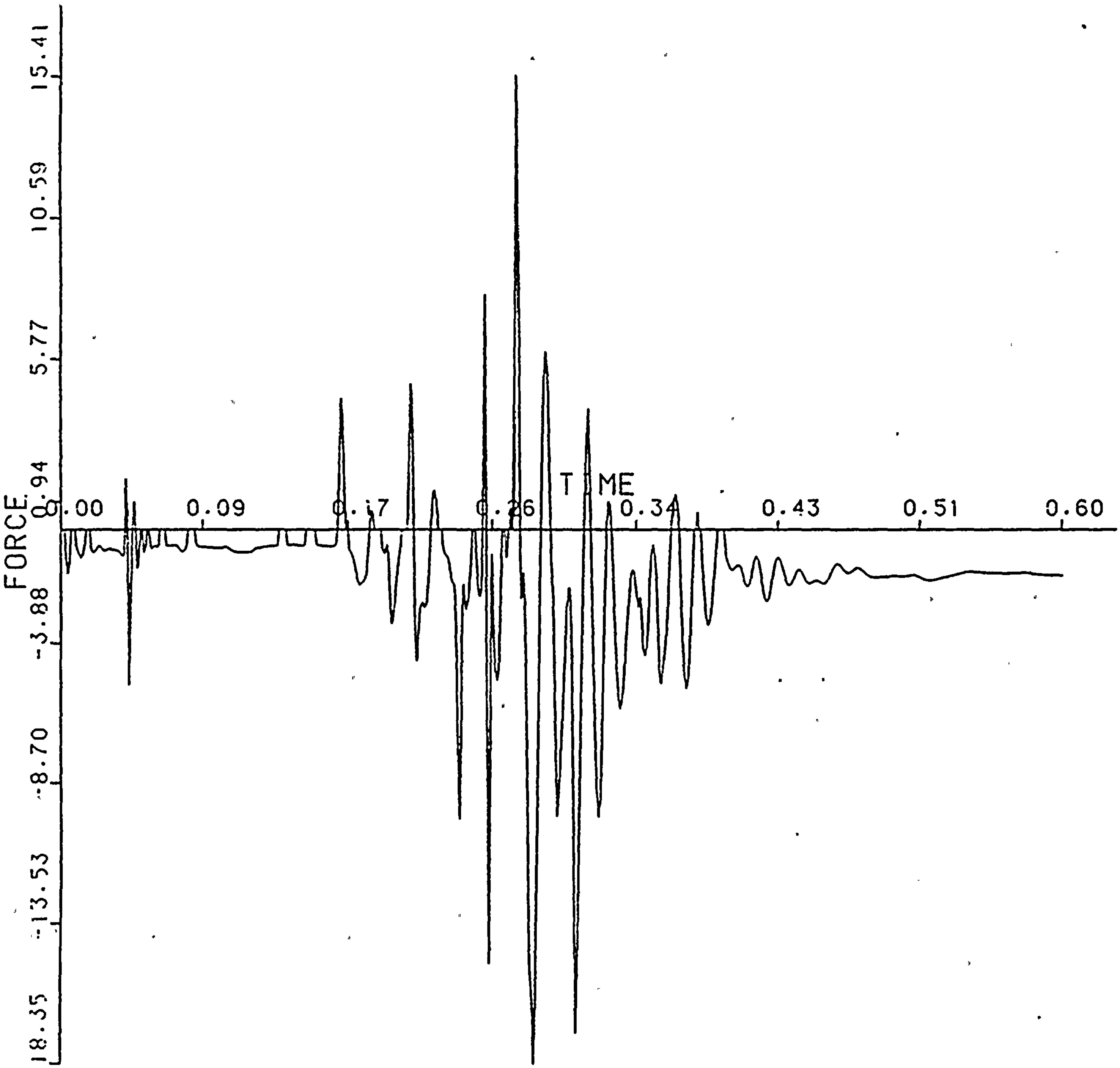
SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 31, MAGNITUDE AT NODE POINT 529



DONE BY: MC DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 32, MAGNITUDE AT NODE POINT 665

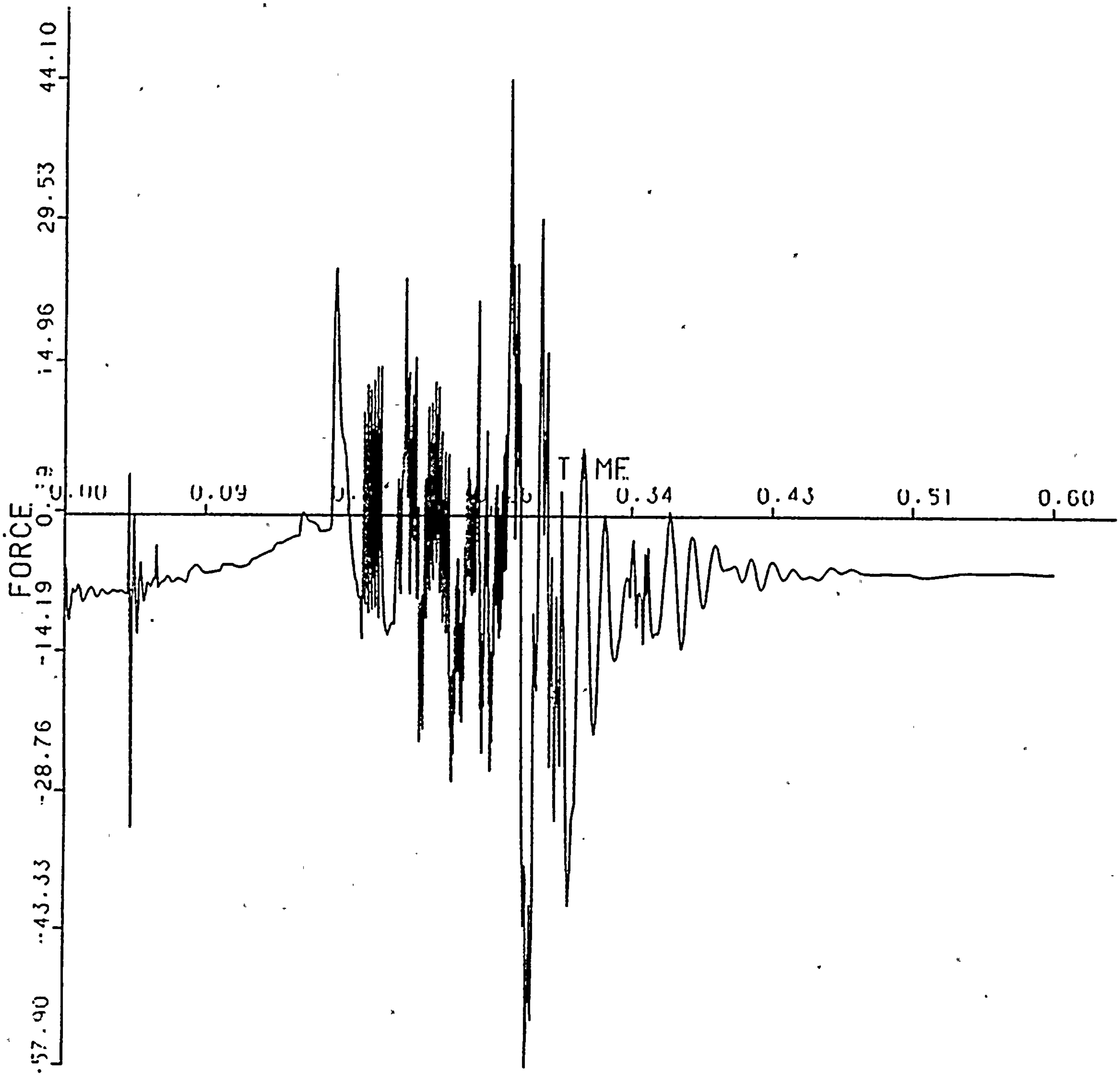


DONE BY: MK DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

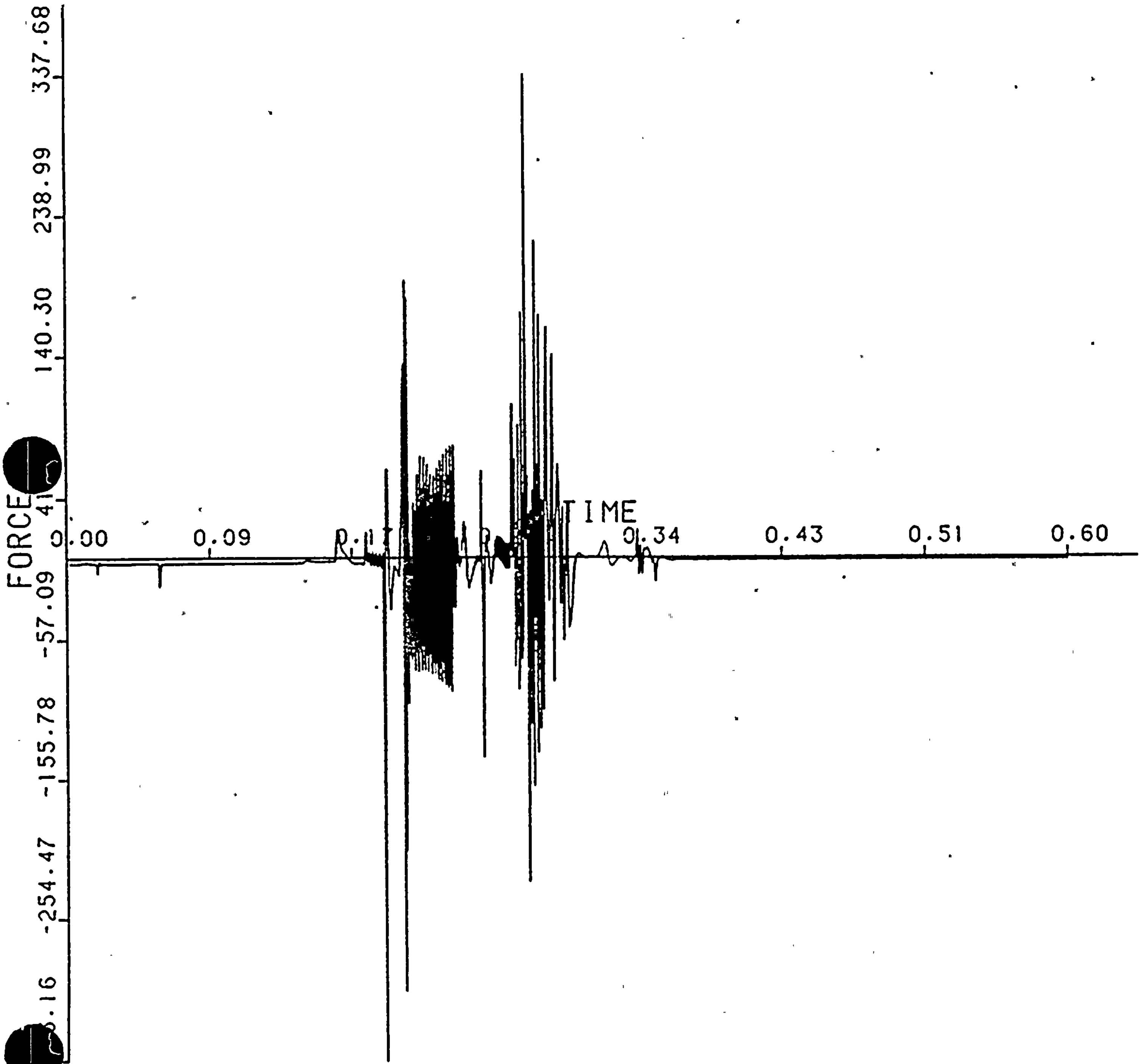
SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 33. MAGNITUDE AT NODE POINT 657



DONE BY: MR DATE: 5-12-83
CHKD BY: WL DATE: 5-12-83

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 34, MAGNITUDE AT NODE POINT 620

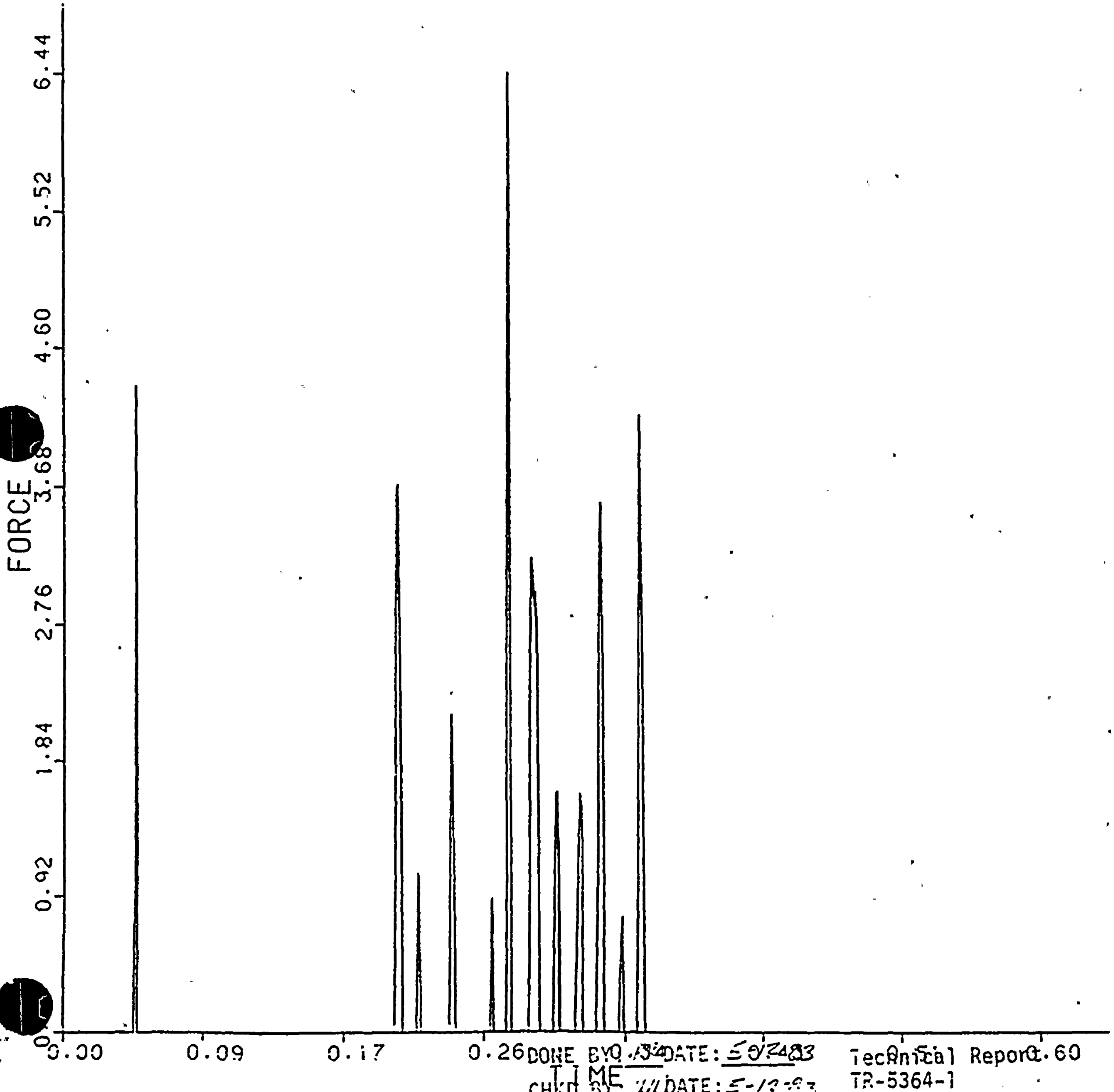


DONE BY: HR DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

Tecnnical Report
TR-5364-1
Revision 0

WILLDINE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 35. MAGNITUDE AT NODE POINT 431

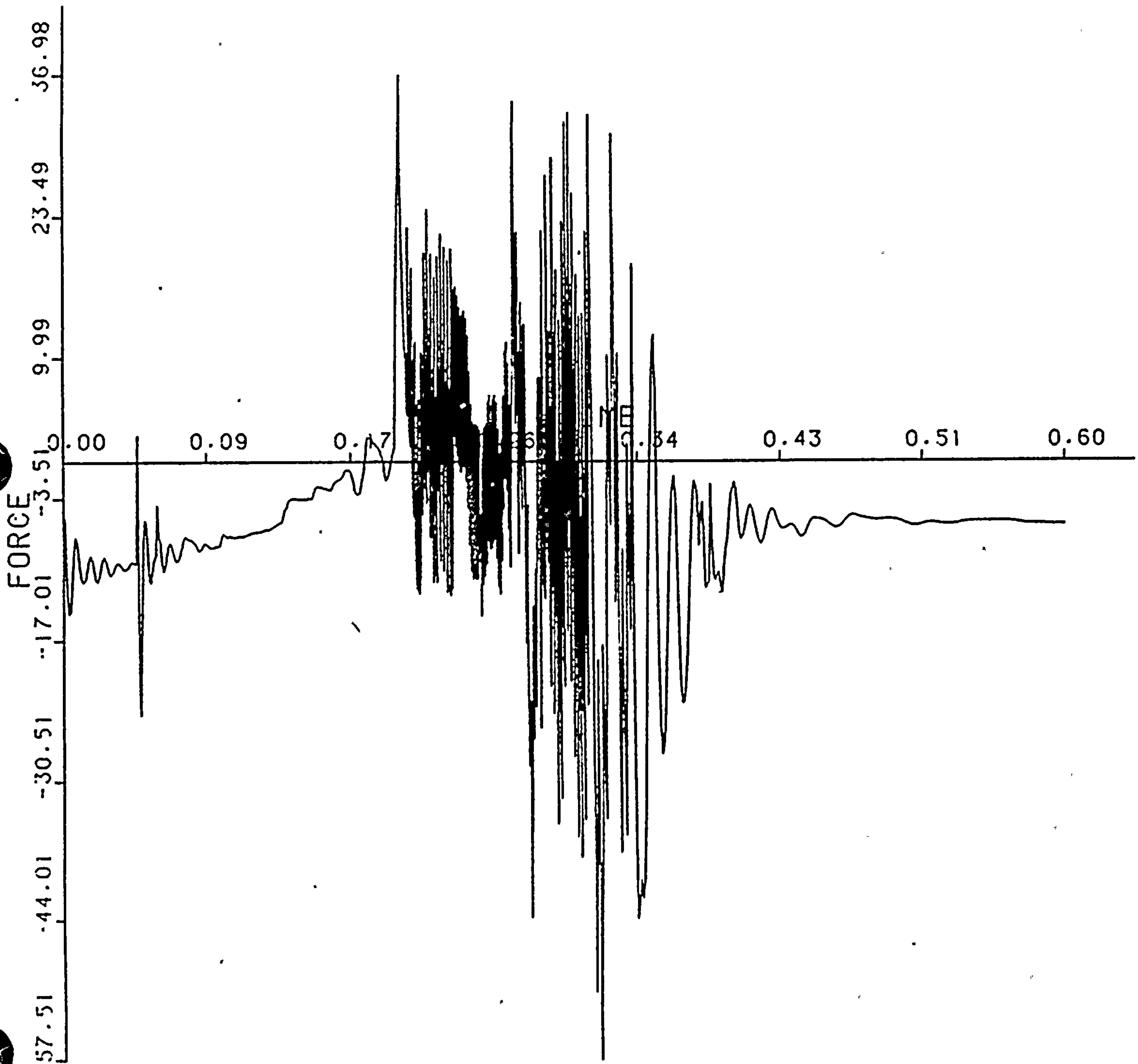


DONE BY: DATE: 5/12/83
CHKD BY: DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 36, MAGNITUDE AT NODE POINT 405

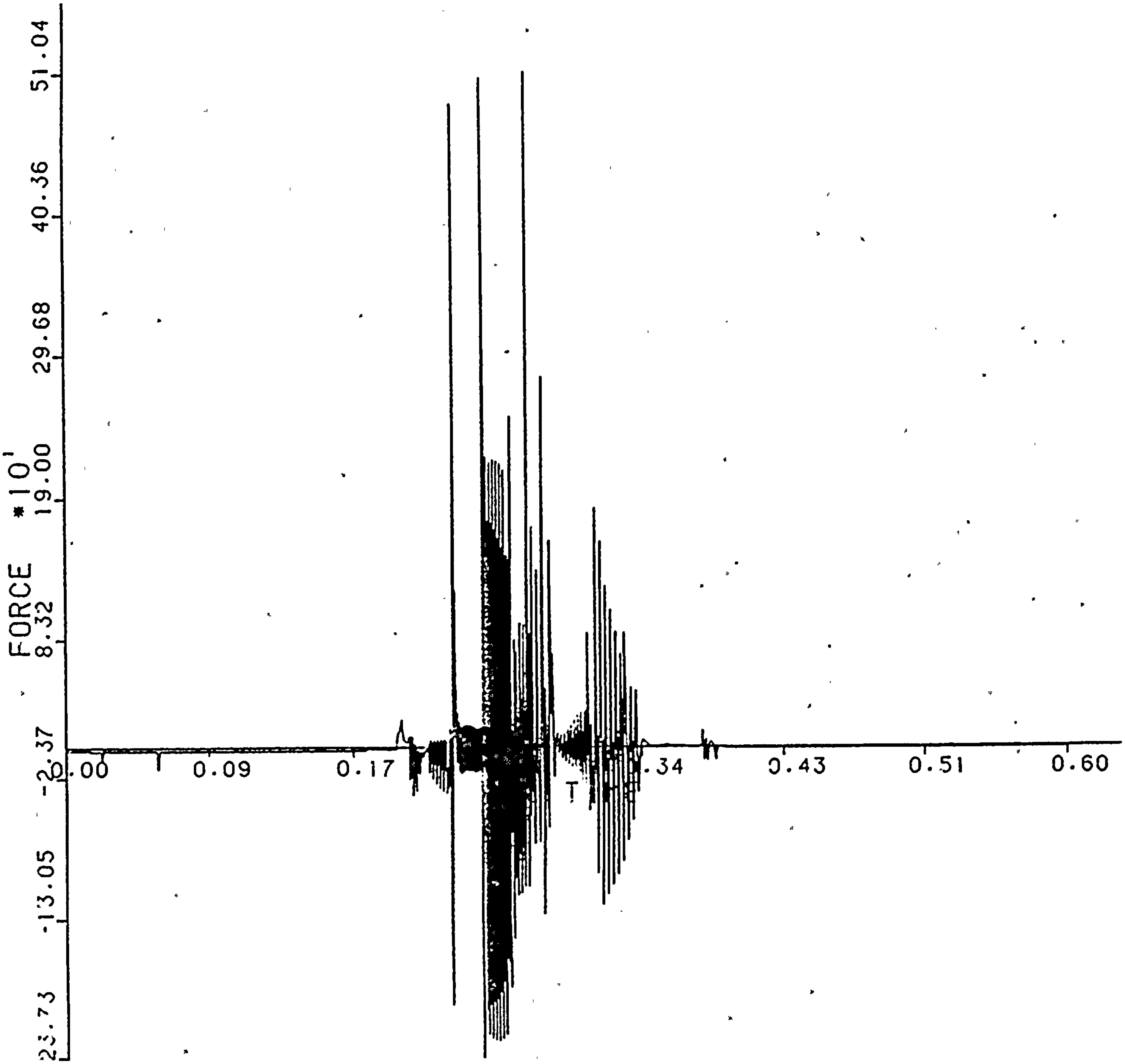


DONE BY: MIL DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

Tecnnical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 37, MAGNITUDE AT NODE POINT 382



DONE BY: ___ DATE: 5-12-83
CHKD BY: ___ DATE: 5-12-83

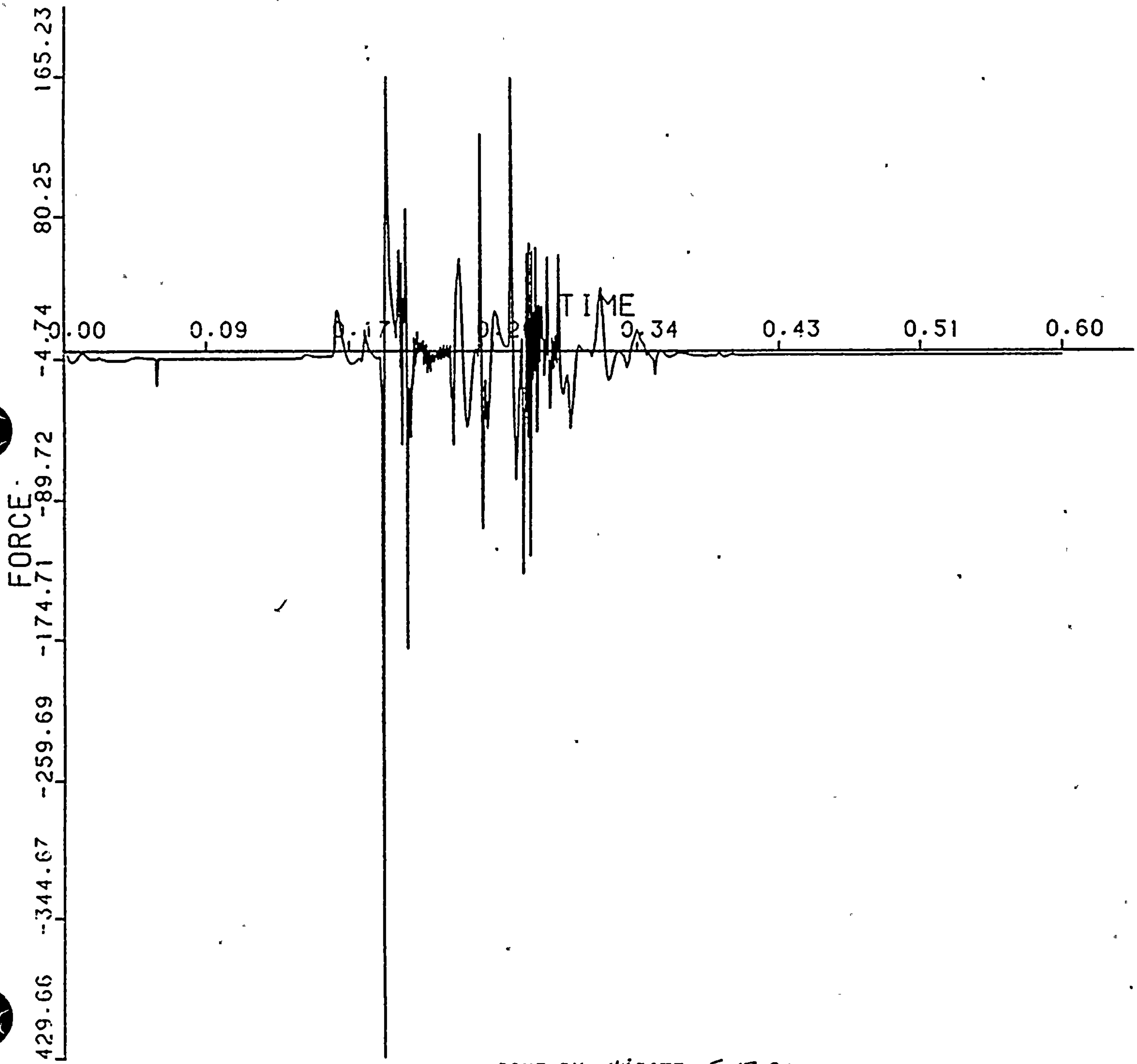
Tecnnical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364   12 MAY 83

YELLOW LOOP SEAL   YELLPSL.IMP

TIME/FORCE TABLE   38. MAGNITUDE AT NODE POINT   610

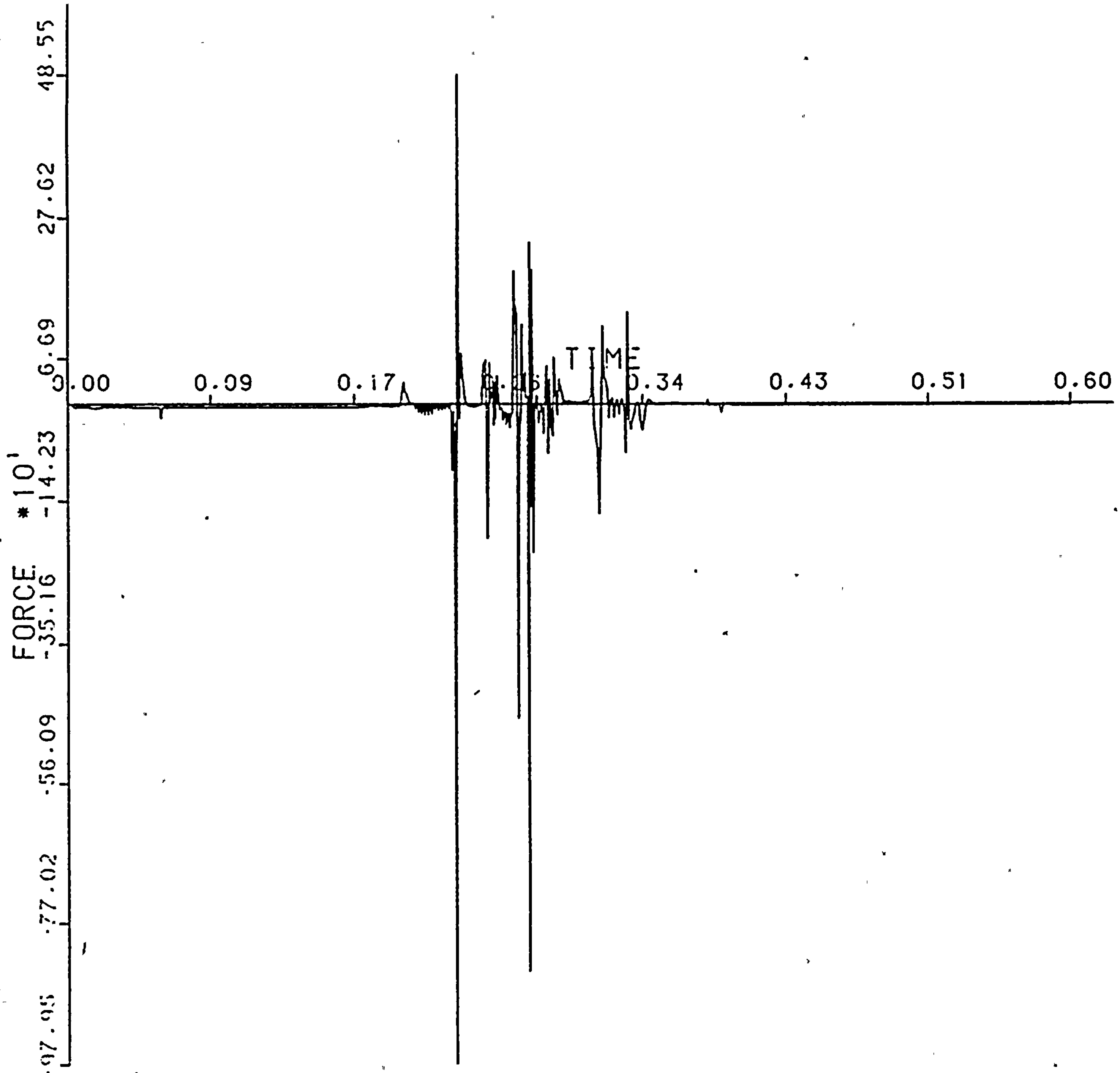


DONE BY: AK DATE: 5-12-83
CHKD BY: AK DATE: 5-12-83

Tecnnical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 39, MAGNITUDE AT NODE POINT 535

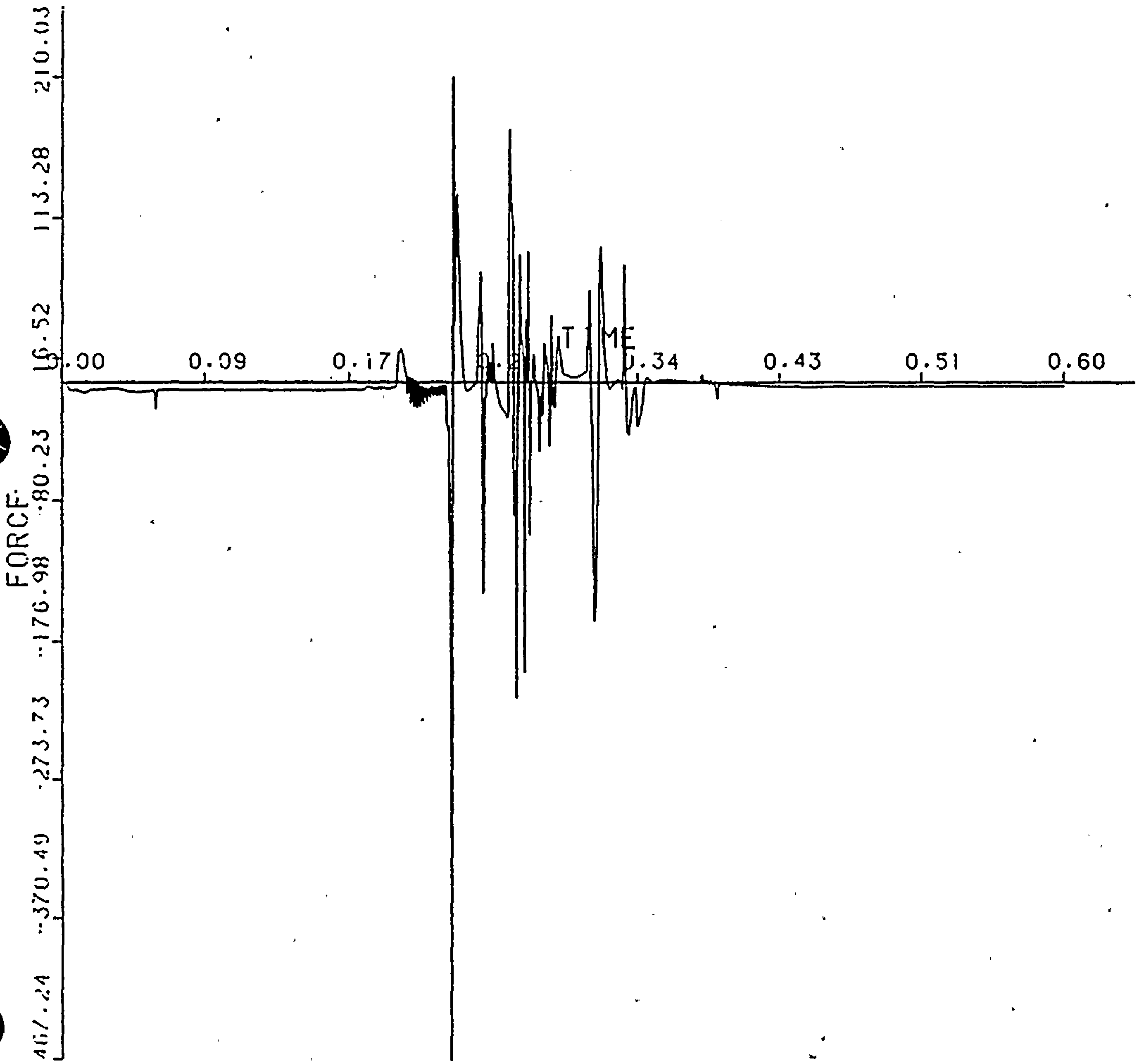


DONE BY: MG DATE: 5-12-83
CHKD BY: AA DATE: 5-12-83

Tecnnical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

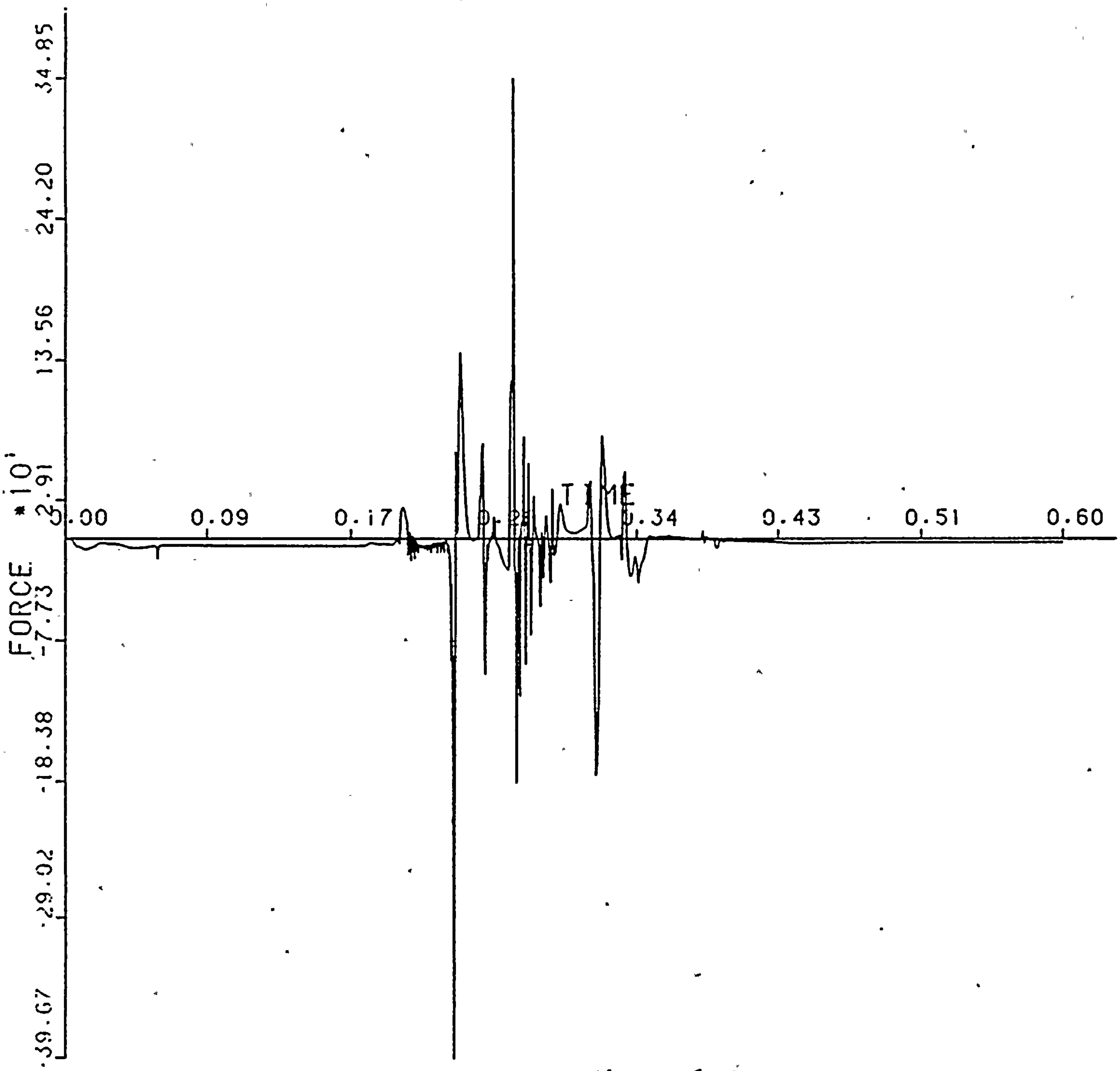
SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 40. MAGNITUDE AT NODE POINT 545



DONE BY: MK DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 41, MAGNITUDE AT NODE POINT 550

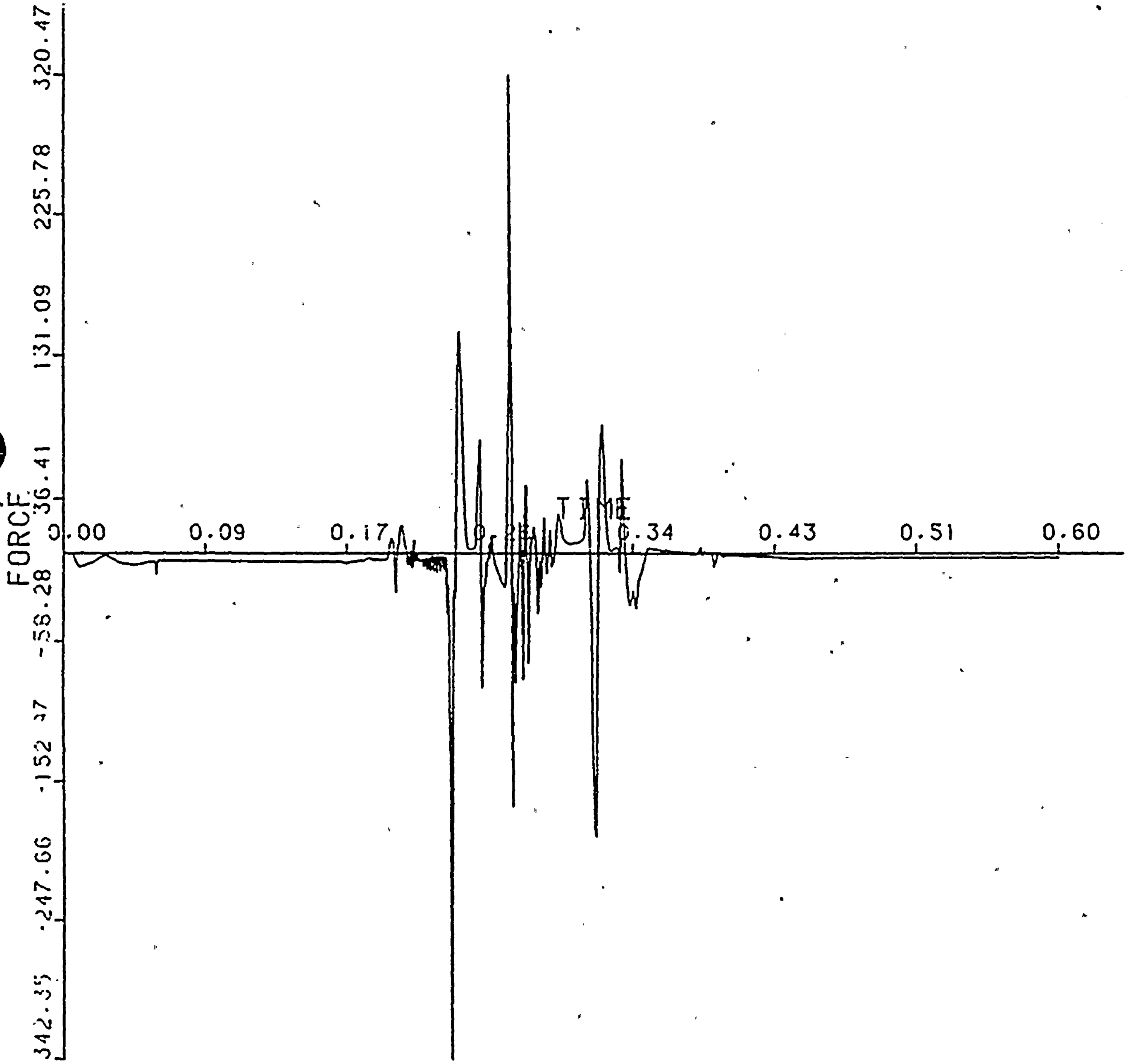


DONE BY: MR DATE: 5-12-83
CHKD BY: LL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 42, MAGNITUDE AT NODE POINT 555



DONE BY: MR DATE: 5-12-83
CHKD BY: KLL DATE: 5-12-83

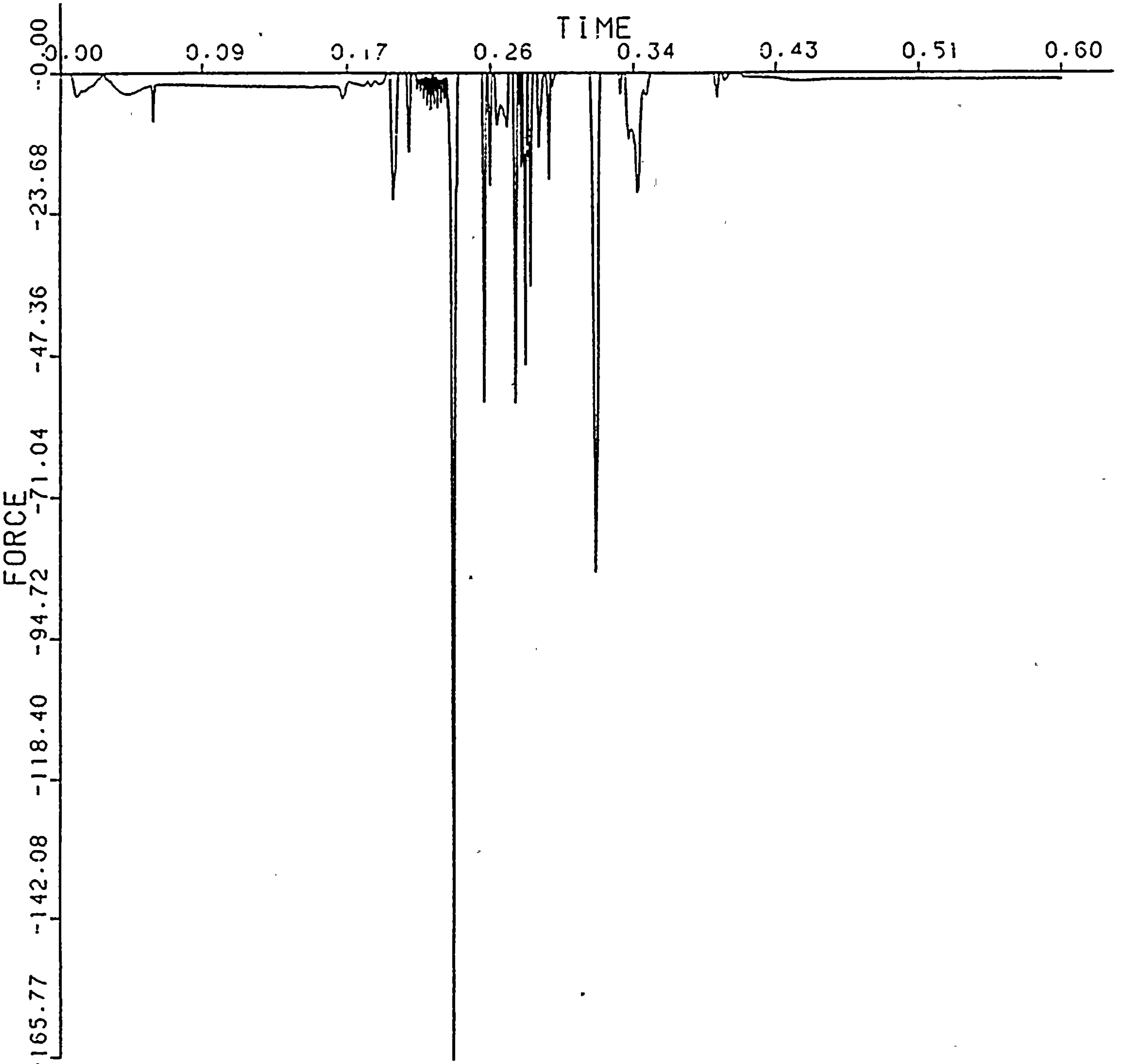
Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83

YELLOW LOOP SEAL - YELLPSL.TMP

TIME/FORCE TABLE 43. MAGNITUDE AT NODE POINT 560



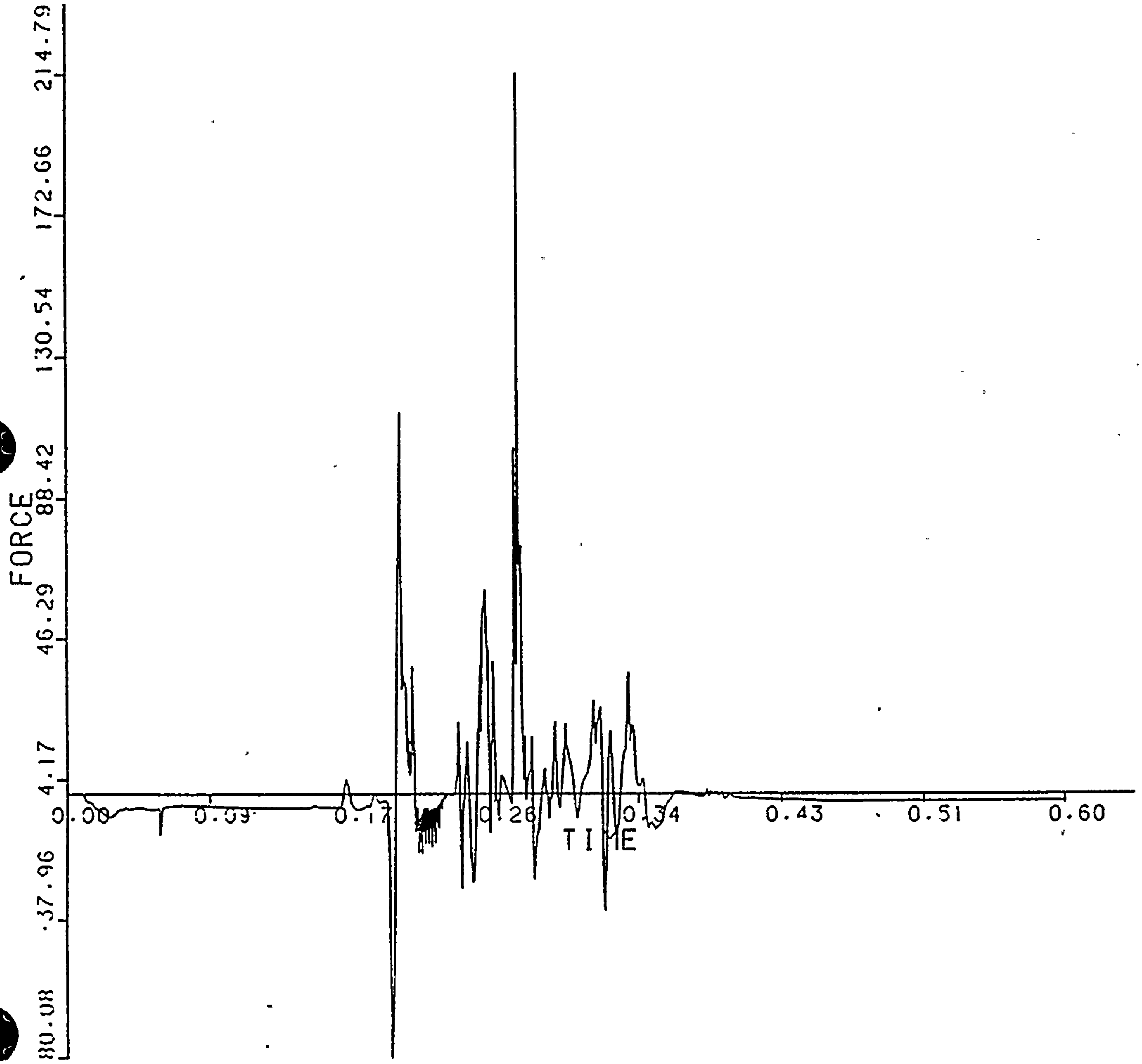
DONE BY: HK DATE: 5-12-83

CHKD BY: LL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 44, MAGNITUDE AT NODE POINT 300



DONE BY: HL DATE: 5-12-83
CHKD BY: LL DATE: 5-12-83

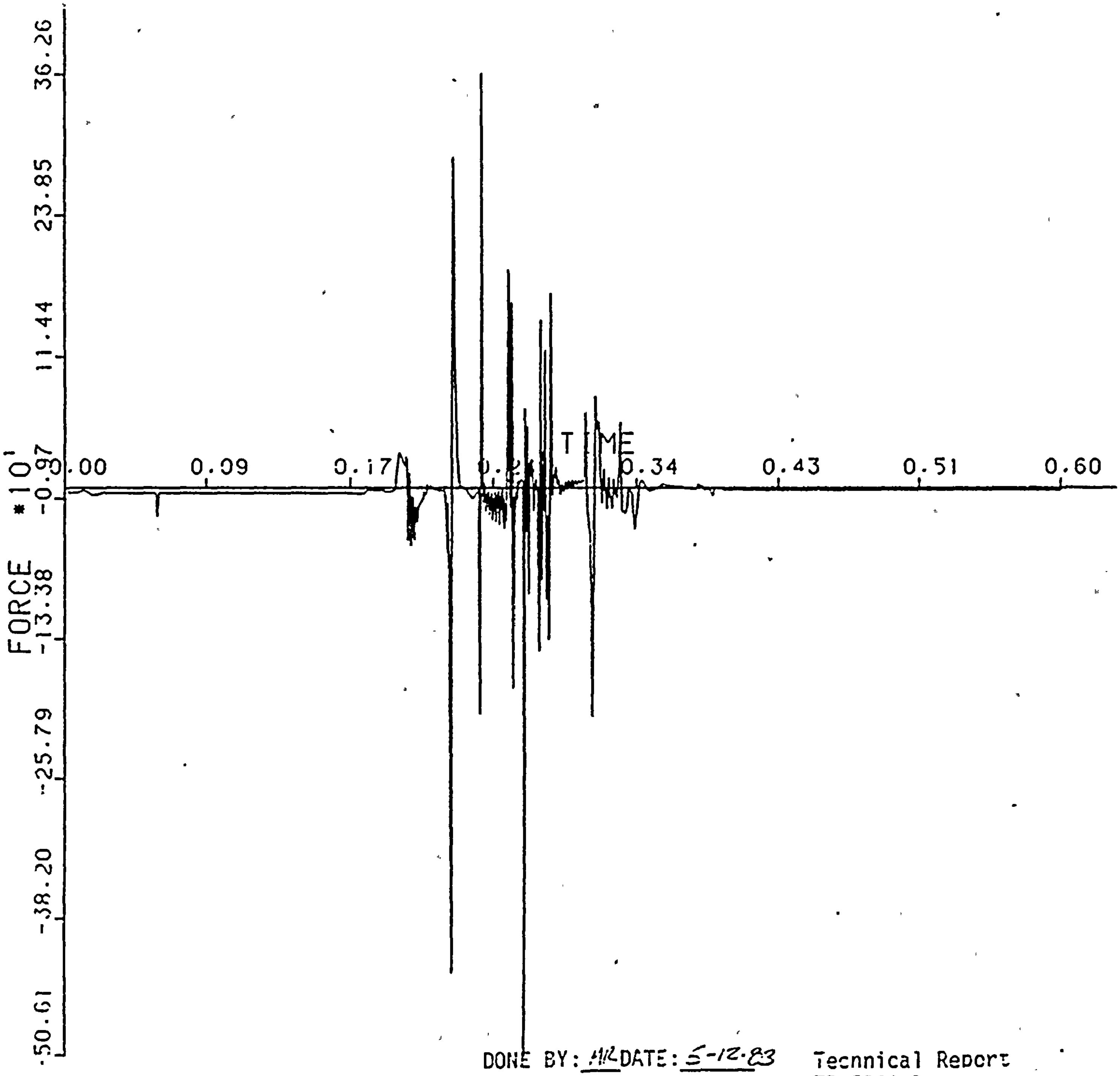
Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83

YELLOW LOOP SEAL - YELLPSL.TMP

TIME/FORCE TABLE 45. MAGNITUDE AT NODE POINT 375

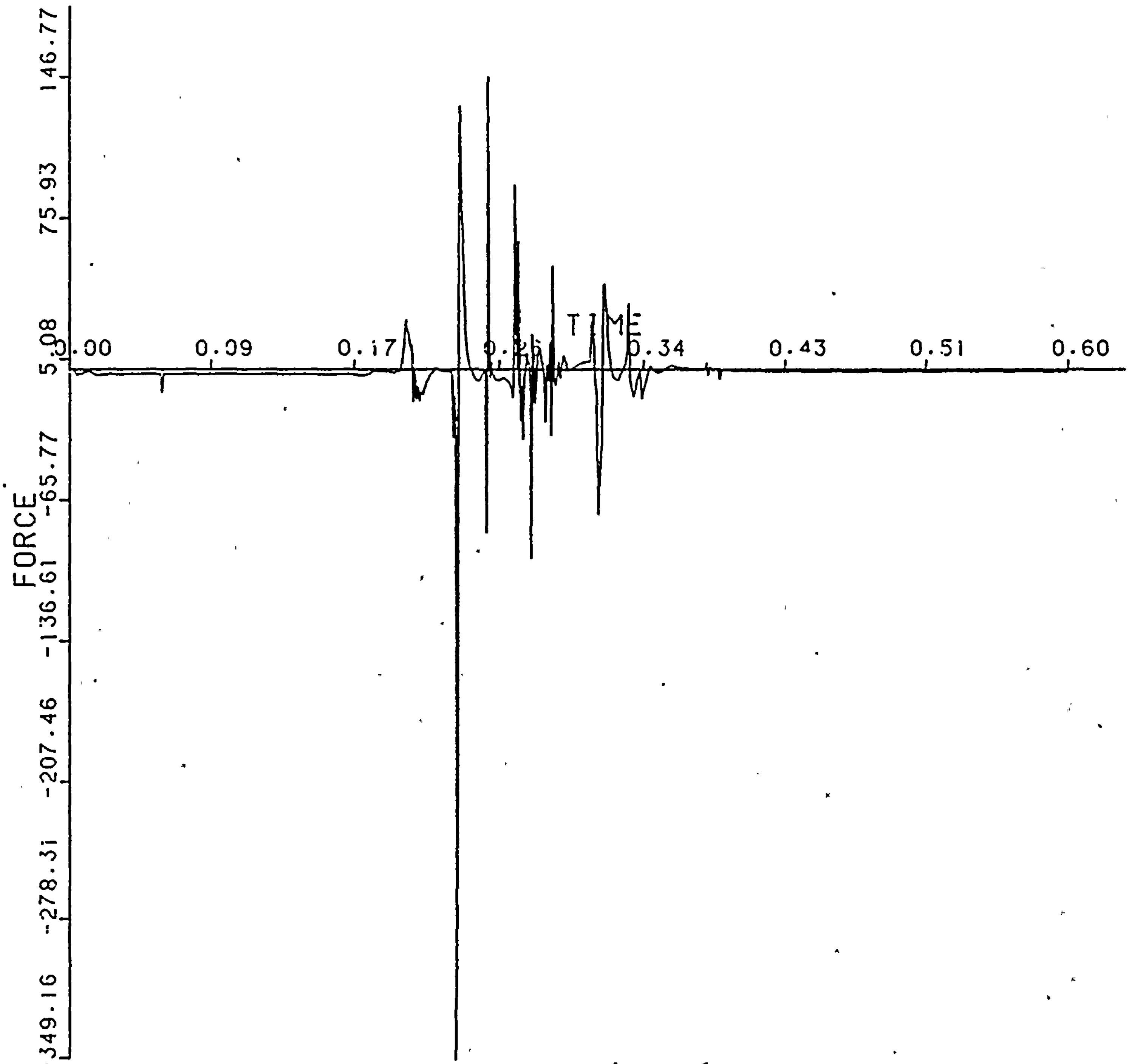


DONE BY: MR DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

Tecnical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

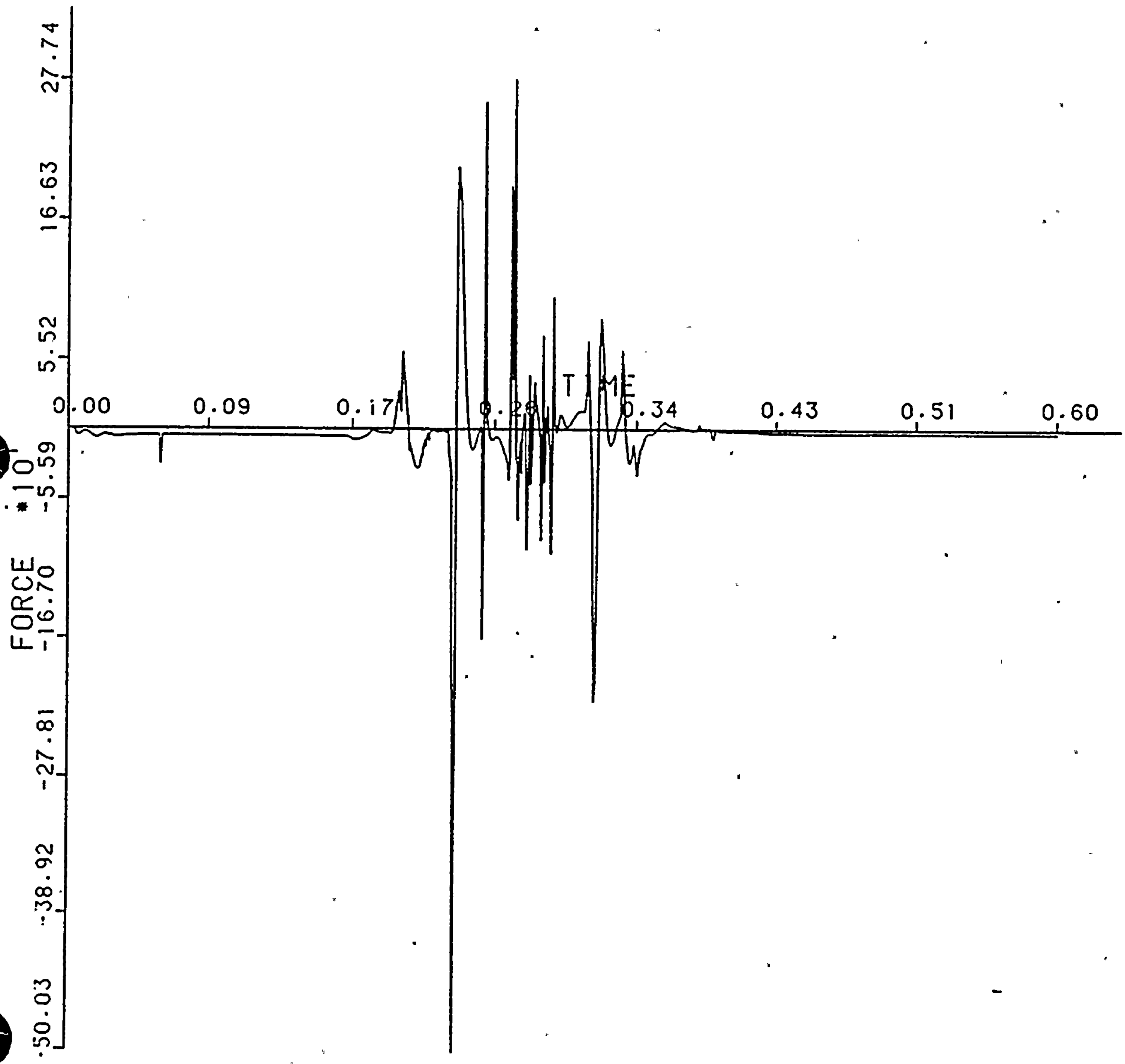
SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 46. MAGNITUDE AT NODE POINT 365



DONE BY: AIL DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE , 47, MAGNITUDE AT NODE POINT 360

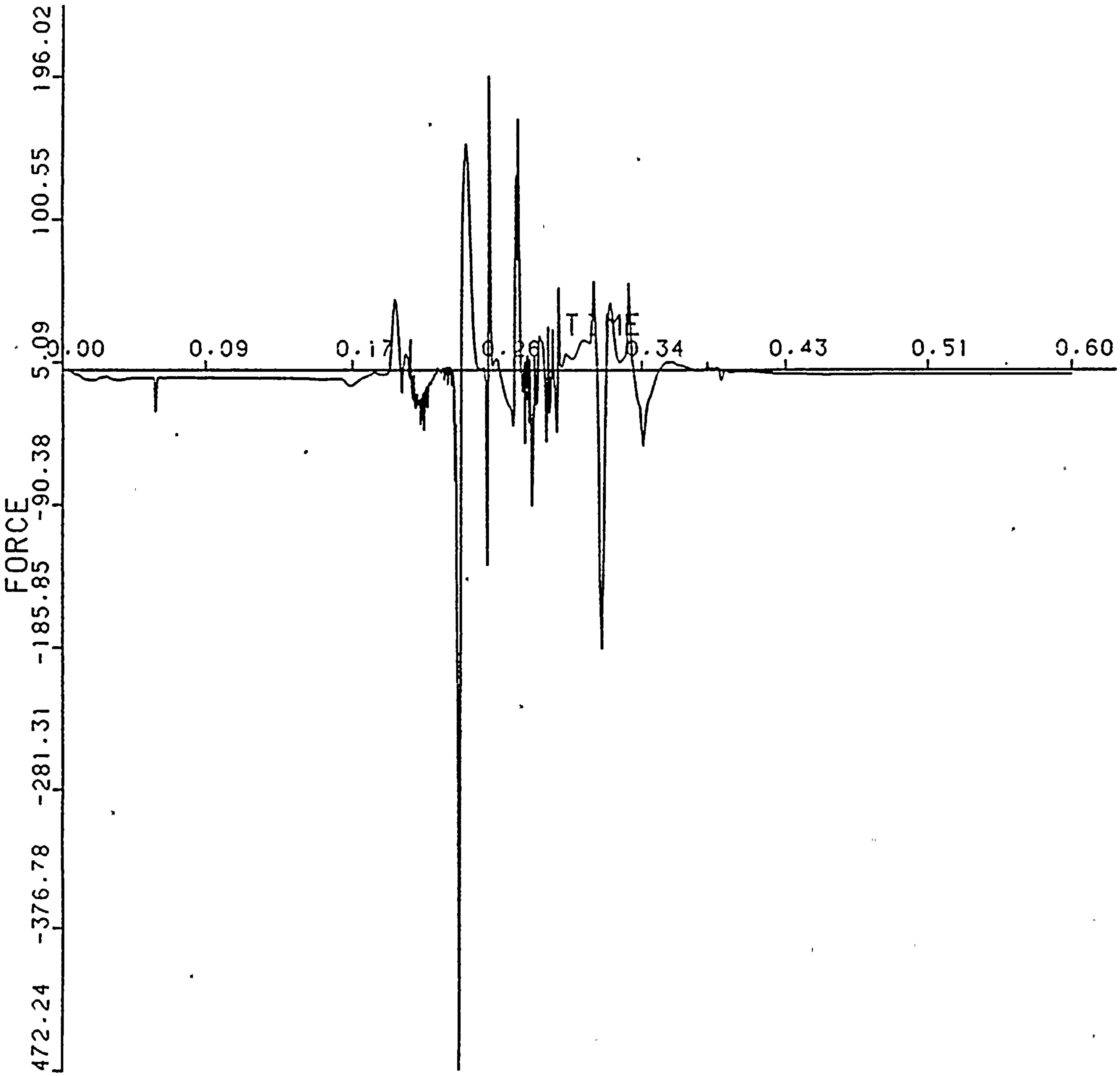


DONE BY: MR DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

Technical Report
TR-5364-1
Revision C

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 48. MAGNITUDE AT NODE POINT 355



DONE BY: MK DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

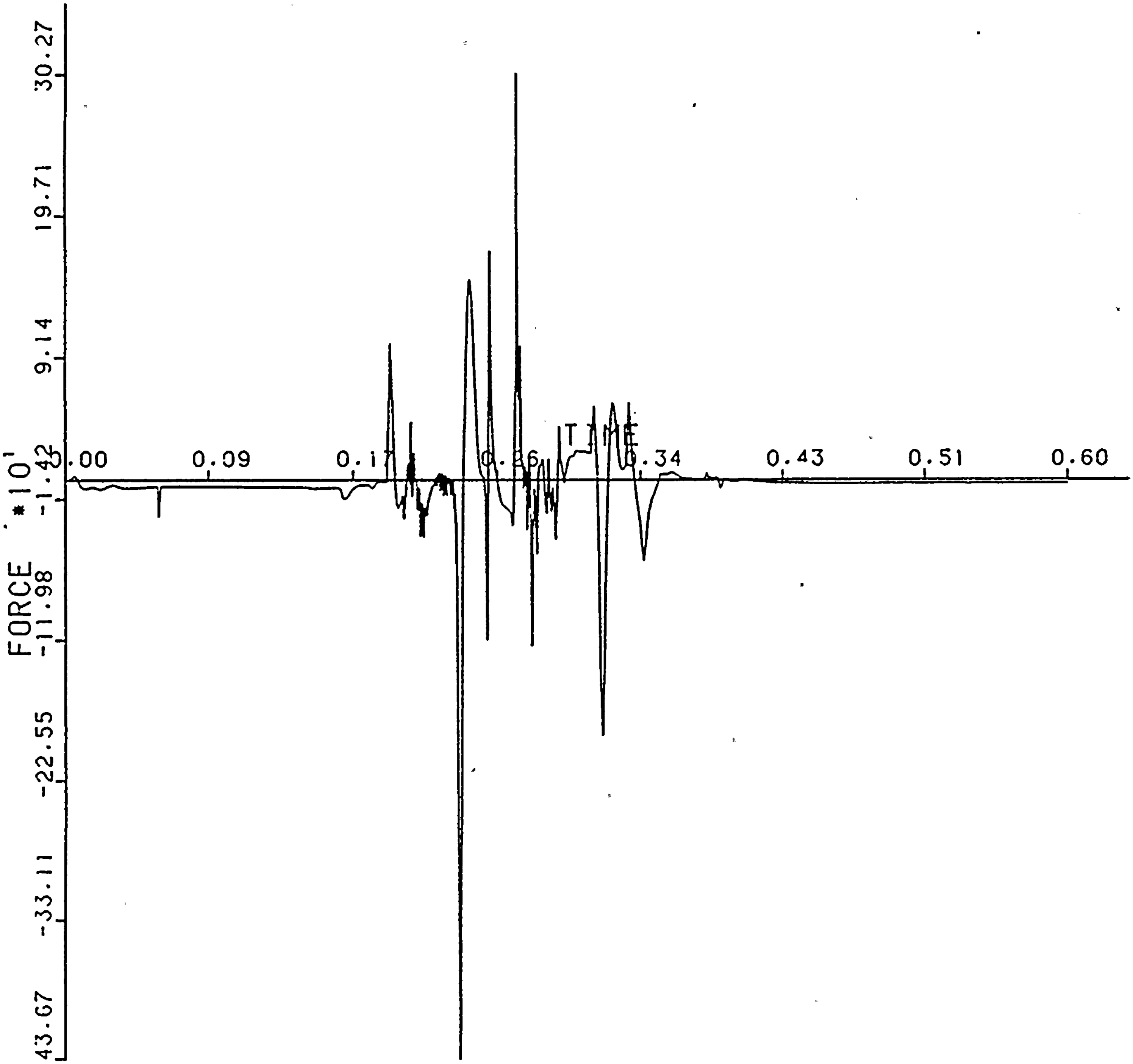
Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83

YELLOW LOOP SEAL - YELLPSL.TMP

TIME/FORCE TABLE 49, MAGNITUDE AT NODE POINT 350



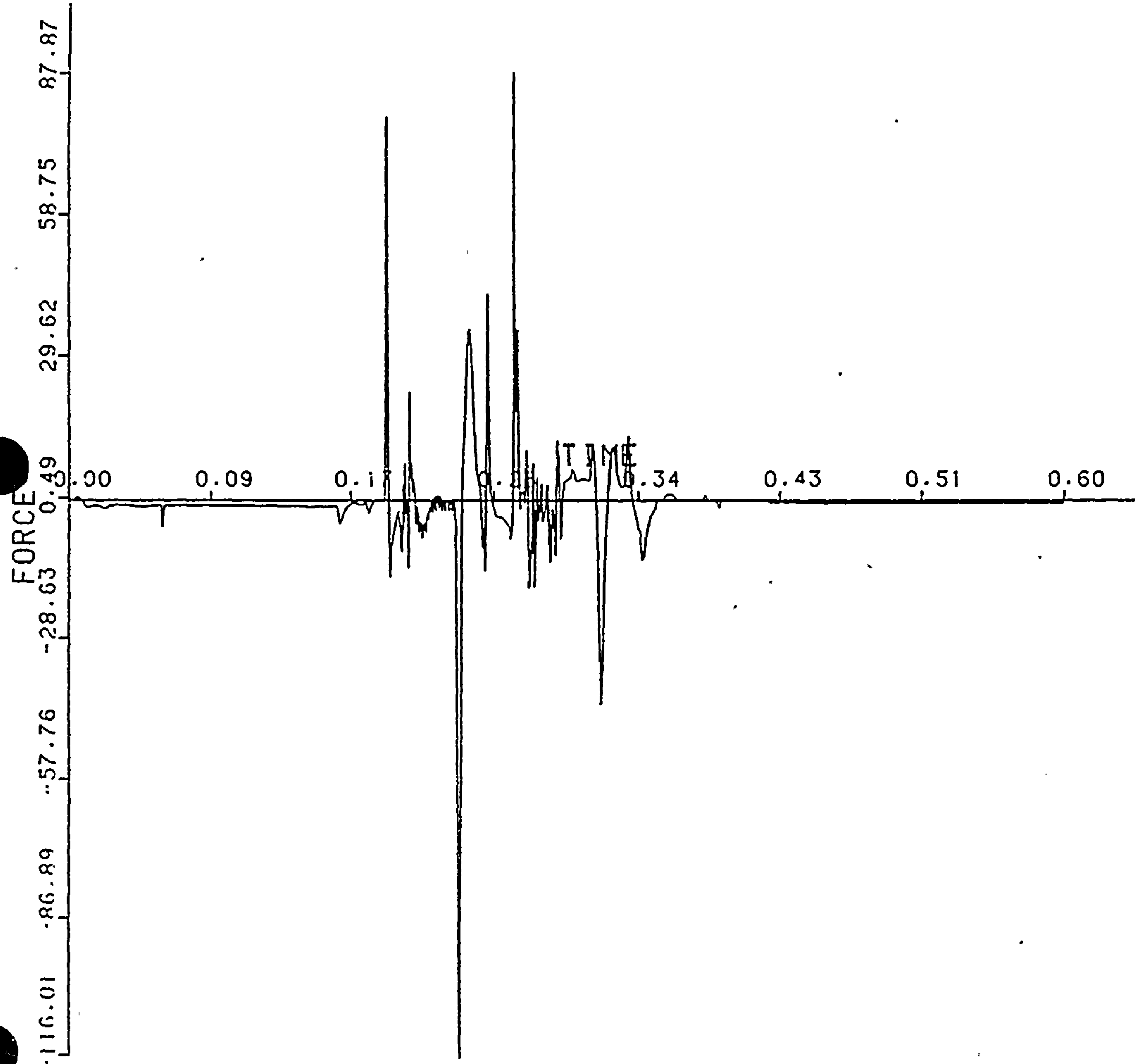
DONE BY: MR DATE: 5-12-83

CHKD BY: ULDATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 50. MAGNITUDE AT NODE POINT 340

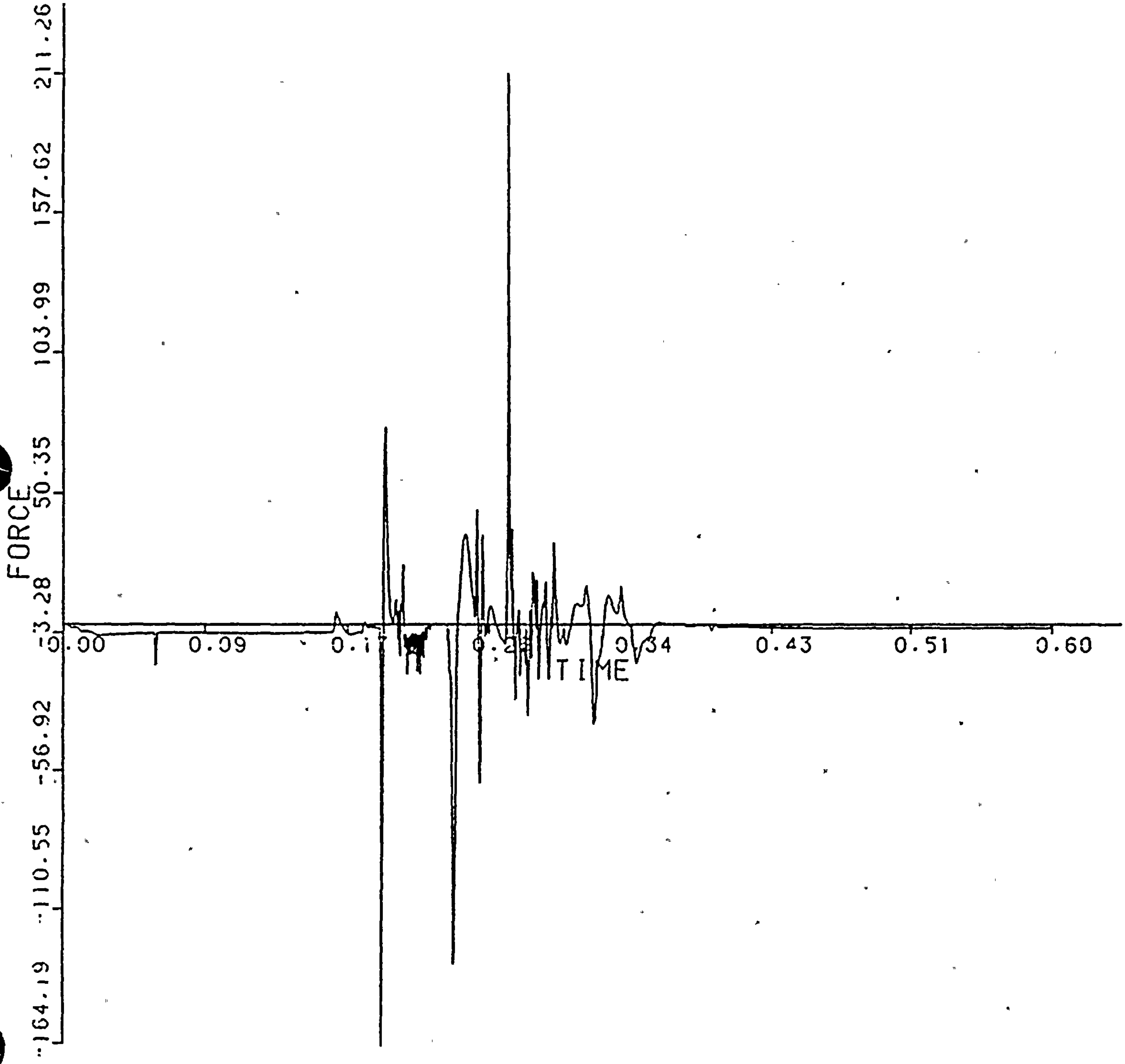


DONE BY: MC DATE: 5-12-83
CHKD BY: MC DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 51. MAGNITUDE AT NODE POINT 335

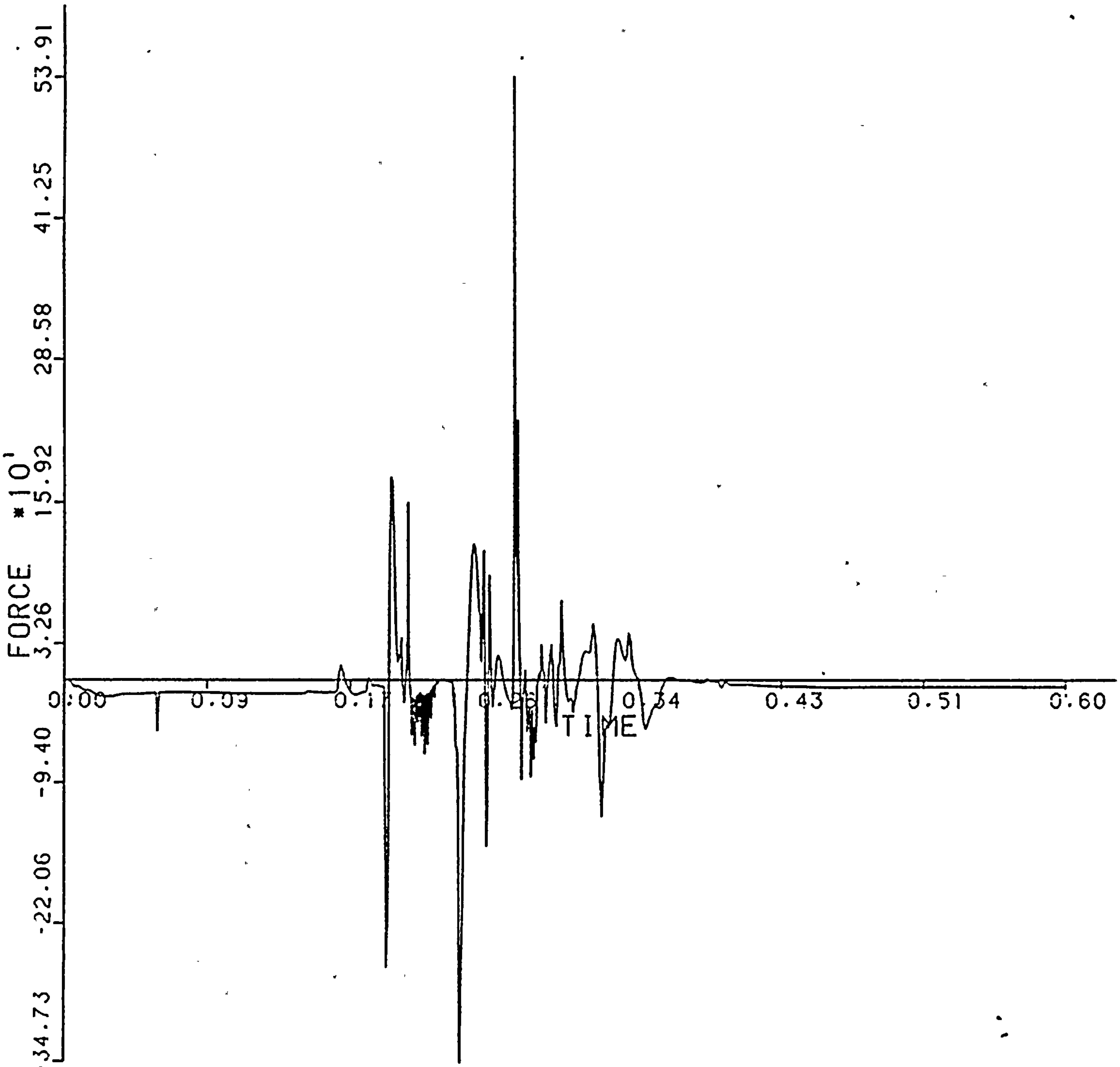


DONE BY: MK DATE: 5-12-83
CHKD BY: ULL DATE: 5-12-83

Tecnnical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE ·52, MAGNITUDE AT NODE POINT 325

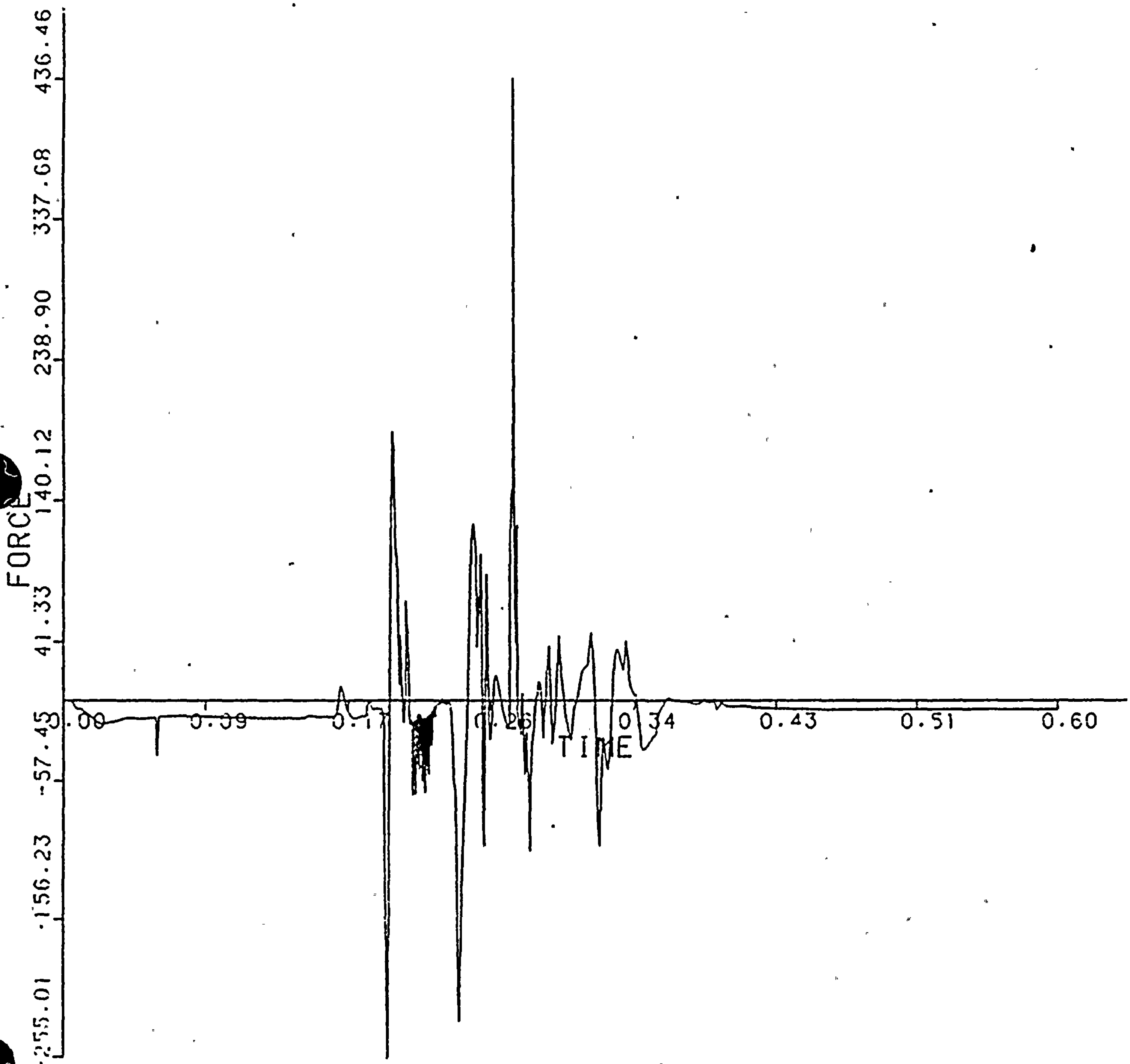


DONE BY: MR DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE '53. MAGNITUDE AT NODE POINT 320



DONE BY: MR DATE: 5-12-83
CHKD BY: ULDATE: 5-12-83

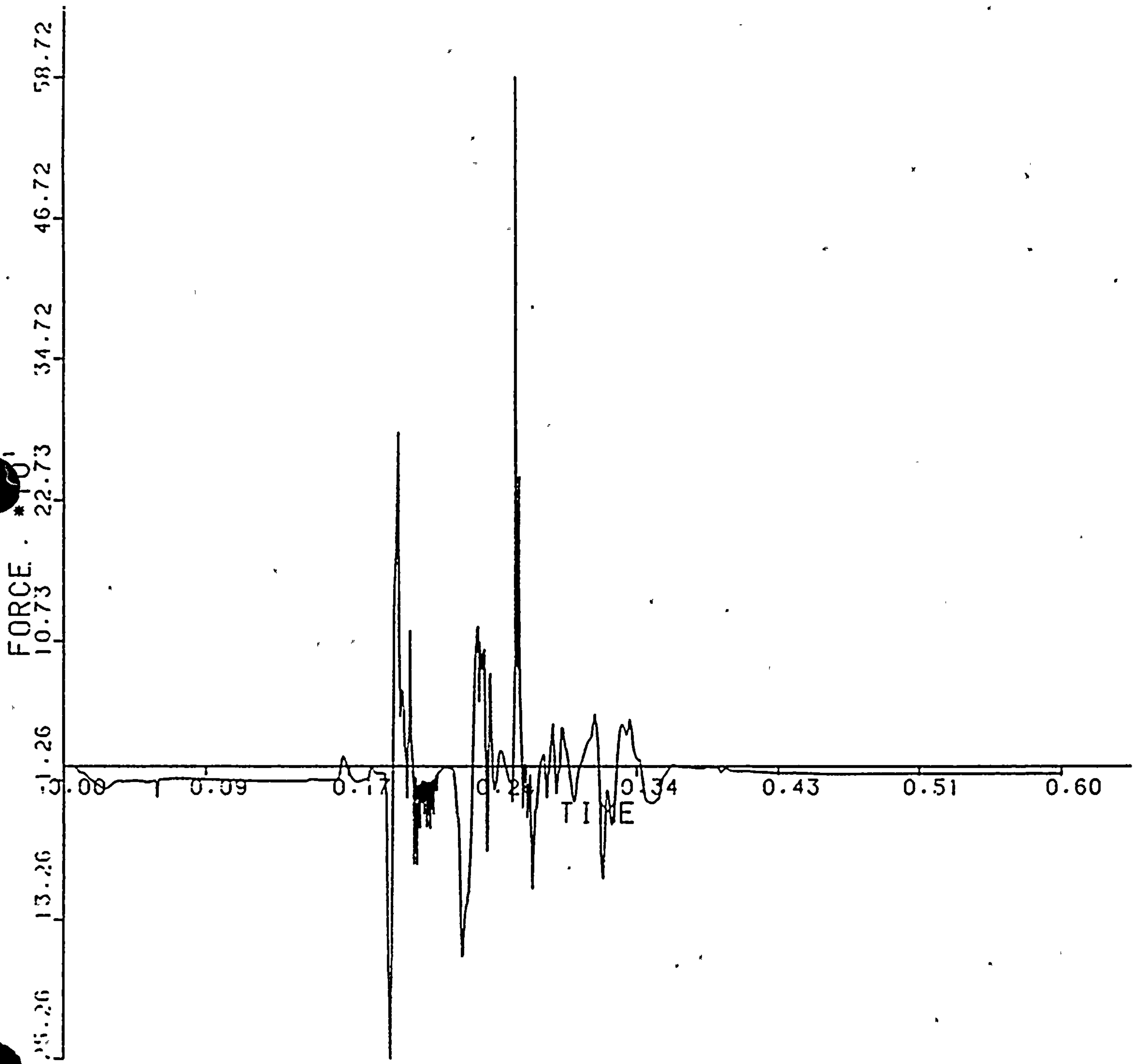
Technical Report
TR-5364-1
Revision 0

4-318 TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83

YELLOW LOOP SEAL - YELLPSL.TMP

TIME/FORCE TABLE 54, MAGNITUDE AT NODE POINT 310



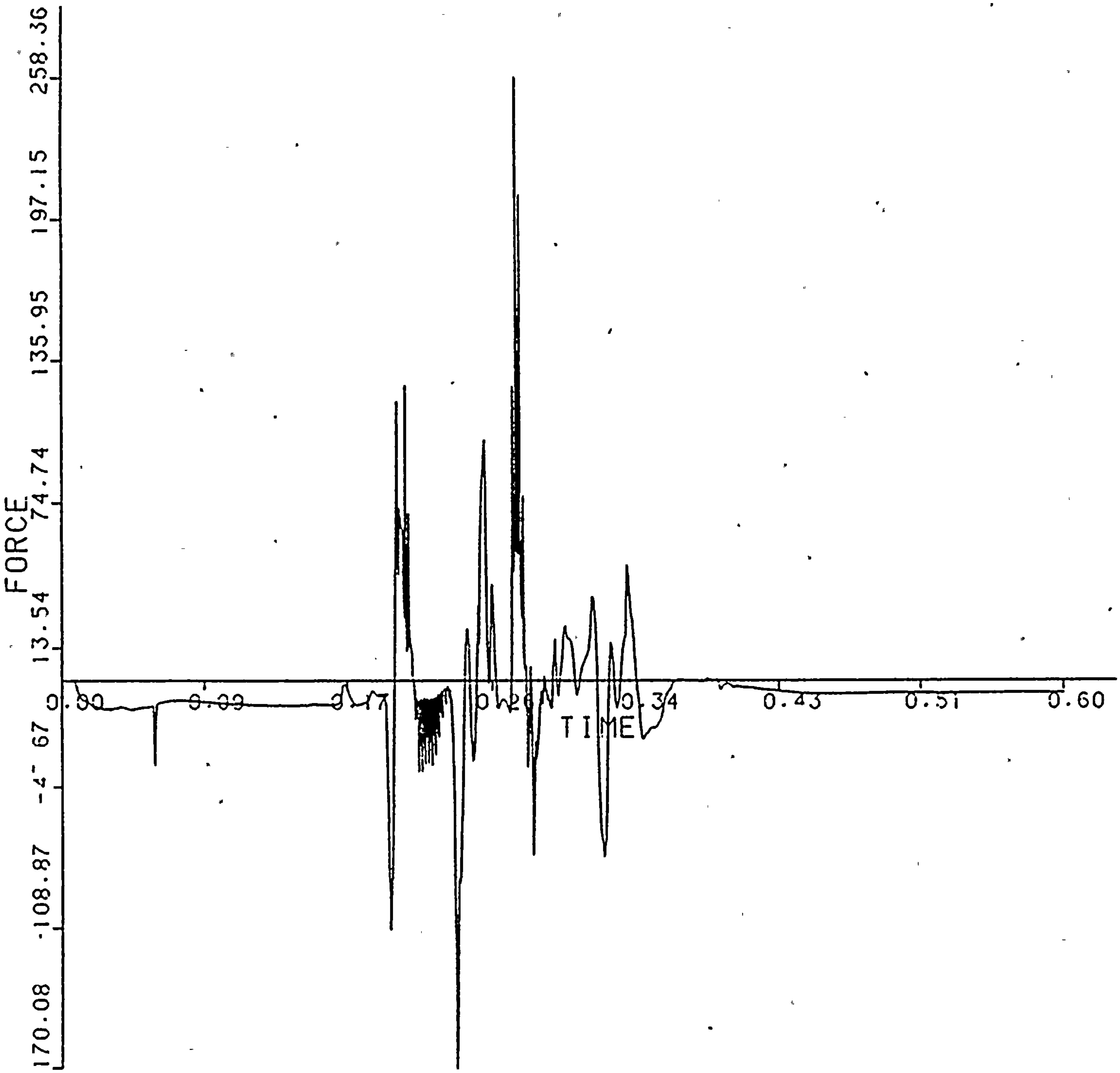
DONE BY: MR DATE: 5-12-83

CHKD BY: LLL DATE: 5-12-83

Tecnnical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 12-MAY-83
YELLOW LOOP SEAL - YELLPSL.TMP
TIME/FORCE TABLE 55, MAGNITUDE AT NODE POINT 295



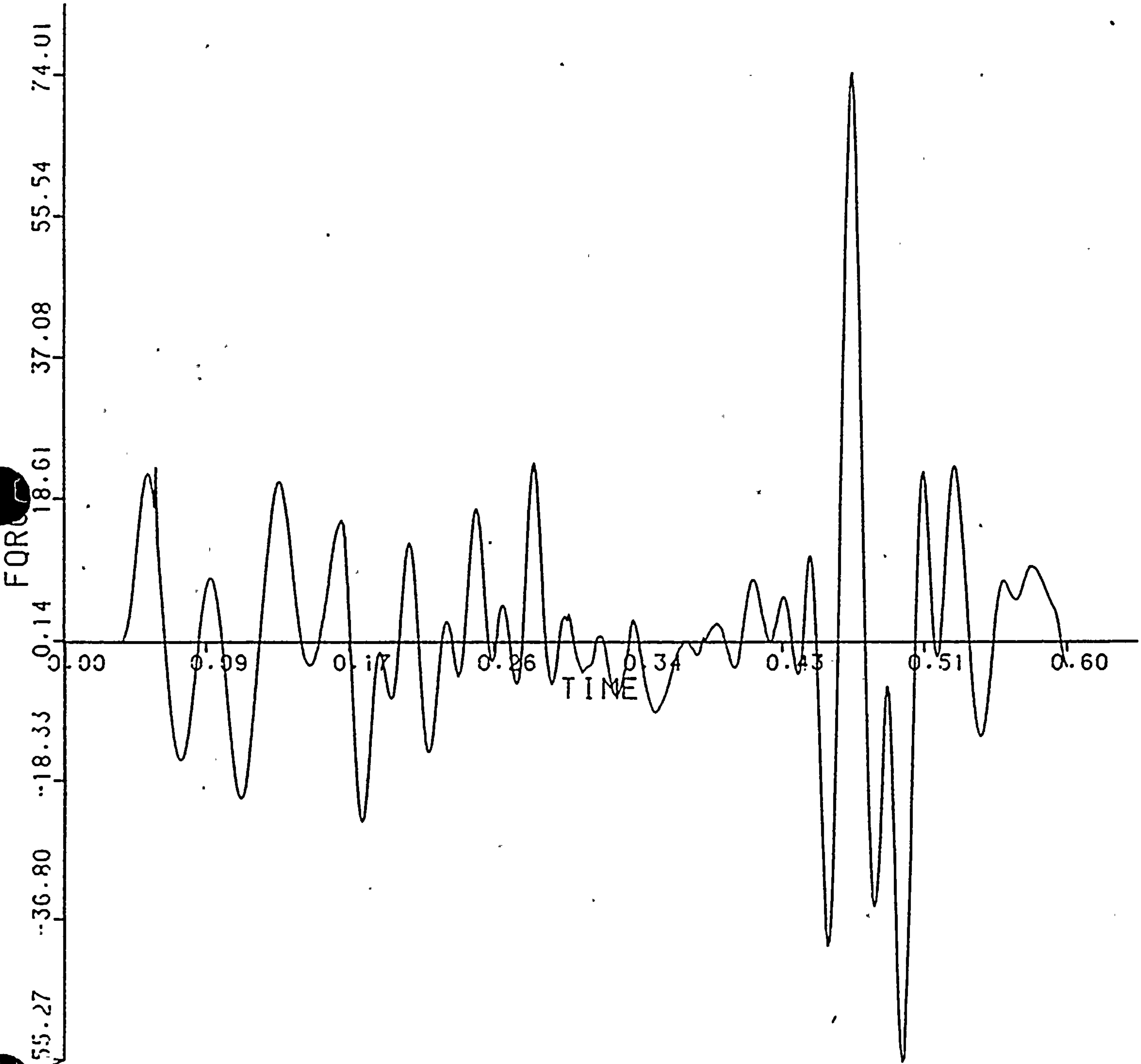
DONE BY: HL DATE: 5-12-83
CHKD BY: LLL DATE: 5-12-83

Tecnnical Report
TR-5364-1
Revision 0

4.8.2 Unit 1 - 400° Solid Liquid Case

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 1, MAGNITUDE AT NODE POINT .109



DONE BY: MZ DATE: 5-2-83
CHKD BY: [illegible] DATE: 5-25-83

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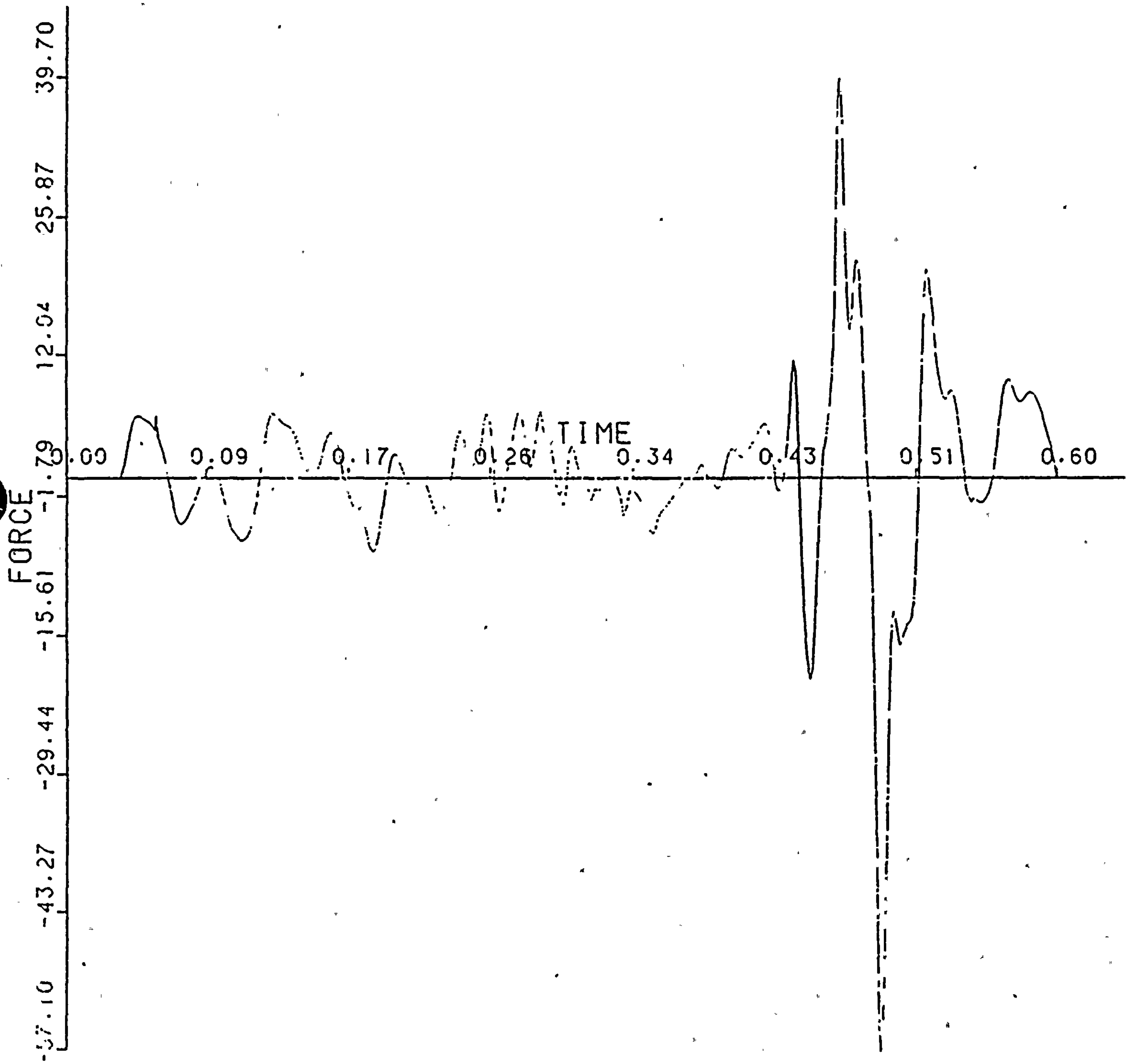
ENGINEERING SERVICES

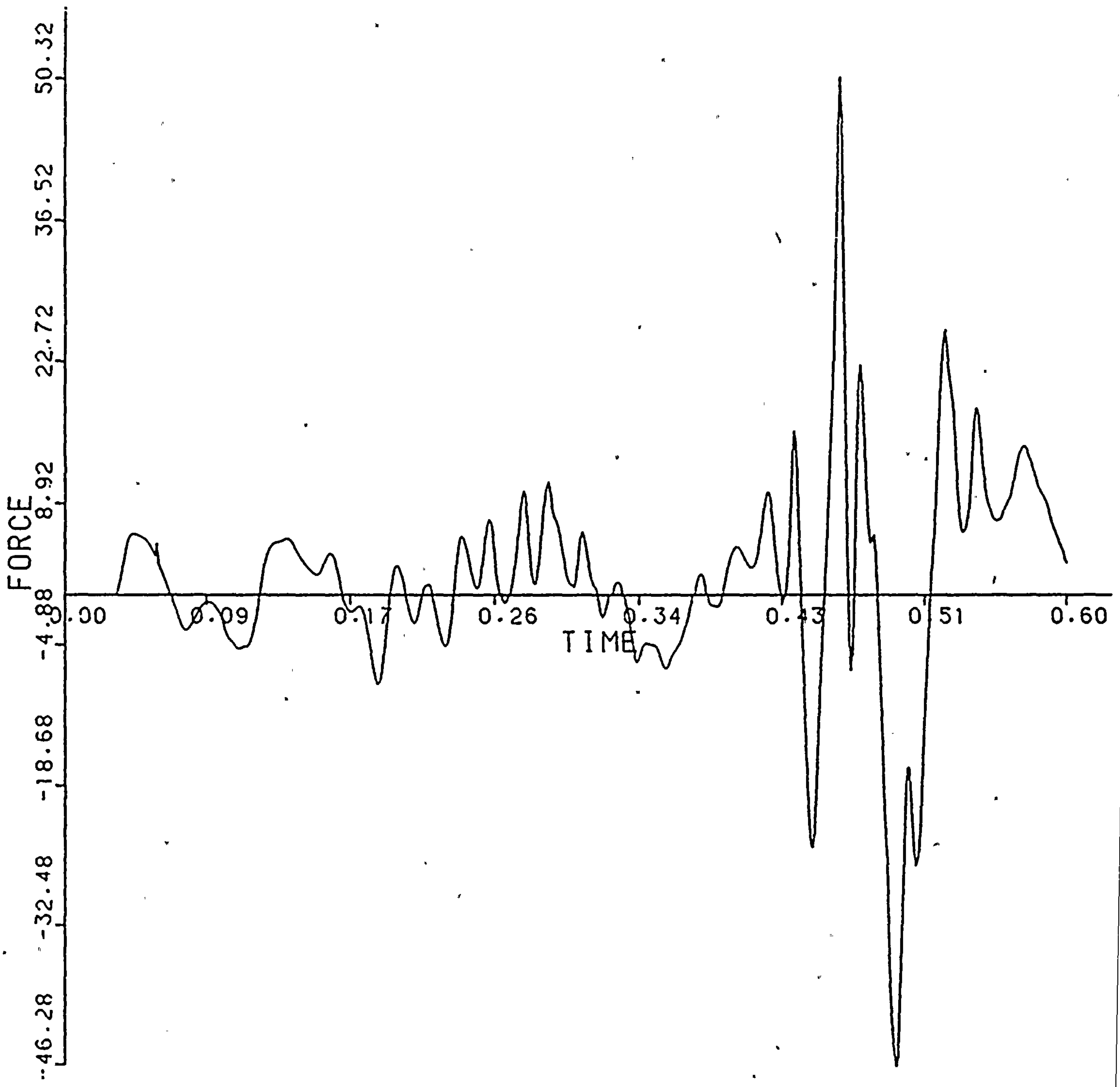
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 2, MAGNITUDE AT NODE POINT 104



DONE BY: ____ DATE: ____
CHKD BY: ____ DATE: ____

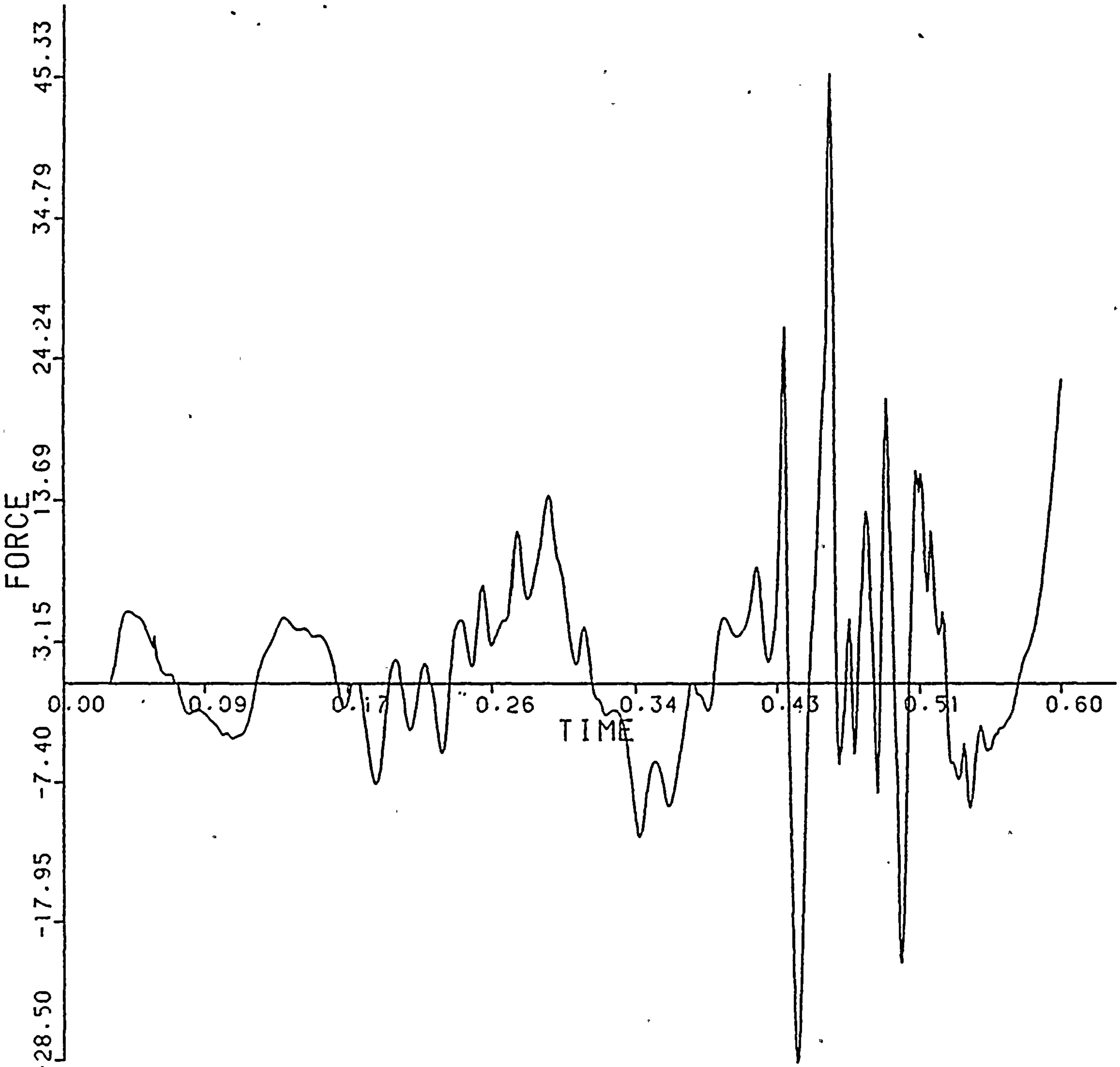
TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 3, MAGNITUDE AT NODE POINT 103



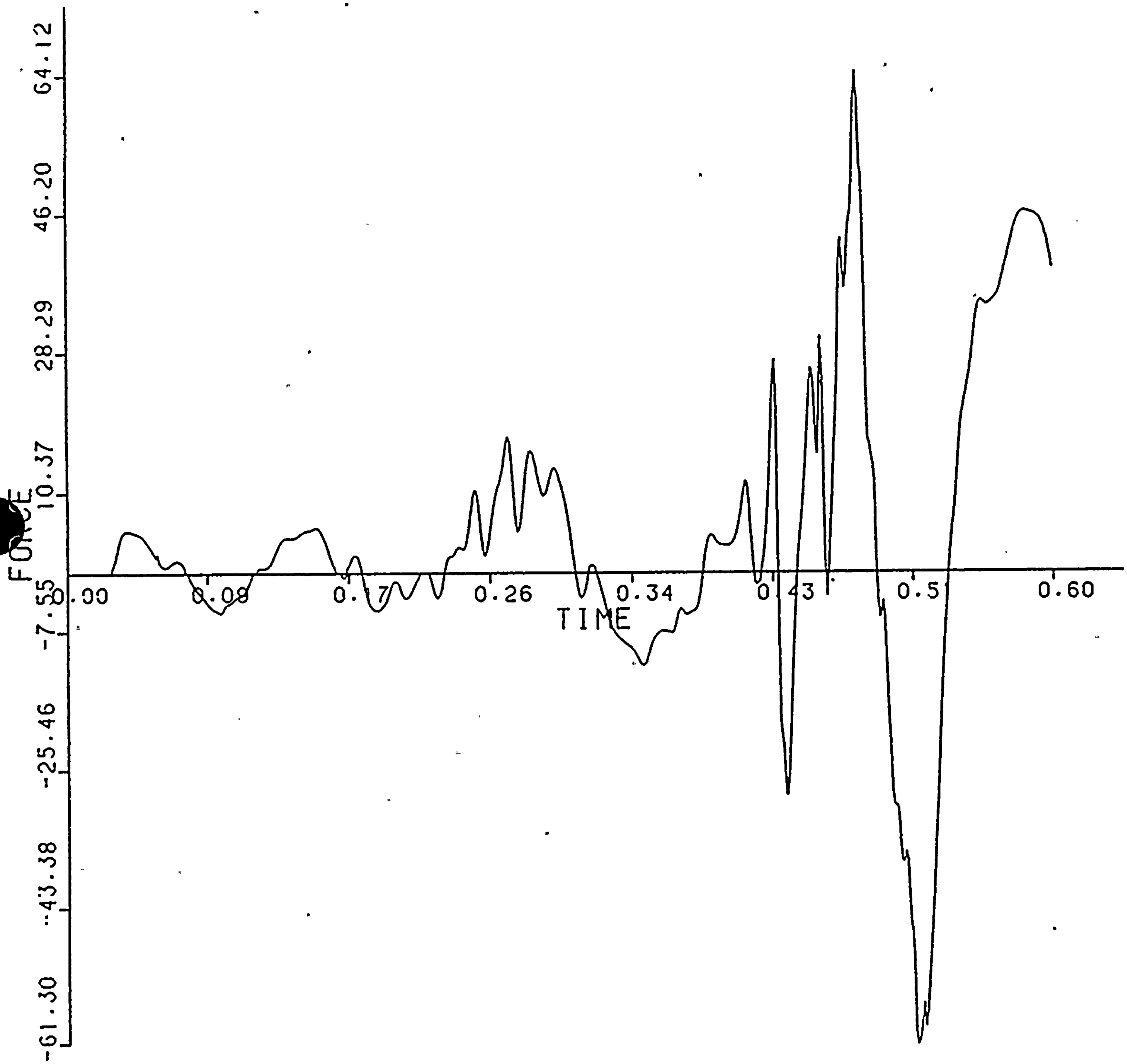
DONE BY: MZ DATE: 5-12-83
CHKD BY: JM DATE: 5-25-83

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 4, MAGNITUDE AT NODE POINT 102



DONE BY: MC DATE: 5-...-83
CHKD BY: JM DATE: 5-25-83

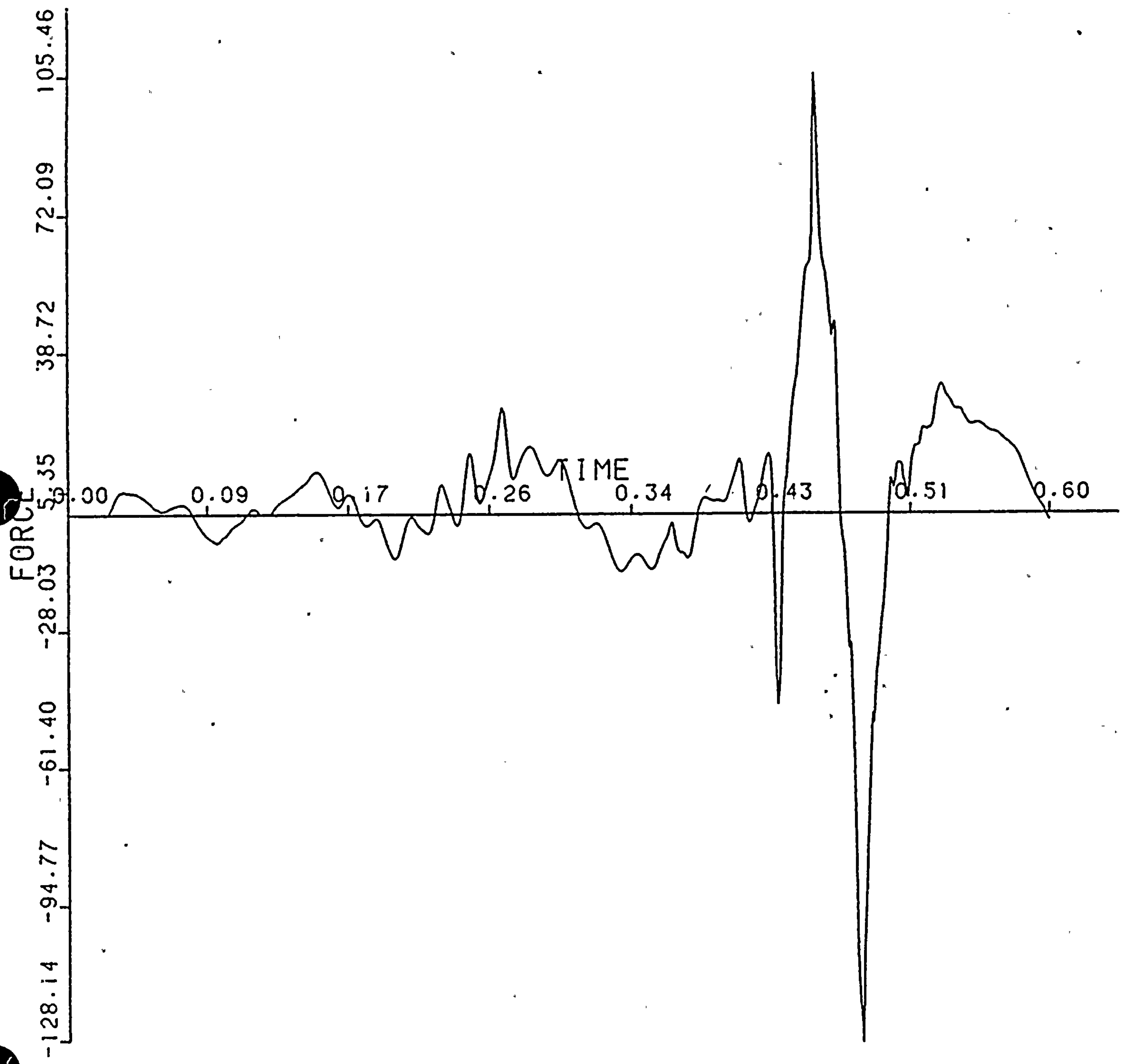
SAP2SAP VERIFICATION 5364   23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE   5, MAGNITUDE AT NODE POINT   100



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

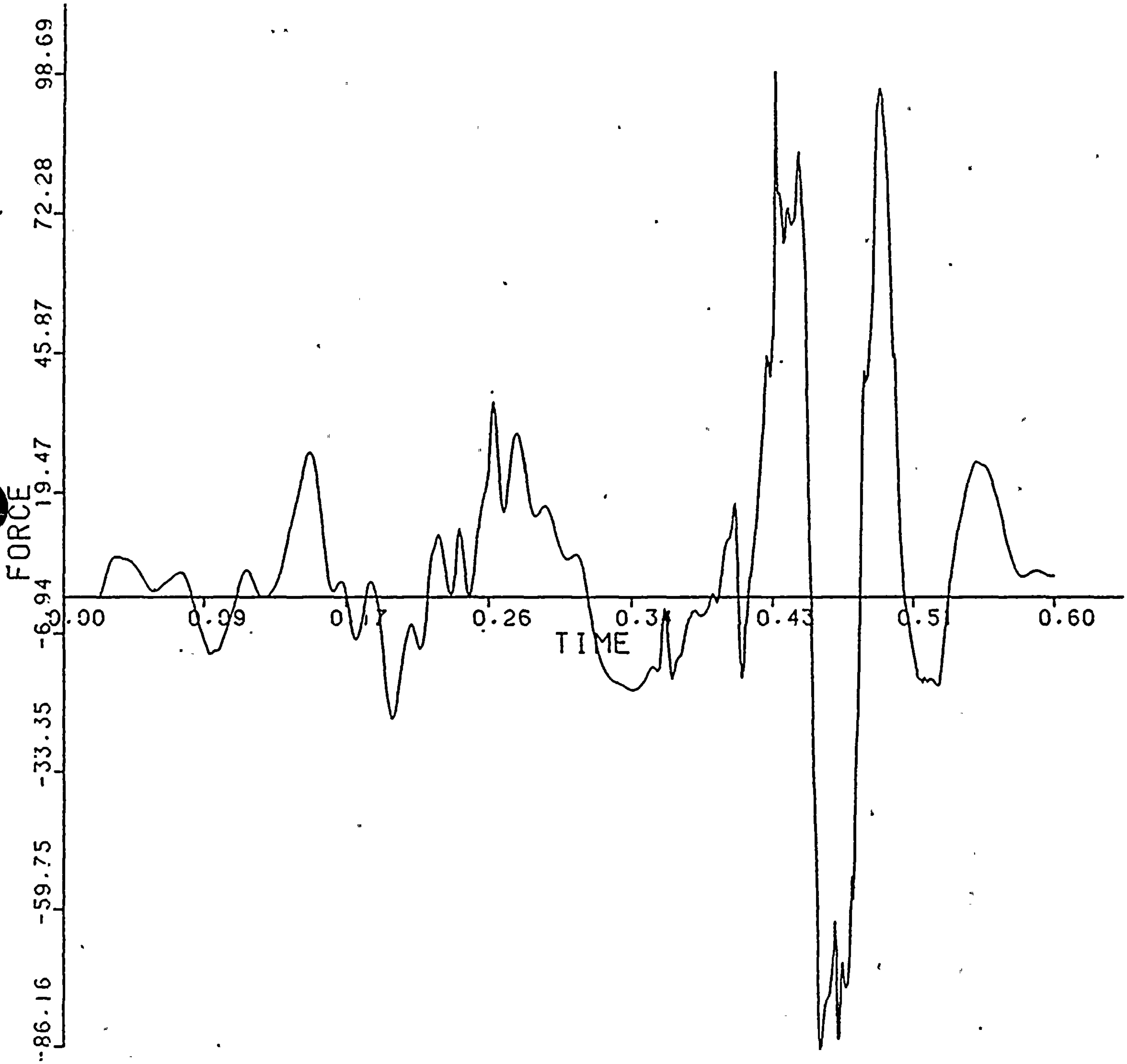
TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 6, MAGNITUDE AT NODE POINT 99



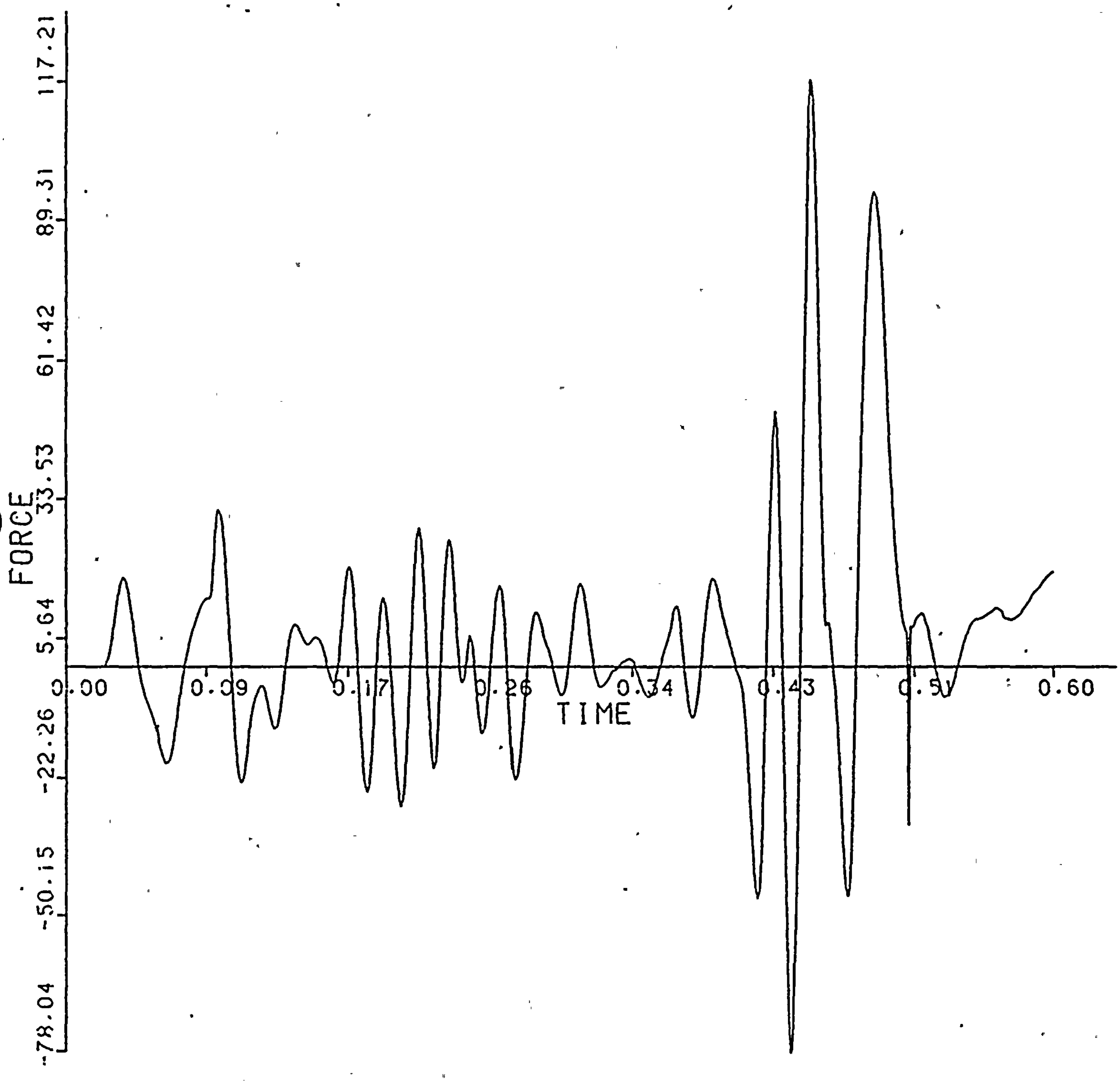
DONE BY: MZ DATE: 5/23/83
CHKD BY: JW DATE: 5-25-83

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 7, MAGNITUDE AT NODE POINT 98



DONE BY: [illegible] DATE: 5 [illegible]
CHKD BY: [illegible] DATE: [illegible]

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 8, MAGNITUDE AT NODE POINT 216



DONE BY: [illegible] DATE: [illegible]
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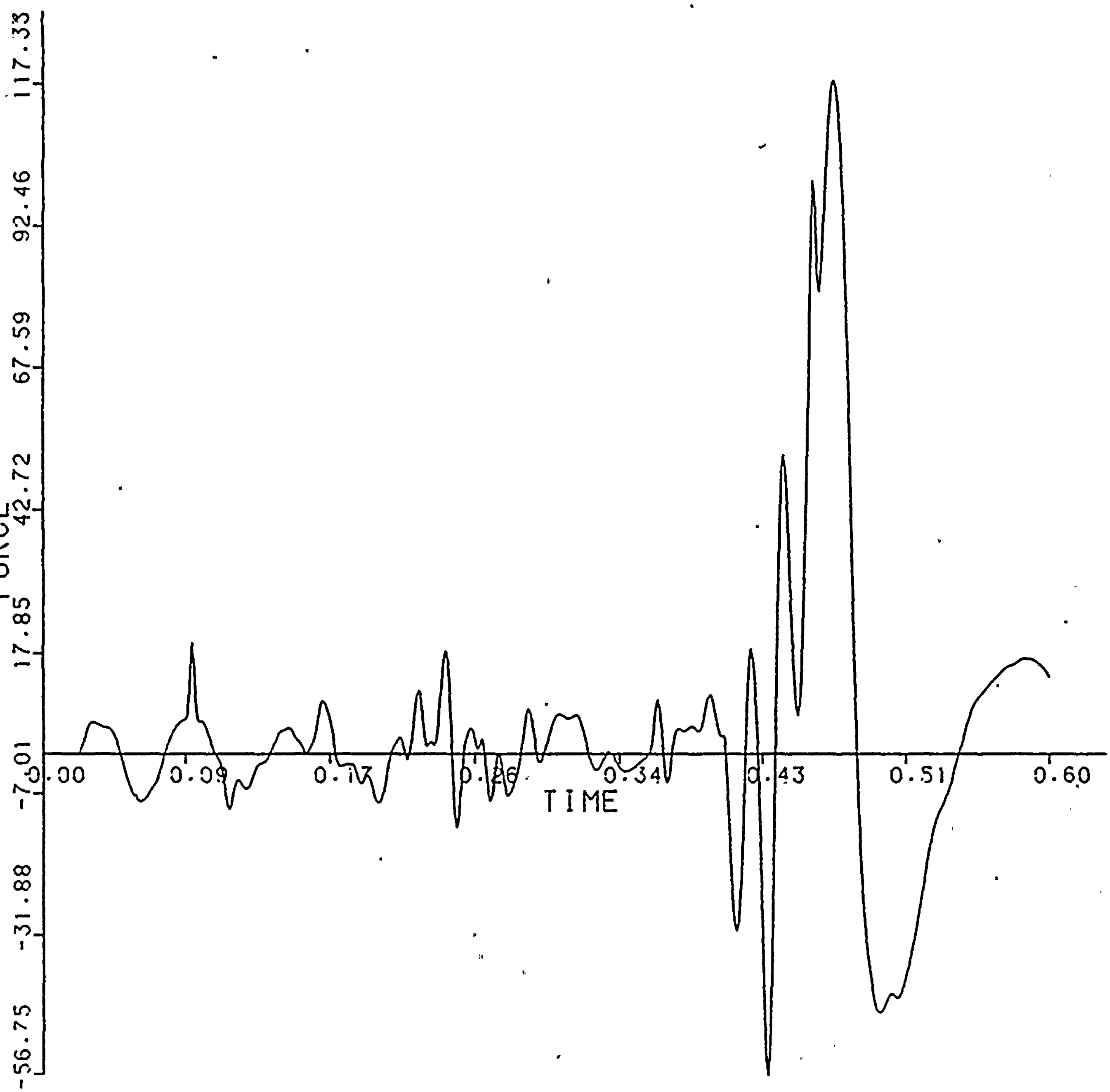
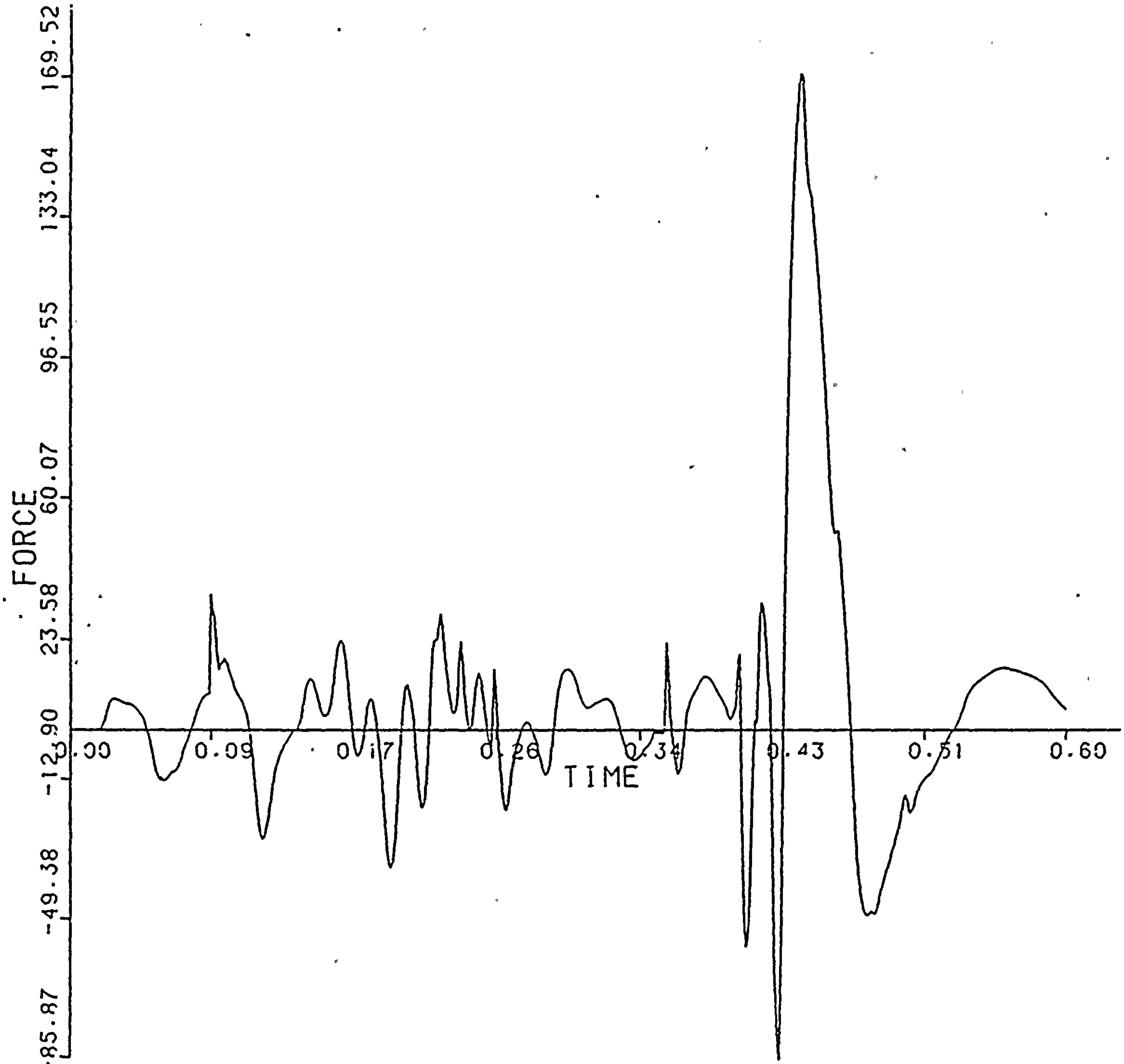
SAP2SAP VERIFICATION 5364 ENGINEERING SERVICES 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 9, MAGNITUDE AT NODE POINT 214



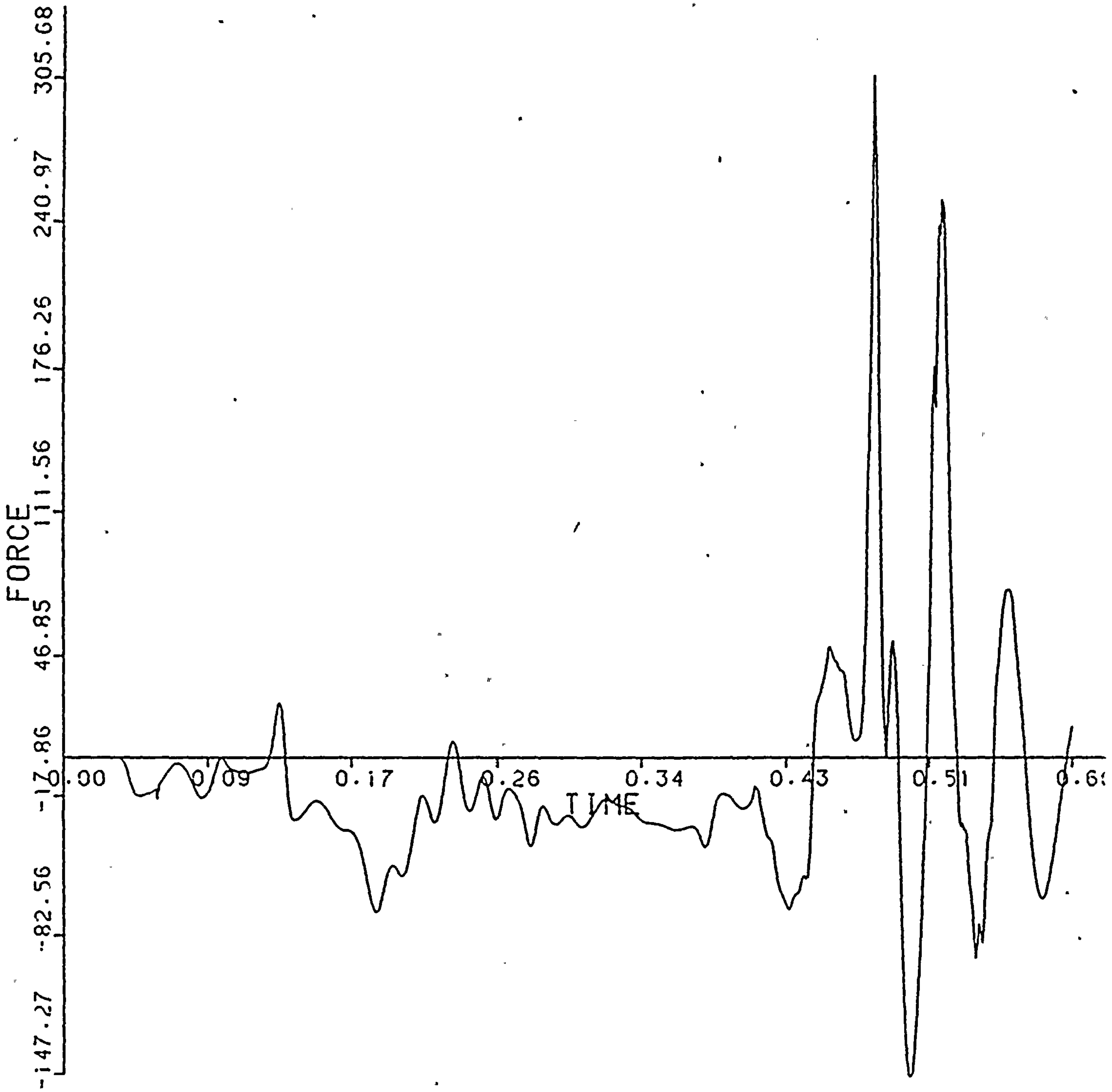
DONE BY: ___ DATE: ___
CHKD BY: ___ DATE: ___

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 10. MAGNITUDE AT NODE POINT 208



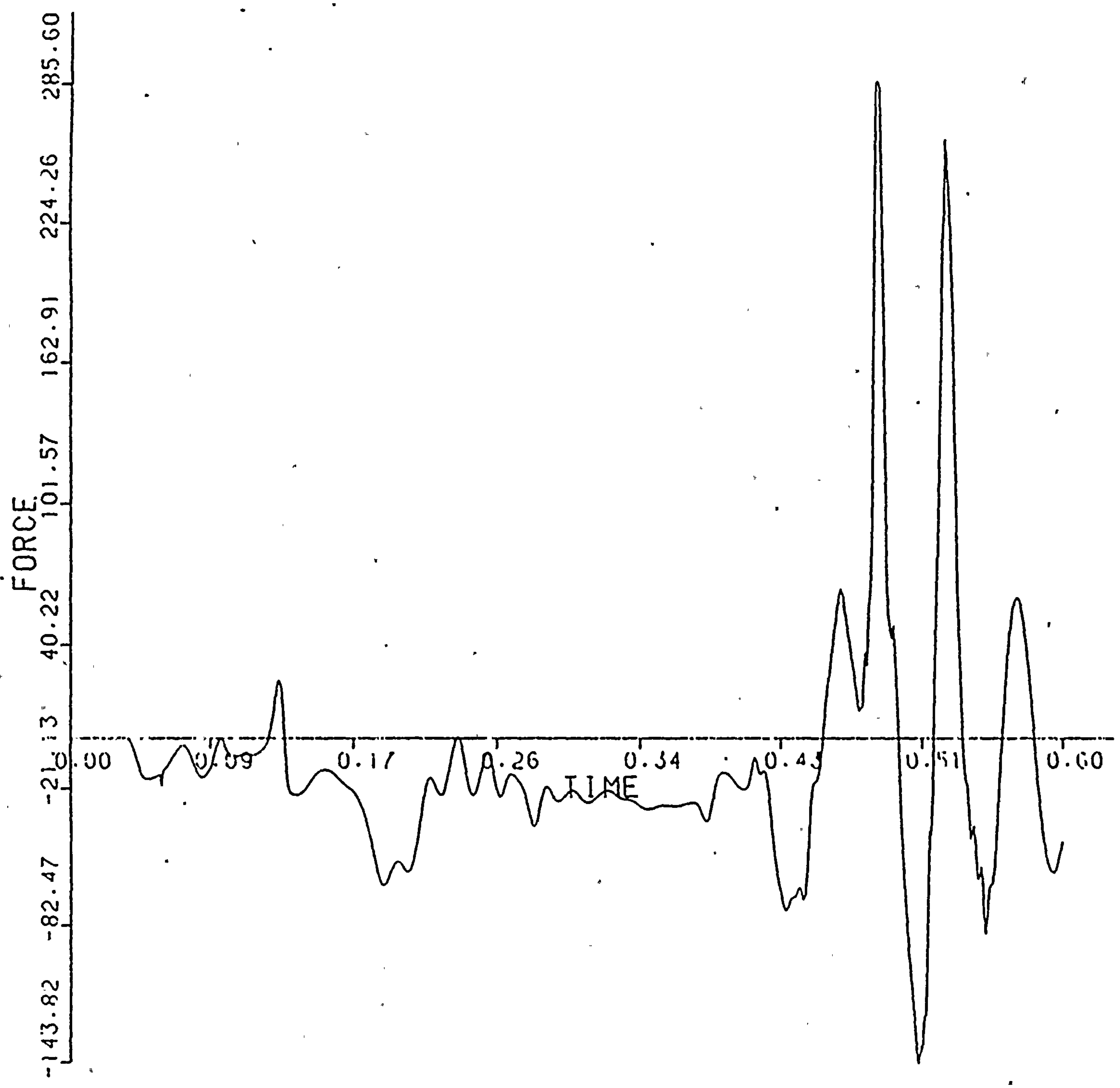
DONE BY: [illegible] DATE: 5-12-83
CHKD BY: [illegible] DATE: 5-25-83

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 11, MAGNITUDE AT NODE POINT 88



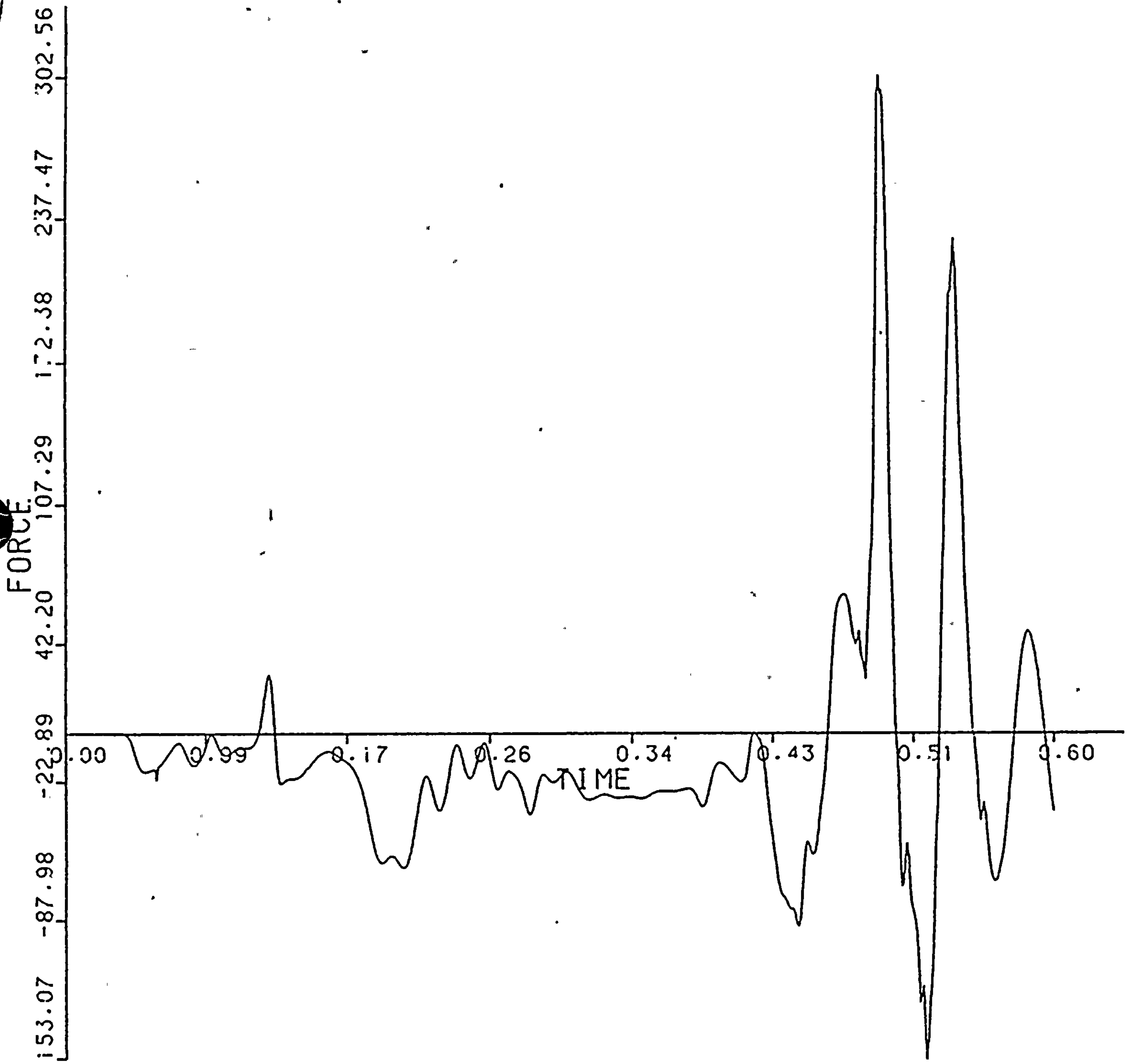
DONE BY: DATE:
CHKD BY: DATE:

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 12, MAGNITUDE AT NODE POINT 83



DONE BY: MZ DATE: 5-24-83
CHKD BY: JJ DATE: 5-25-83

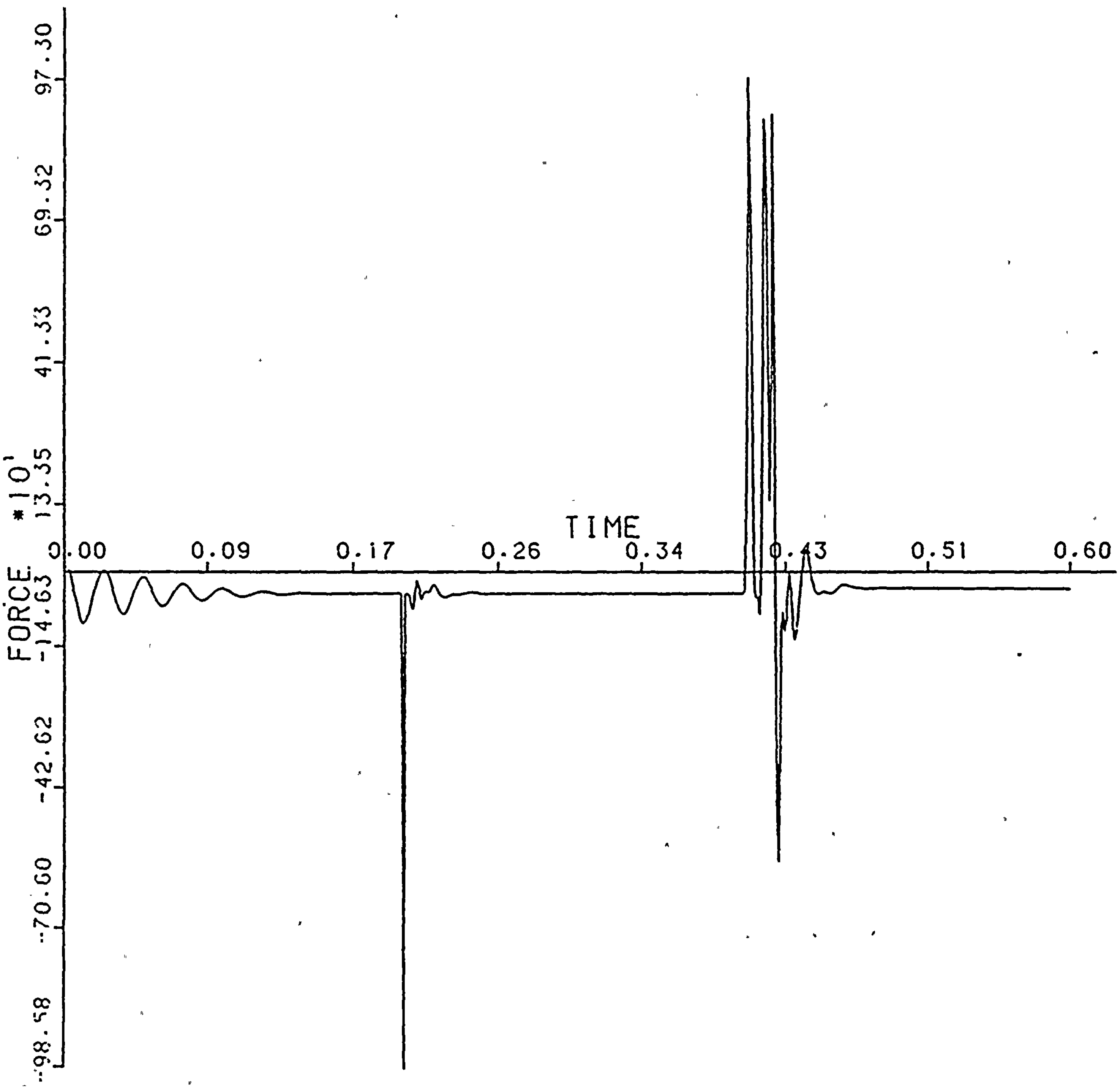
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 13, MAGNITUDE AT NODE POINT 80,



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

TELEDYNE
ENGINEERING SERVICES

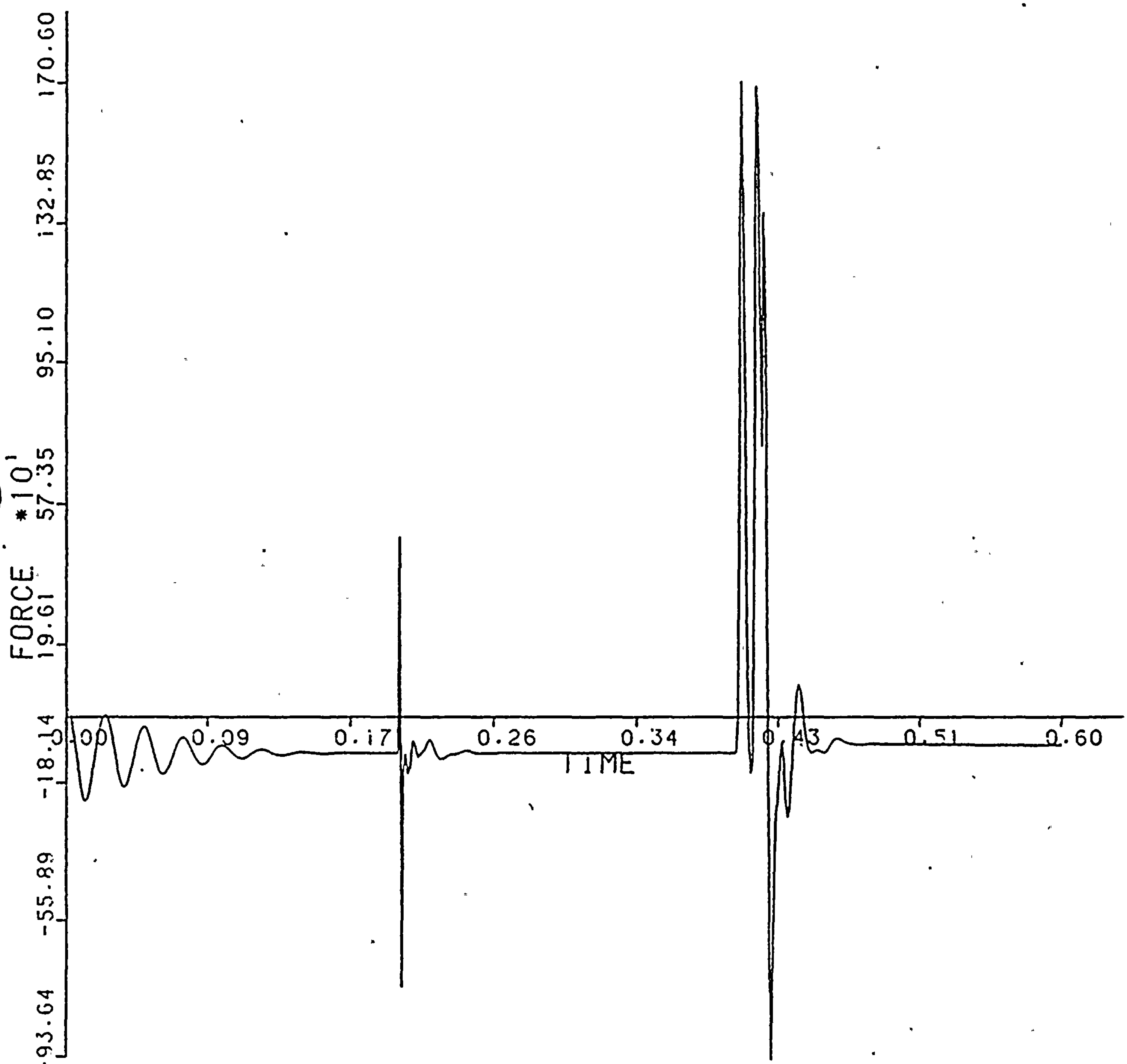
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 14, MAGNITUDE AT NODE POINT 725



DONE BY: [illegible] DATE: 5-[illegible]
CHKD BY: [illegible] DATE: 5-25-83

TELEDYNE ENGINEERING SERVICES

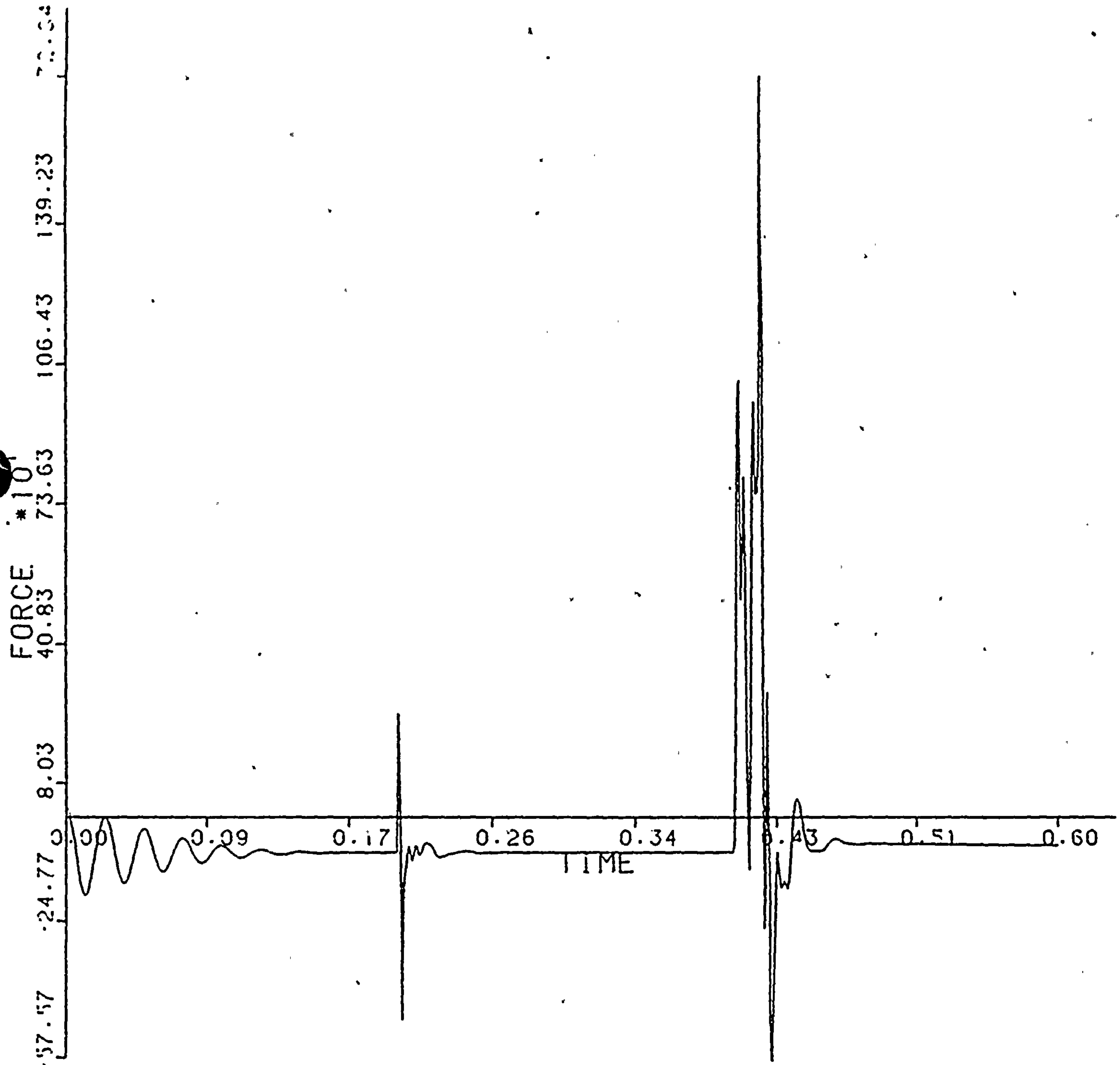
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 15, MAGNITUDE AT NODE POINT 717



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

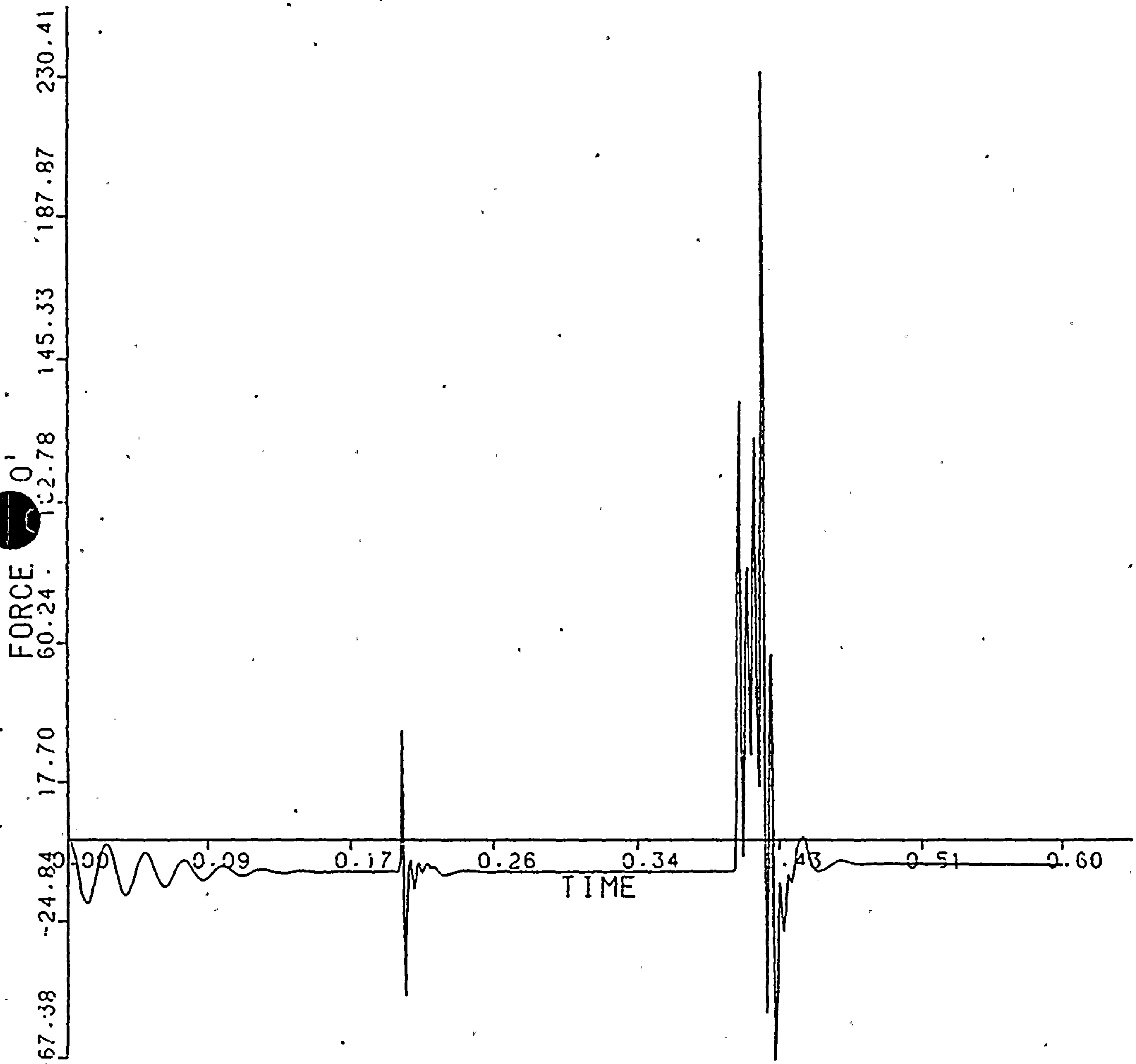
TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 16, MAGNITUDF AT NODE POINT 710



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

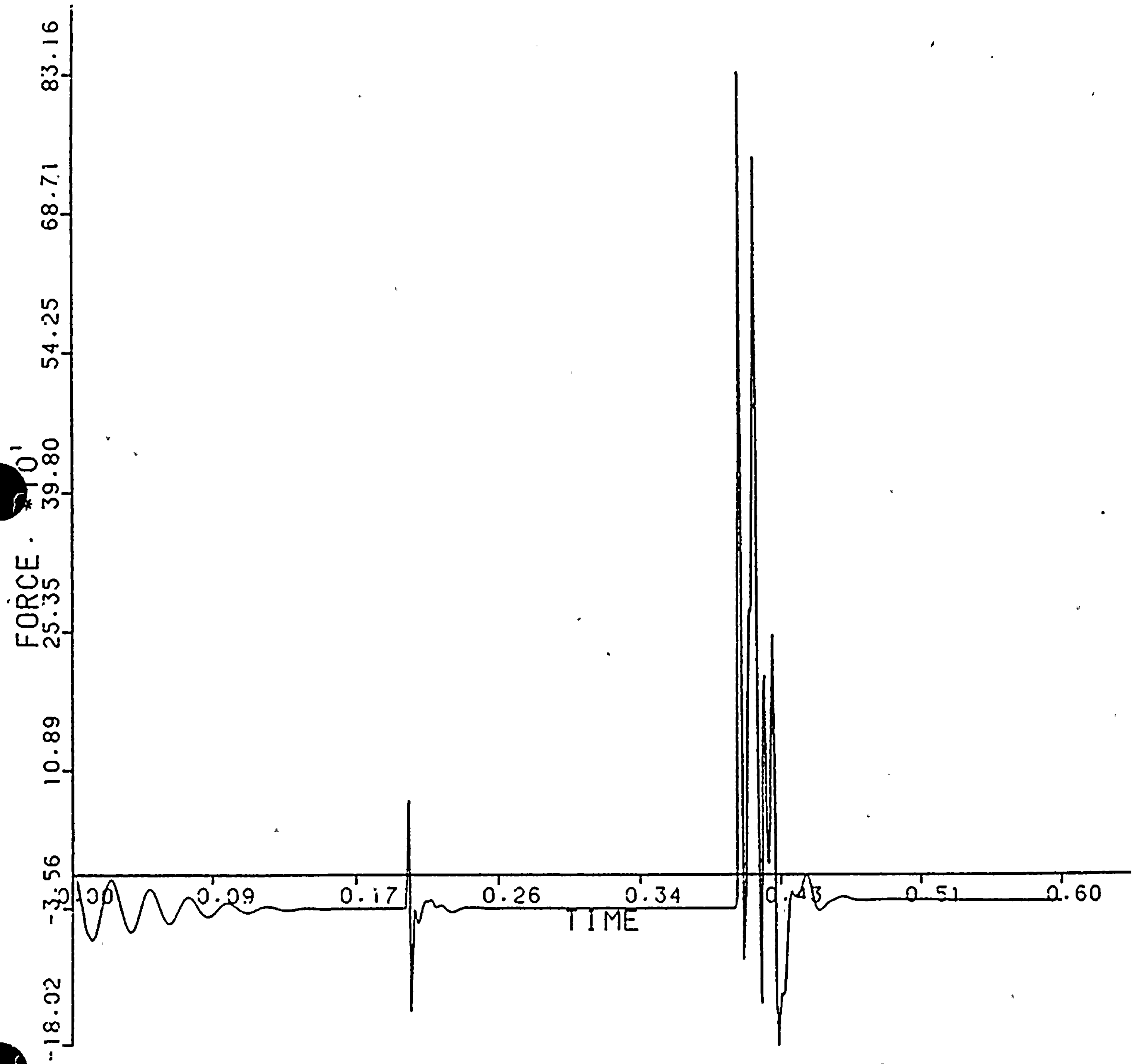
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 17, MAGNITUDE AT NODE POINT 680



DONE BY: DATE:
CHKD BY: DATE:

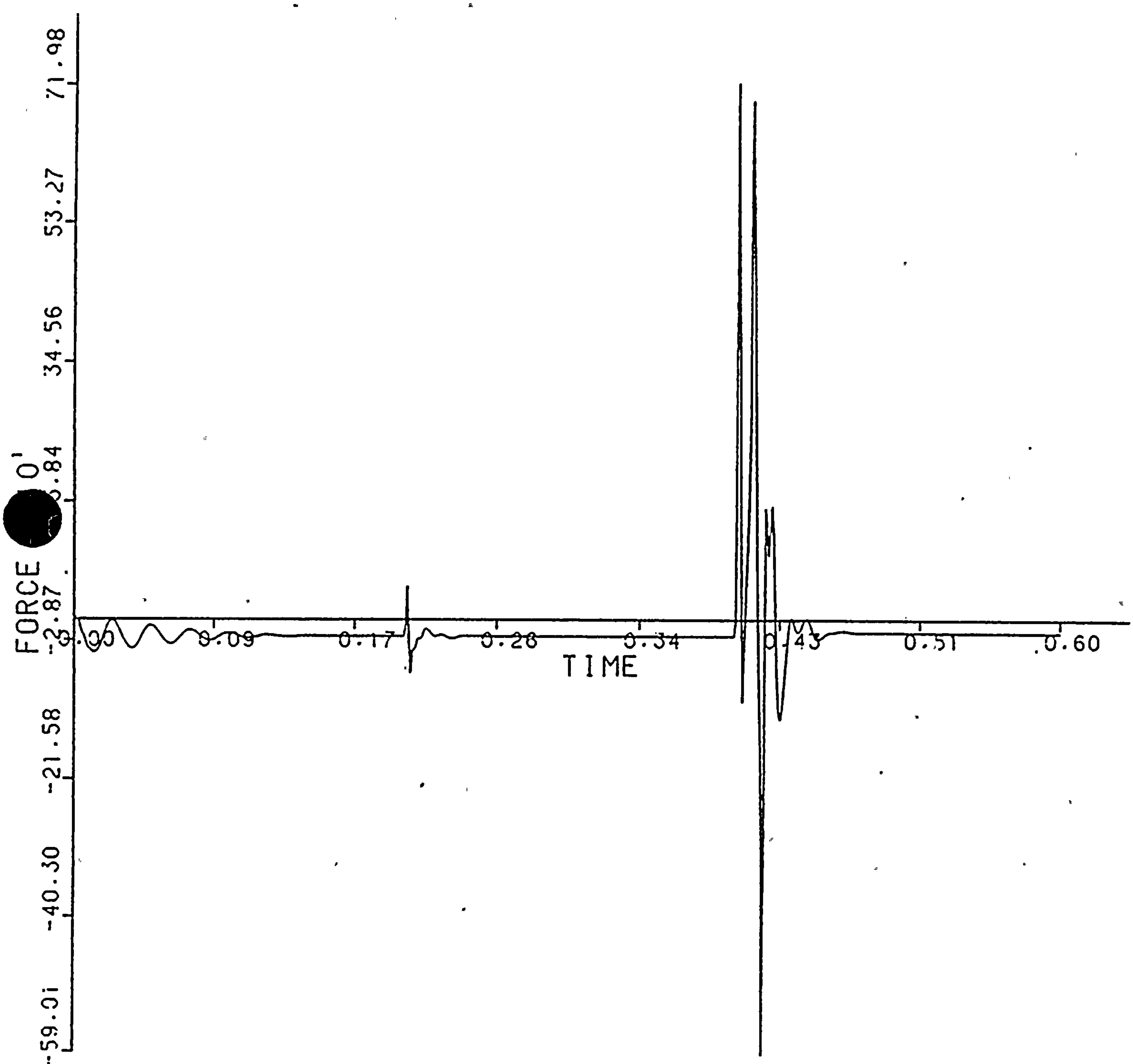
TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE , 18, MAGNITUDE AT NODE POINT 600



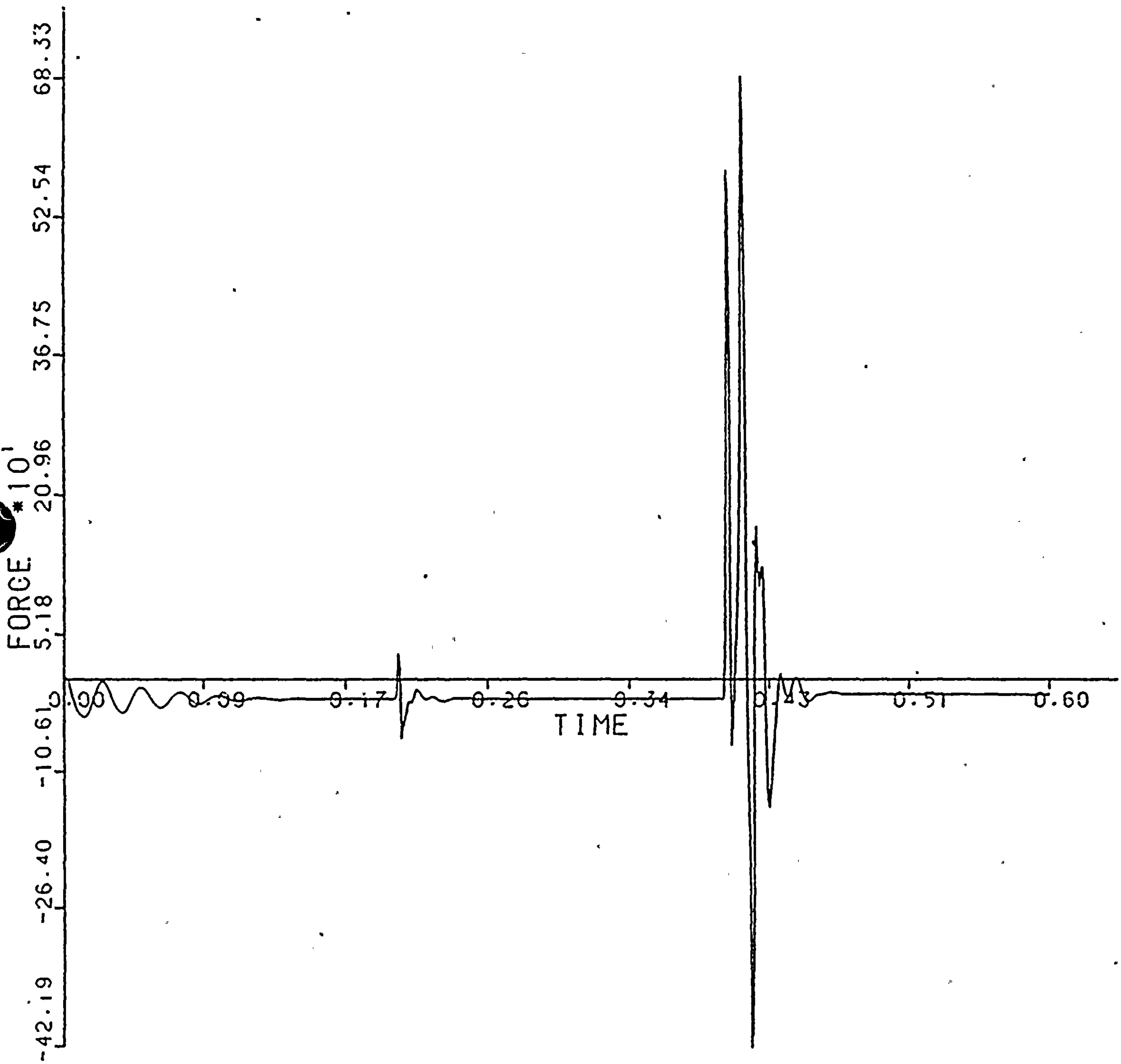
DONE BY: [illegible] DATE: 5-[illegible]-83
CHKD BY: [illegible] DATE: 5-25-83

SAP2SAP VERIFICATION 5364   23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE   19, MAGNITUDE AT NODE POINT   590



DONE BY: [illegible] DATE: 5-[illegible]
CHKD BY: [illegible] DATE: [illegible]

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 20, MAGNITUDE AT NODE POINT 585

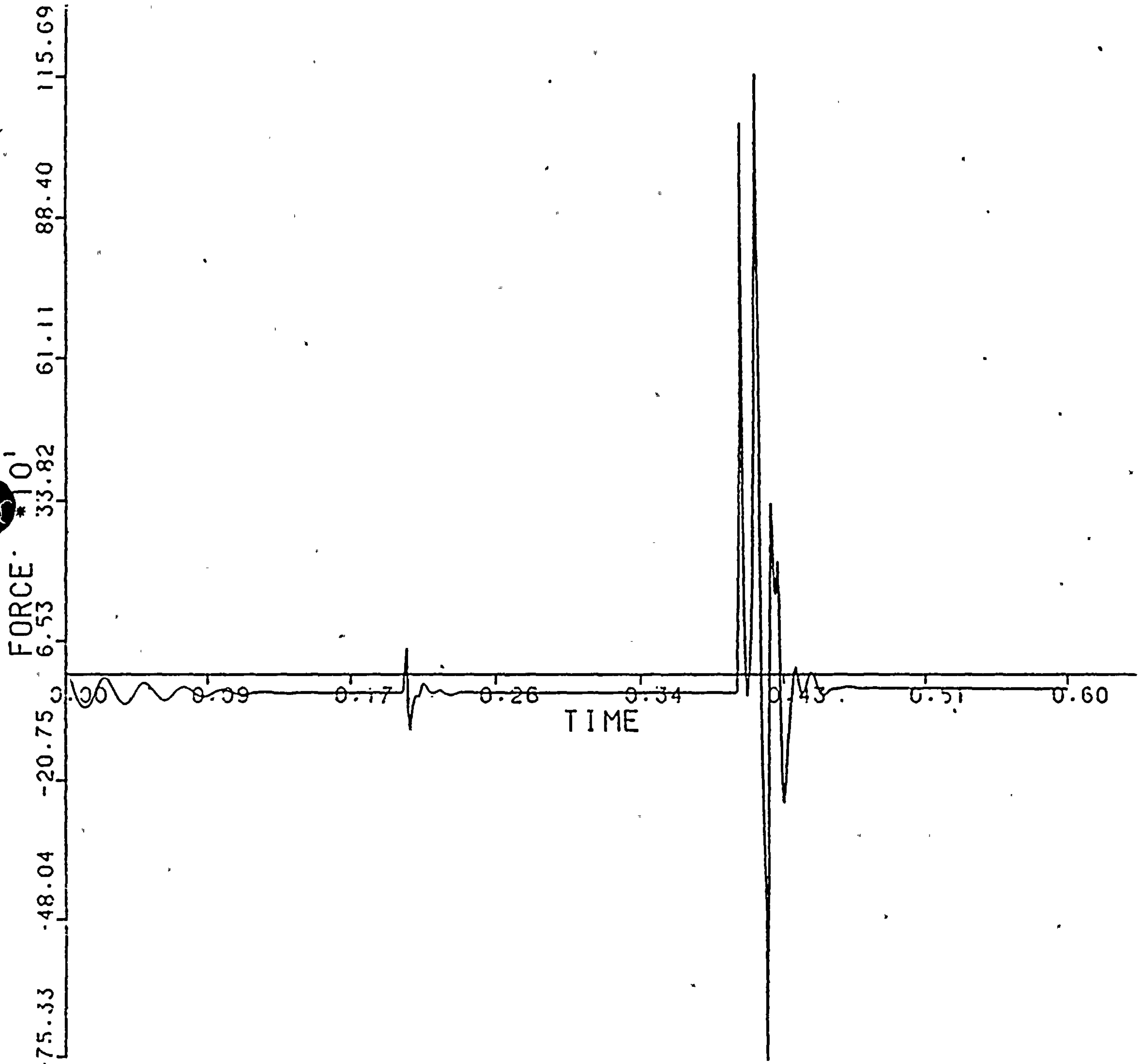


DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

Technical Report
TR-5364-1
Revision 0

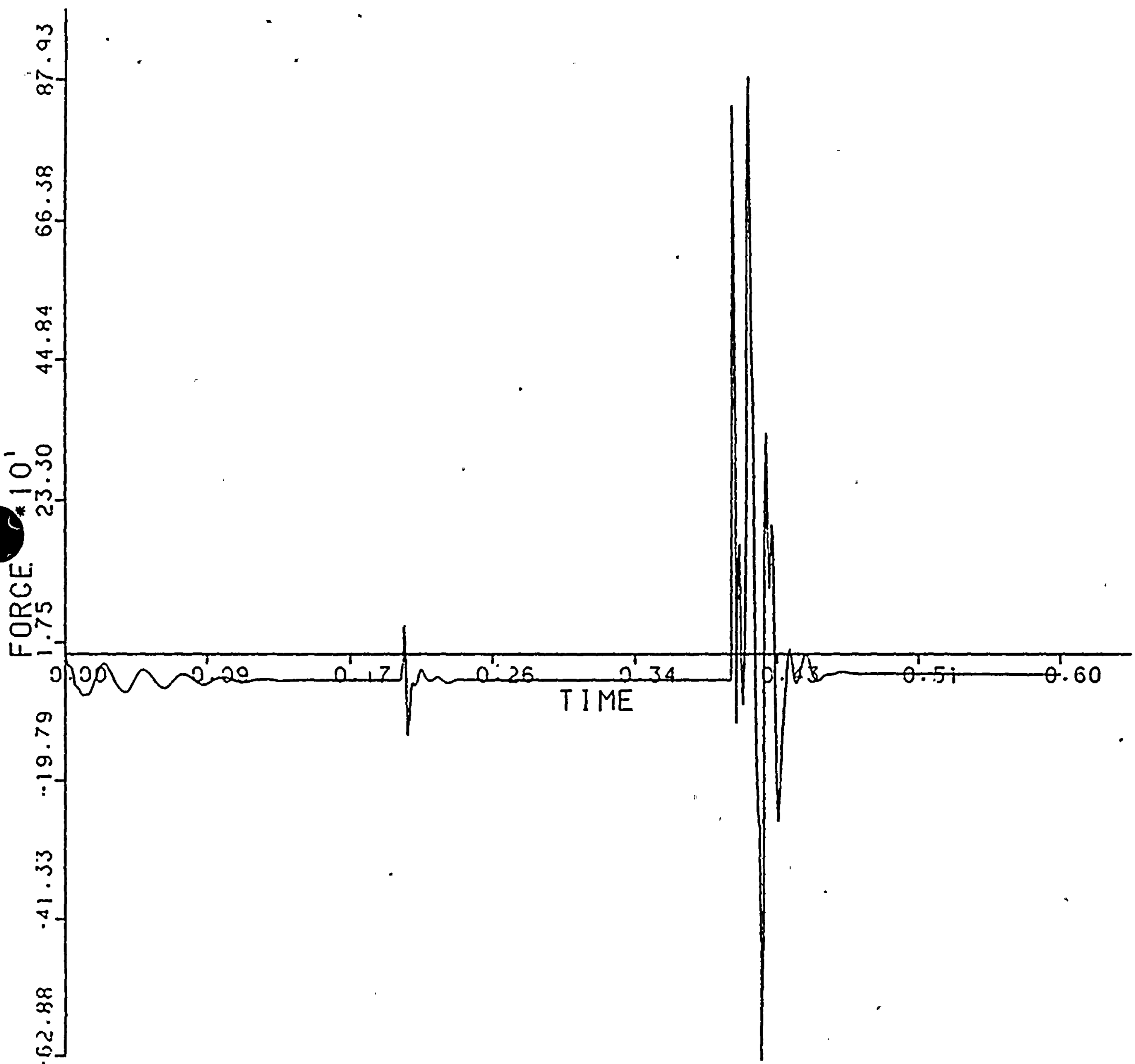
TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 21, MAGNITUDE AT NODE POINT 575



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 22, MAGNITUDE AT NODE POINT 435

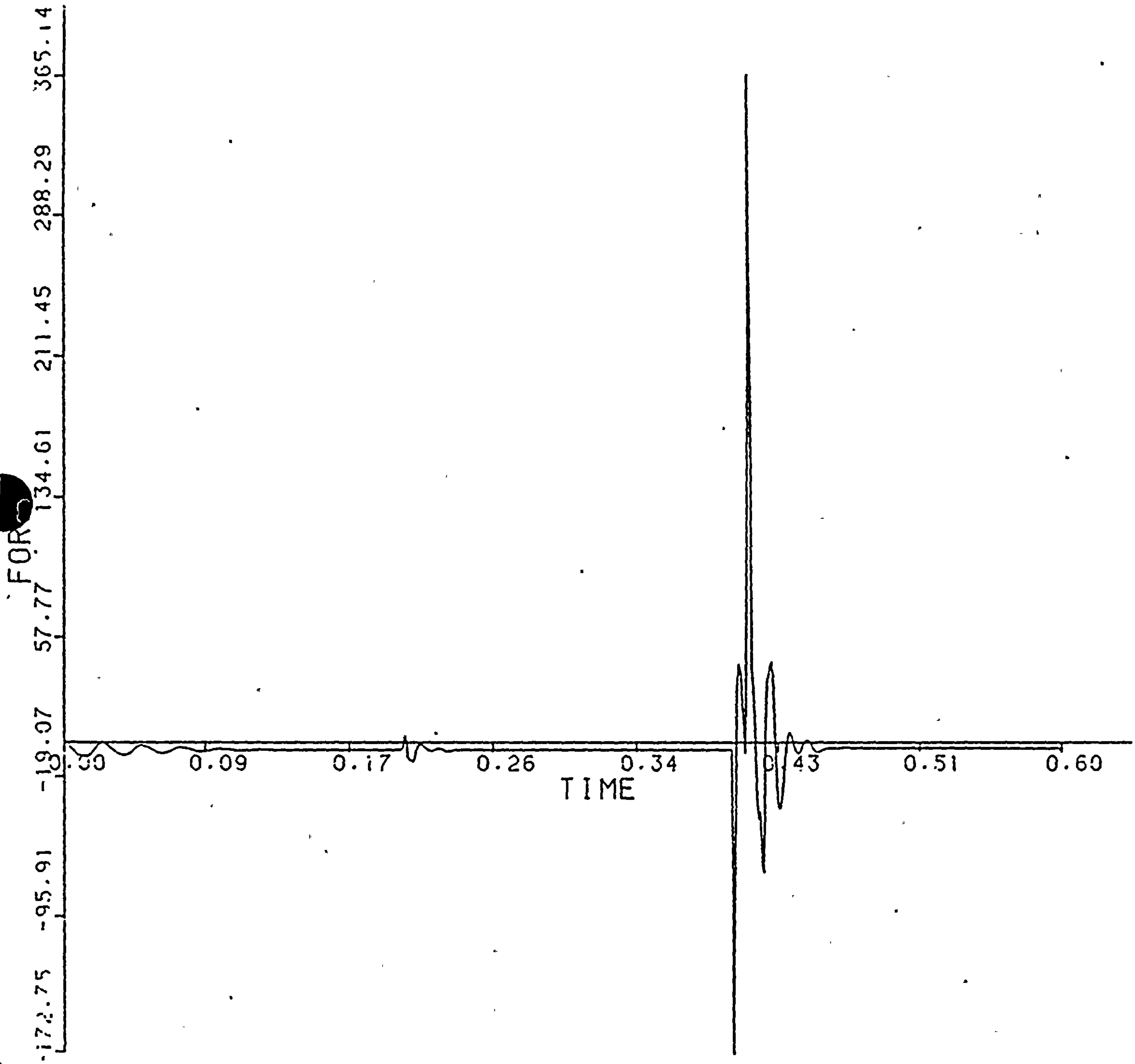


DONE BY: ___ DATE: ___
CHKD BY: ___ DATE: ___

Technical Report
TR-5364-1
Revision 0

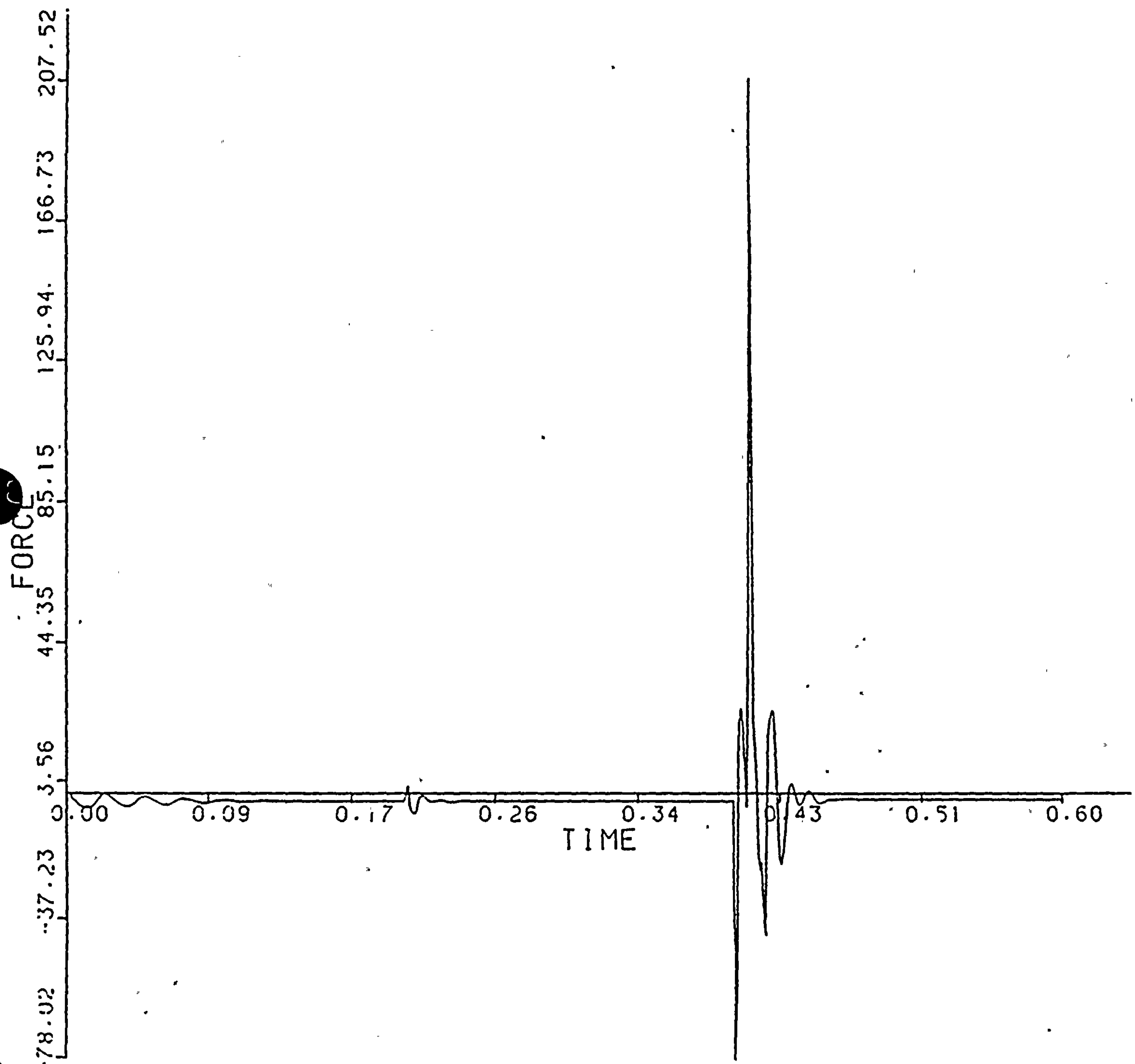
 TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 23, MAGNITUDE AT NODE POINT 440



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

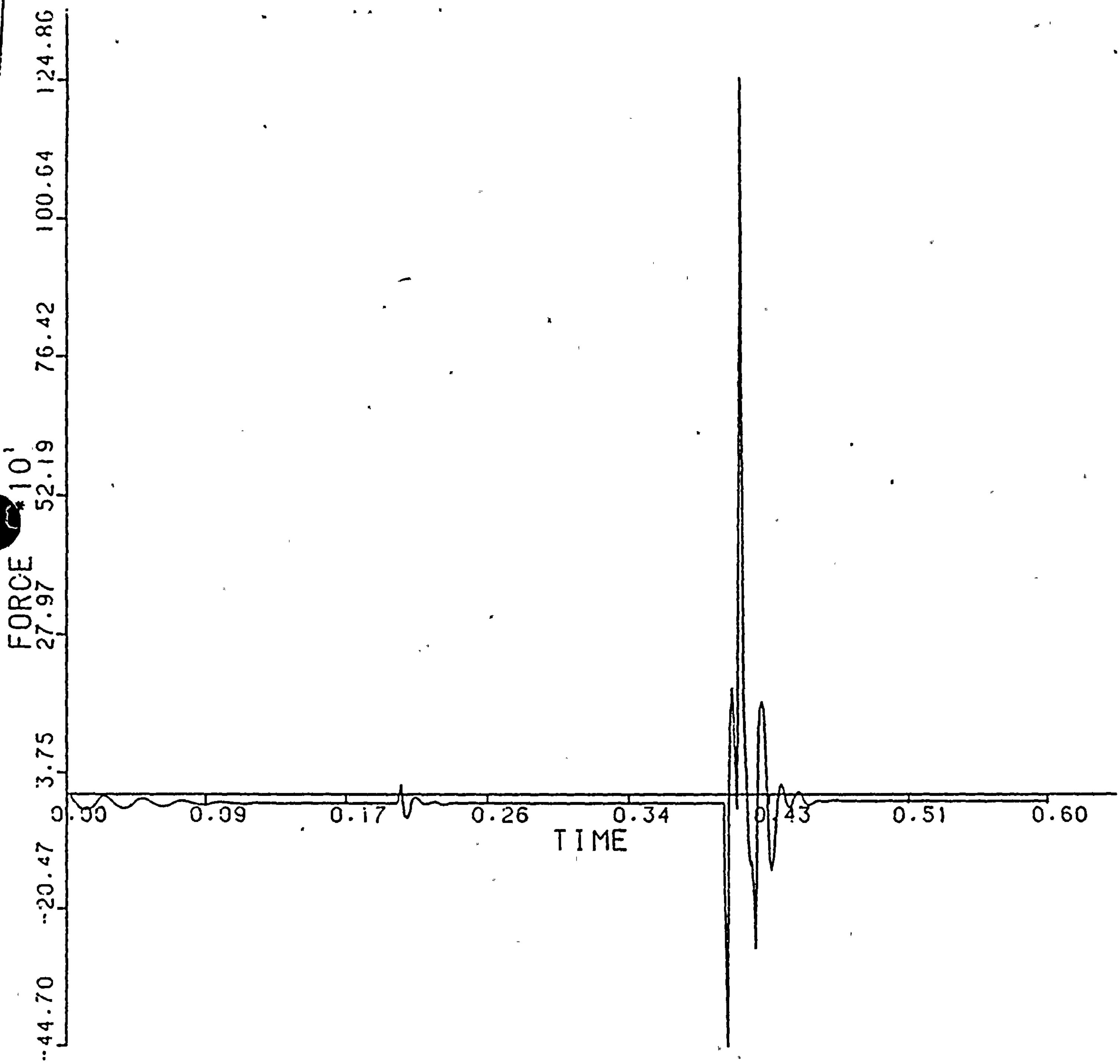
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 24, MAGNITUDE AT NODE POINT 450



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

TELEDYNE ENGINEERING SERVICES

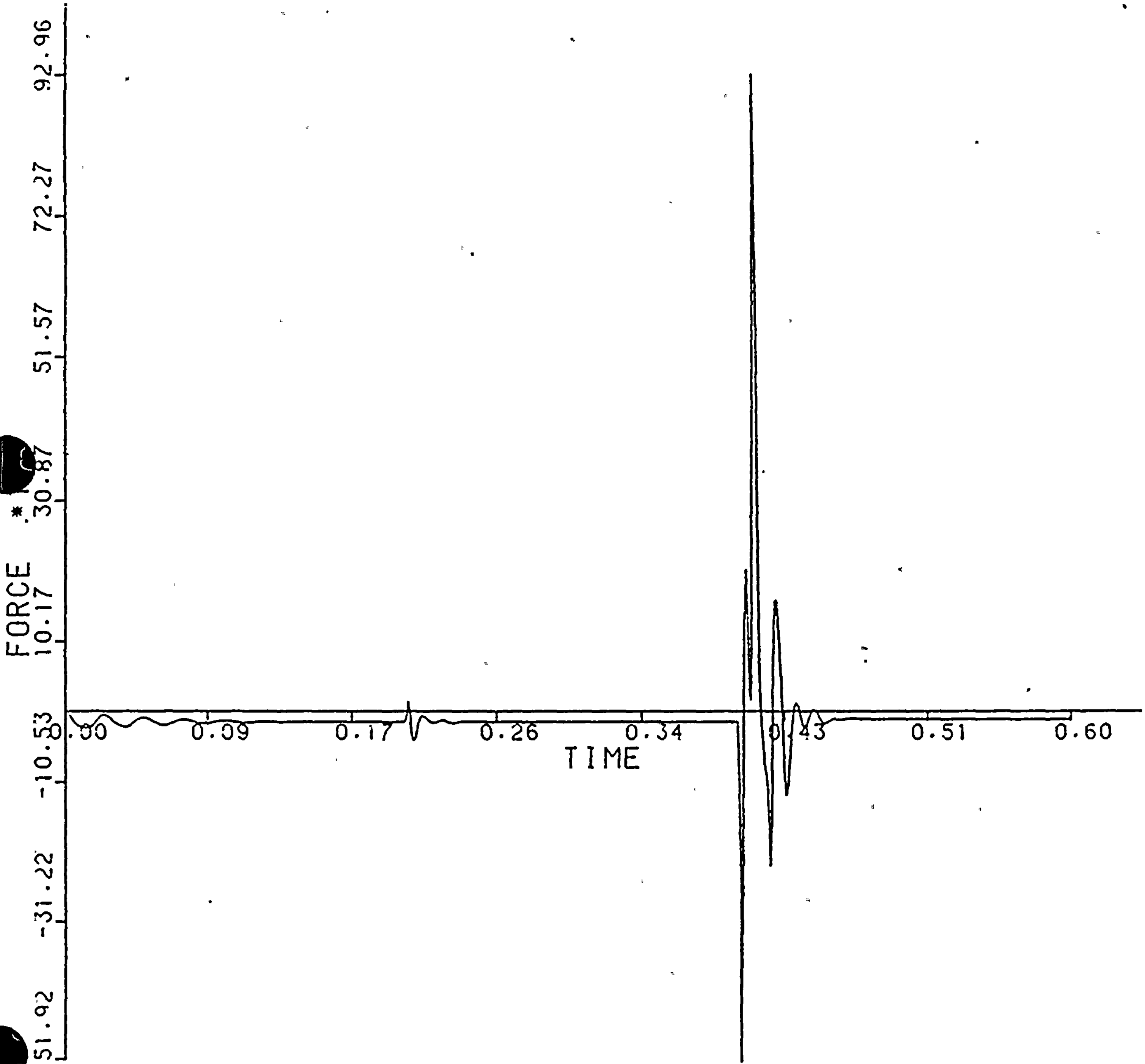
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 25, MAGNITUDE AT NODE POINT 460



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

TELEDYNE
ENGINEERING SERVICES

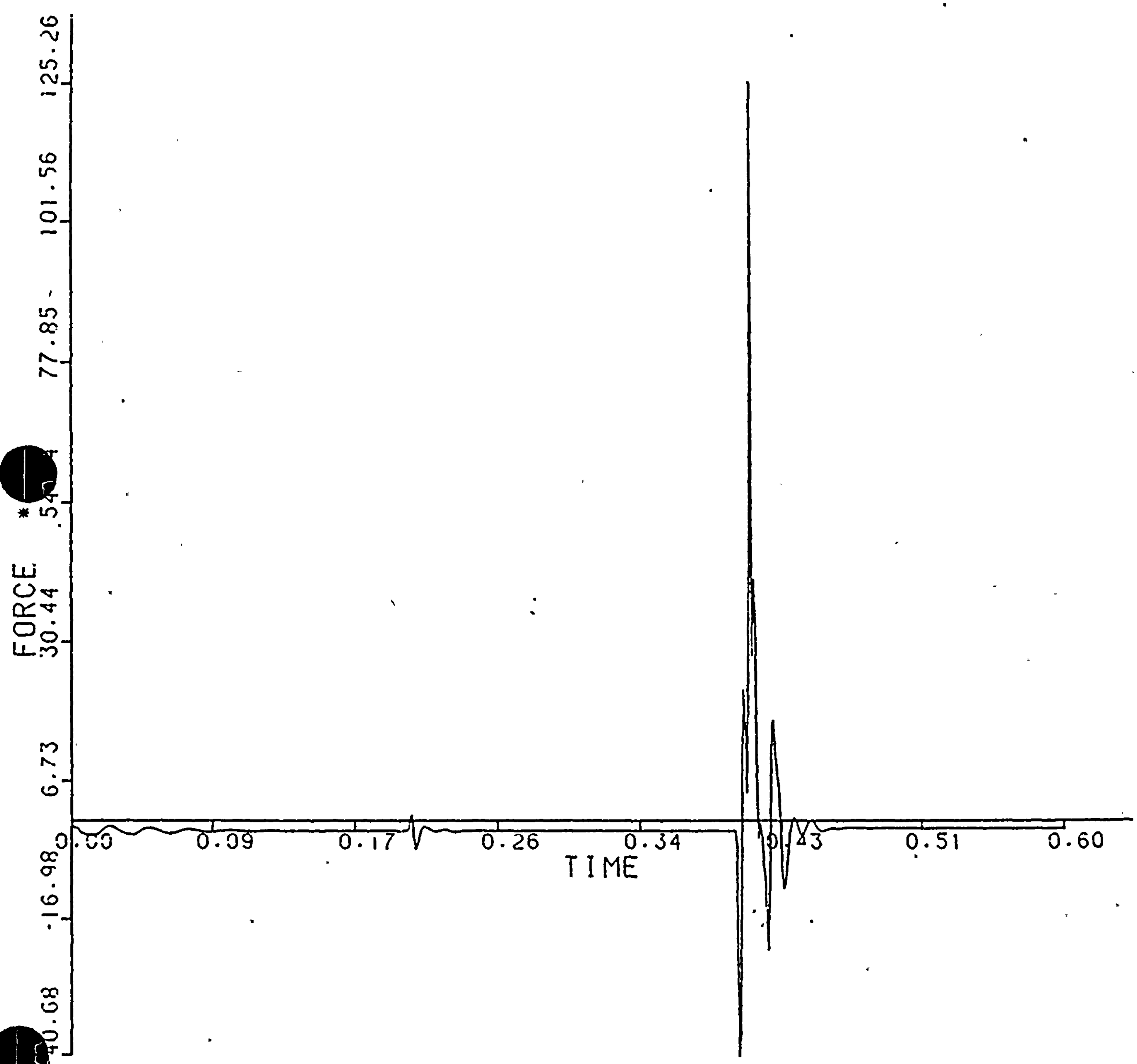
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 26, MAGNITUDE AT NODE POINT 465



DONE BY: DATE:
CHKD BY: DATE:

TELEDYNE
ENGINEERING SERVICES

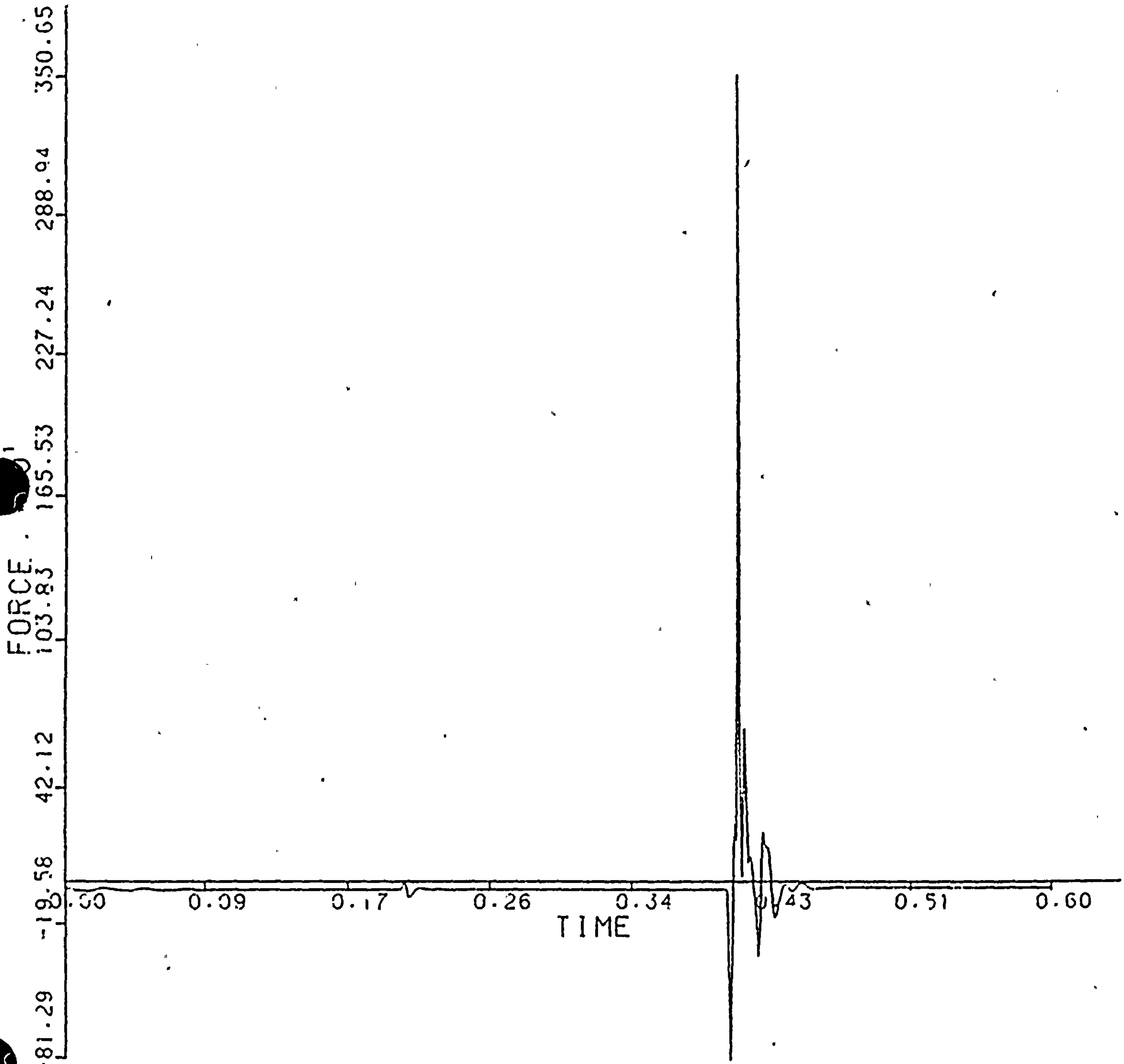
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 27, MAGNITUDE AT NODE POINT 475



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

TELEDYNE
ENGINEERING SERVICES

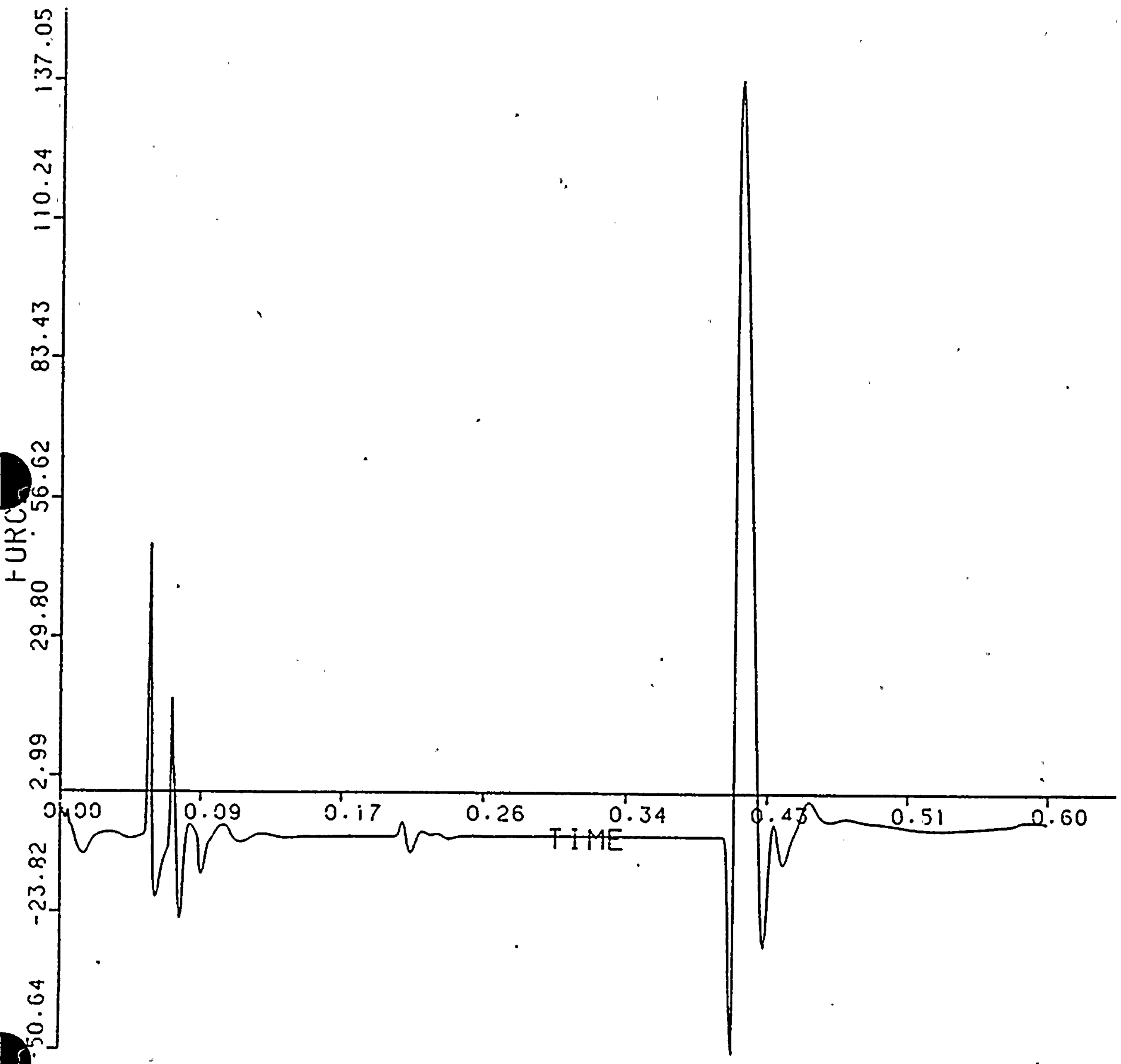
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 28, MAGNITUDE AT NODE POINT 485



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

TELEDYNE
ENGINEERING SERVICES

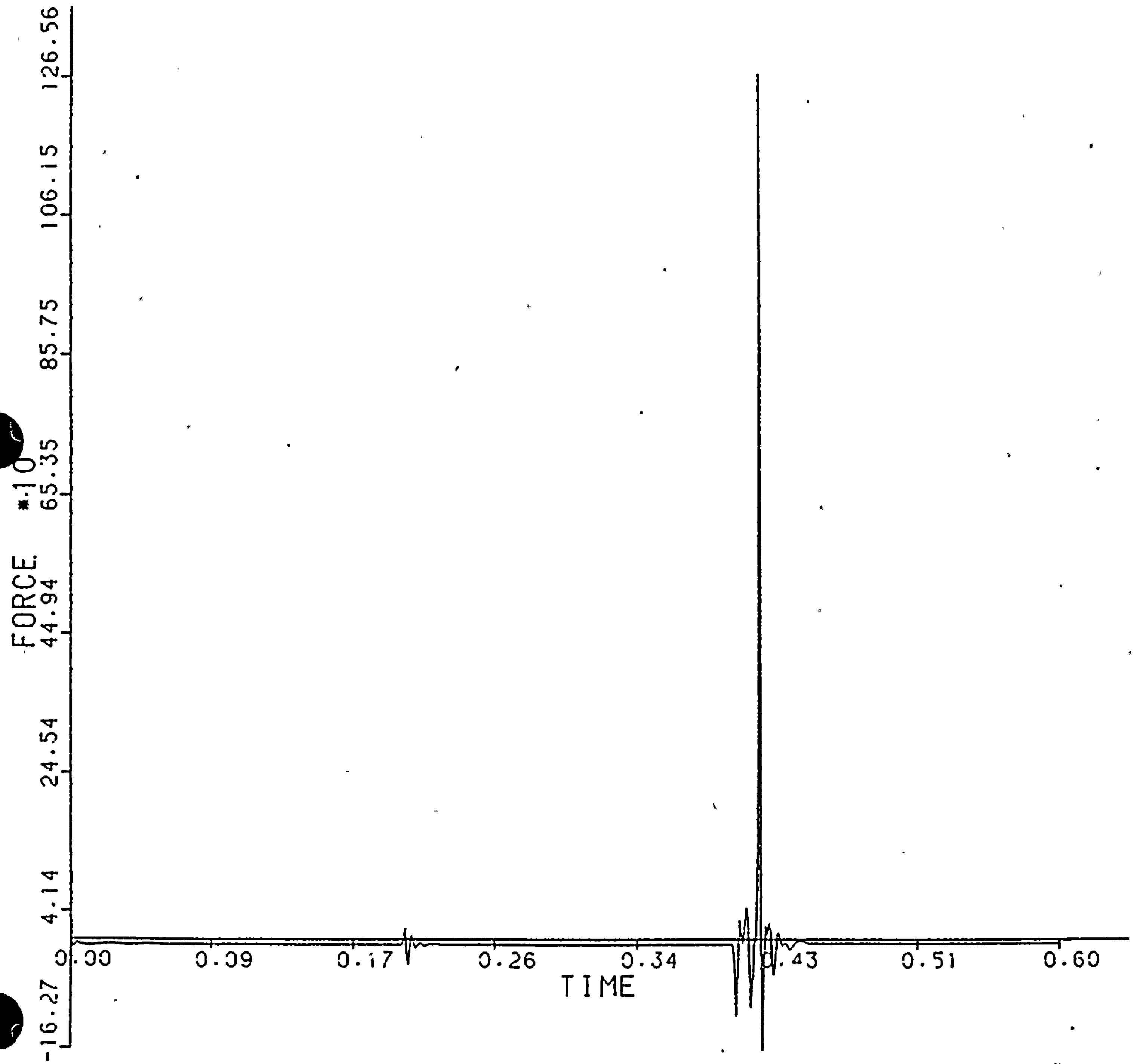
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 29, MAGNITUDE AT NODE POINT 529



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

TELEDYNE
ENGINEERING SERVICES

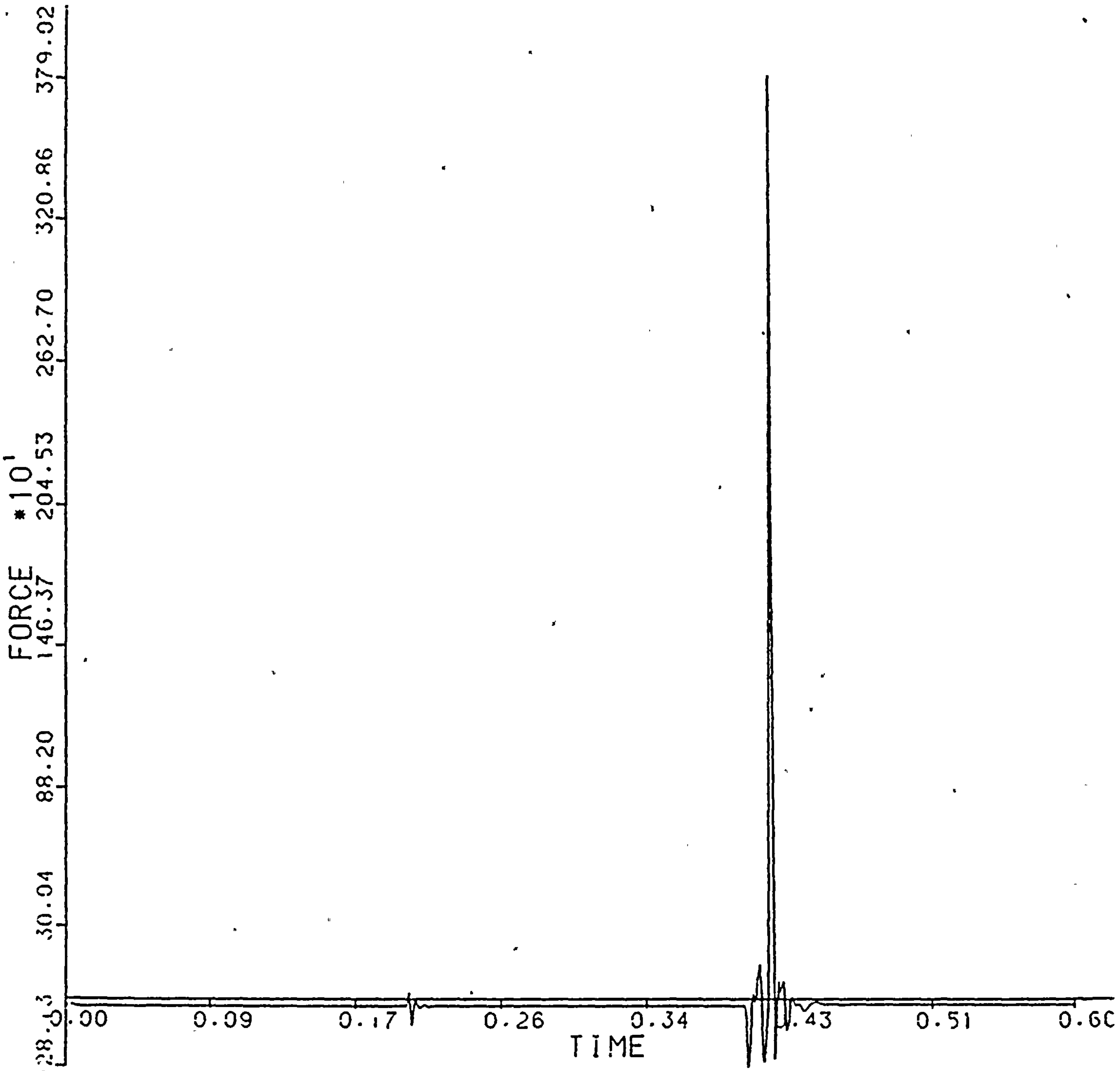
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 30, MAGNITUDE AT NODE POINT 665



DONE BY: DATE:
CHKD BY: DATE:

TELEDYNE
ENGINEERING SERVICES

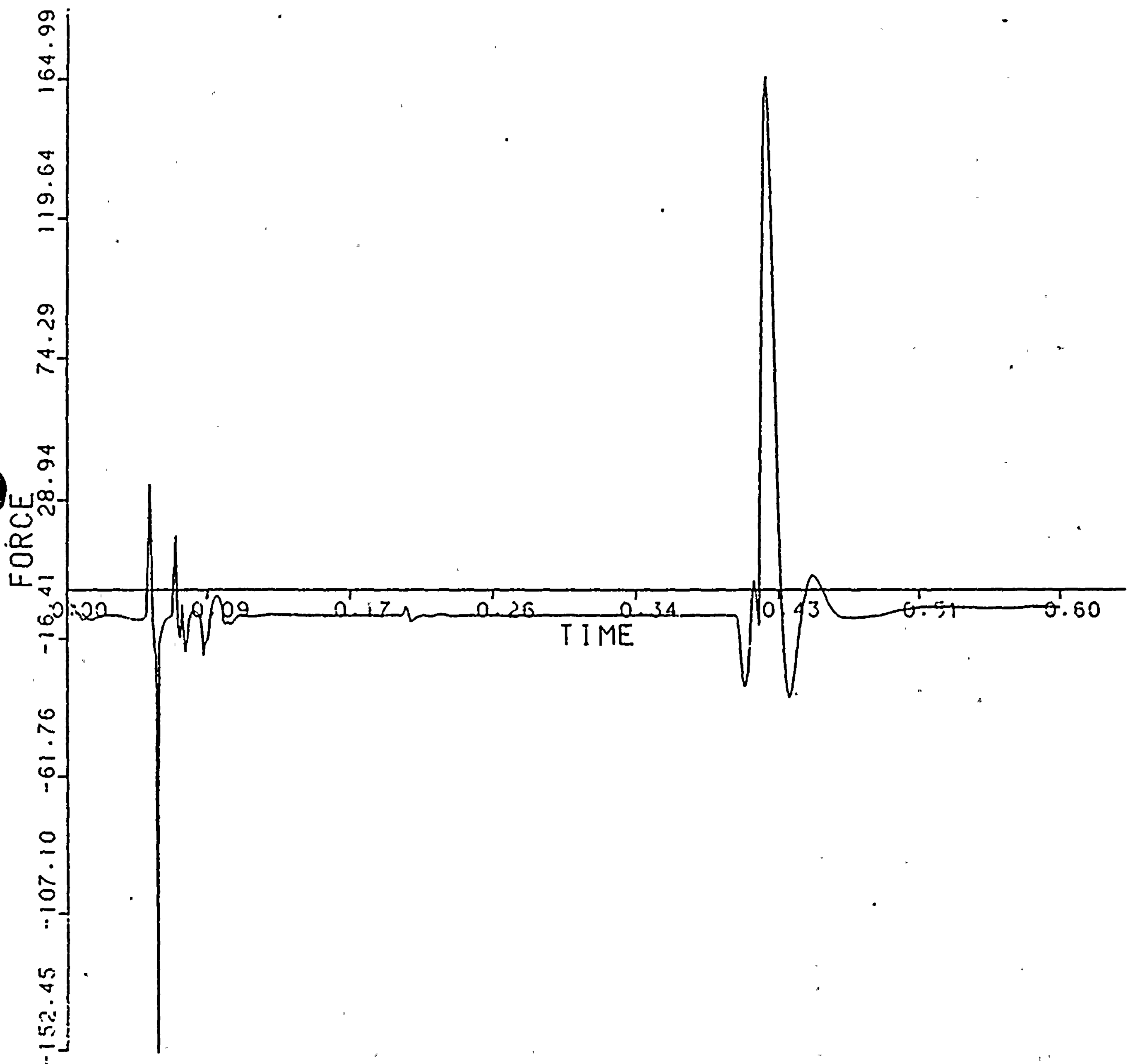
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE ' 31, MAGNITUDE AT NODE POINT 657



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

TELEDYNE
ENGINEERING SERVICES

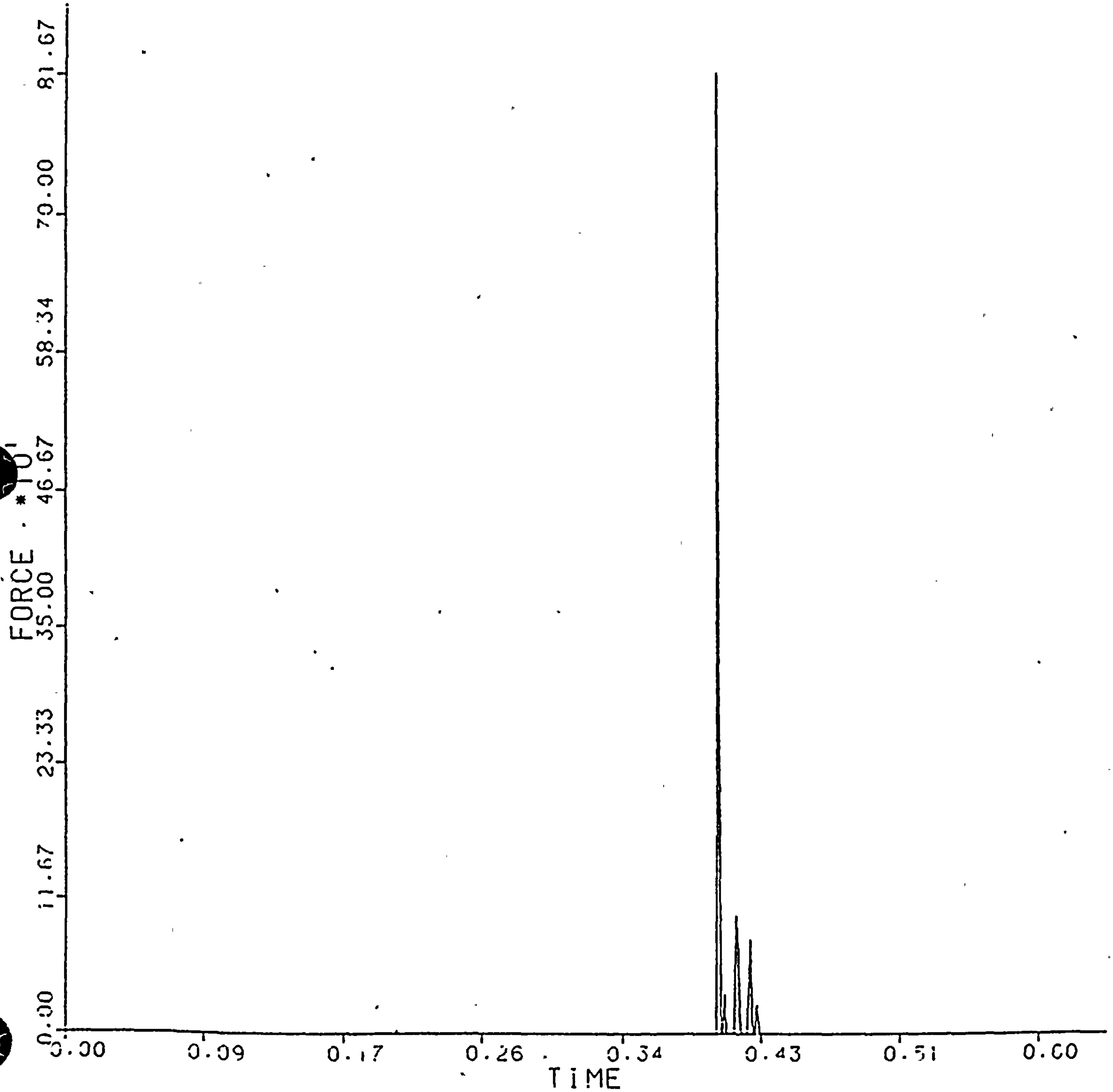
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE, 32, MAGNITUDE AT NODE POINT 620



DONE BY: DATE:
CHKD BY: DATE:

TELEDYNE
ENGINEERING SERVICES

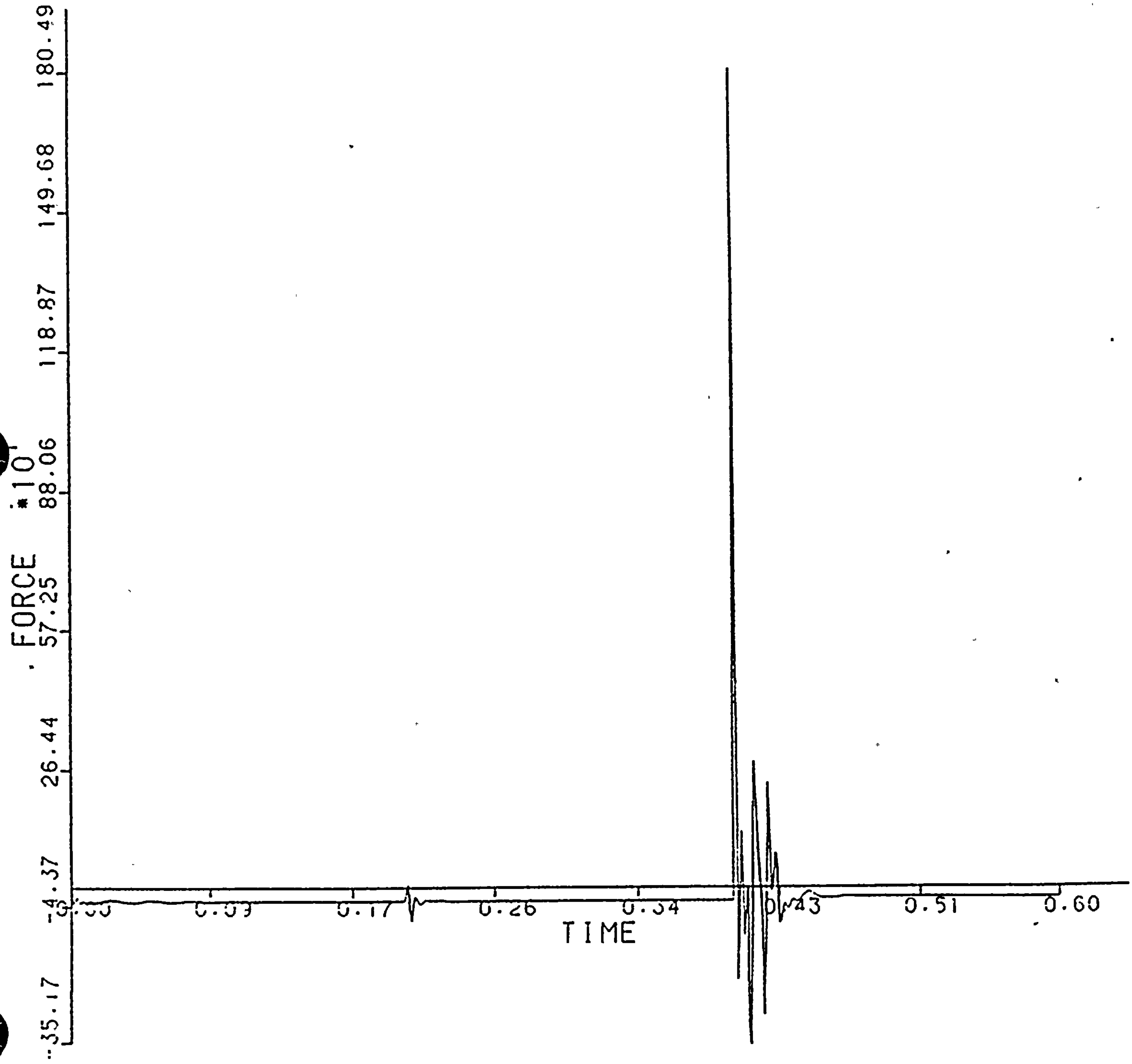
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1. 0-600 MS
TIME/FORCE TABLE 33, MAGNITUDE AT NODE POINT 431



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

TELEDYNE
ENGINEERING SERVICES

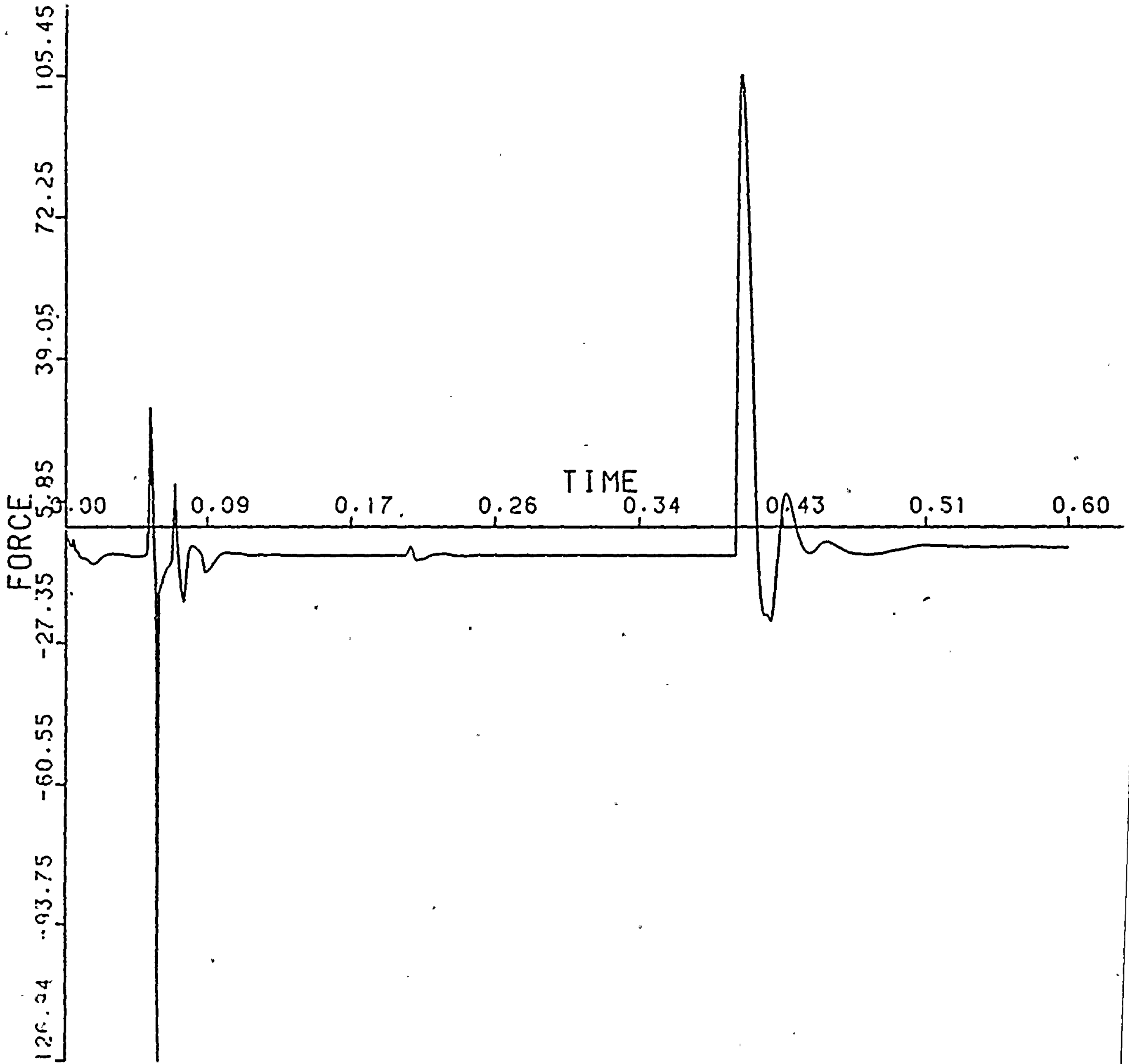
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 34, MAGNITUDE AT NODE POINT 405



DONE BY: DATE:
CHKD BY: DATE:

TELEDYNE
ENGINEERING SERVICES

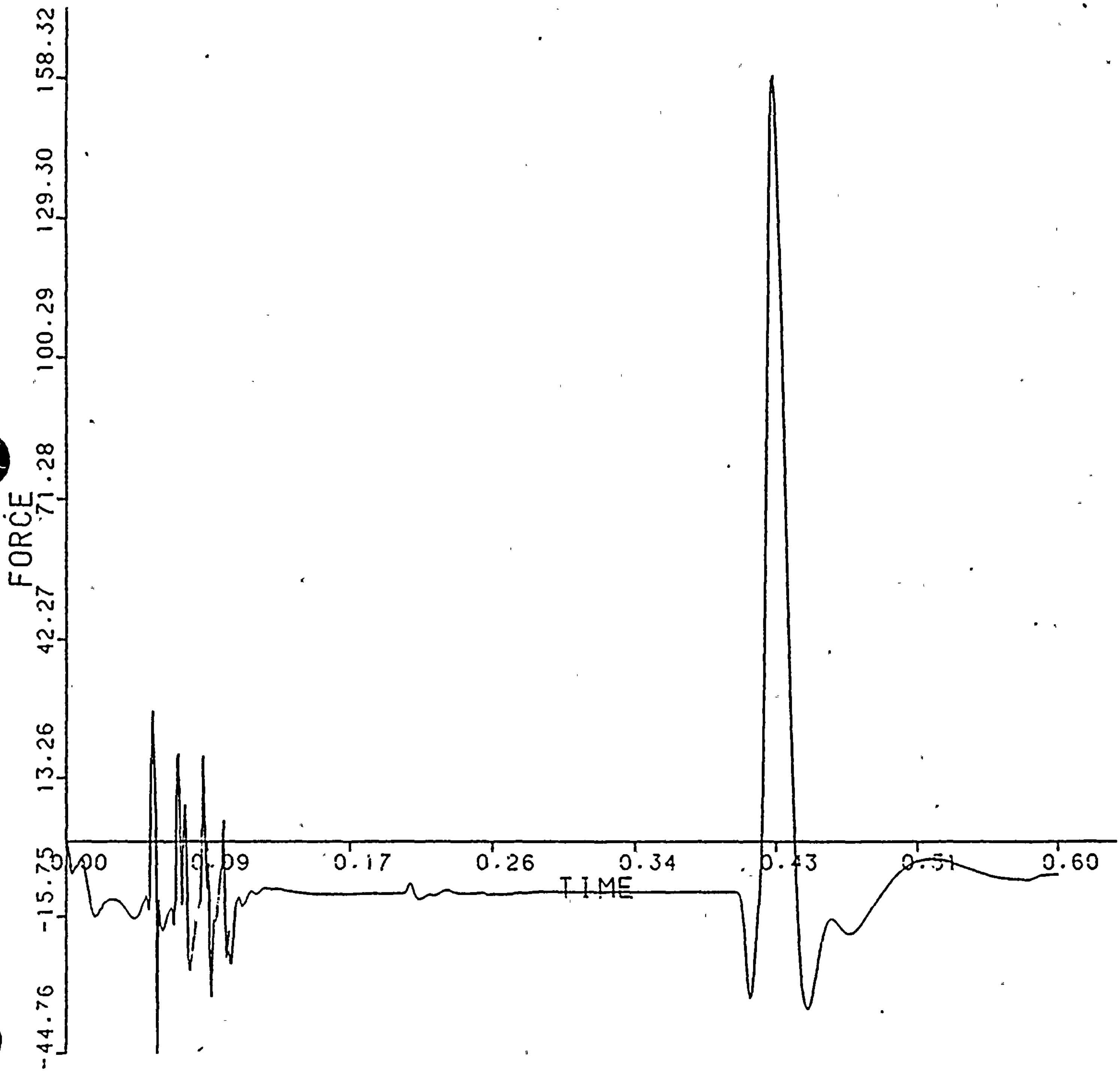
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 35, MAGNITUDE AT NODE POINT 382



DONE BY: DATE:
CHKD BY: DATE:

TELEDYNE
ENGINEERING SERVICES

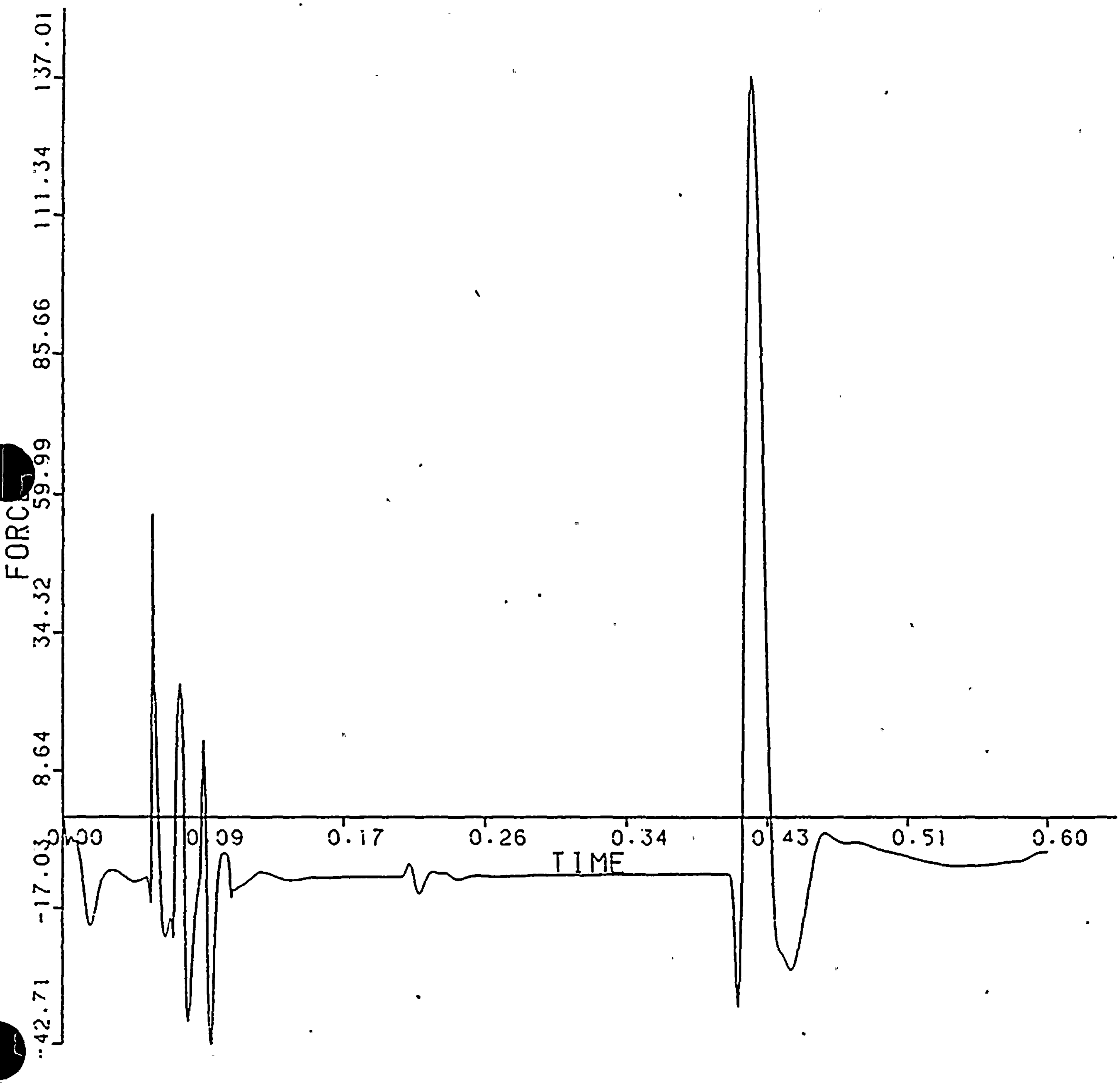
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 36, MAGNITUDE AT NODE POINT 610



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

TELEDYNE ENGINEERING SERVICES

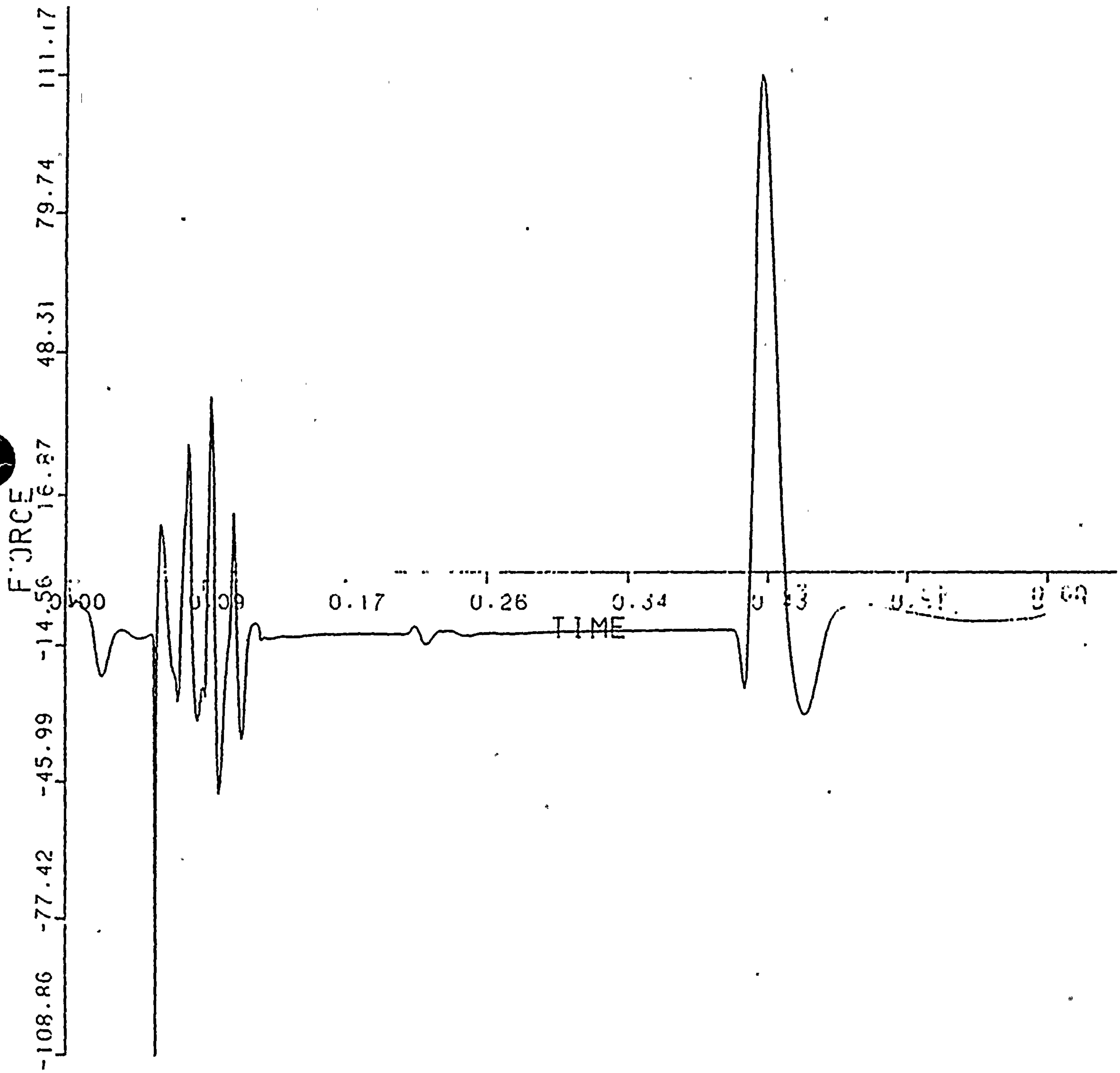
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 37, MAGNITUDE AT NODE POINT 535



DONE BY: DATE:
CHKD BY: DATE:

TELEDYNE
ENGINEERING SERVICES

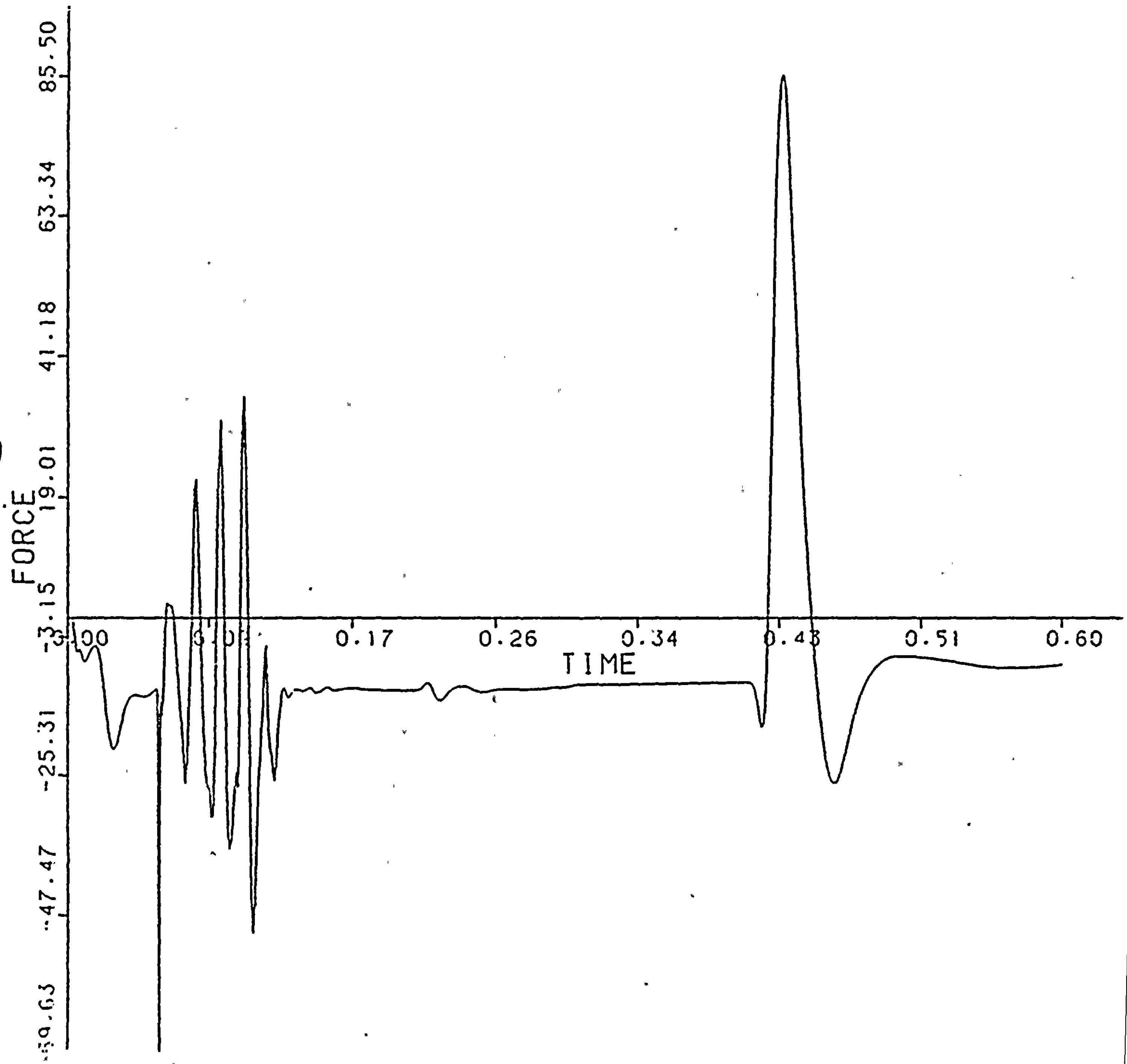
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 38, MAGNITUDE AT NODE POINT 545



DONE BY: MZ DATE: 5-23-83
CHKD BY: JM DATE: 5-25-83

TELEDYNE
ENGINEERING SERVICES

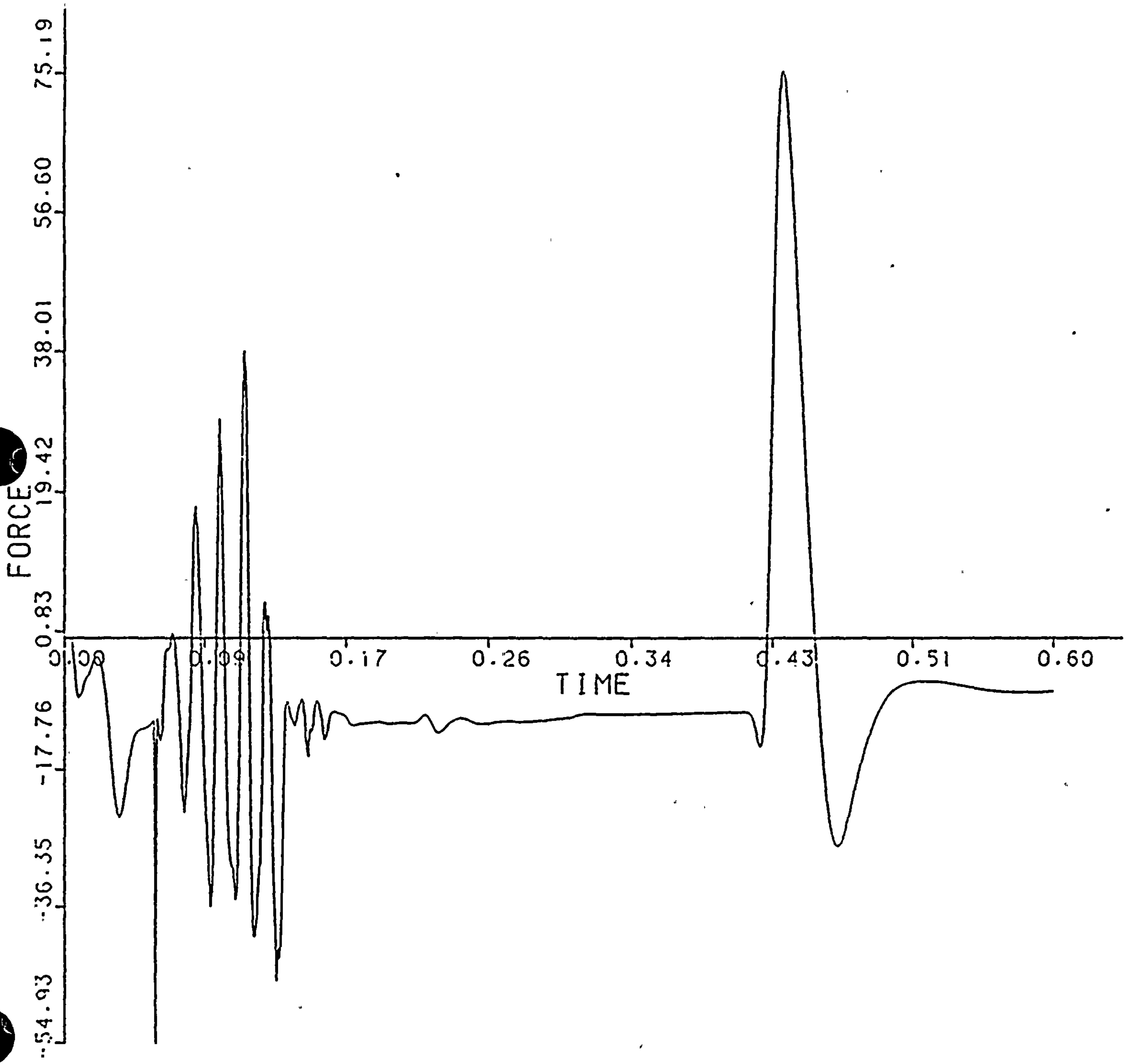
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 39. MAGNITUDE AT NODE POINT 550



DONE BY: MZ DATE: 5-2-83
CHKD BY: JH DATE: 5-25-83

TELEDYNE
ENGINEERING SERVICES

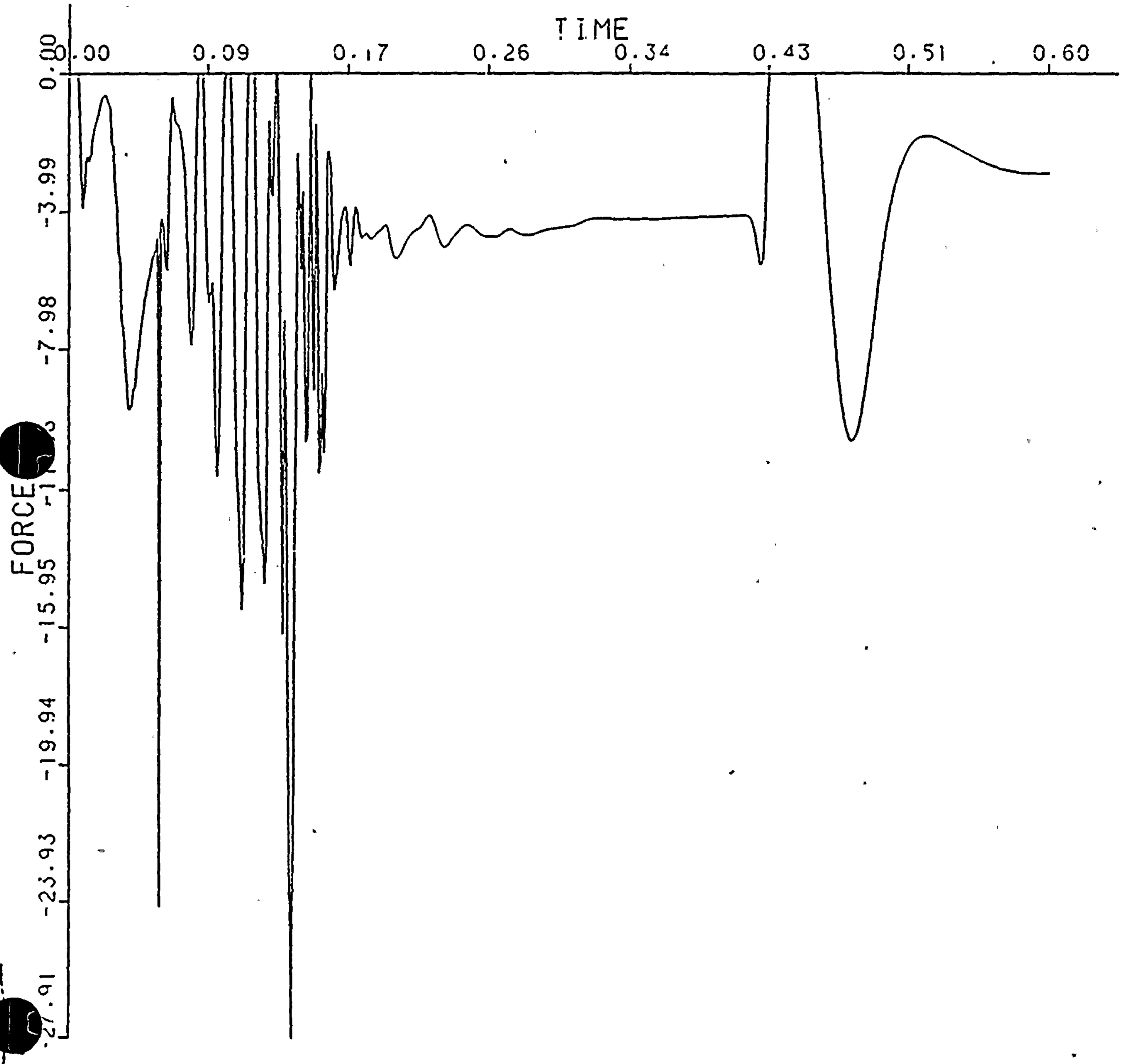
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 40, MAGNITUDE AT NODE POINT 555



DONE BY: KZ DATE: 5-21-83
CHKD BY: W DATE: 5-25-83

TELEDYNE
ENGINEERING SERVICES

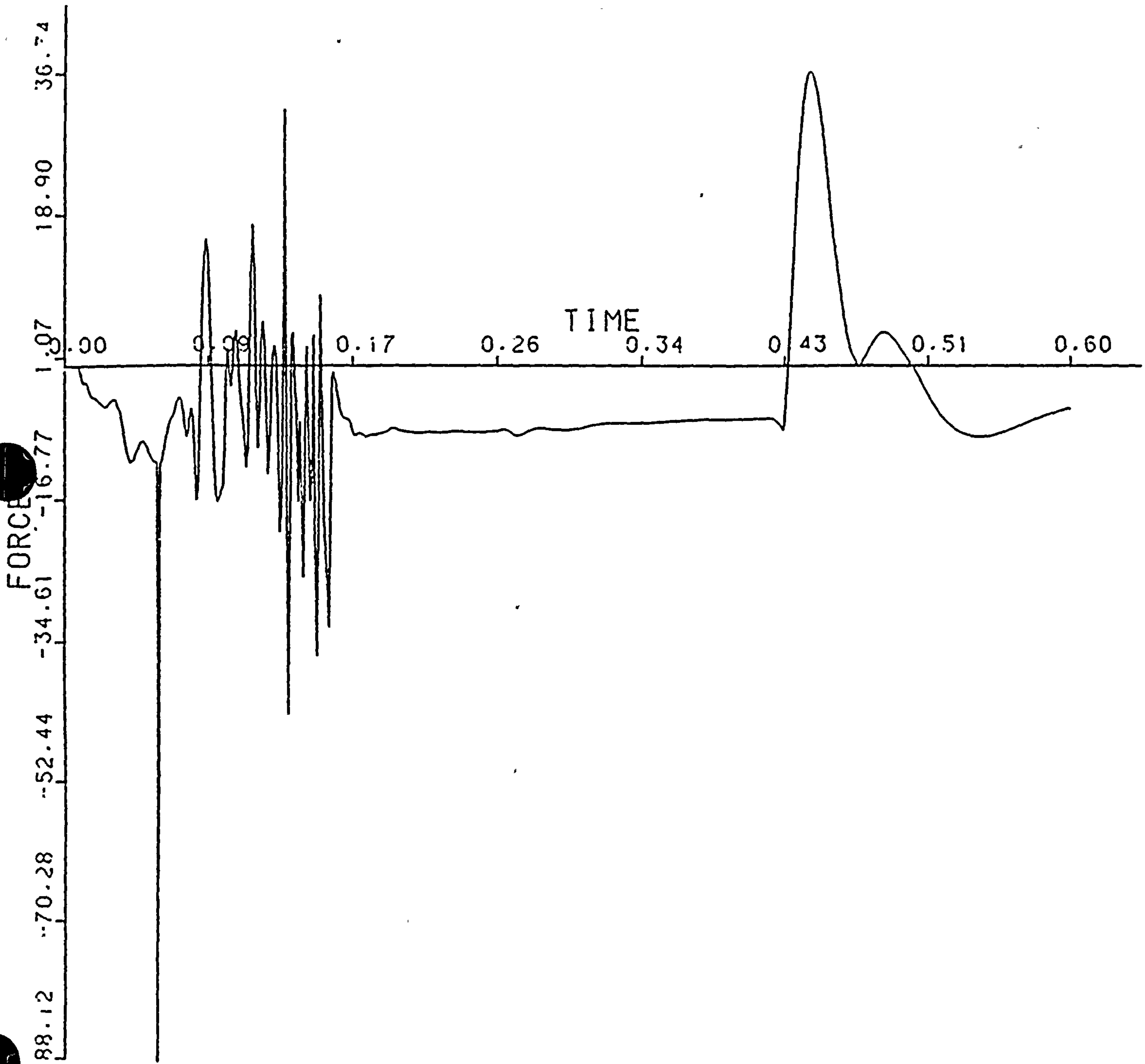
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 41, MAGNITUDE AT NODE POINT 560



DONE BY: MZ DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

TELEDYNE ENGINEERING SERVICES

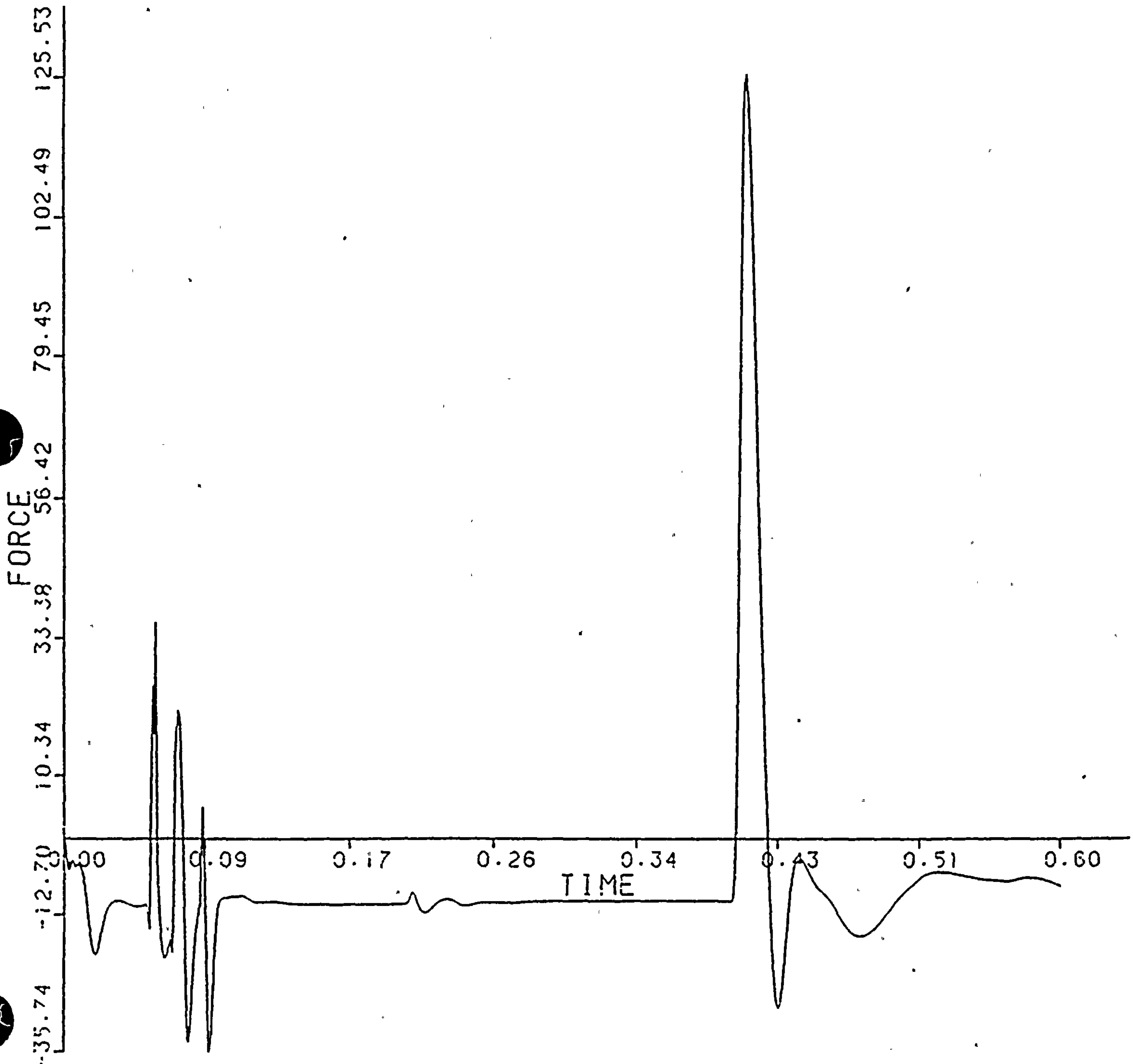
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 42, MAGNITUDE AT NODE POINT 300



DONE BY: MZ DATE: 5-2-85
CHKD BY: JW DATE: 5-23-85

TELEDYNE
ENGINEERING SERVICES

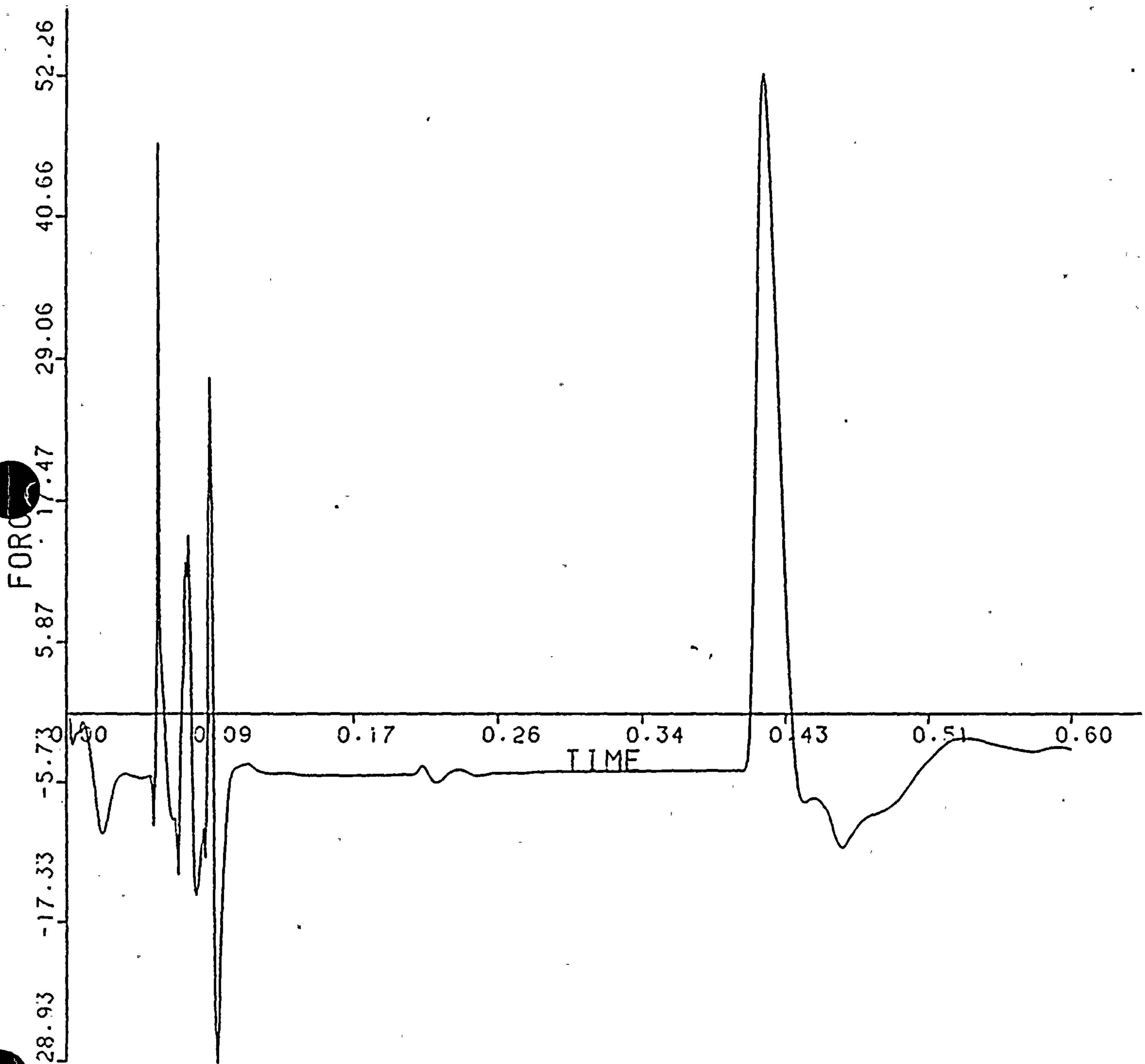
SAP2SAP VERIFICATION 5364 23 MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 43, MAGNITUDE AT NODE POINT 375



DONE BY: VR DATE: 5-2-83
CHKD BY: JH DATE: 5-25-83

TELEDYNE
ENGINEERING SERVICES

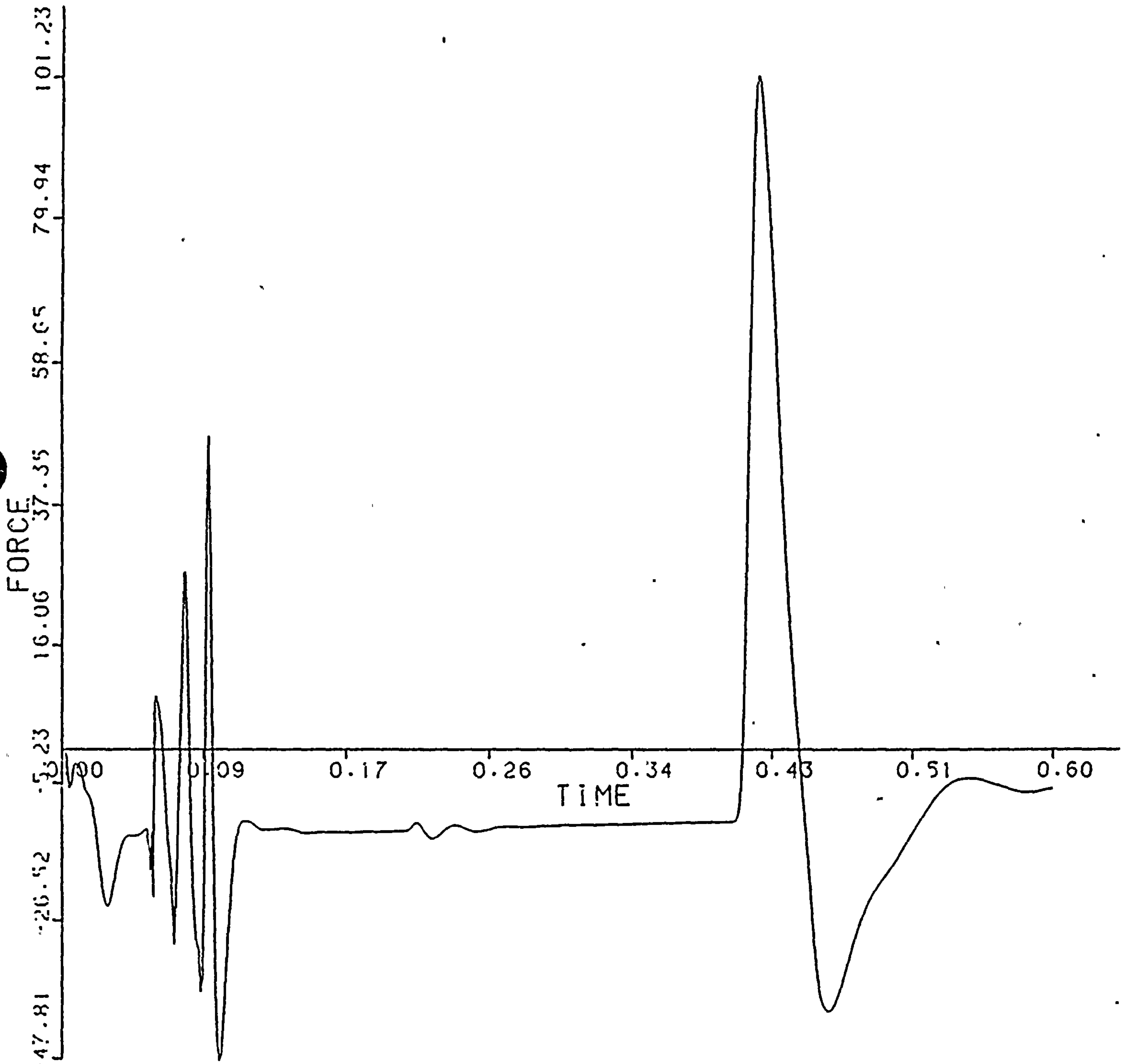
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 44, MAGNITUDE AT NODE POINT 365



DONE BY: DATE:
CHKD BY: DATE:

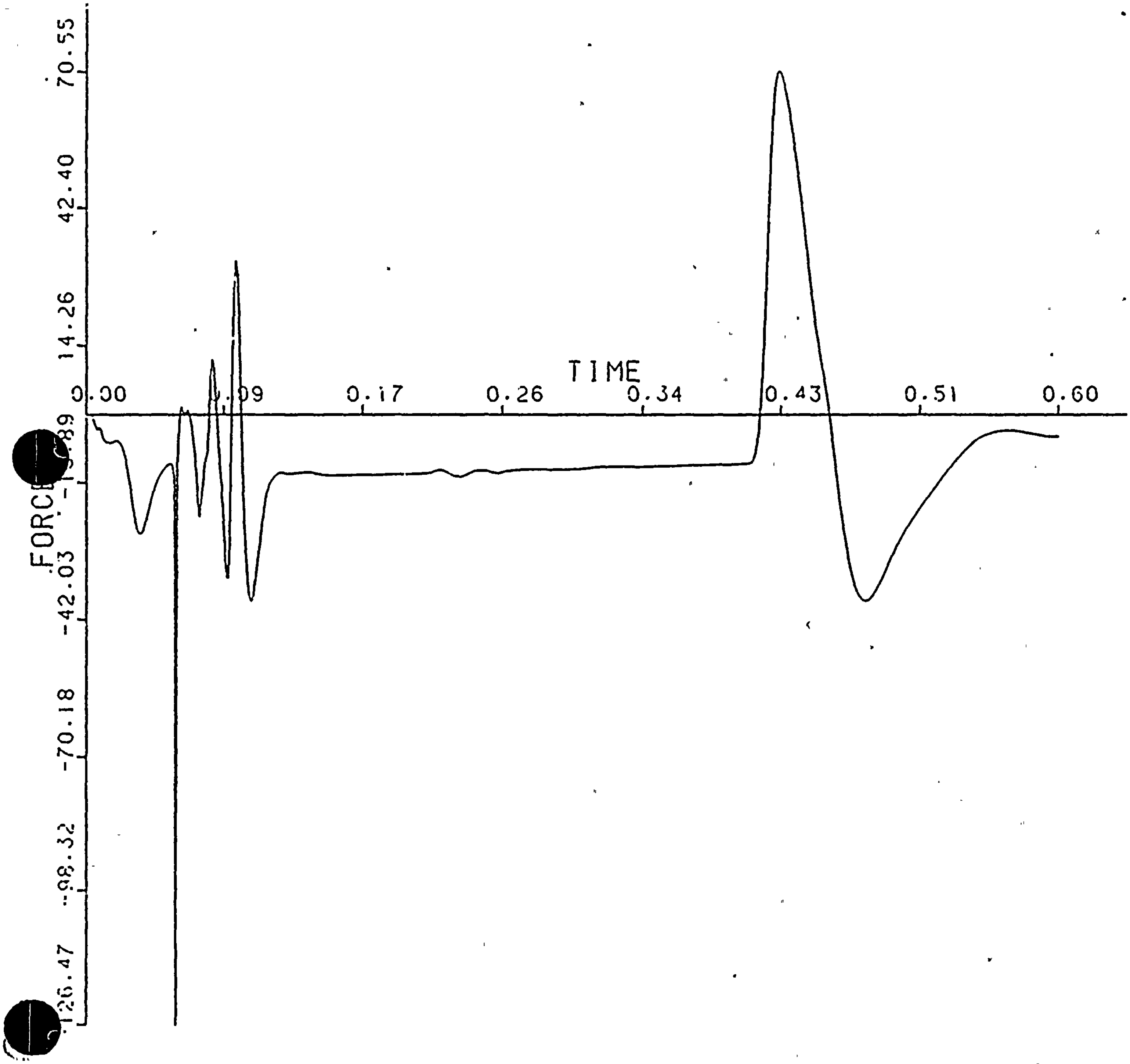
TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364   23 MAY 83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE   45, MAGNITUDE AT NODE POINT   360



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

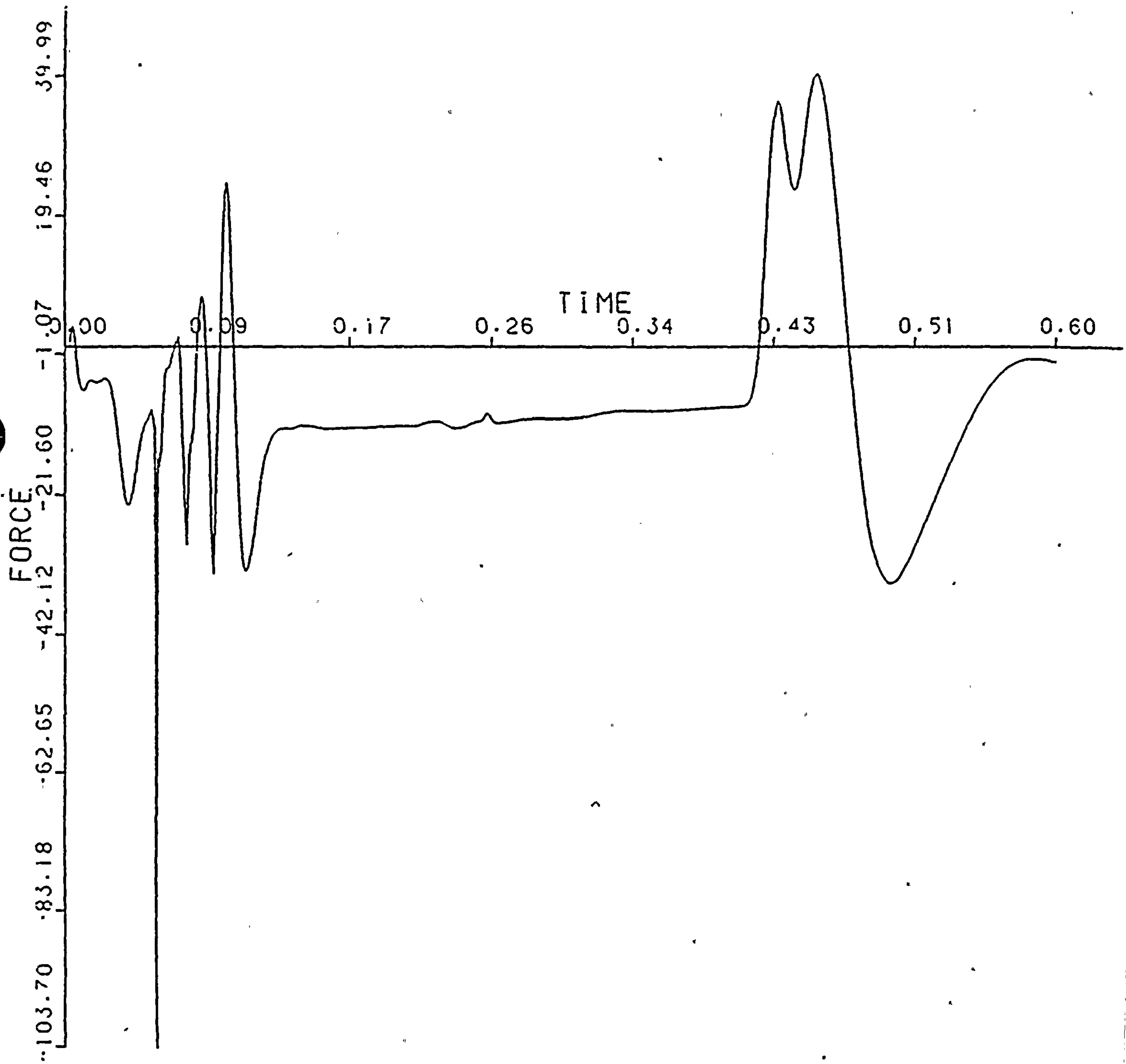
SAP2SAP VERIFICATION 5364 23 MAY 85
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 46, MAGNITUDE AT NODE POINT 355.



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

TELEDYNE
ENGINEERING SERVICES

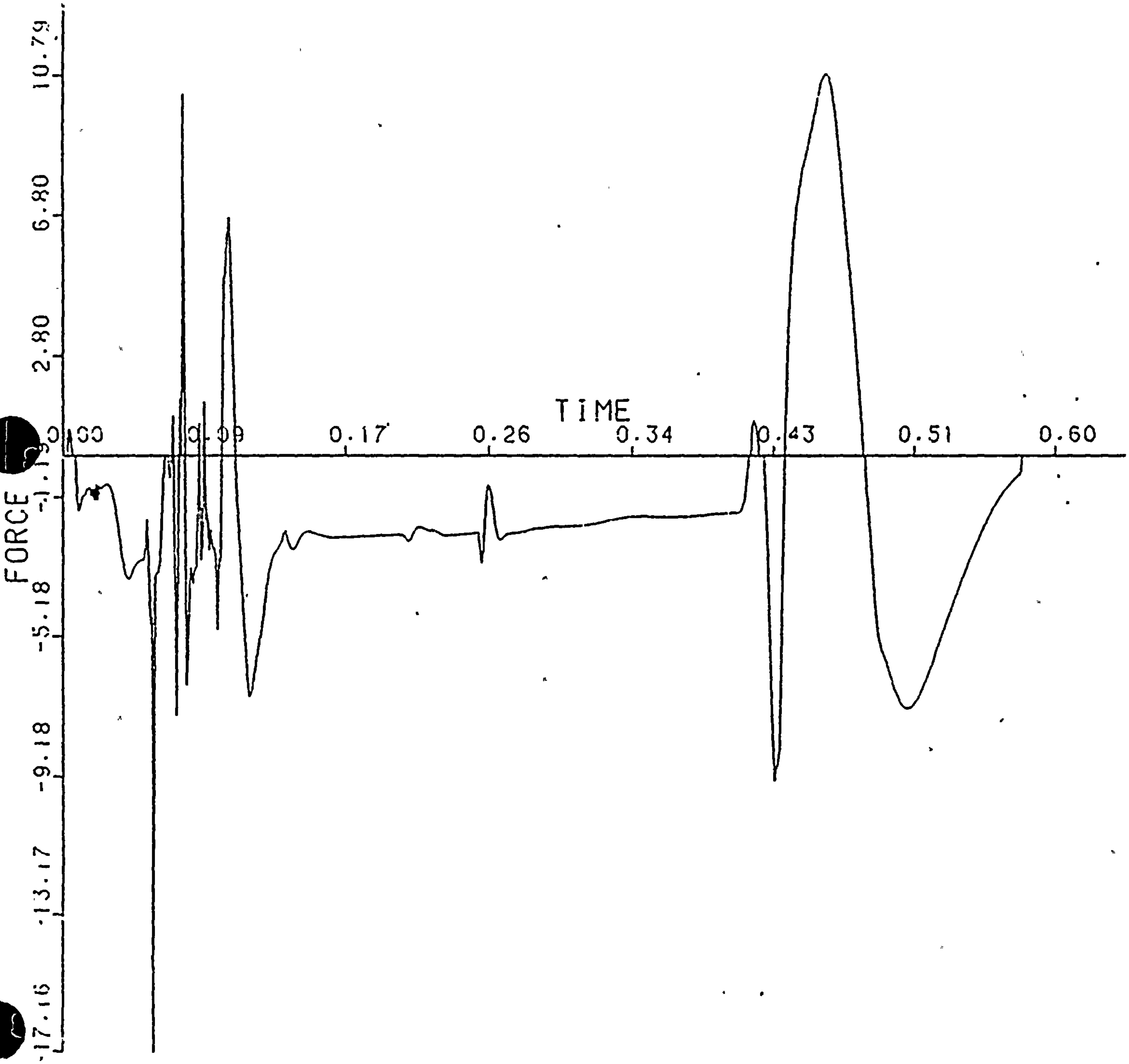
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 47, MAGNITUDE AT NODE POINT 350



DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

TELEDYNE
ENGINEERING SERVICES

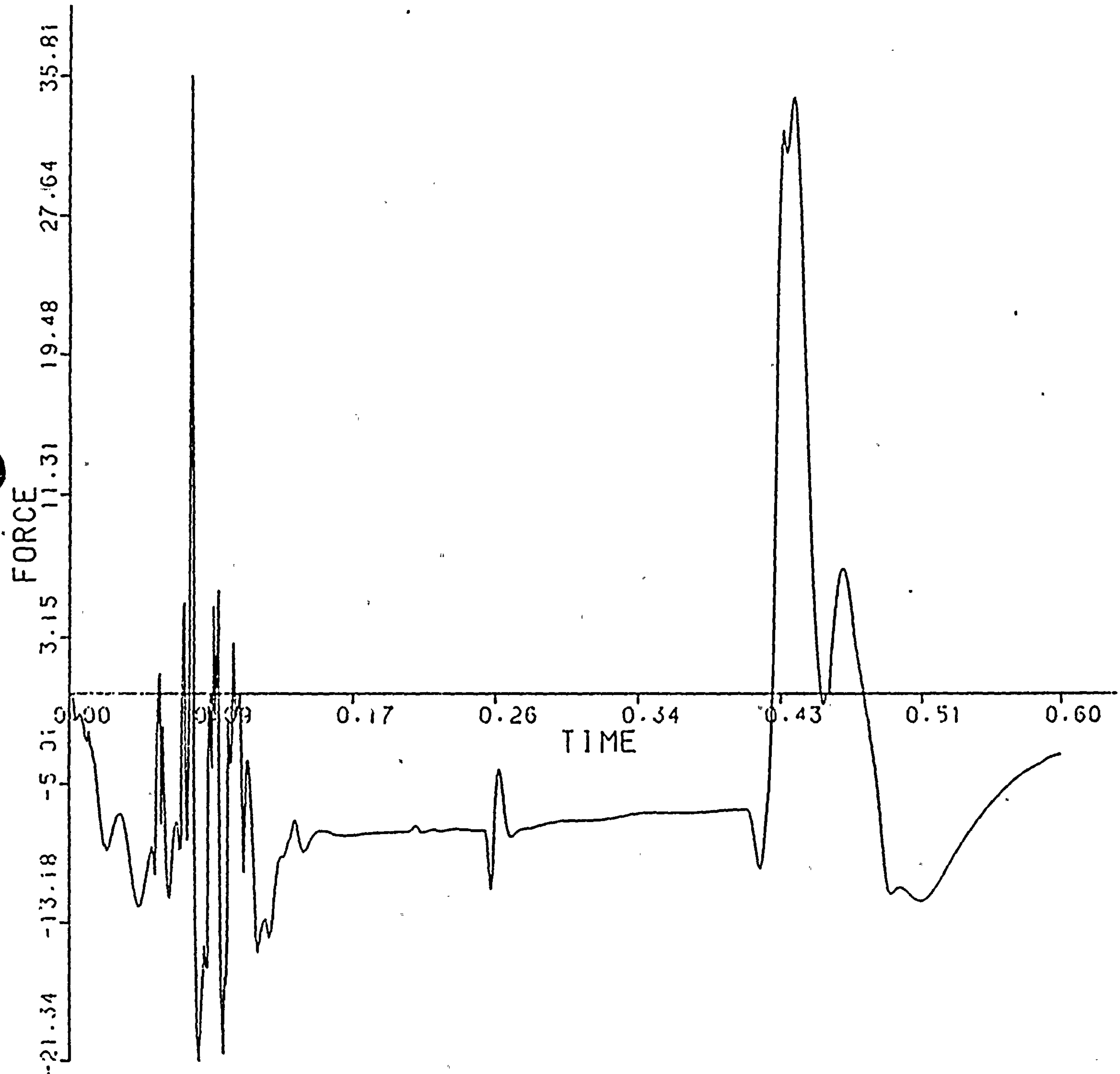
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 48, MAGNITUDE AT NODE POINT 340



DONE BY: DATE:
CHKD BY: DATE:

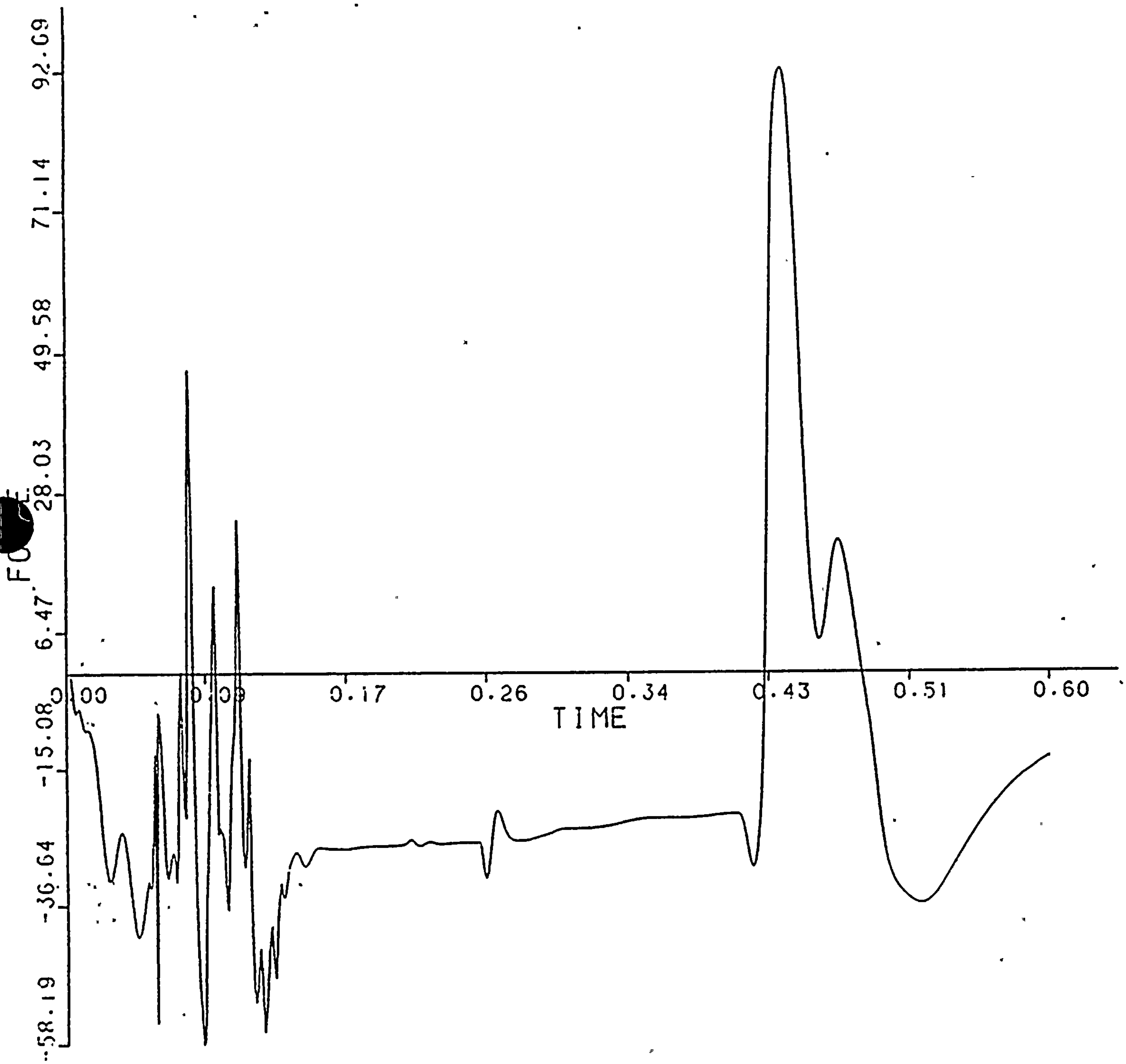
TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 49, MAGNITUDE AT NODE POINT 335



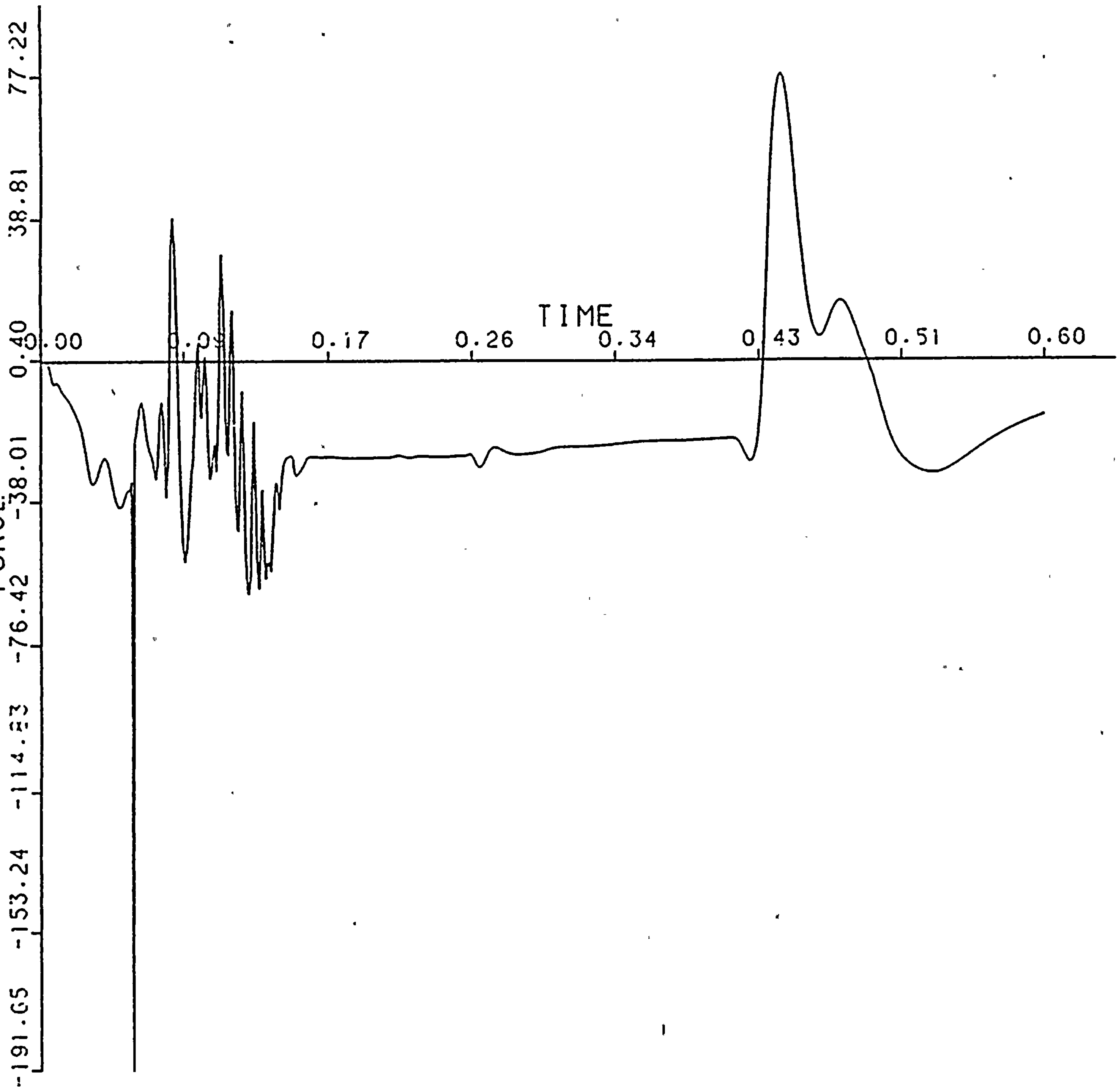
DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE . 50, MAGNITUDE AT NODE POINT 325



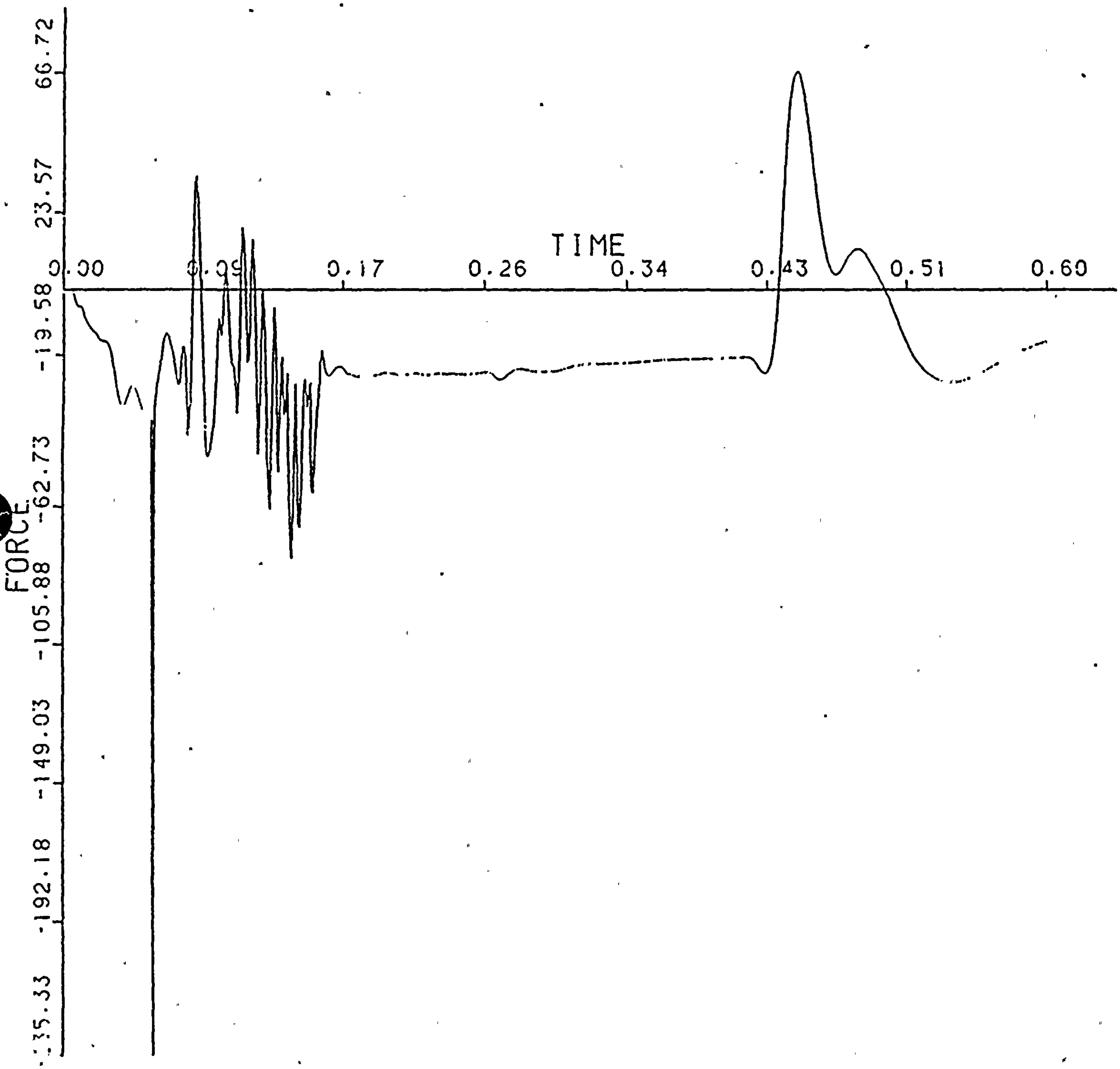
DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1. 0-600 MS
TIME/FORCE TABLE 51. MAGNITUDE AT NODE POINT 320



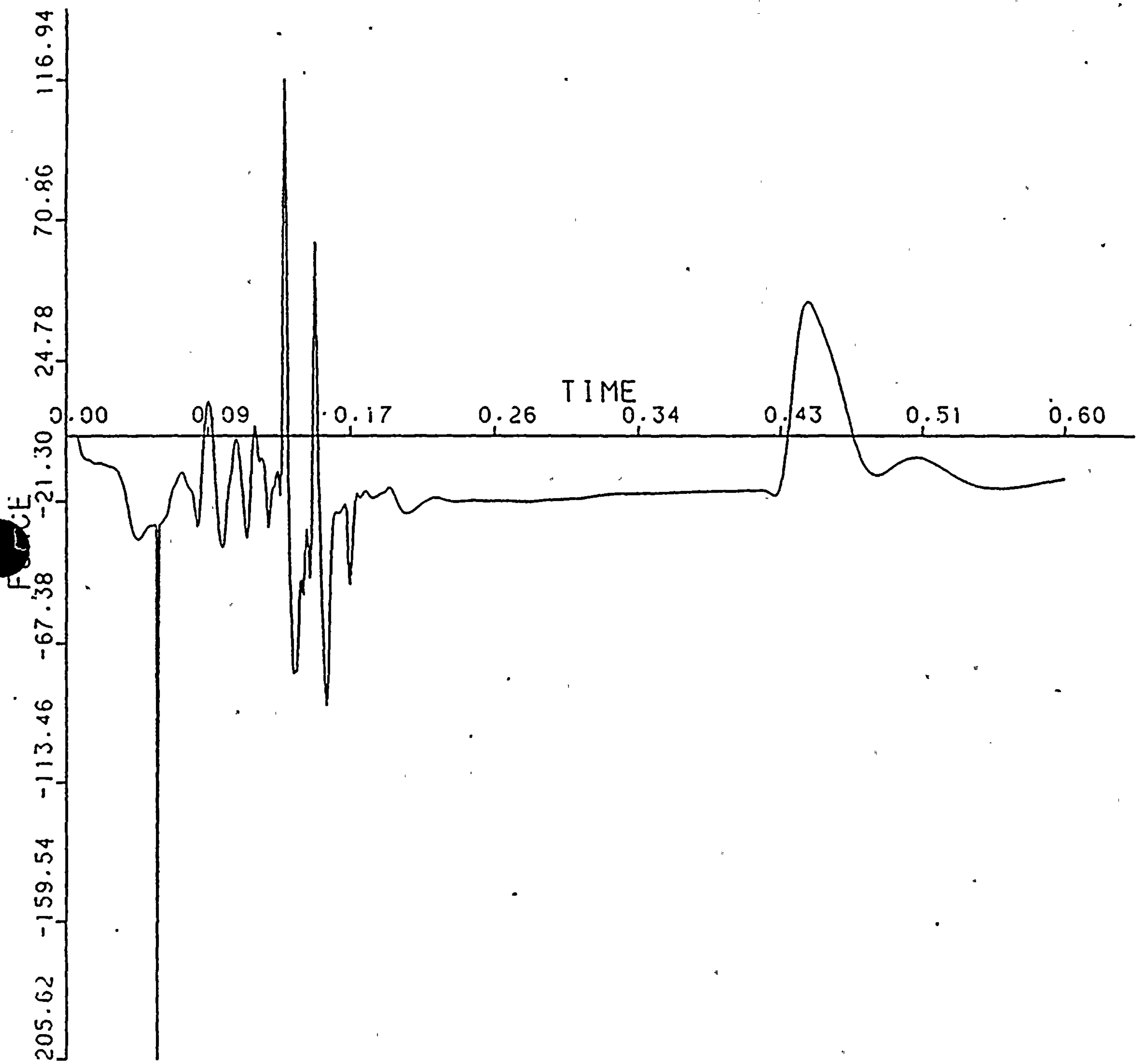
DONE BY: [illegible] DATE: 5-[illegible]
CHKD BY: [illegible] DATE: 5-25-83

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 52, MAGNITUDE AT NODE POINT 310



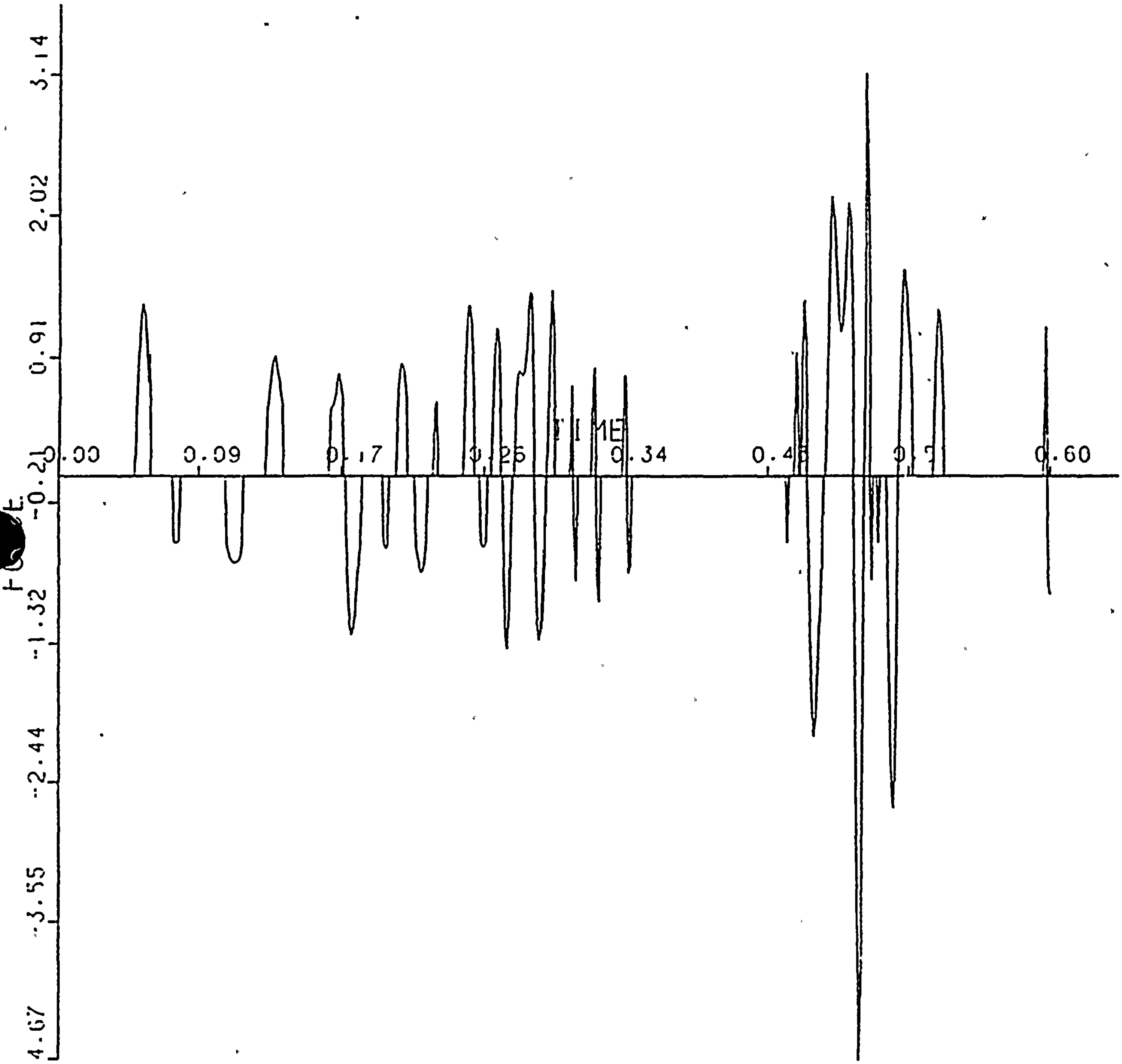
DONE BY: ___ DATE: ___
CHKD BY: ___ DATE: ___

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 53, MAGNITUDE AT NODE POINT 295



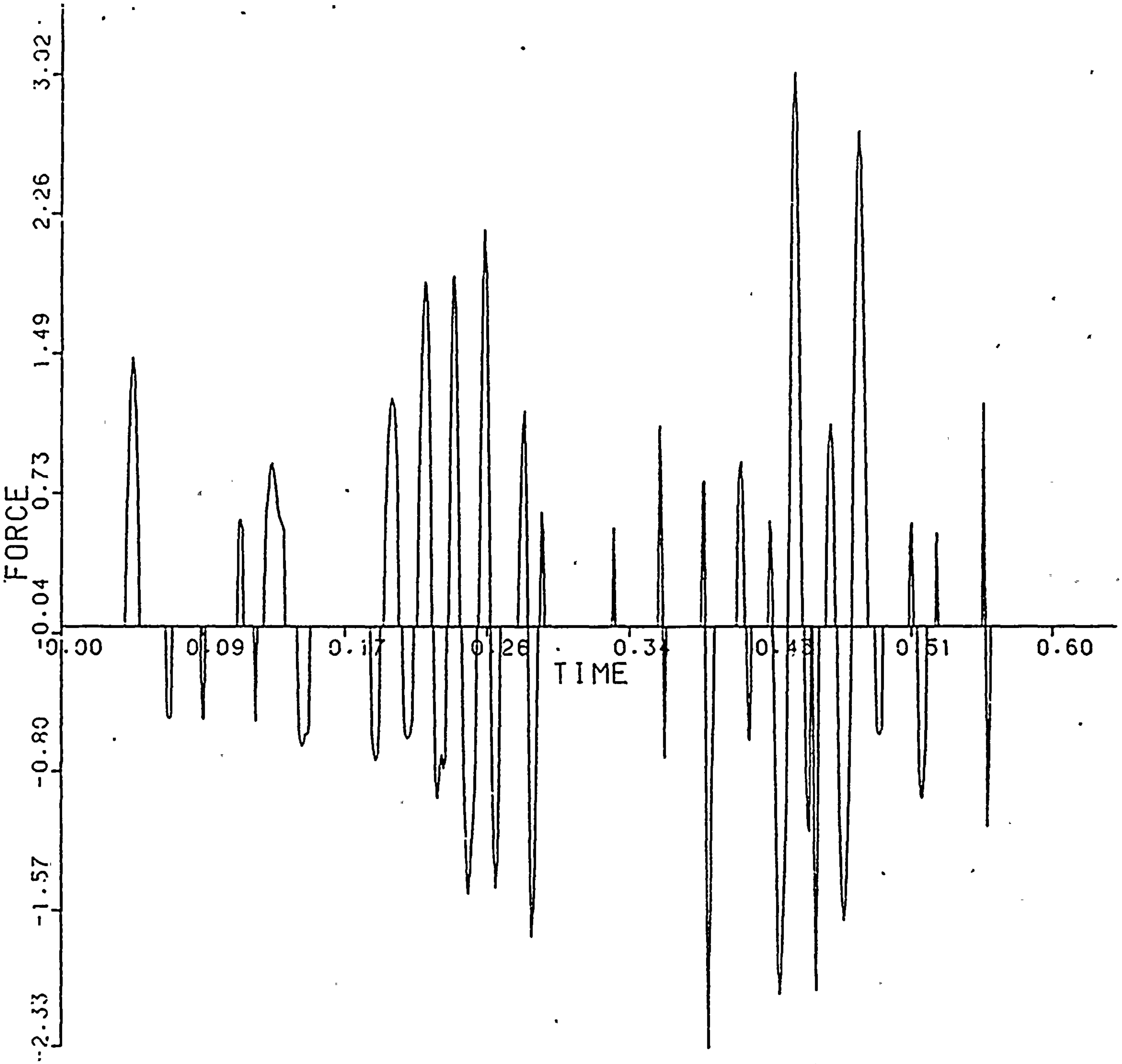
DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 54, MAGNITUDE AT NODE POINT 114



DONE BY: DATE:
CHKD BY: DATE:

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED. SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 55, MAGNITUDE AT NODE POINT 162

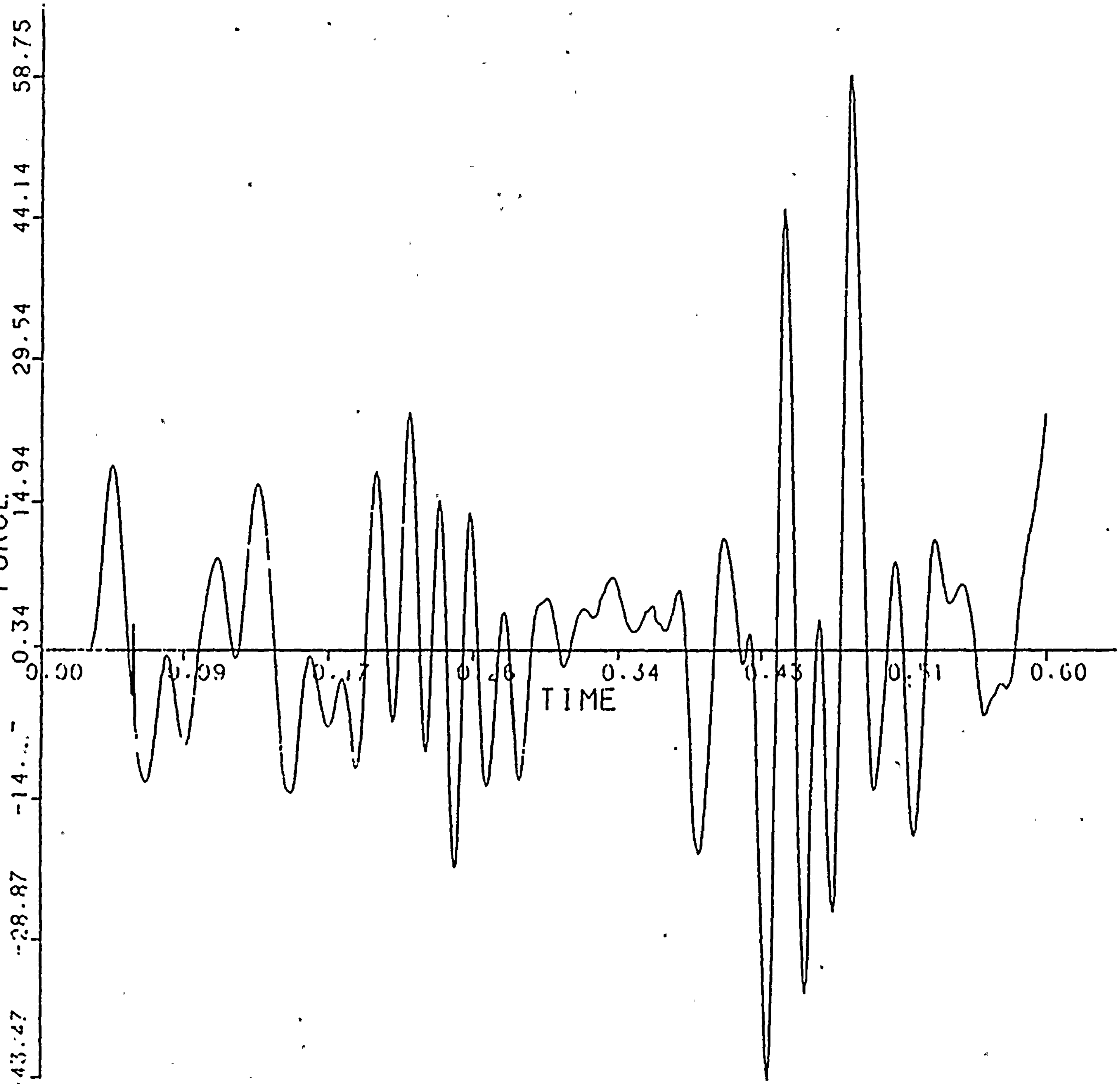


DONE BY: ___ DATE: ___
CHKD BY: ___ DATE: ___

SAP2SAP VERIFICATION 5364 23-MAY-83

YEL-RED SOLID UNIT 1, 0-600 MS

TIME/FORCE TABLE 56, MAGNITUDE AT NODE POINT 157

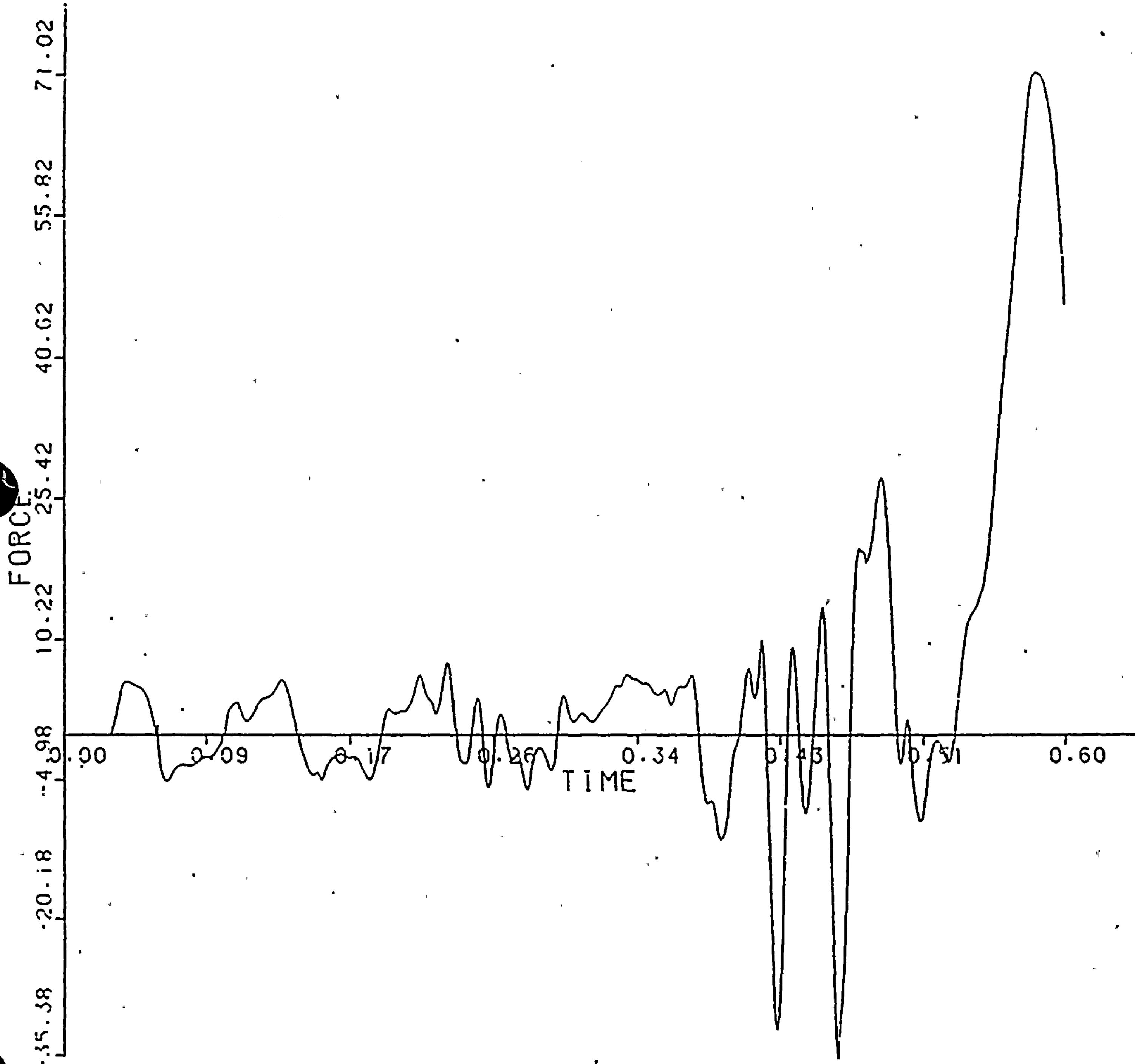


DONE BY: ___ DATE: ___

CHKD BY: ___ DATE: ___

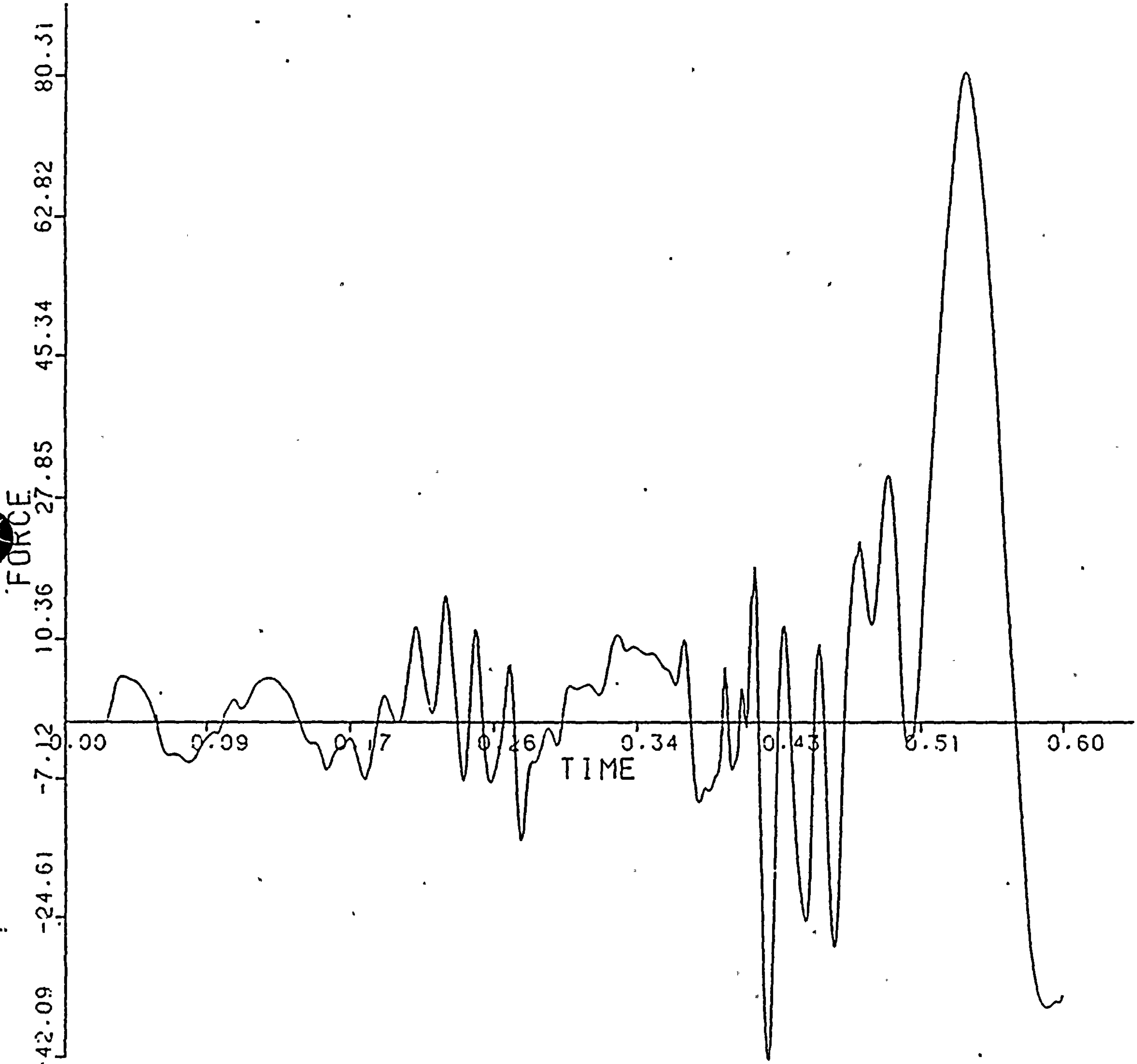
TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 57, MAGNITUDE AT NODE POINT 150



DONE BY: DATE:
CHKD BY: DATE:

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 58, MAGNITUDE AT NODE POINT 148



DONE BY: DATE:
CHKD BY: DATE:

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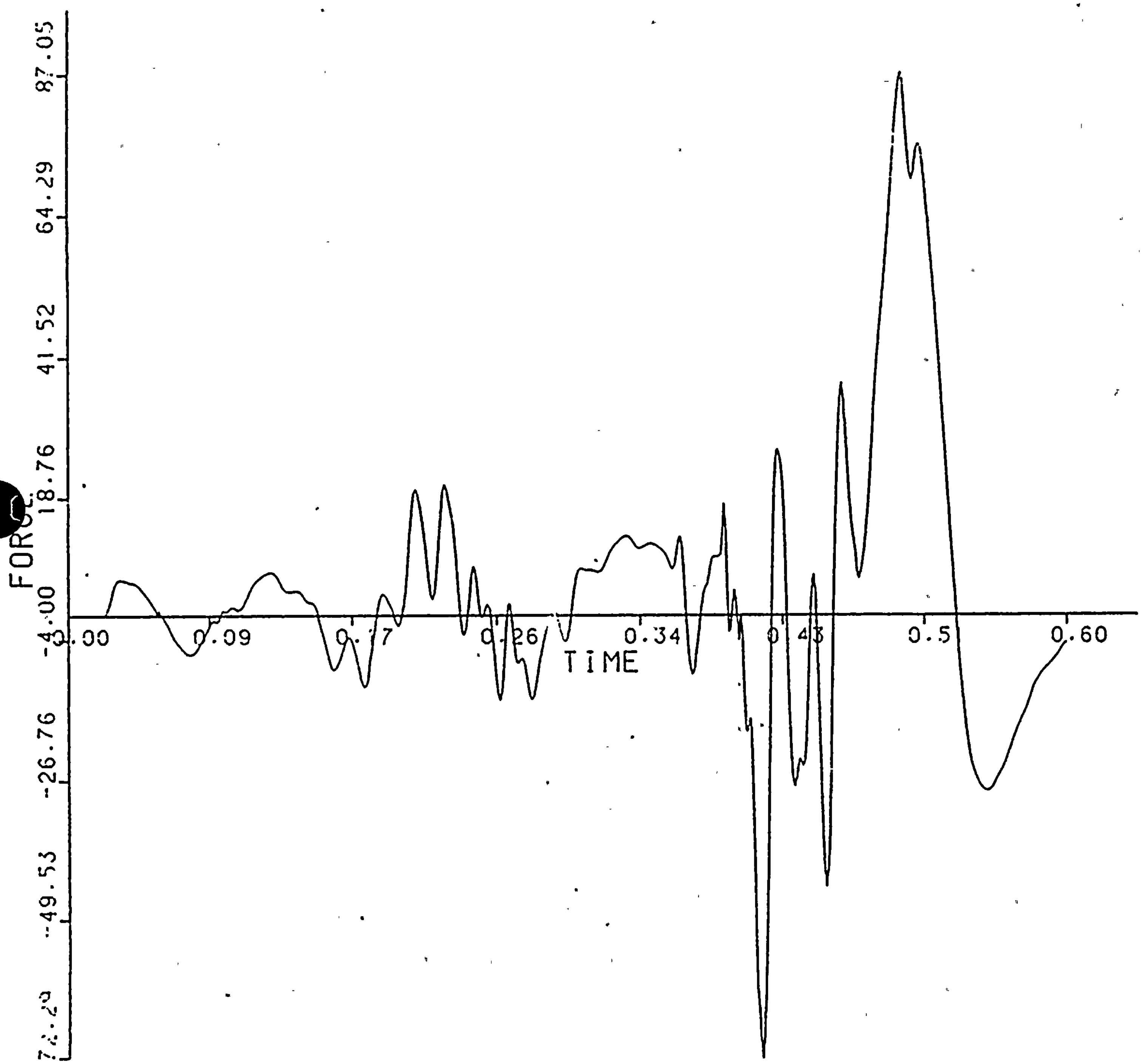
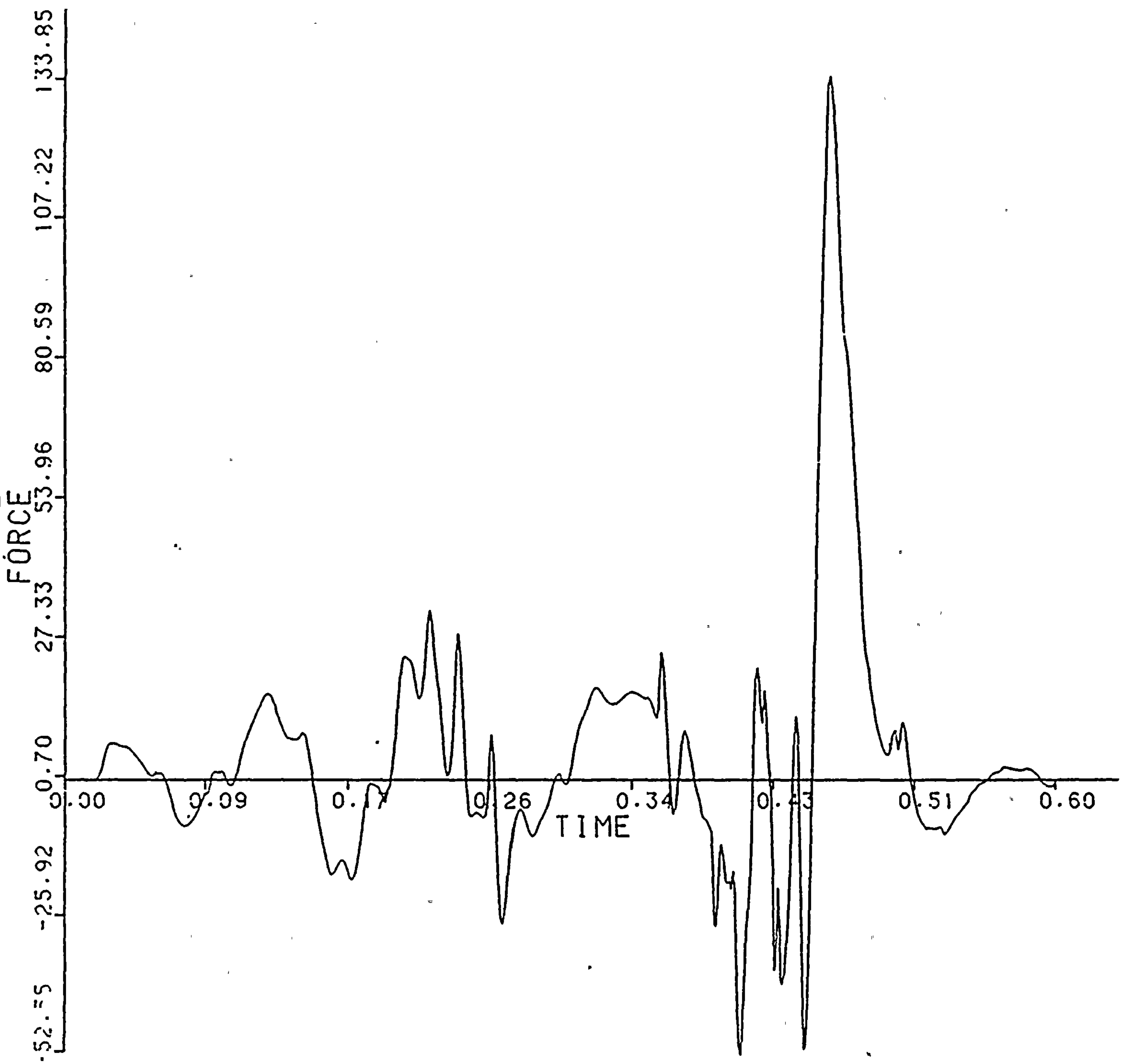
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 59, MAGNITUDE AT NODE POINT 146



DONE BY: ___ DATE: ___
CHKD BY: ___ DATE: ___

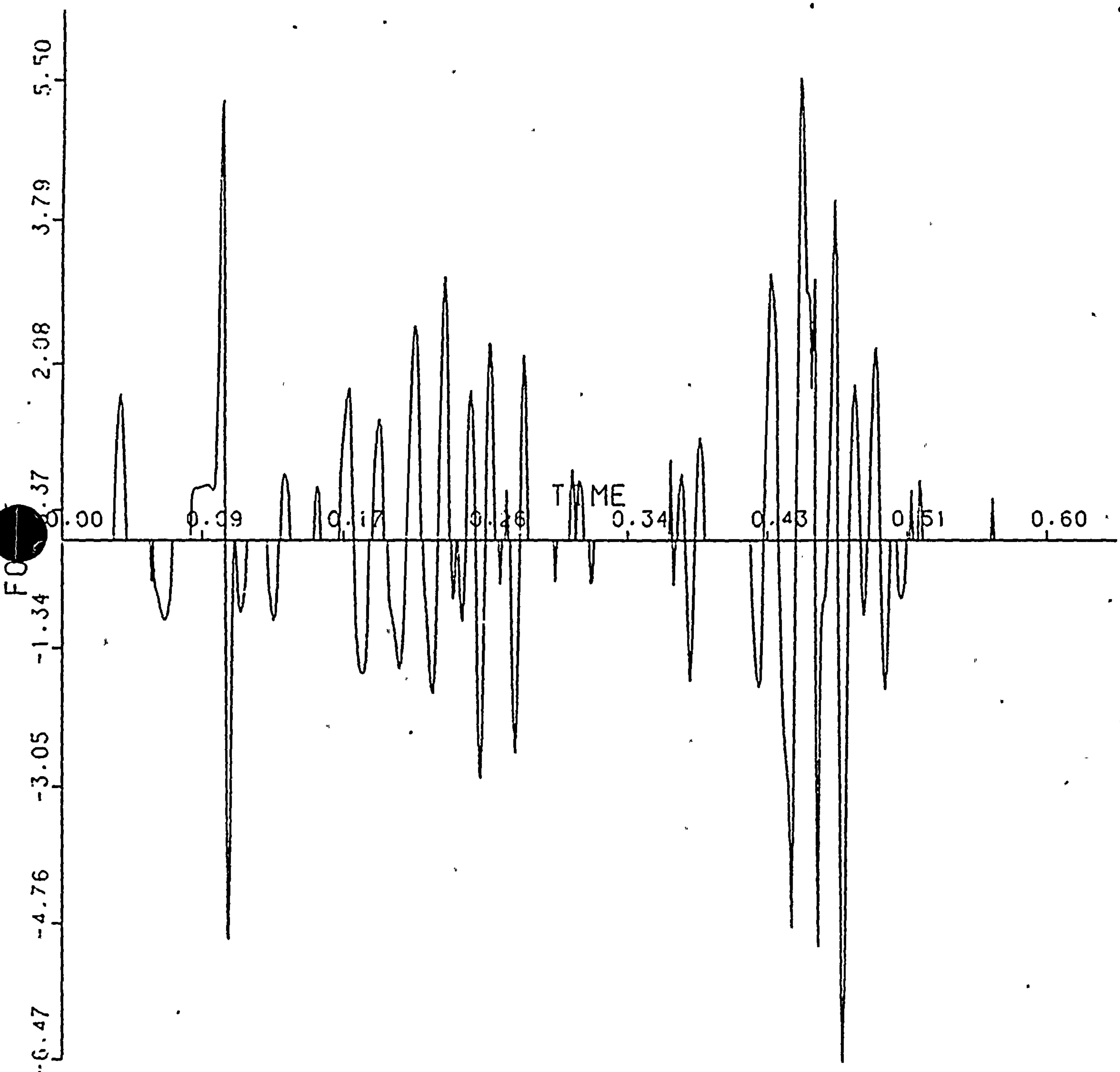
TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 60, MAGNITUDE AT NODE POINT 144



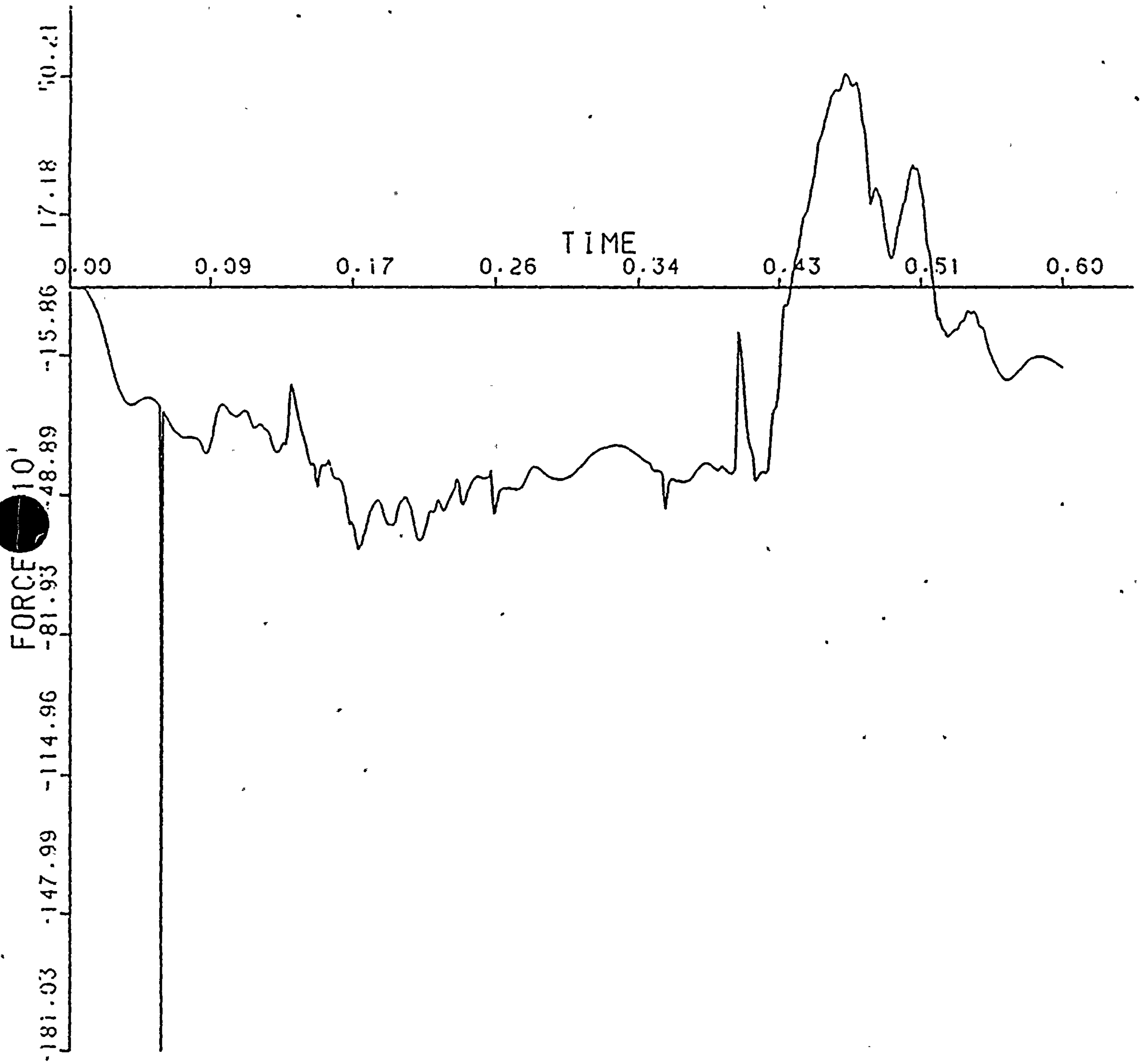
DONE BY: DATE:
CHKD BY: DATE:

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 61, MAGNITUDE AT NODE POINT 223



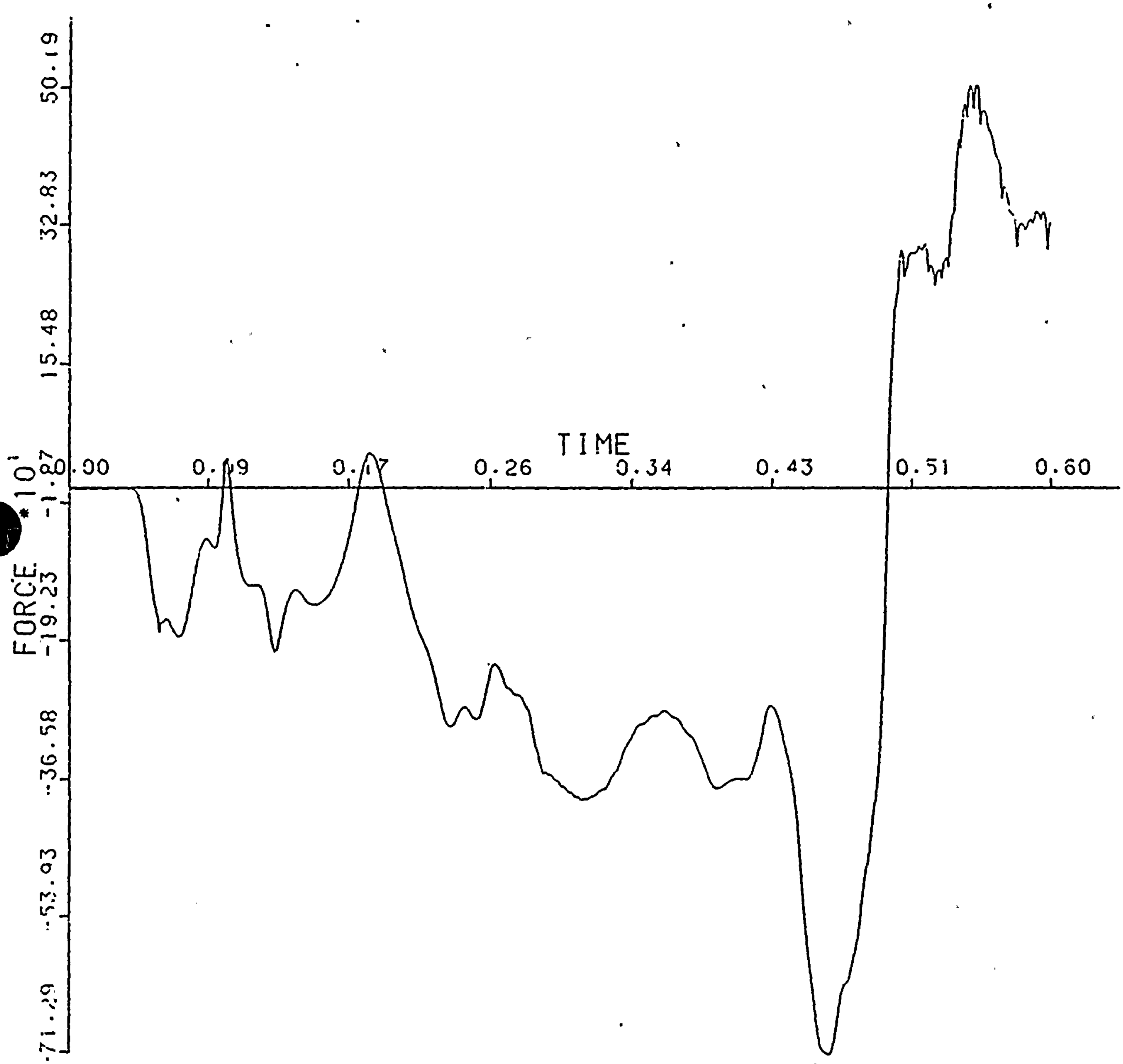
DONE BY: [illegible] DATE: [illegible]
CHKD BY: [illegible] DATE: [illegible]

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 62, MAGNITUDE AT NODE POINT 260



DONE BY: MZ DATE: 5-23-83
CHKD BY: JM DATE: 5-25-83

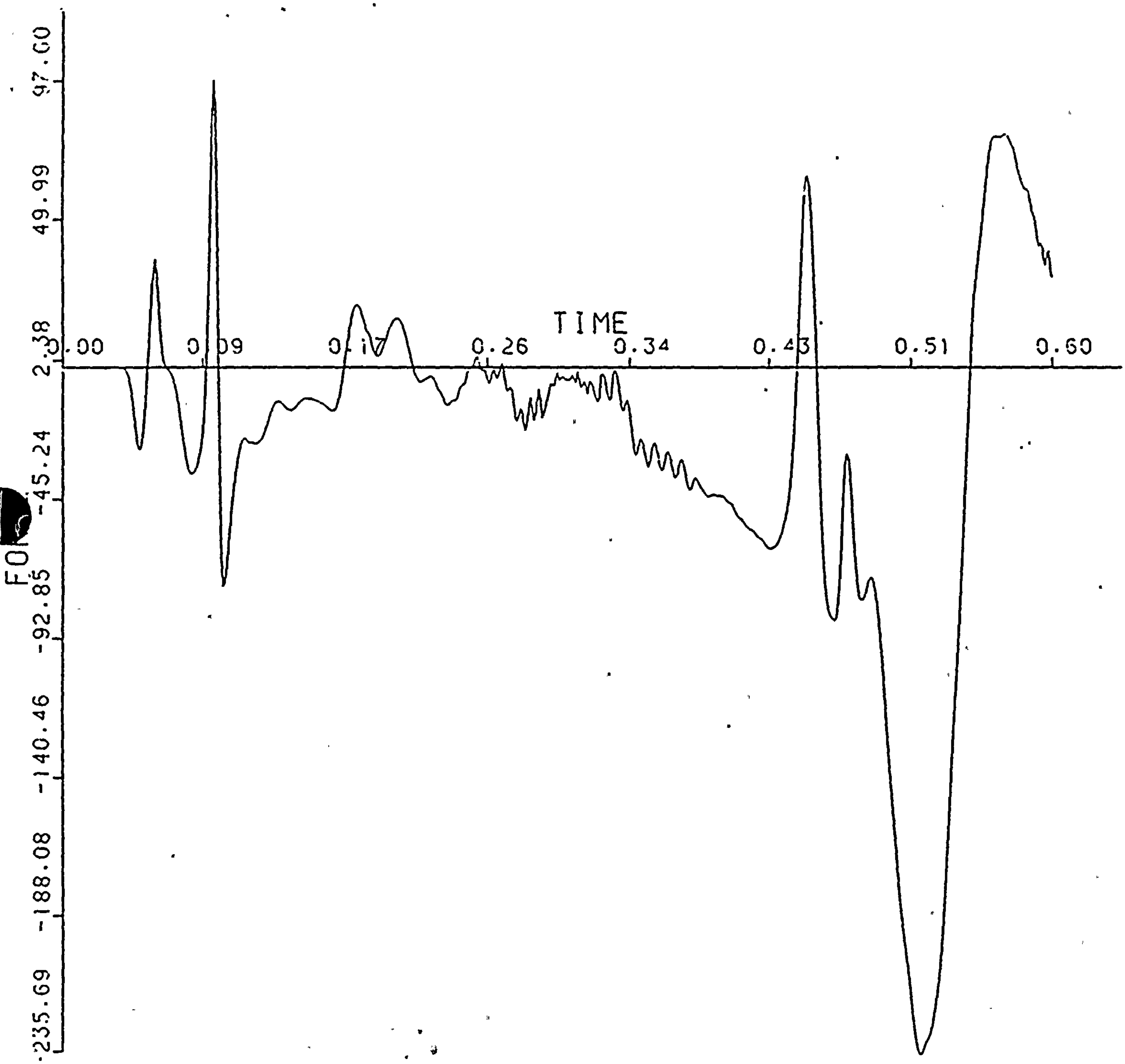
W ENGINEERING SERVICES
SAP2SAP VERIFICATION 5364 23-MAY-83
YFL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE G.S. MAGNITUDE AT NODE POINT 68



DONE BY: MR DATE: 5/23/83
CHKD BY: DM DATE: 5-23-83

4-384 TELEDYNE ENGINEERING SERVICES

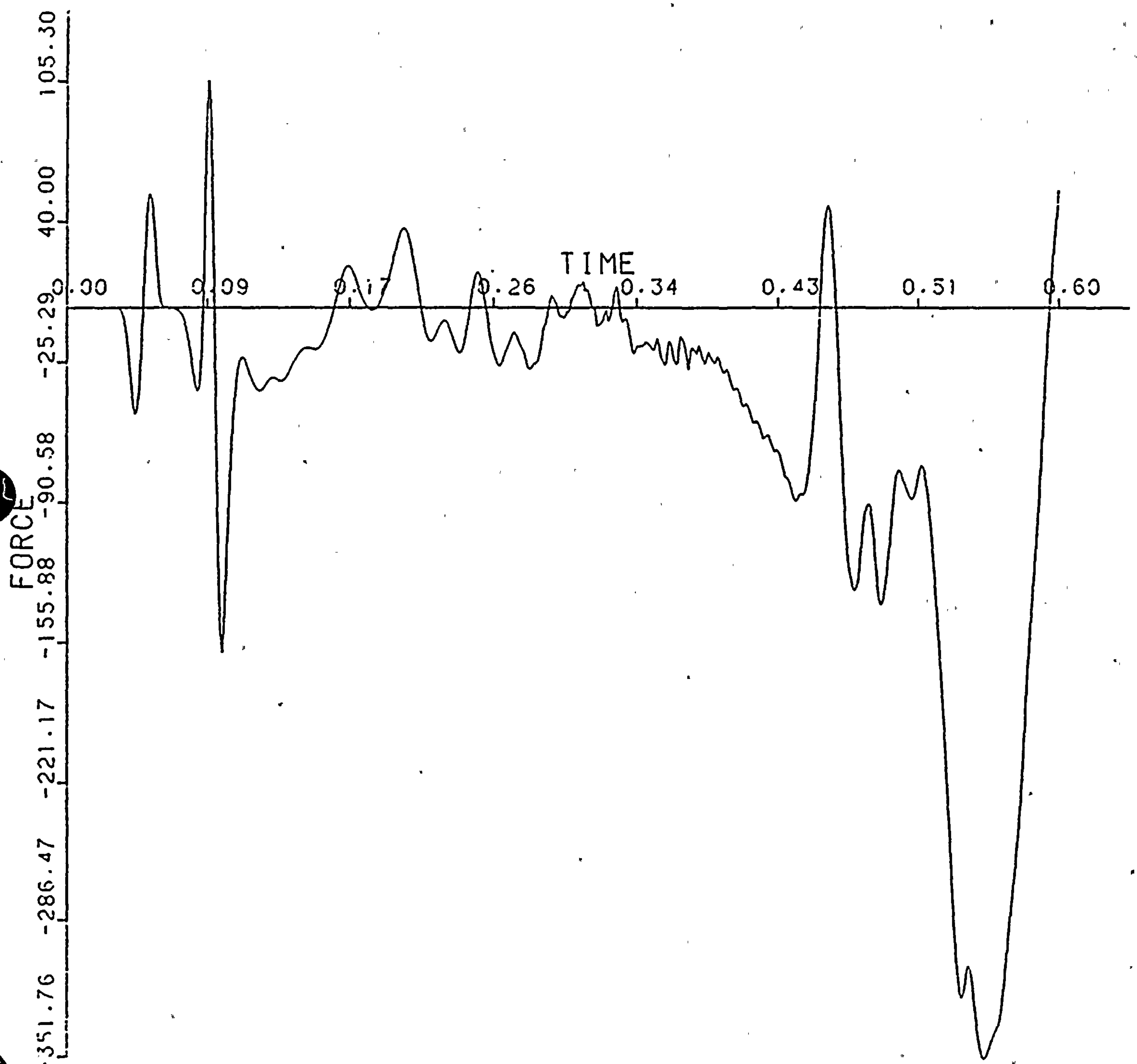
SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 64, MAGNITUDE AT NODE POINT 58



DONE BY: MZ DATE: 5/1/83
CHKD BY: JM DATE: 5-23-83

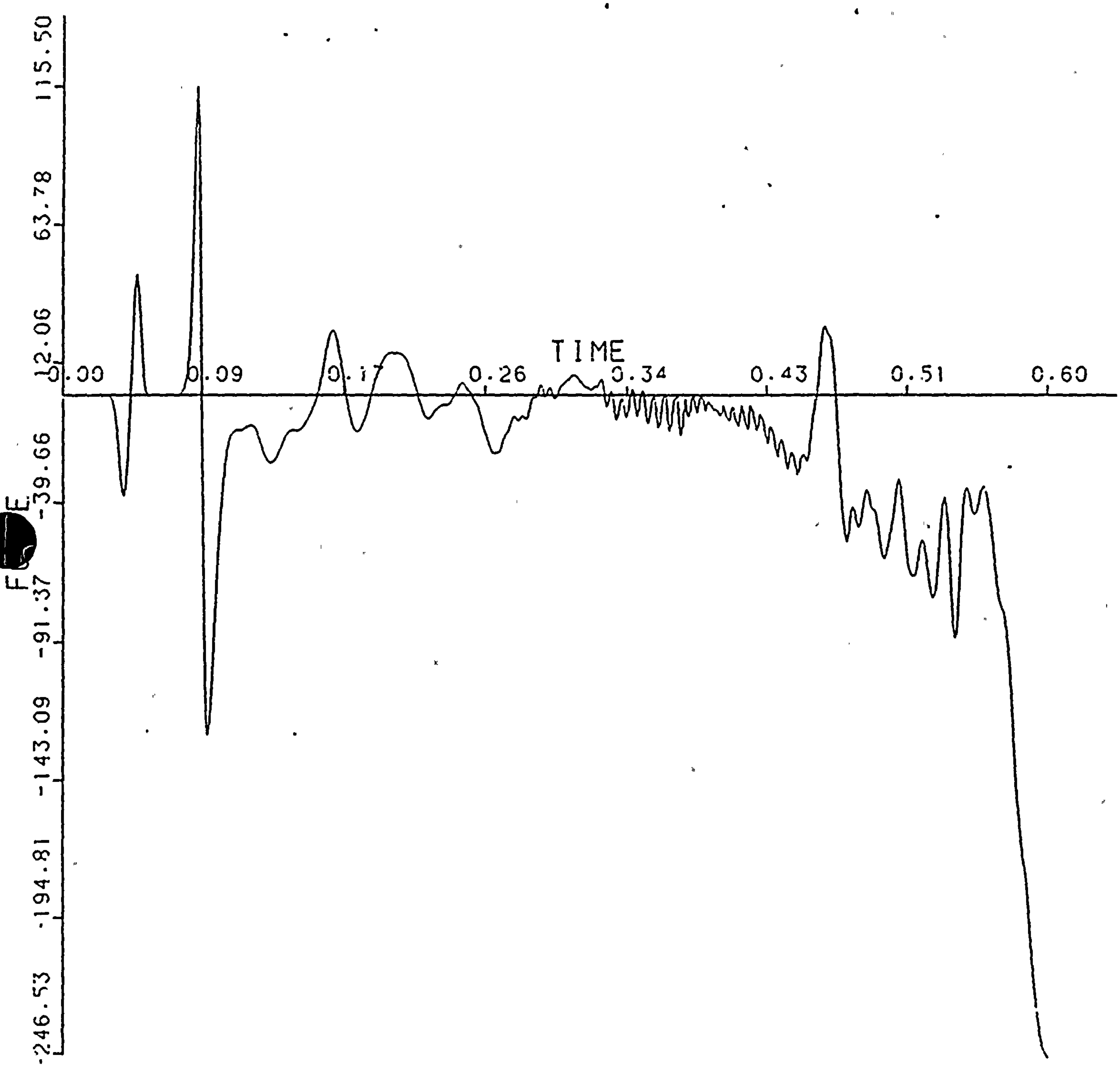
TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 23-MAY-83
YFL RFD SOLID UNIT 1, 0.600 MS
TIME/FORCE TABLE 65, MAGNITUDE AT NODE POINT



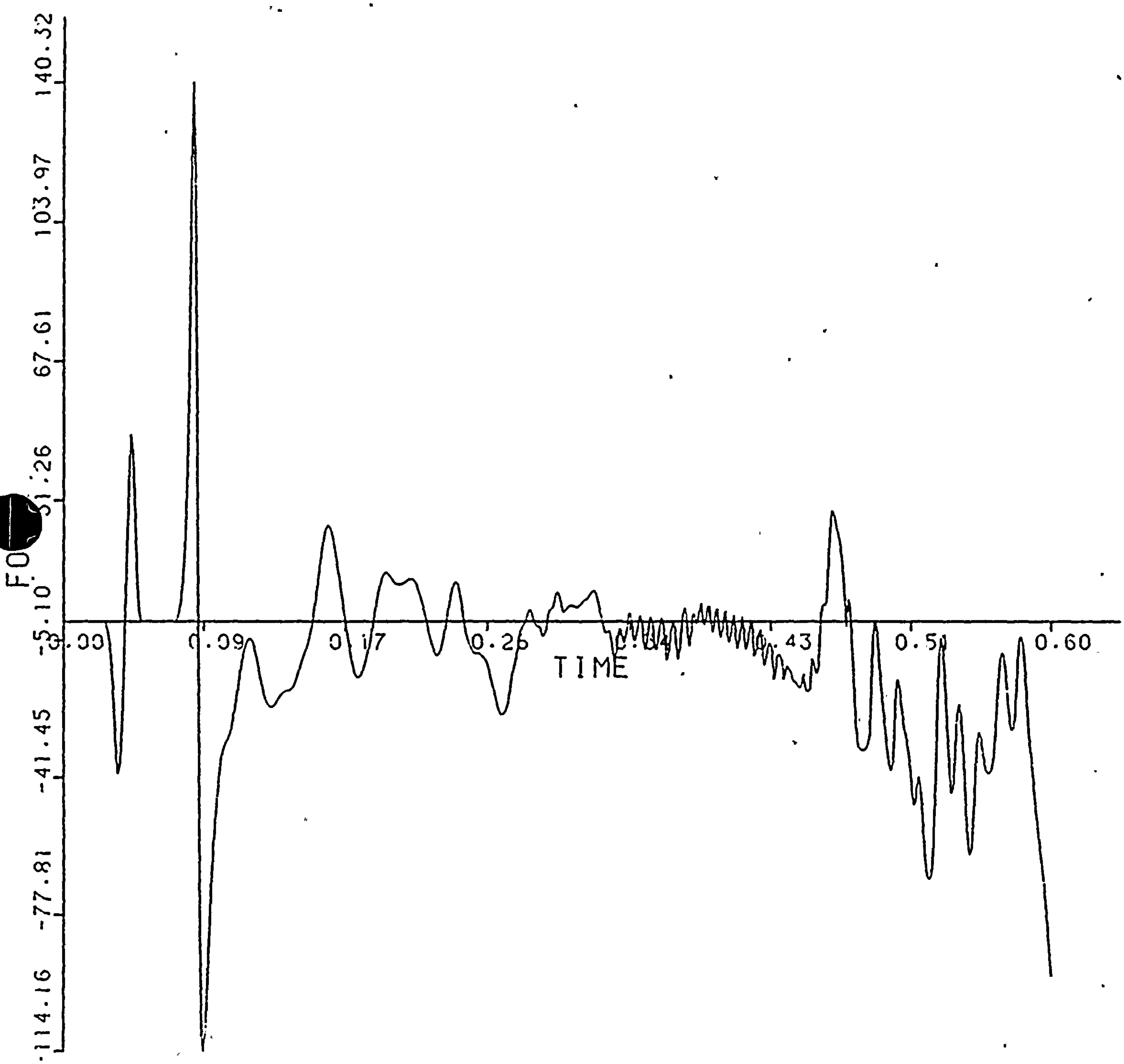
DONE BY: MC DATE: 5/23/83
CHKD BY: JH DATE: 5-23-83

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 66, MAGNITUDE AT NODE POINT 48



DONE BY: MR DATE: 5/1/83
CHKD BY: CW DATE: 5-23-83

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 67, MAGNITUDE AT NODE POINT 40

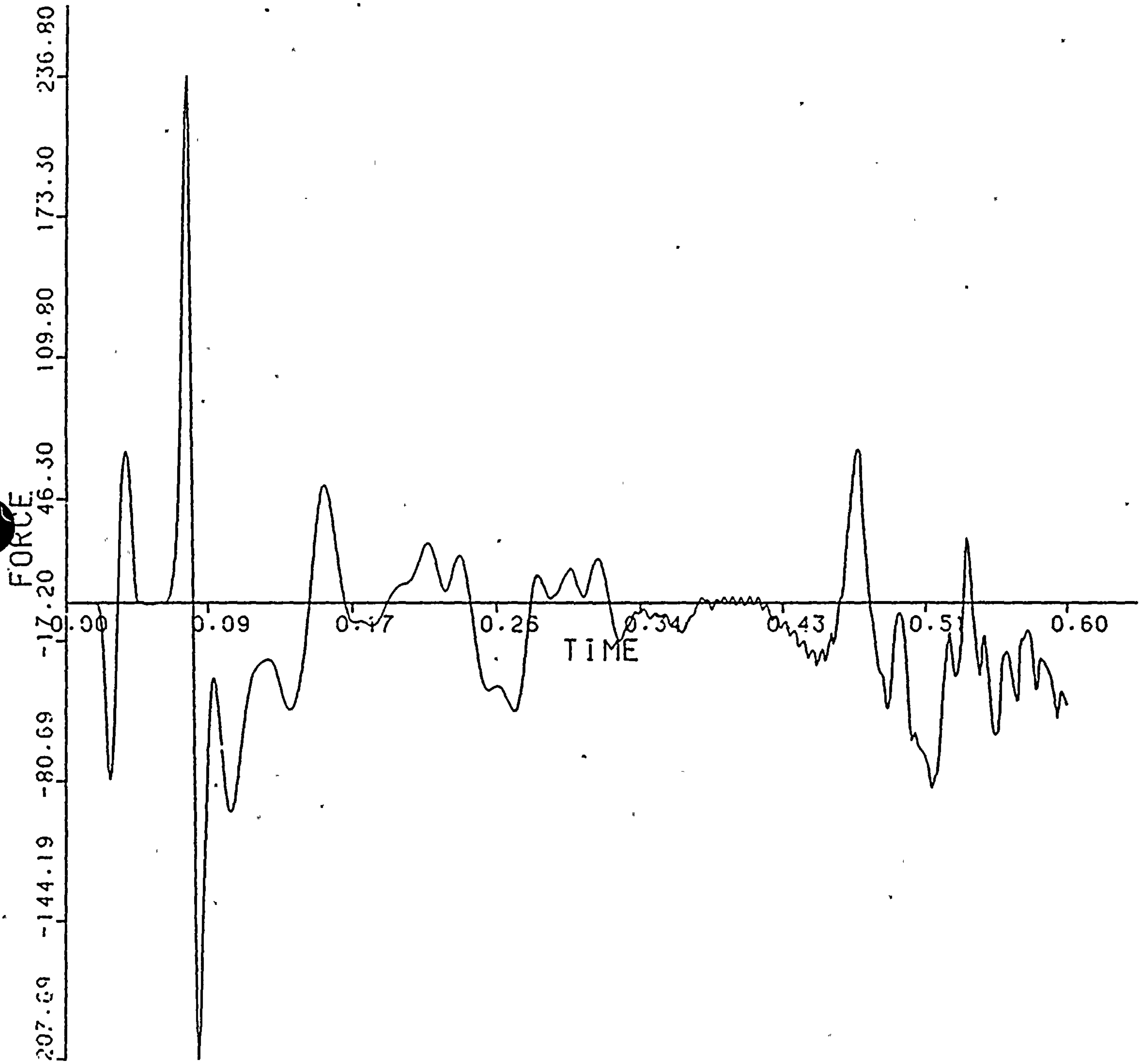


DONE BY: MZ DATE: 5/16/83
CHKD BY: CLL DATE: 5-23-83

4-388

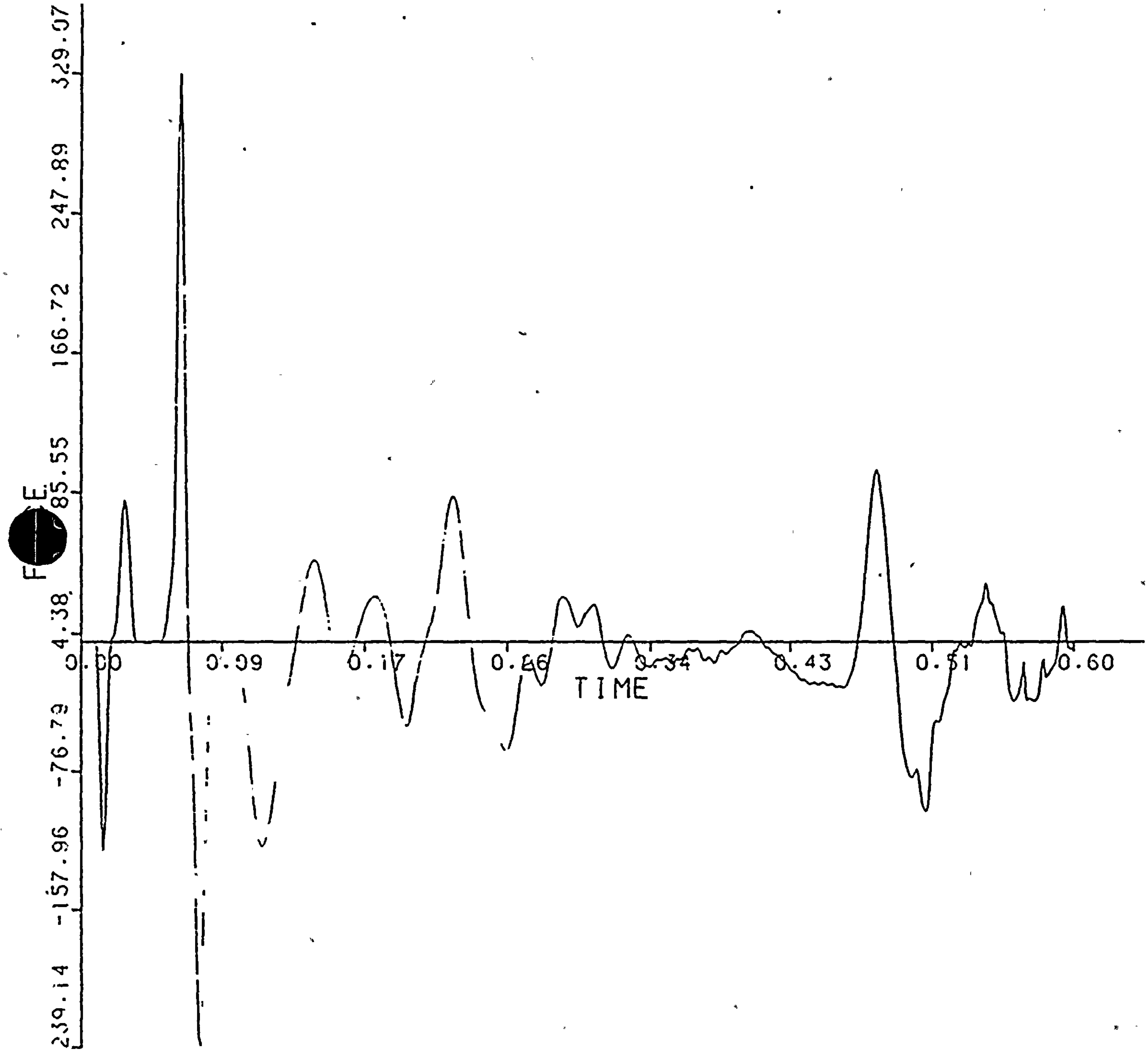
TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 68, MAGNITUDE AT NODE POINT 34



DONE BY: MZ DATE: 5/23/83
CHKD BY: JH DATE: 5-23-83

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 69, MAGNITUDE AT NODE POINT 18



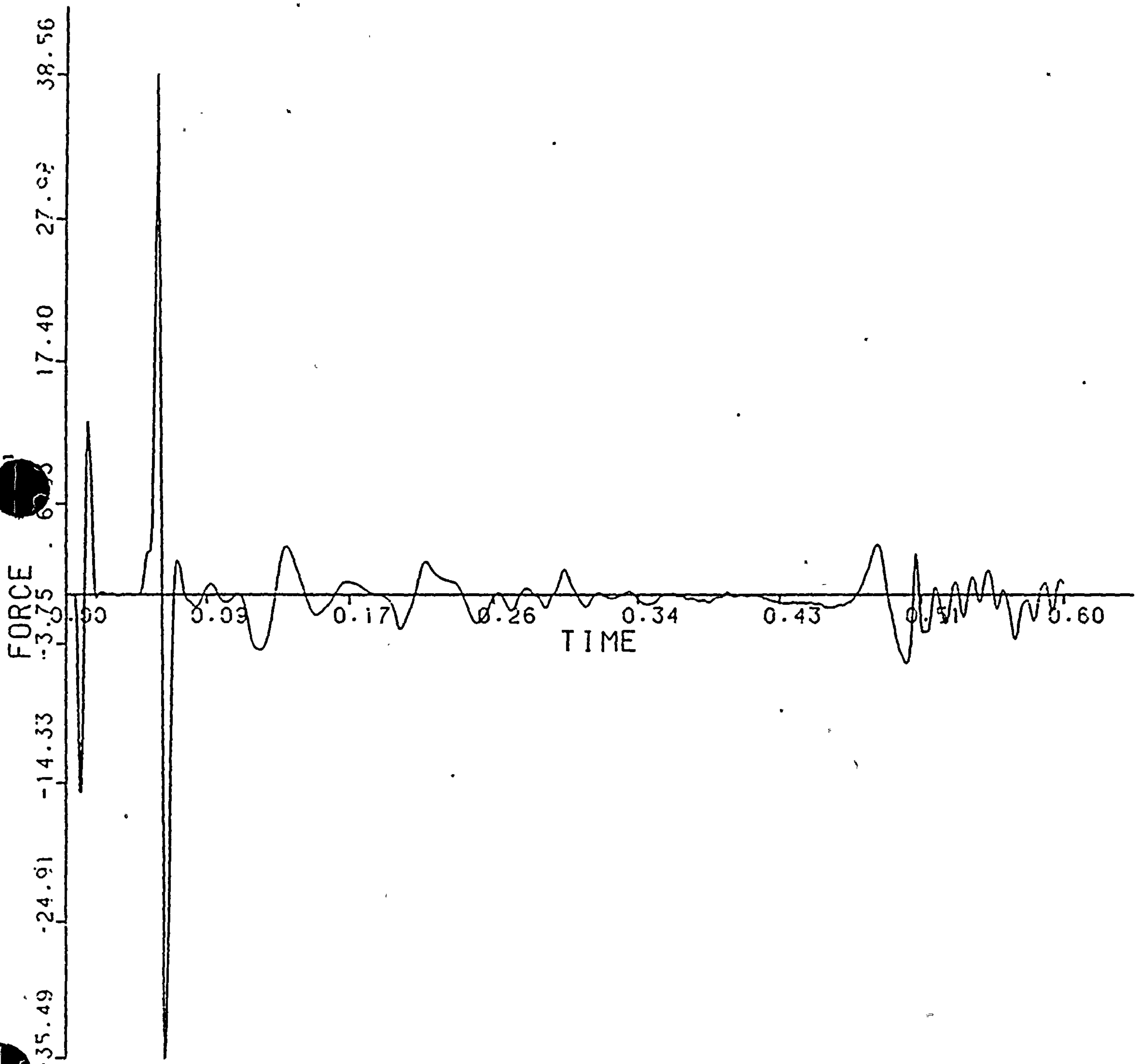
DONE BY: MR DATE: 5/12/83
CHKD BY: CH DATE: 5-23-83

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 23-MAY-83

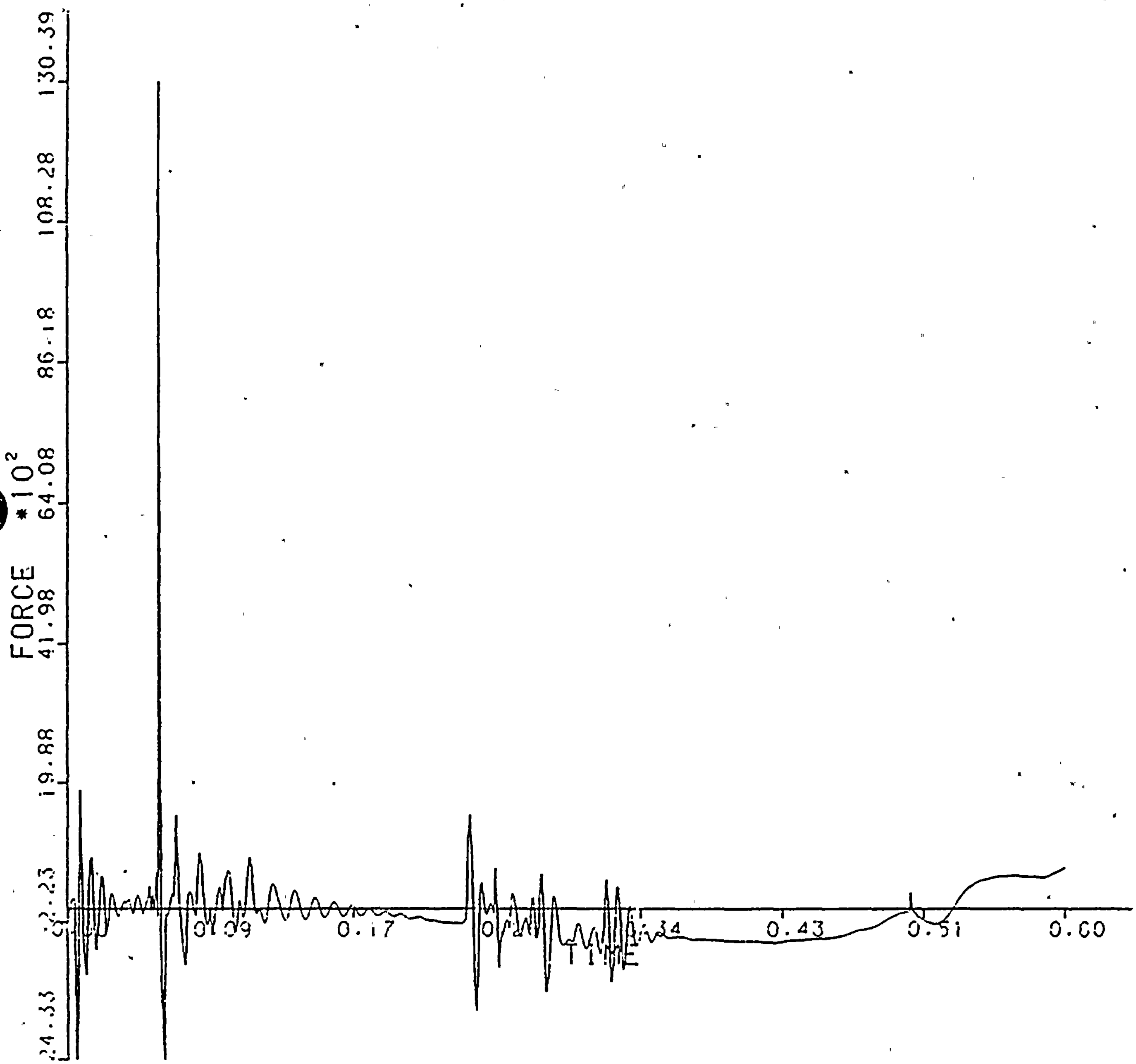
YEL-RED SOLID UNIT 1, 0-600 MS

TIME/FORCE TABLE 70. MAGNITUDE AT NODE POINT 8



DONE BY: MZ DATE: 5/16/83
CHKD BY: [illegible] DATE: 5-23-83

SAP2SAP VERIFICATION 5364 23-MAY-83
YEL-RED SOLID UNIT 1, 0-600 MS
TIME/FORCE TABLE 71, MAGNITUDE AT NODE POINT 4



DONE BY: MR DATE: 5/23/83
CHKD BY: CAL DATE: 5-23-83

4.8.3 Quarter Model - Cold Loop Seal/Steam Case

BY CMM DATE 3-16-83 CHKD. BY KJG DATE 5-24-83	1/4 MODEL LENGTHS ; NODES (SRV) ANALYSIS	SHEET NO. 1 OF 1 PROJ. NO. 5364

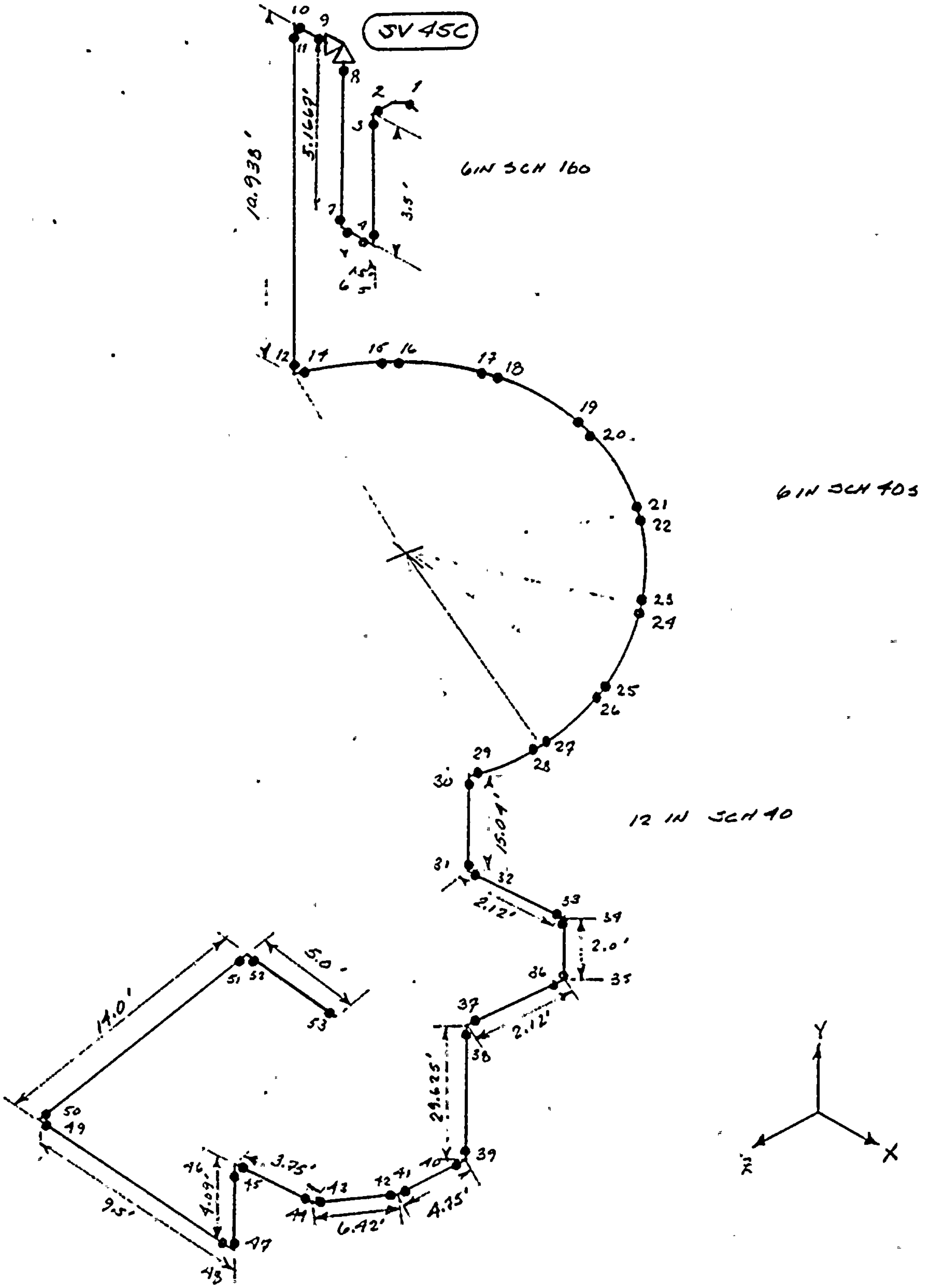
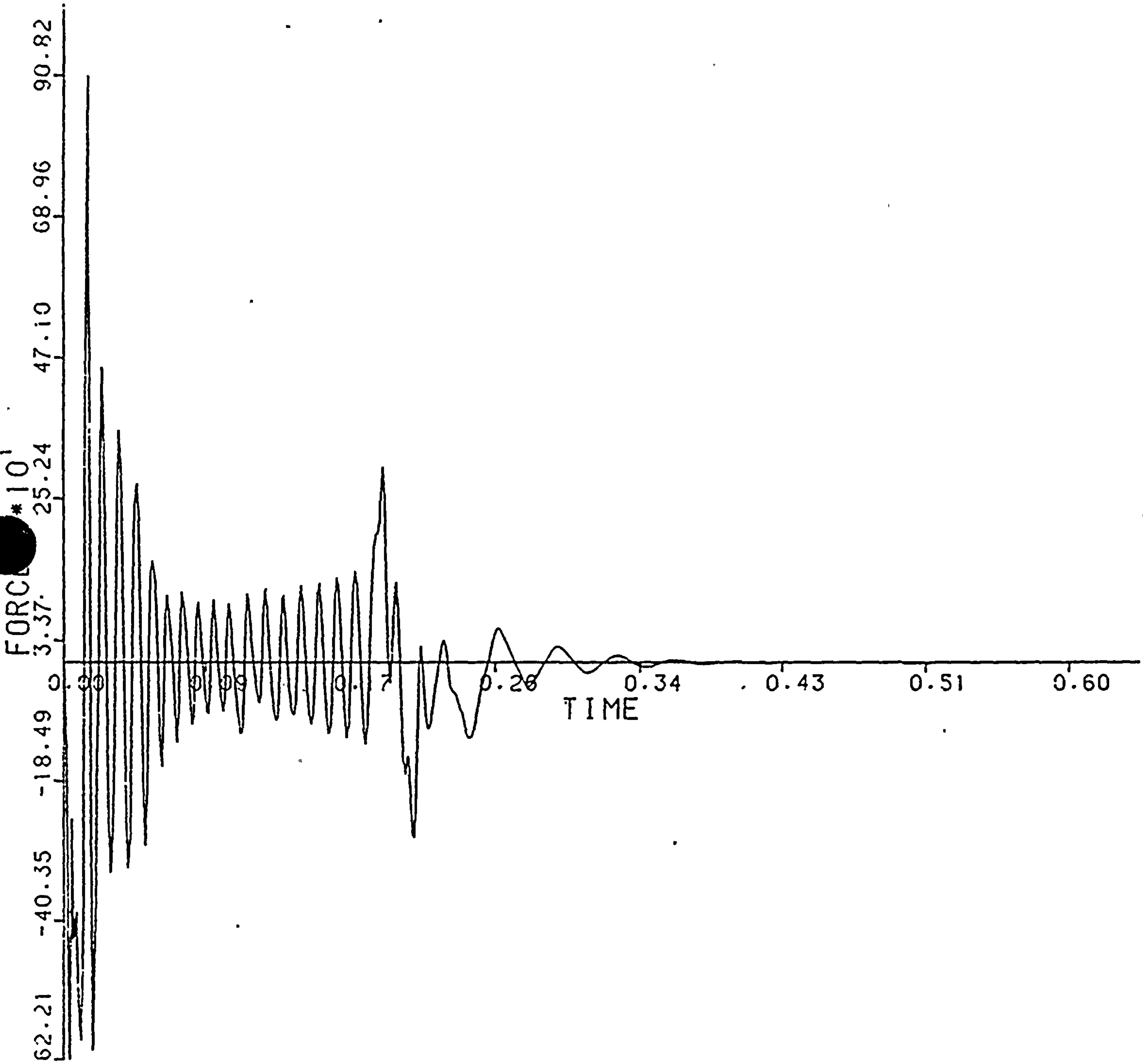


FIGURE 4.8.2-1

SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 1. MAGNITUDE AT NODE POINT 118



DONE BY: [illegible] DATE: 5-26-83
CHKD BY: [illegible] DATE: 5-27-83

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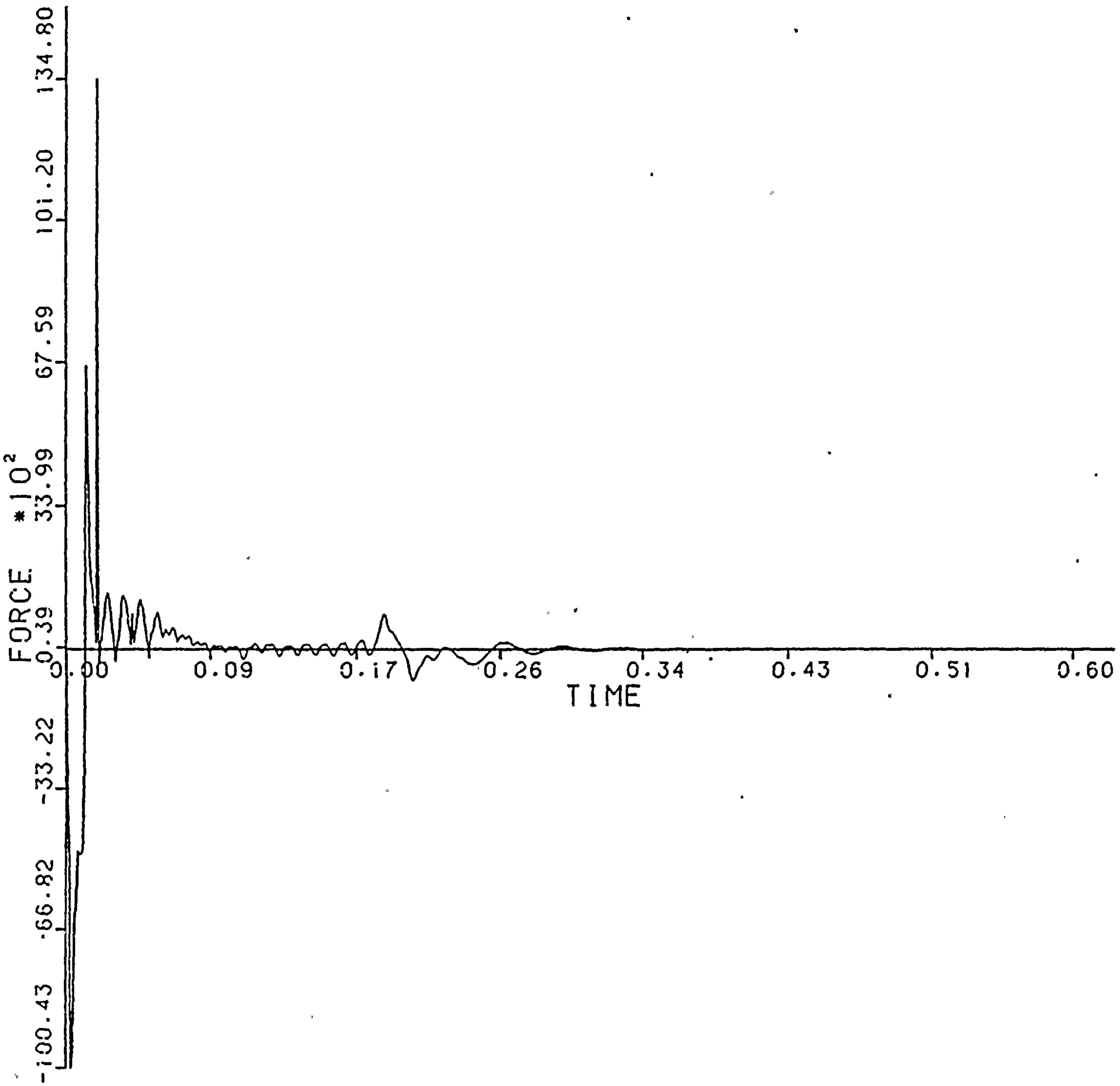
SAP/SAP VERIFICATION 5364 24 MAY 83
QUARTER MODEL UNIT 2 TOROIDAL
TIME FORCE TABLE 2, MAGNITUDE AT NODE POINT 114



DONE BY: [signature] DATE: 5-26-83
CHKD BY: KTG DATE: 5-27-83

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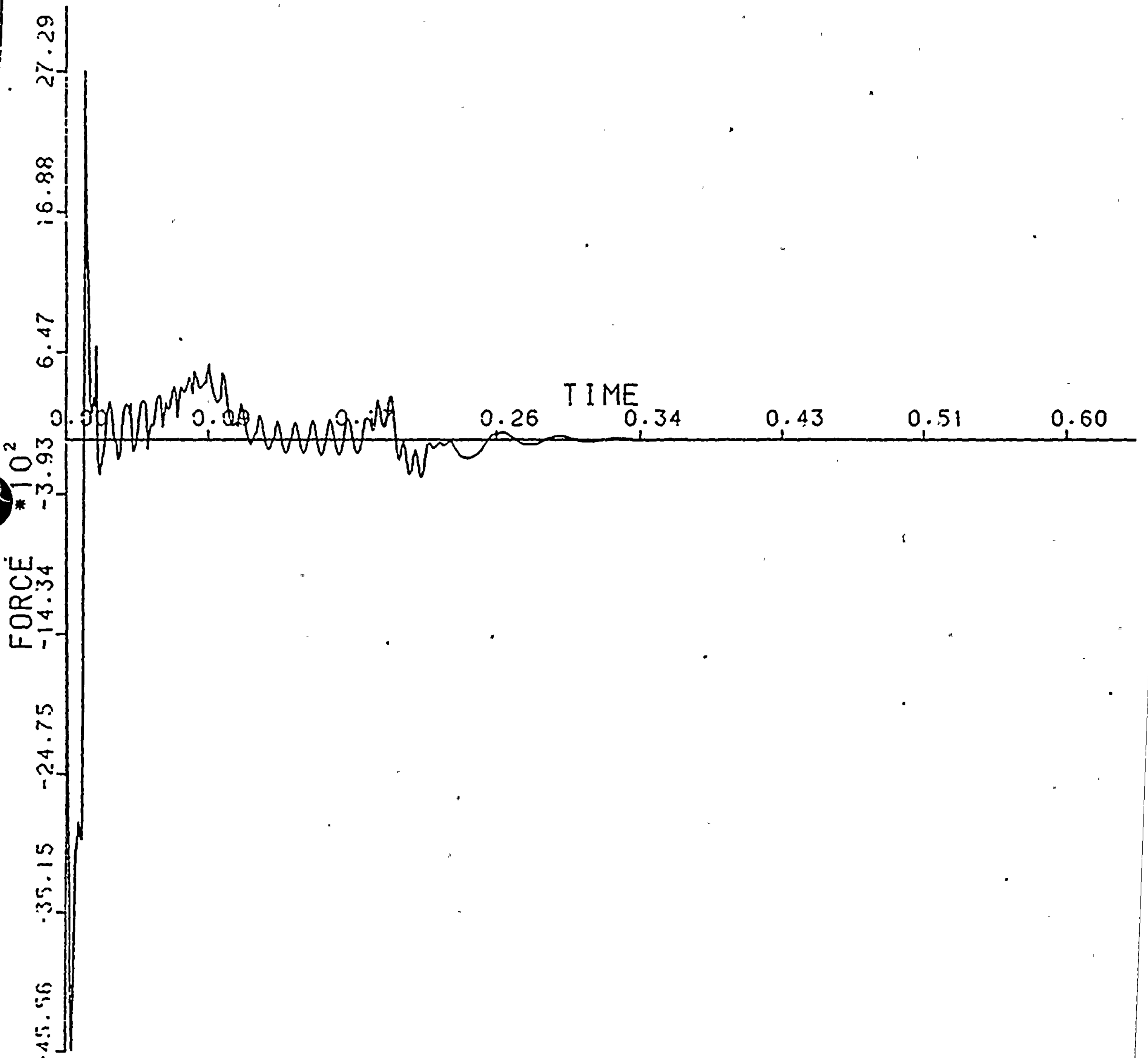
SAP2SAP VERIFICATION 5364 24-MAY-83

QUARTER MODEL UNIT 2 LOOPSEAL

TIME/FORCE TABLE 3, MAGNITUDE AT NODE POINT 111



DONE BY: DATE: 5-26-83
CHKD BY: DATE: 5-27-83

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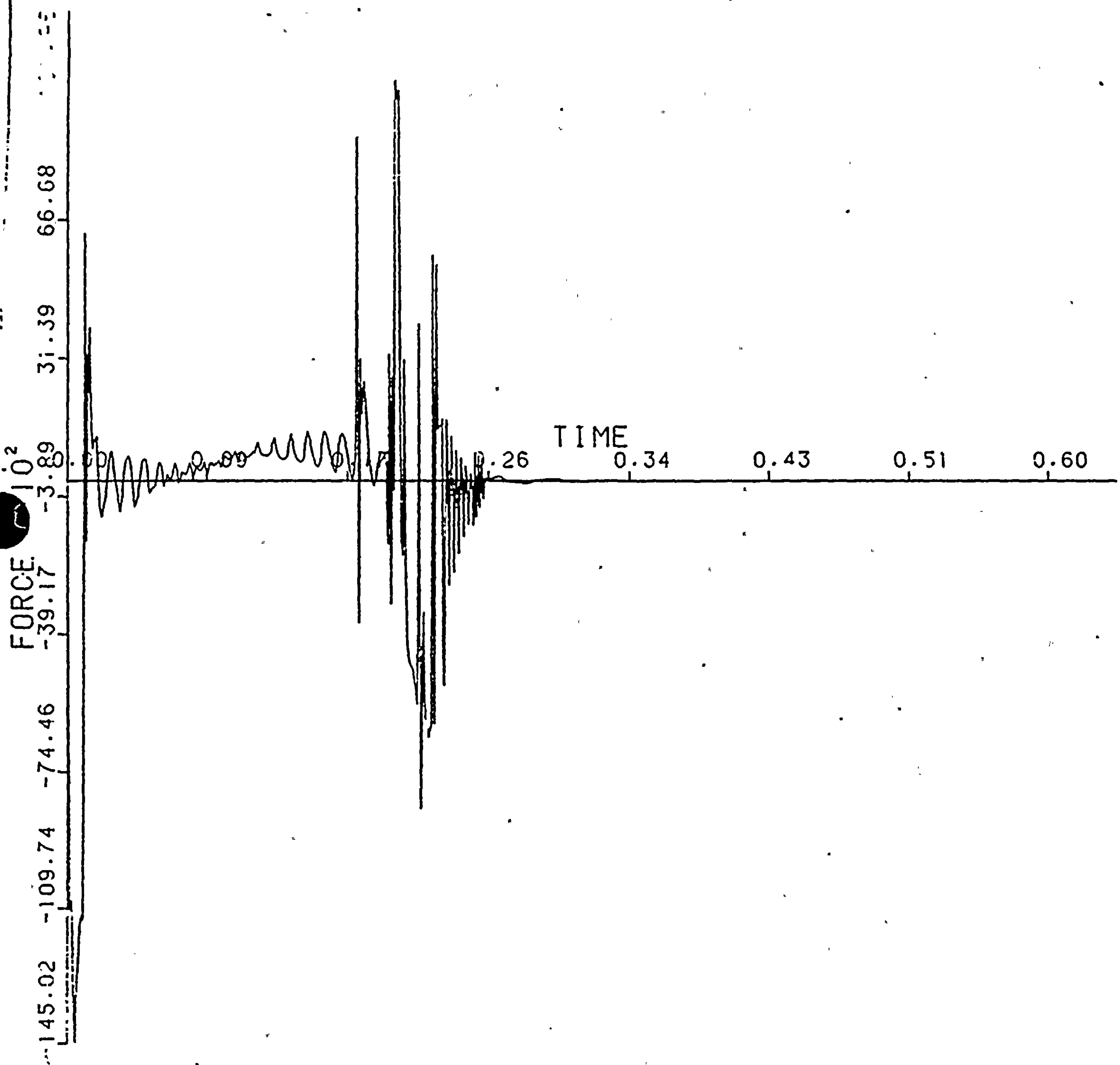
SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 4, MAGNITUDE AT NODE POINT 107



DONE BY [illegible] DATE: 5-26-83
CHKD BY: [illegible] DATE: 5-27-83

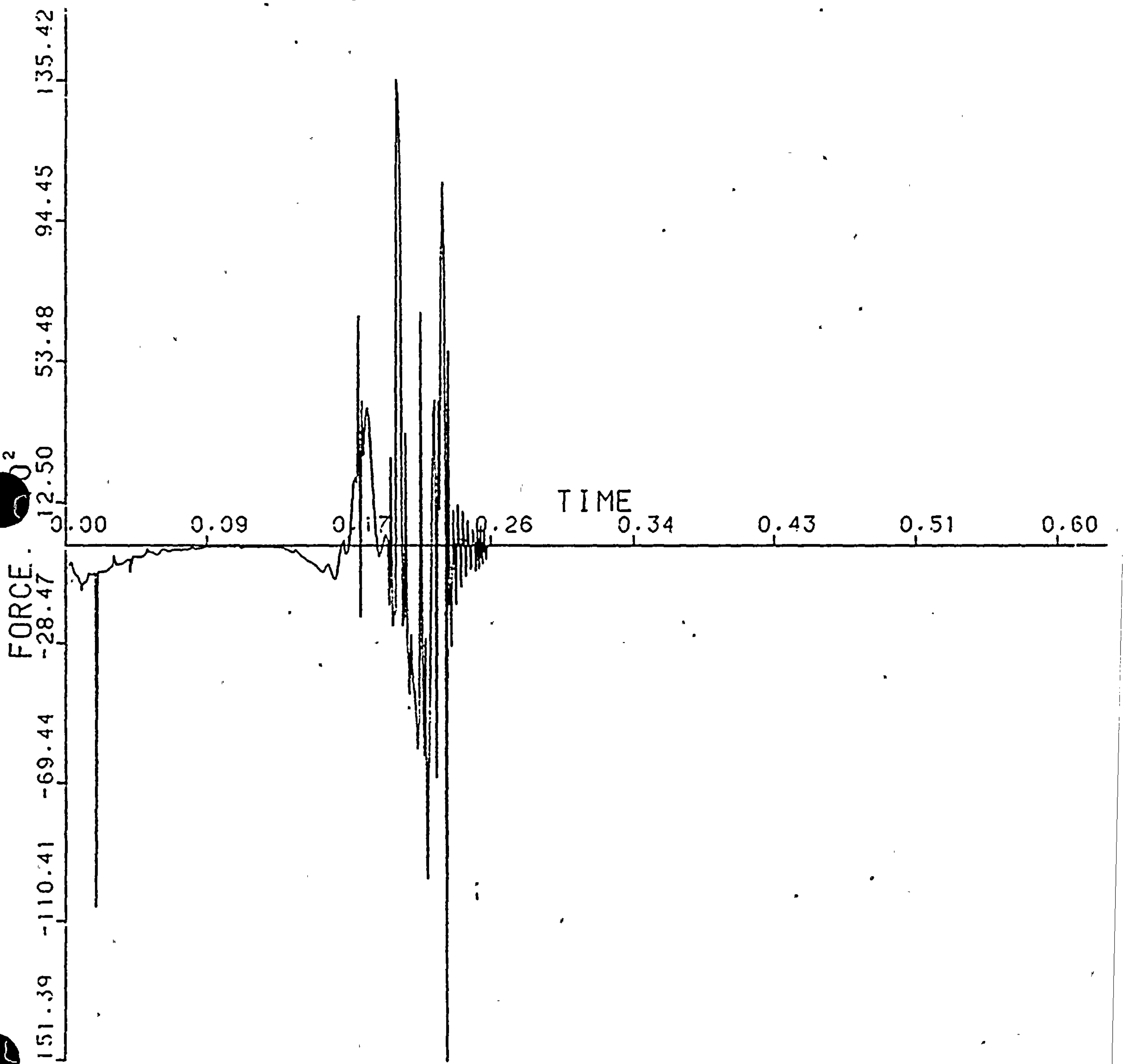
Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 24-MAY-83

QUARTER MODEL UNIT 2 LOOPSEAL

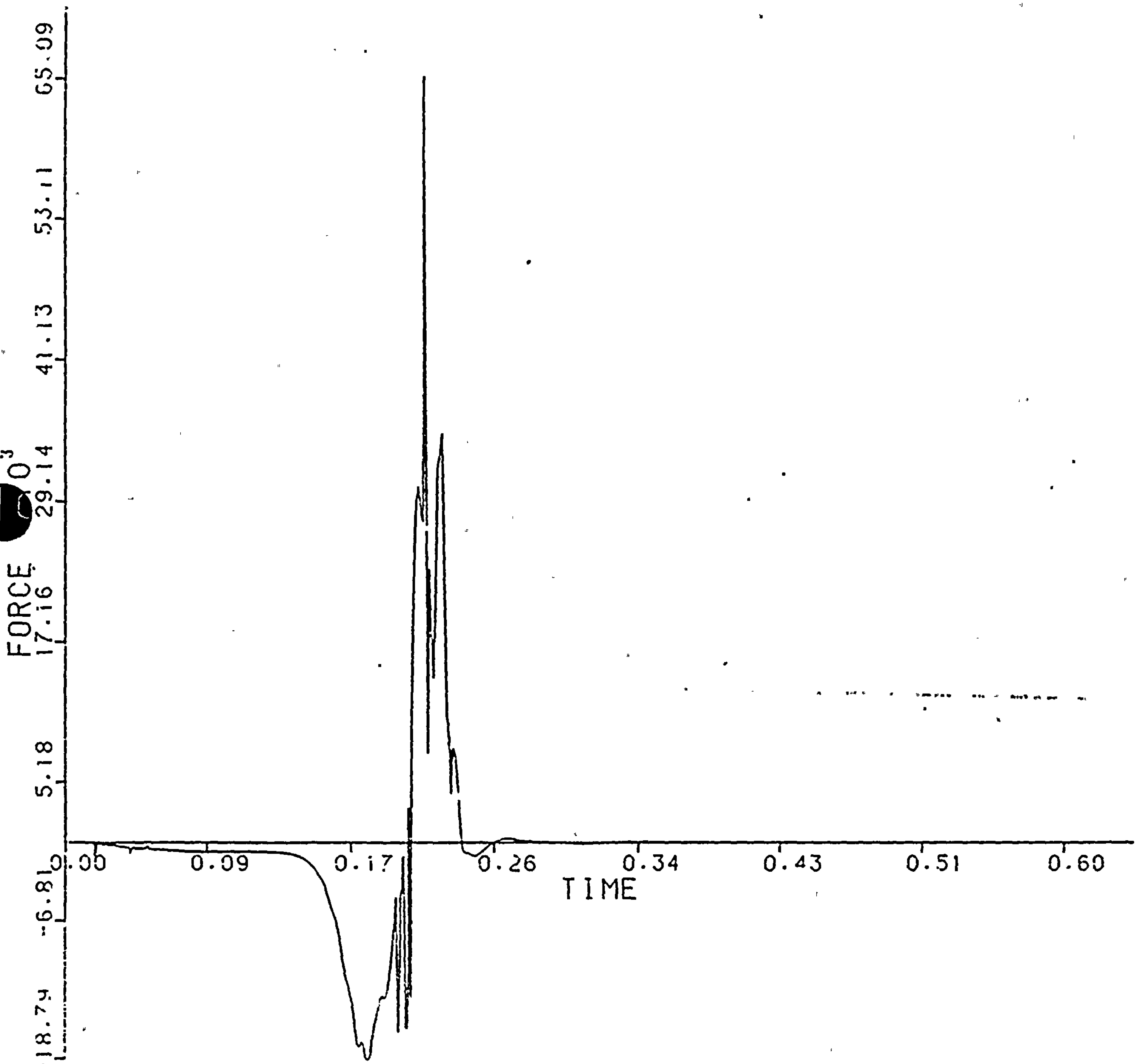
TIME/FORCE TABLE 5, MAGNITUDE AT NODE POINT 98



DONE BY: [signature] DATE: 5-26-83

CHKD BY: [initials] DATE: 5-27-83

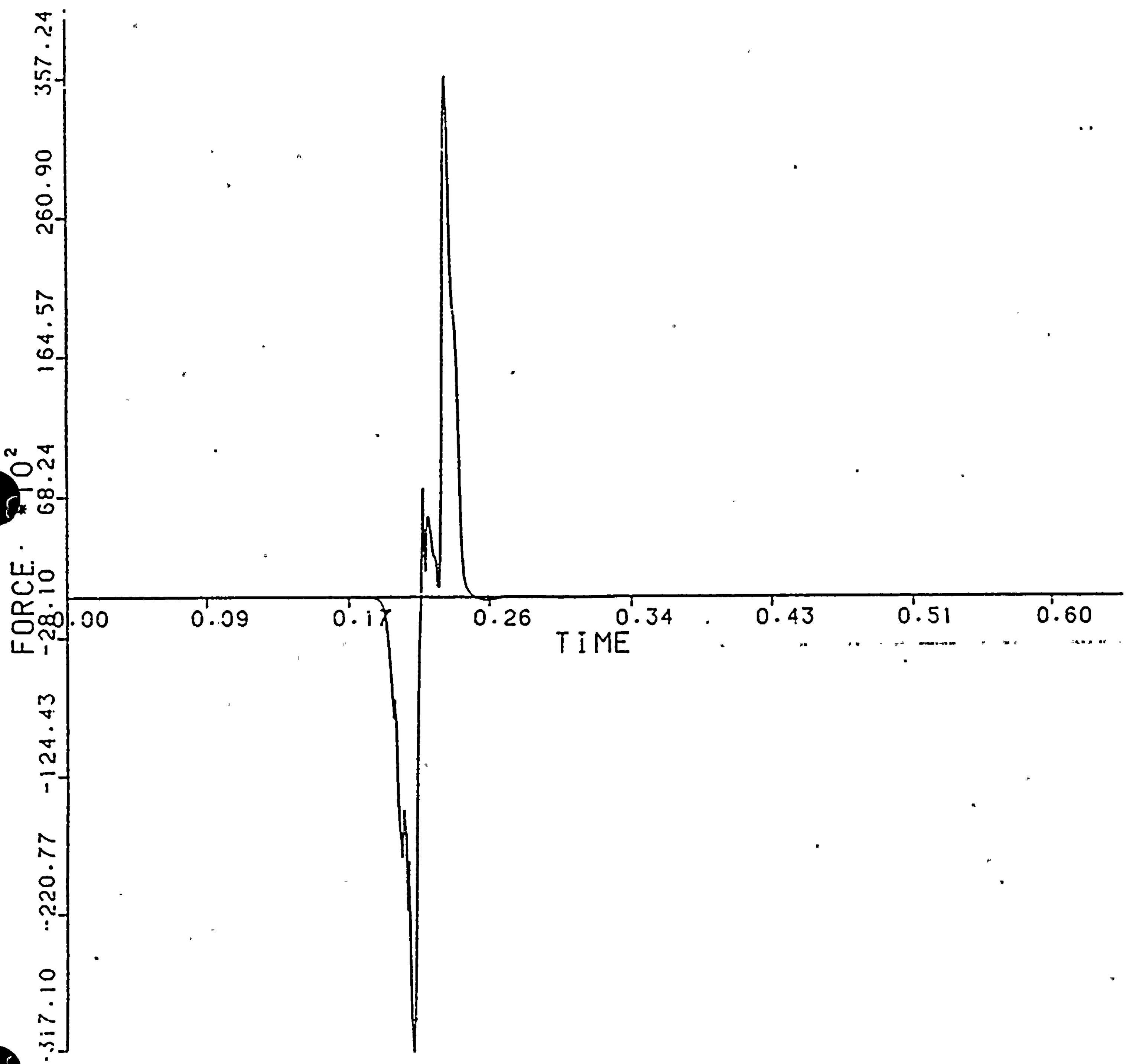
SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 6, MAGNITUDE AT NODE POINT 90



DONE BY: DATE:
CHKD BY: DATE:

TELEDYNE ENGINEERING SERVICES
24-MAY-83

SAP2SAP VERIFICATION 5364
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 7, MAGNITUDE AT NODE POINT 88



DONE BY: [illegible] DATE: 5-26-83
CHKD BY: [illegible] DATE: 5-27-83

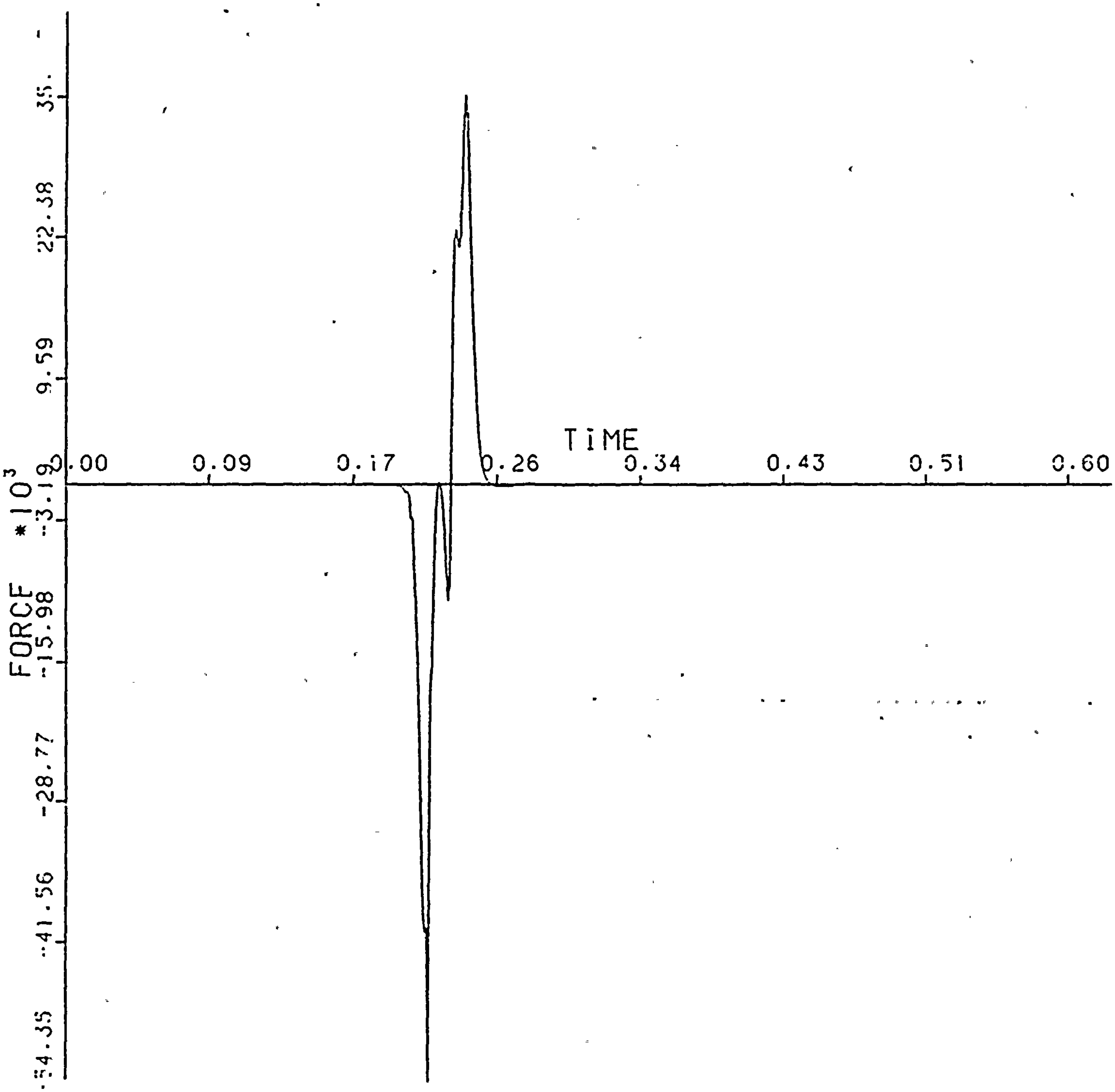
Technical Report:
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 24-MAY-83

QUARTER MODEL UNIT 2 LOOPSEAL

TIME/FORCE TABLE S. MAGNITUDE AT NODE POINT 86



DONE BY: [illegible] DATE: 5-26-83

CHKD BY: [illegible] DATE: 5-27-83

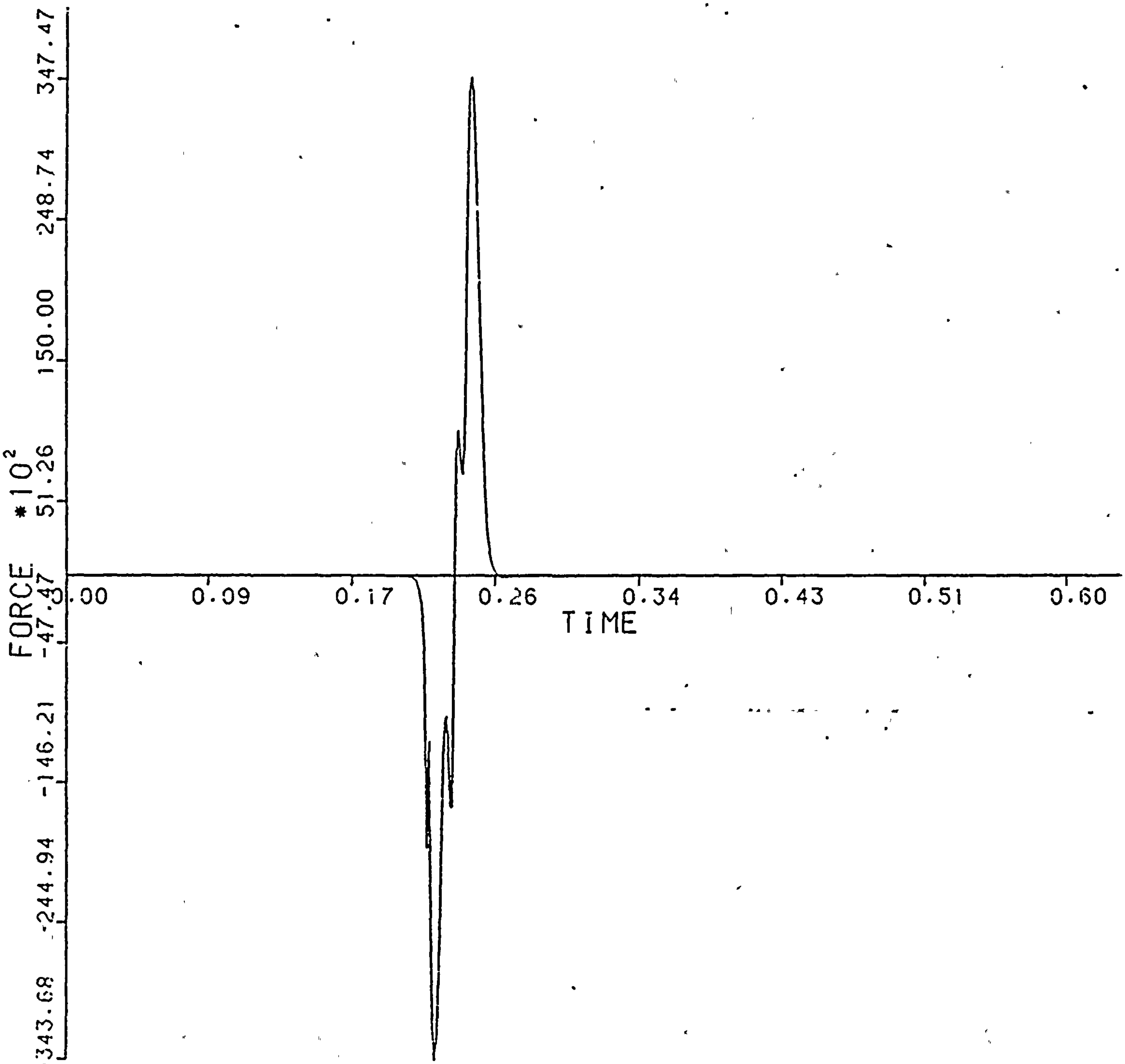
4-402

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 24-MAY-83

QUARTER MODEL UNIT 2 LOOPSEAL

TIME/FORCE TABLE 9, MAGNITUDE AT NODE POINT 84



DONE BY: [illegible] DATE: 5-26-83

CHKD BY: [illegible] DATE: 5-27-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE
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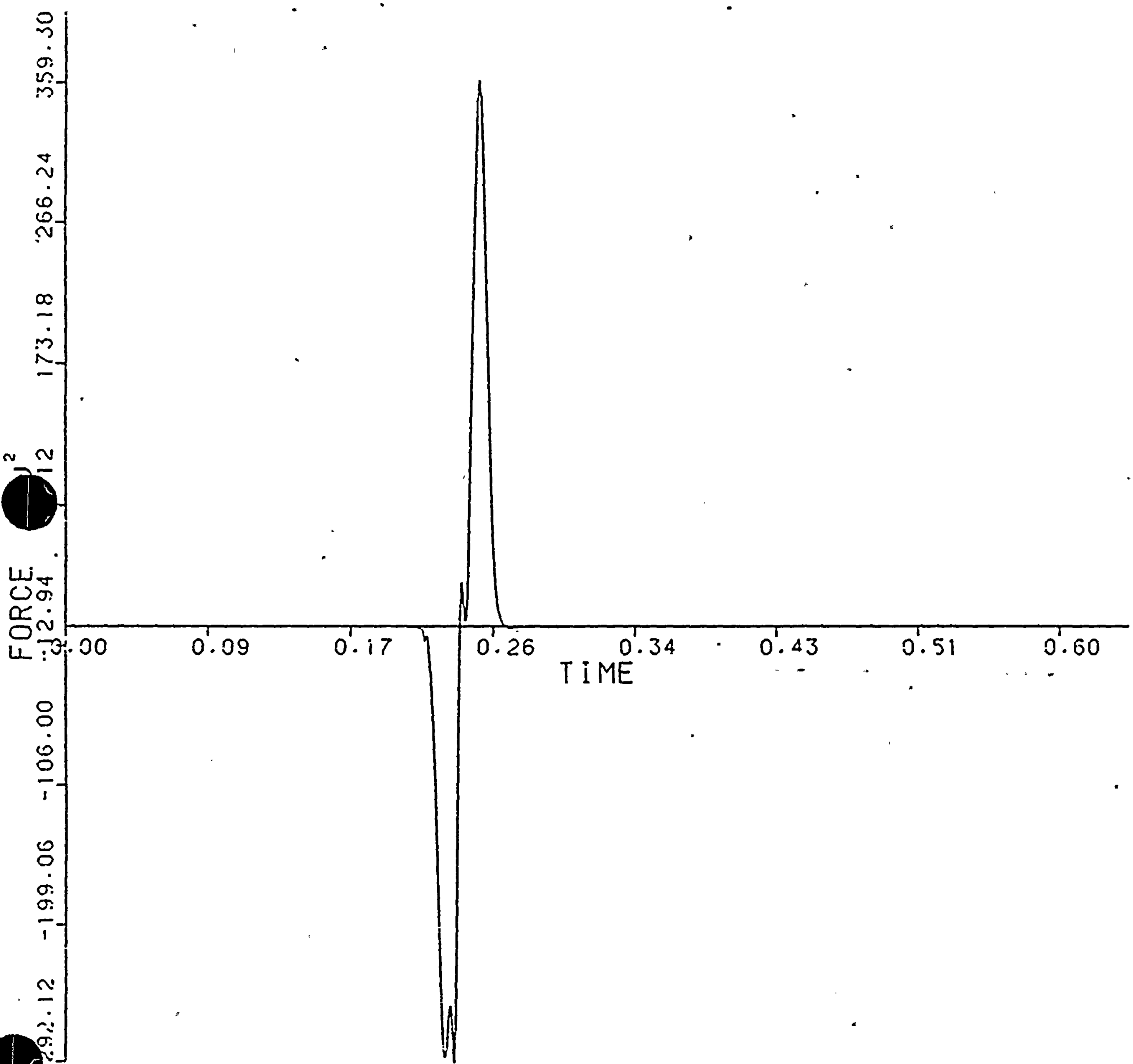
SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 10, MAGNITUDE AT NODE POINT 82

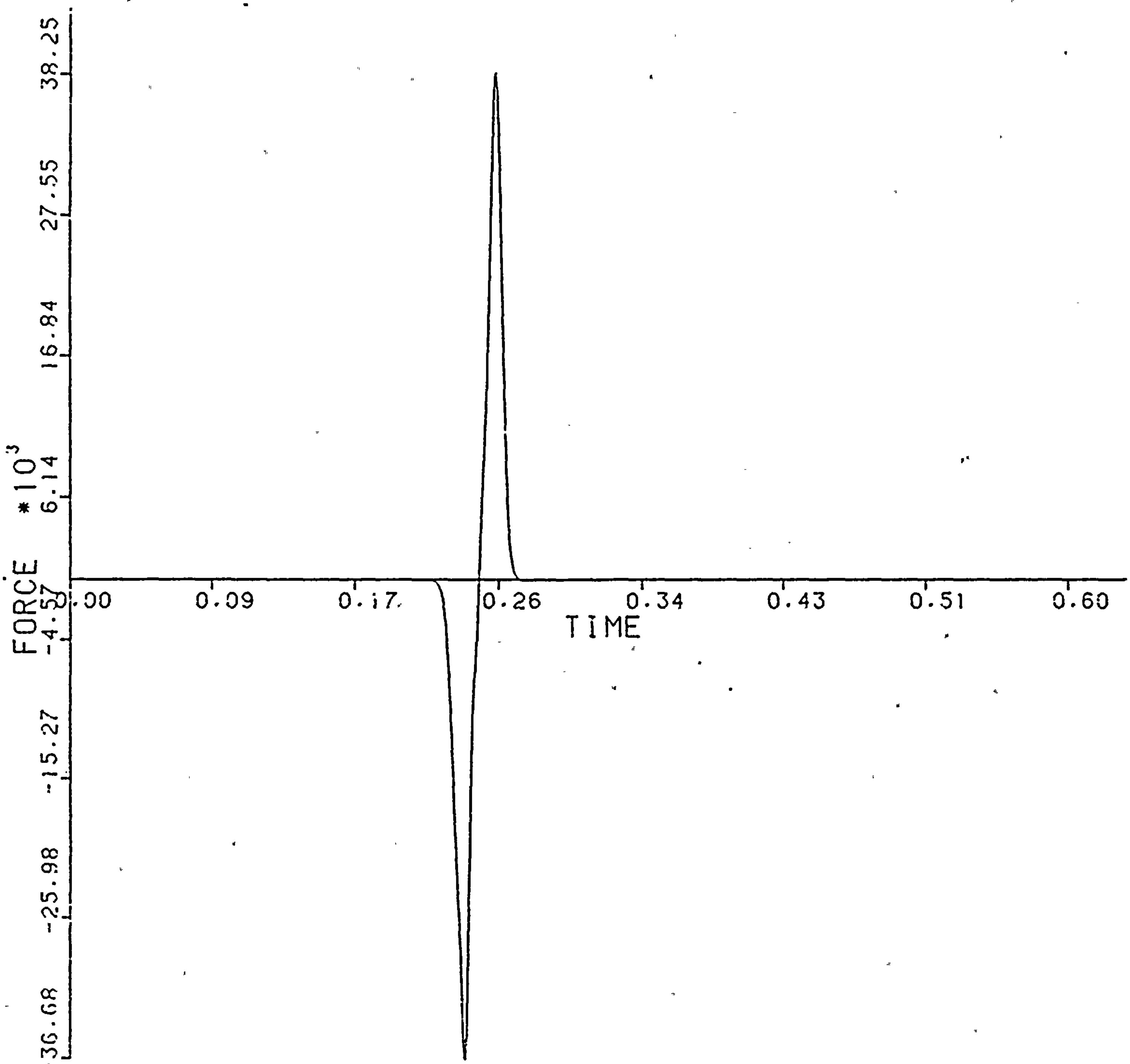


DONE BY: DATE:
CHKD BY: DATE:

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 11. MAGNITUDE AT NODE POINT 80



DONE BY: DATE: 5-26-83
CHKD BY: DATE: 5-27-83

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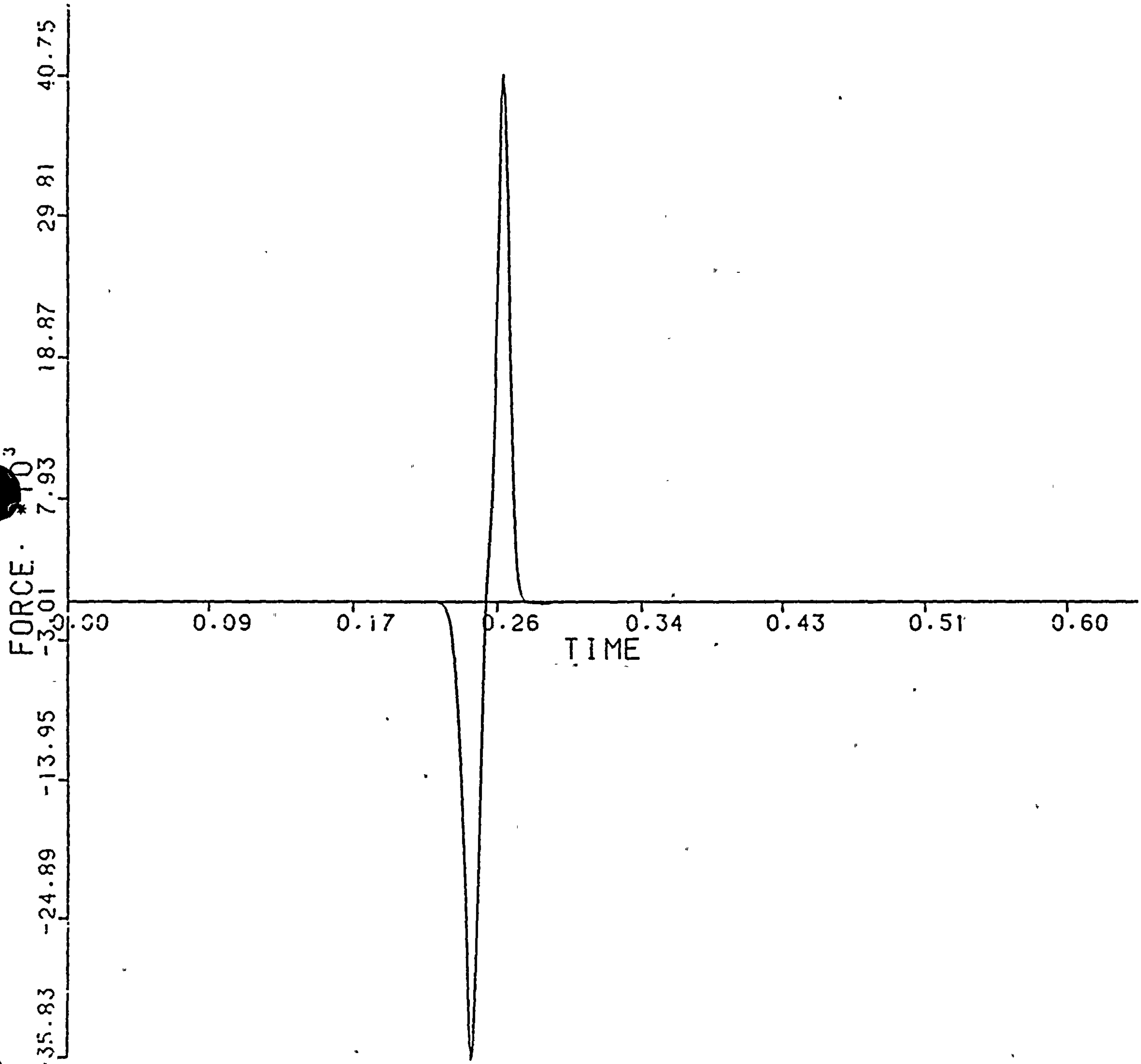
SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 12, MAGNITUDE AT NODE POINT 78



DONE BY: [illegible] DATE: 5-26-83
CHKD BY: [illegible] DATE: 5-27-83

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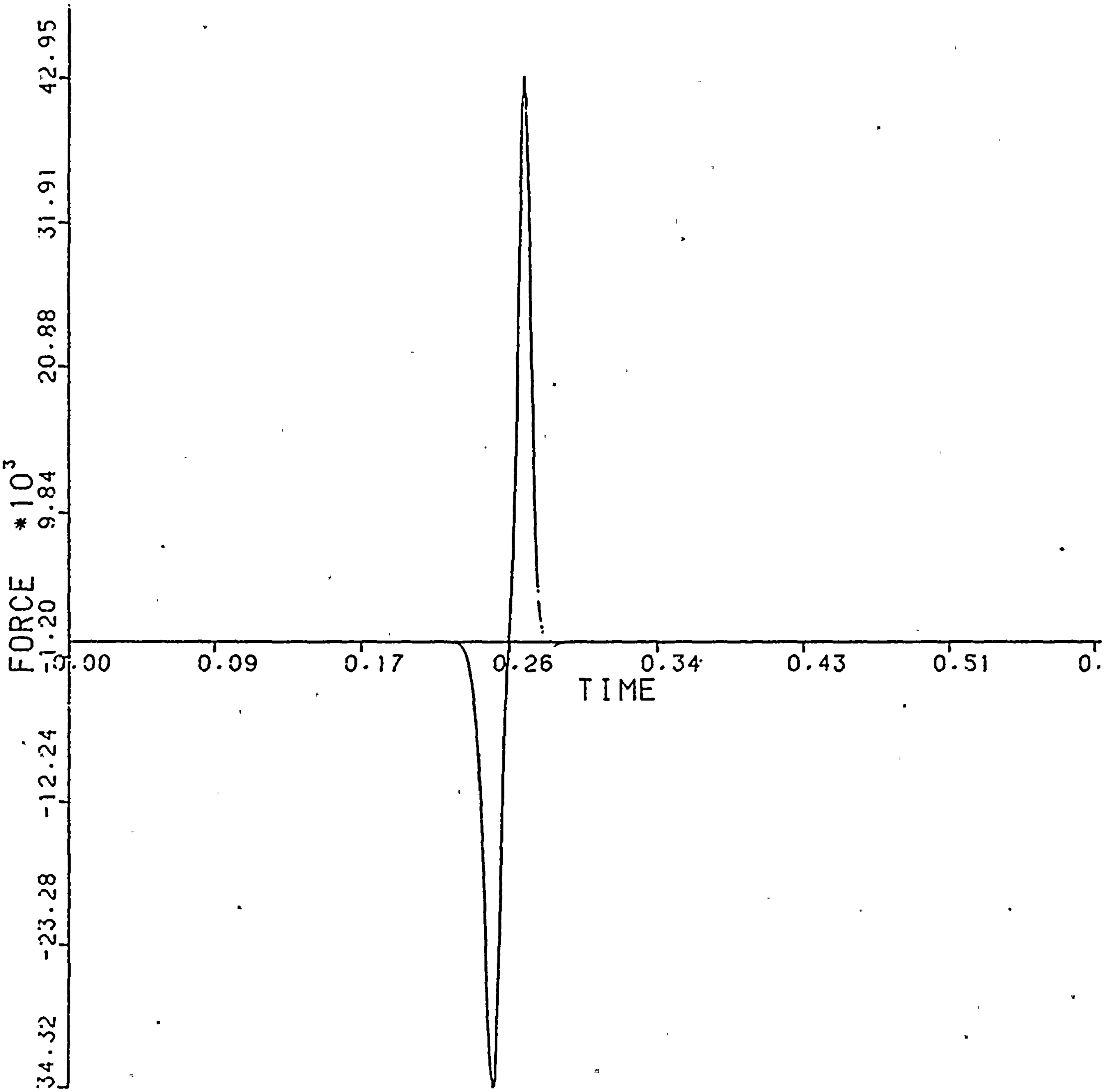
SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 13. MAGNITUDE AT NODE POINT 7



DONE BY: DATE:
CHKD BY: DATE:

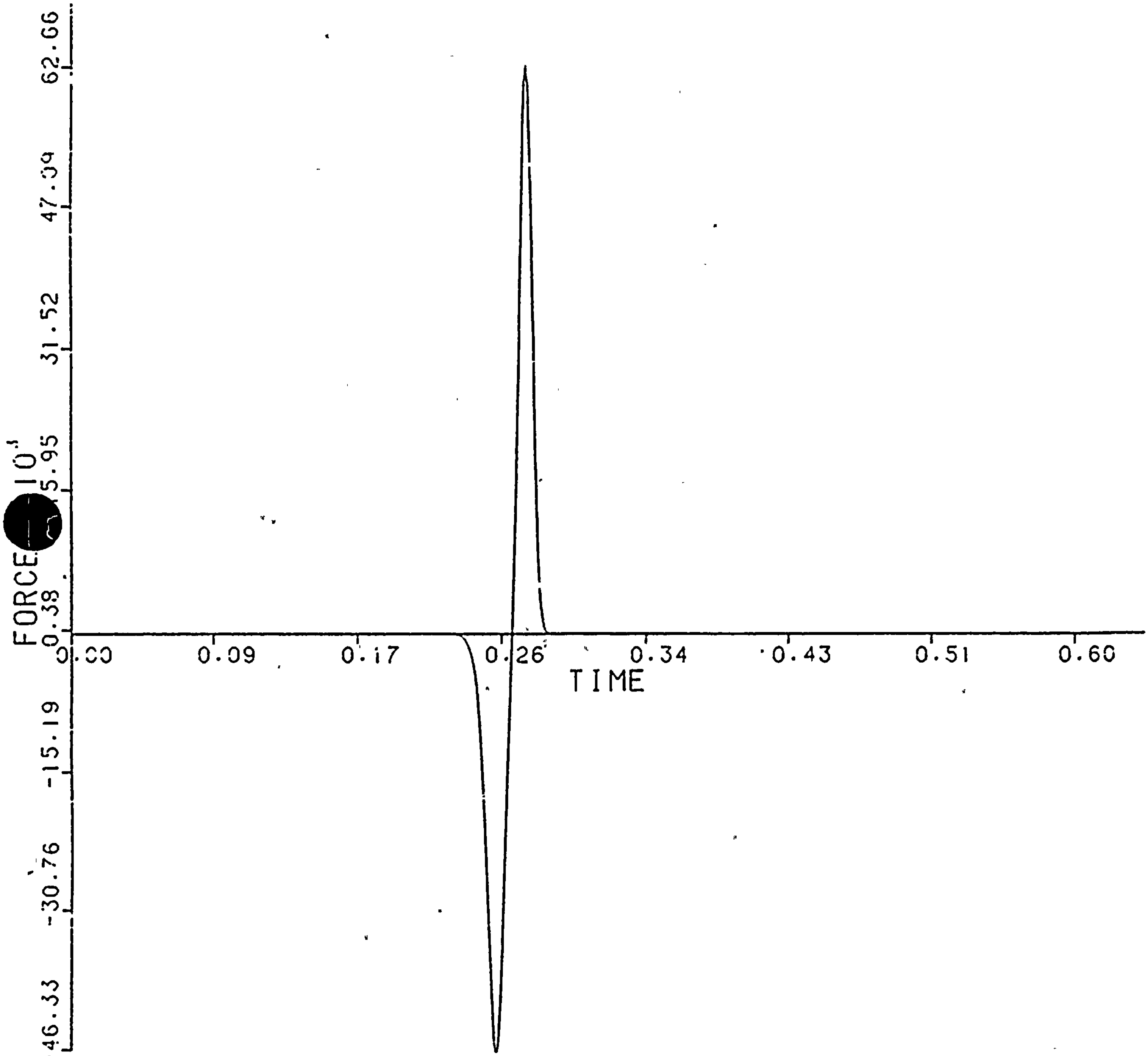
Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 24-MAY-83

QUARTER MODEL UNIT 2 LOOPSEAL

TIME/FORCE TABLE 14, MAGNITUDE AT NODE POINT 74

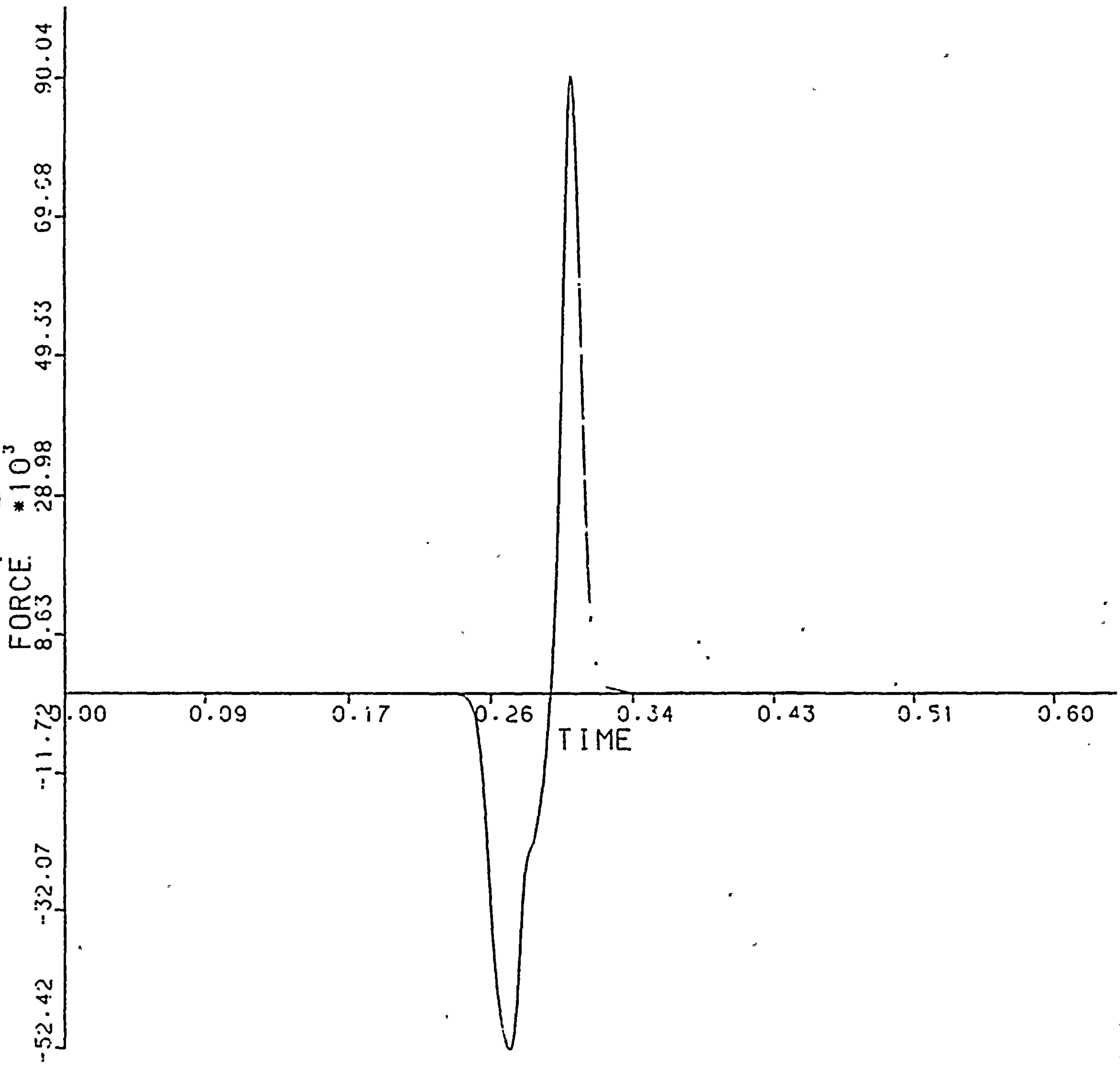


DONE BY: CWJ DATE: 5-26-83

CHKD BY: KTG DATE: 5-27-83

TELEDYNE ENGINEERING SERVICES

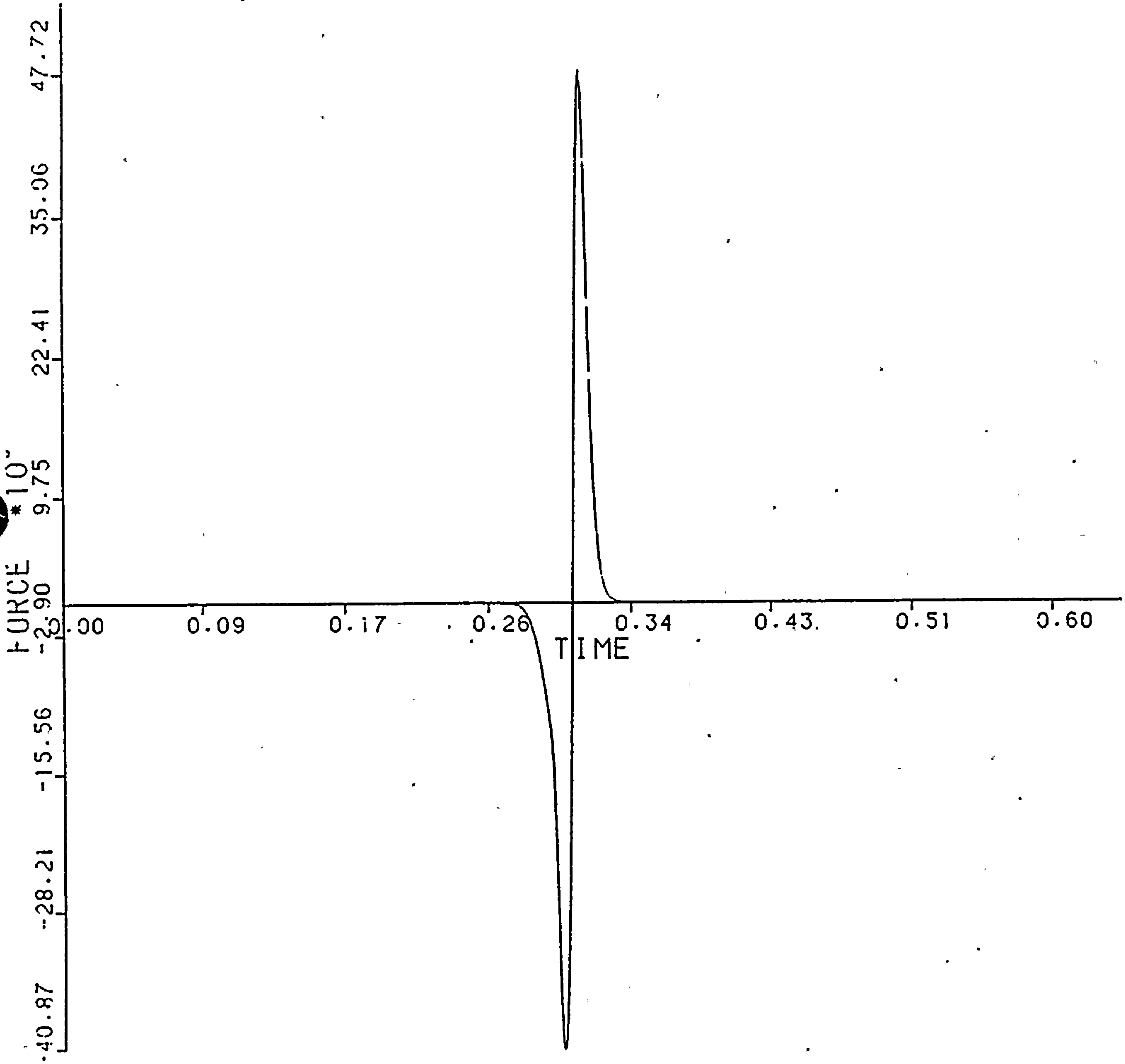
SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 15, MAGNITUDE AT NODE POINT 70



DONE BY [signature] DATE: 5-26-83
CHKD BY: [initials] DATE: 5-27-83

TELEDYNE ENGINEERING SERVICES

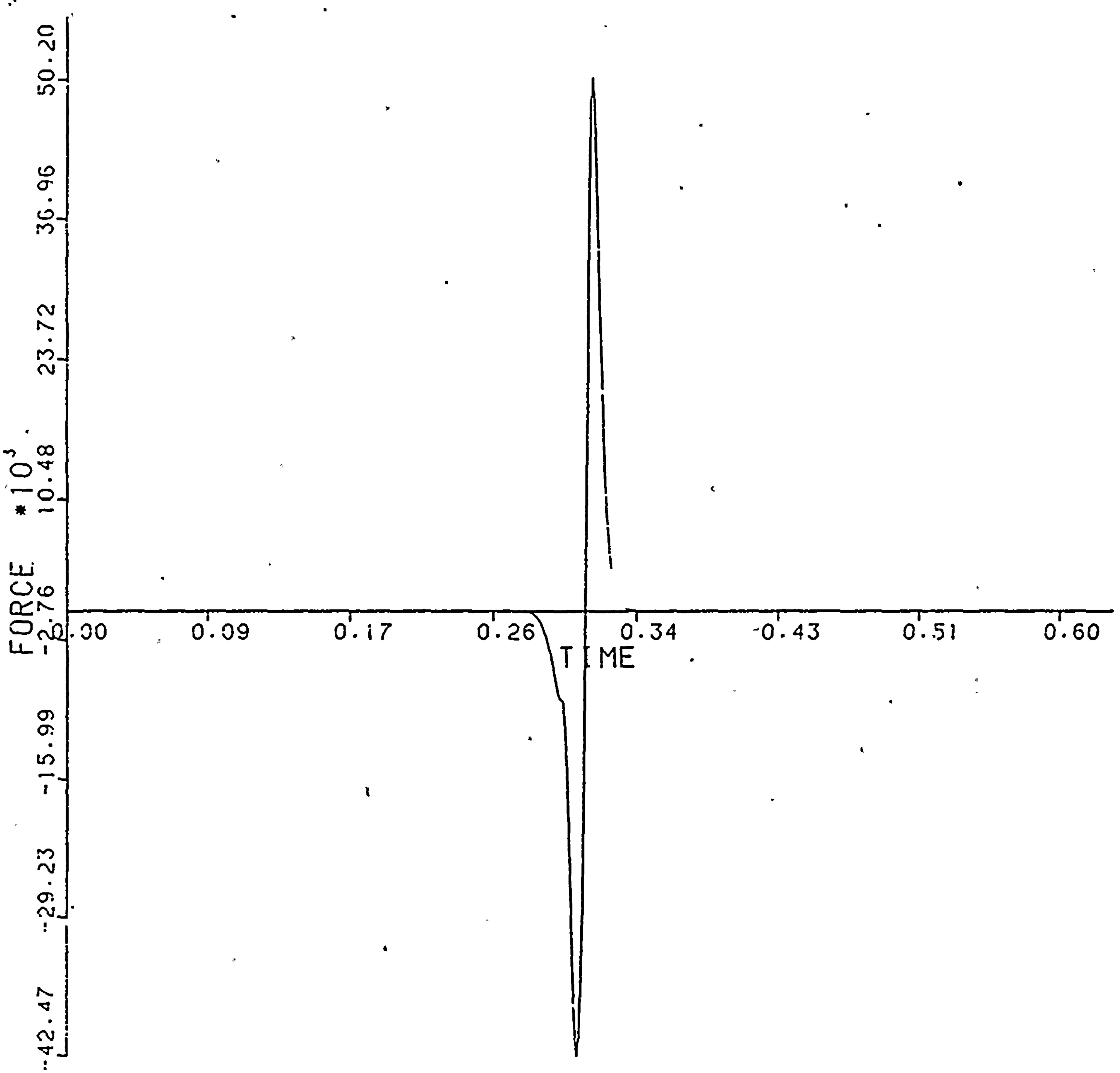
SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 16, MAGNITUDE AT NODE POINT 64



DONE BY: DATE: 5-26-83
CHKD BY: DATE: 5-27-83

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 17. MAGNITUDE AT NODE POINT 60



DONE BY: DATE: 5-26-83
CHKD BY: KTG DATE: 5-27-83

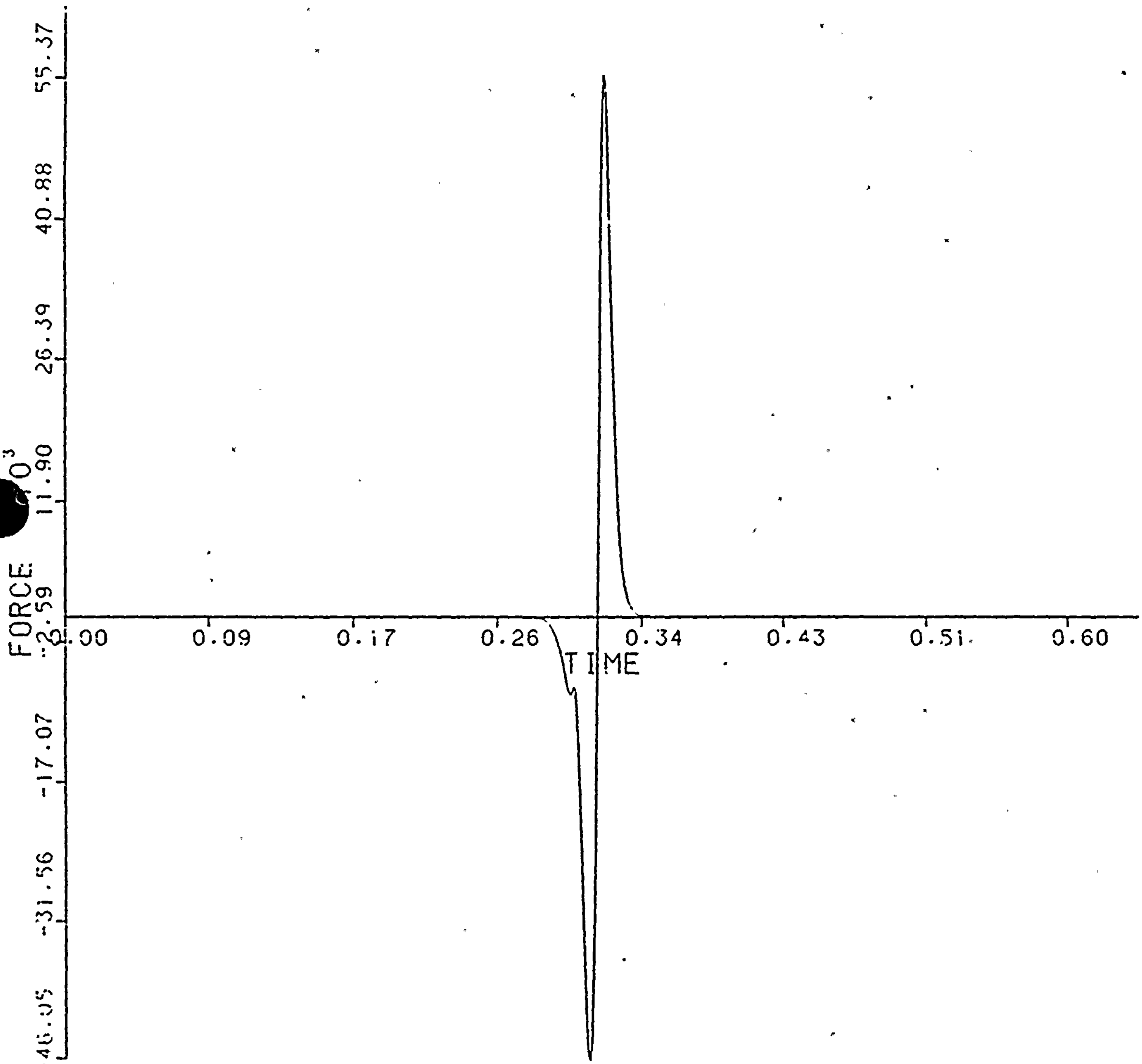
Technical Report
TR-5364-1
Revision 0

4-411 TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 . 24-MAY-83

QUARTER MODEL UNIT 2 LOOPSEAL

TIME/FORCE TABLE 18, MAGNITUDE AT NODE POINT 54



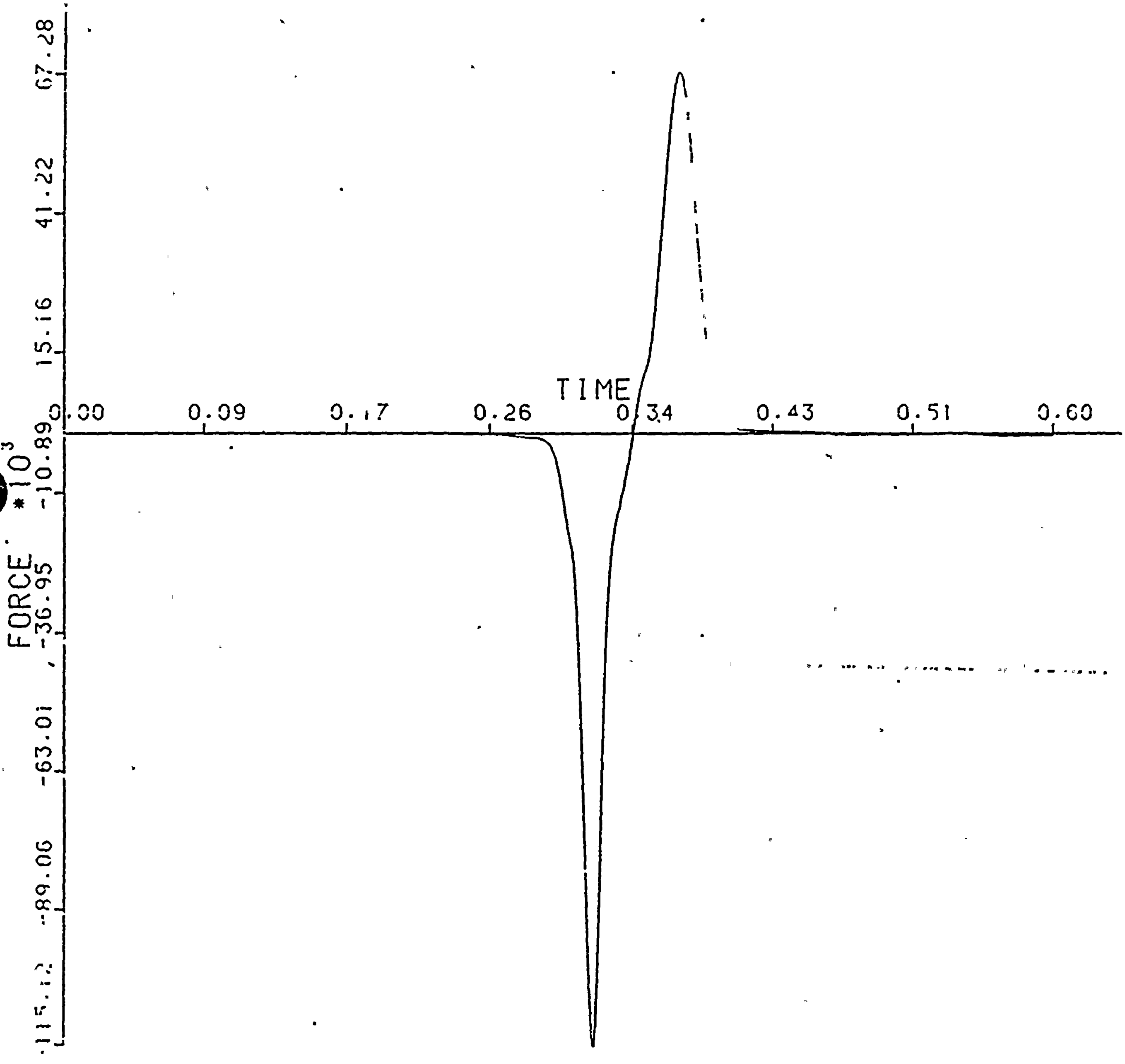
DONE BY: DATE: 5-26-83

CHKD BY: DATE: 5-27-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 19, MAGNITUDE AT NODE POINT 48

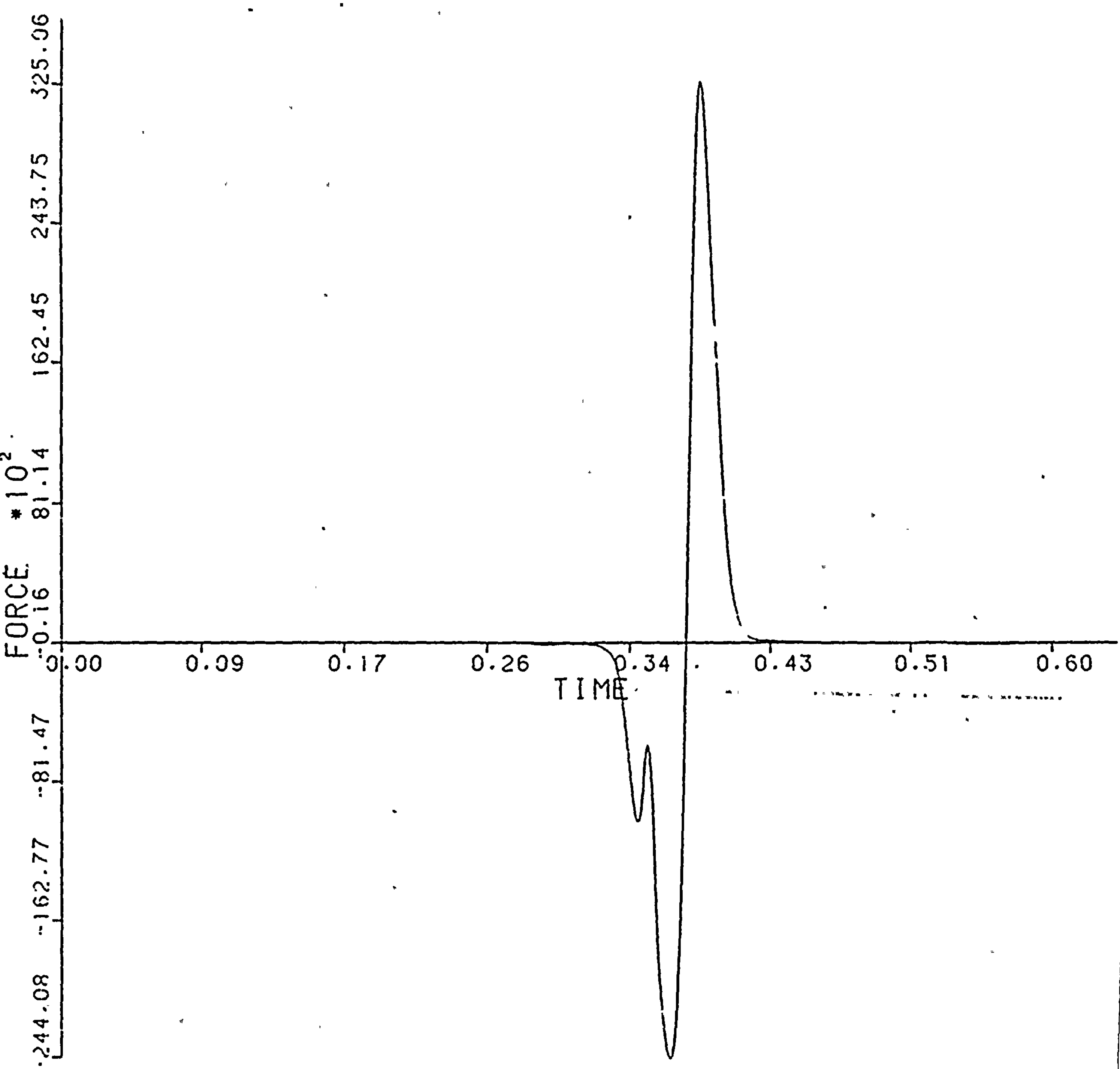


DONE BY [signature] DATE: 5-26-83
CHKD BY: [initials] DATE: 5-27-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 20, MAGNITUDE AT NODE POINT 42

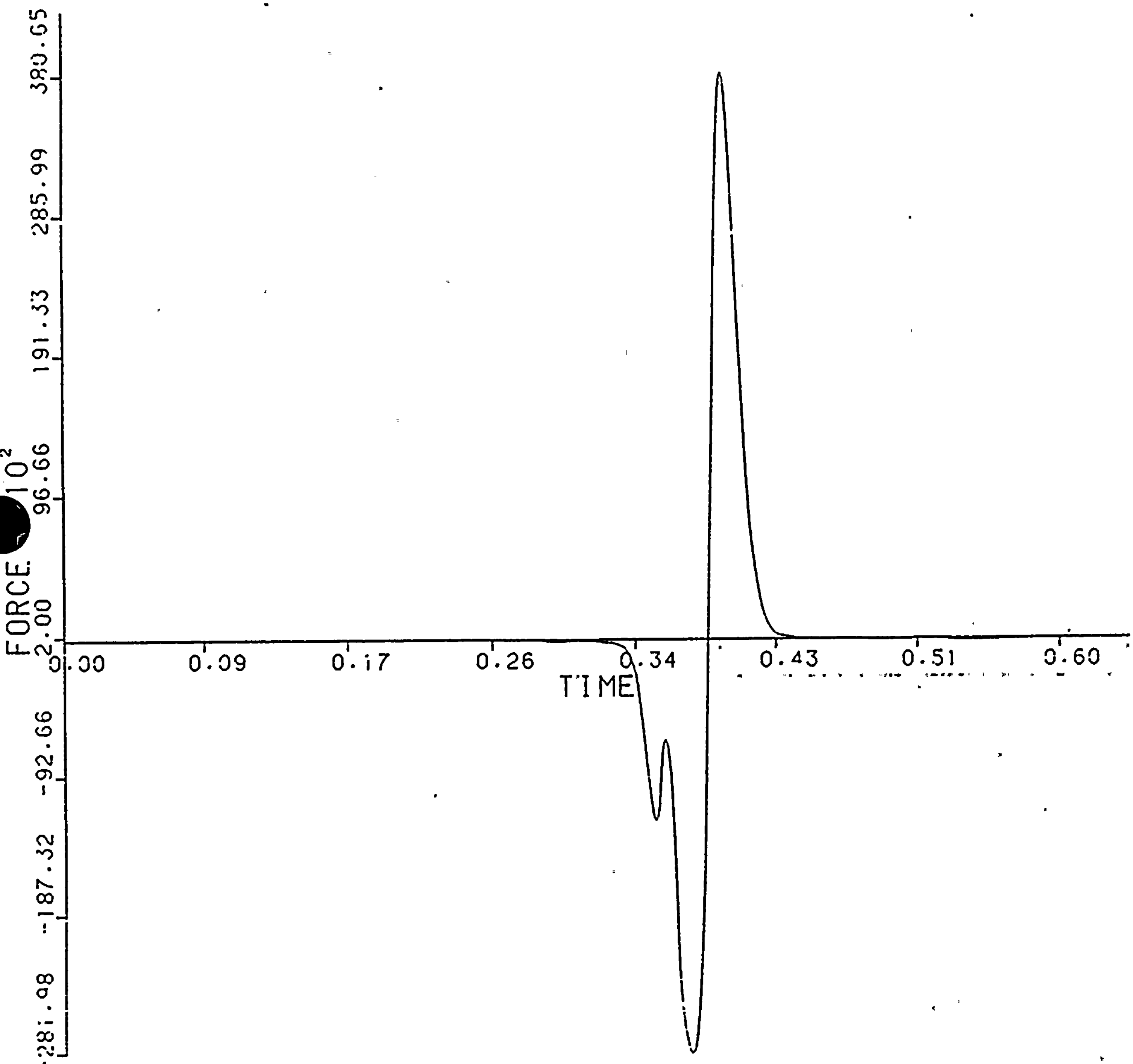


DONE BY: DATE: 5-26-83
CHKD BY: DATE: 5-27-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 21, MAGNITUDE AT NODE POINT 38

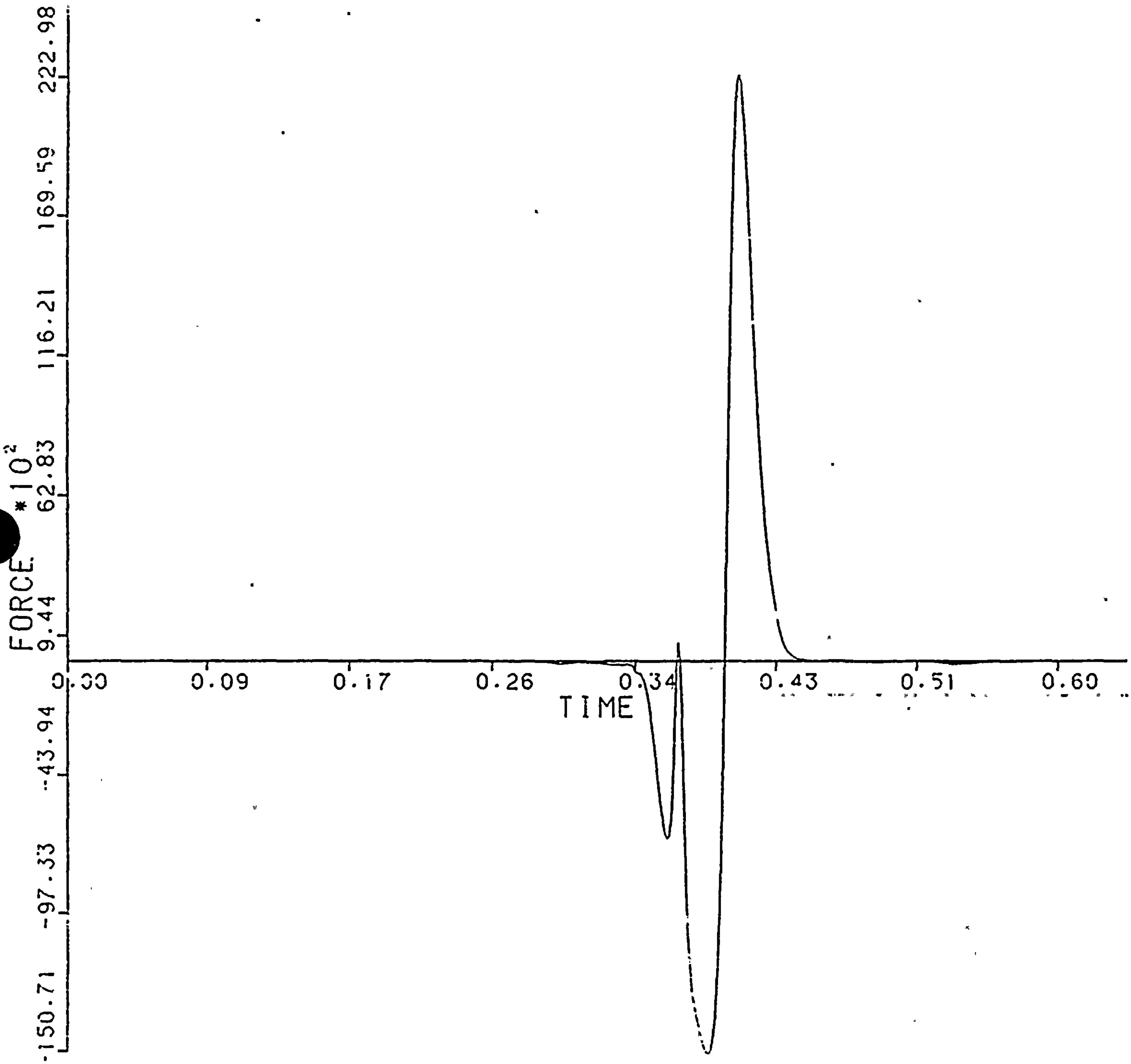


DONE BY: DATE:
CHKD BY: DATE:

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

SAP_SAP VERIFICATION 5364   24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE   22. MAGNITUDE AT NODE POINT   34

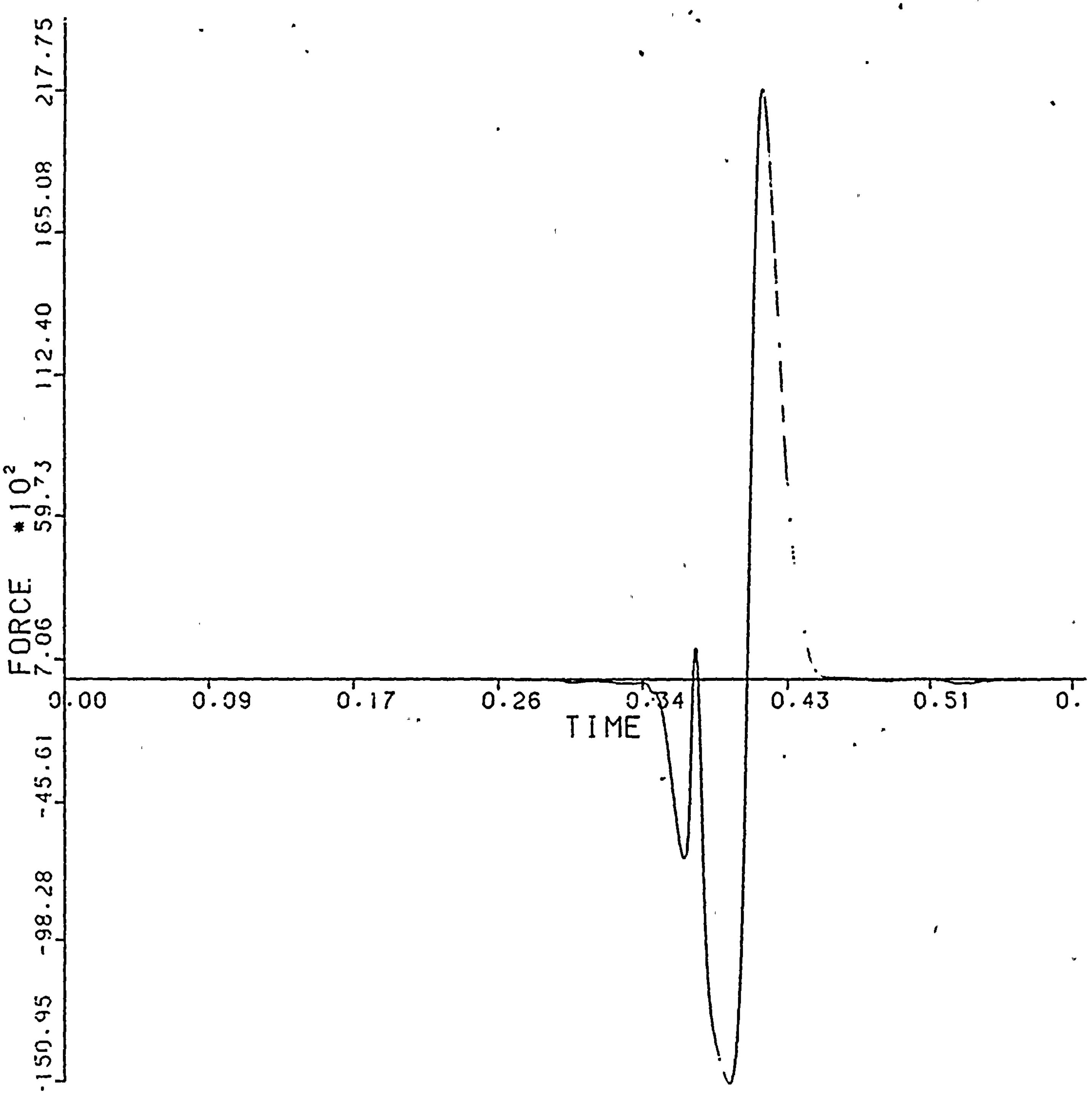


DONE BY [signature] DATE: 5-26-83
CHKD BY: [initials] DATE: 5-27-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 23, MAGNITUDE AT NODE POINT 32



DONE BY [illegible] DATE: 5-26-83
CHKD BY: [illegible] DATE: 5-27-83

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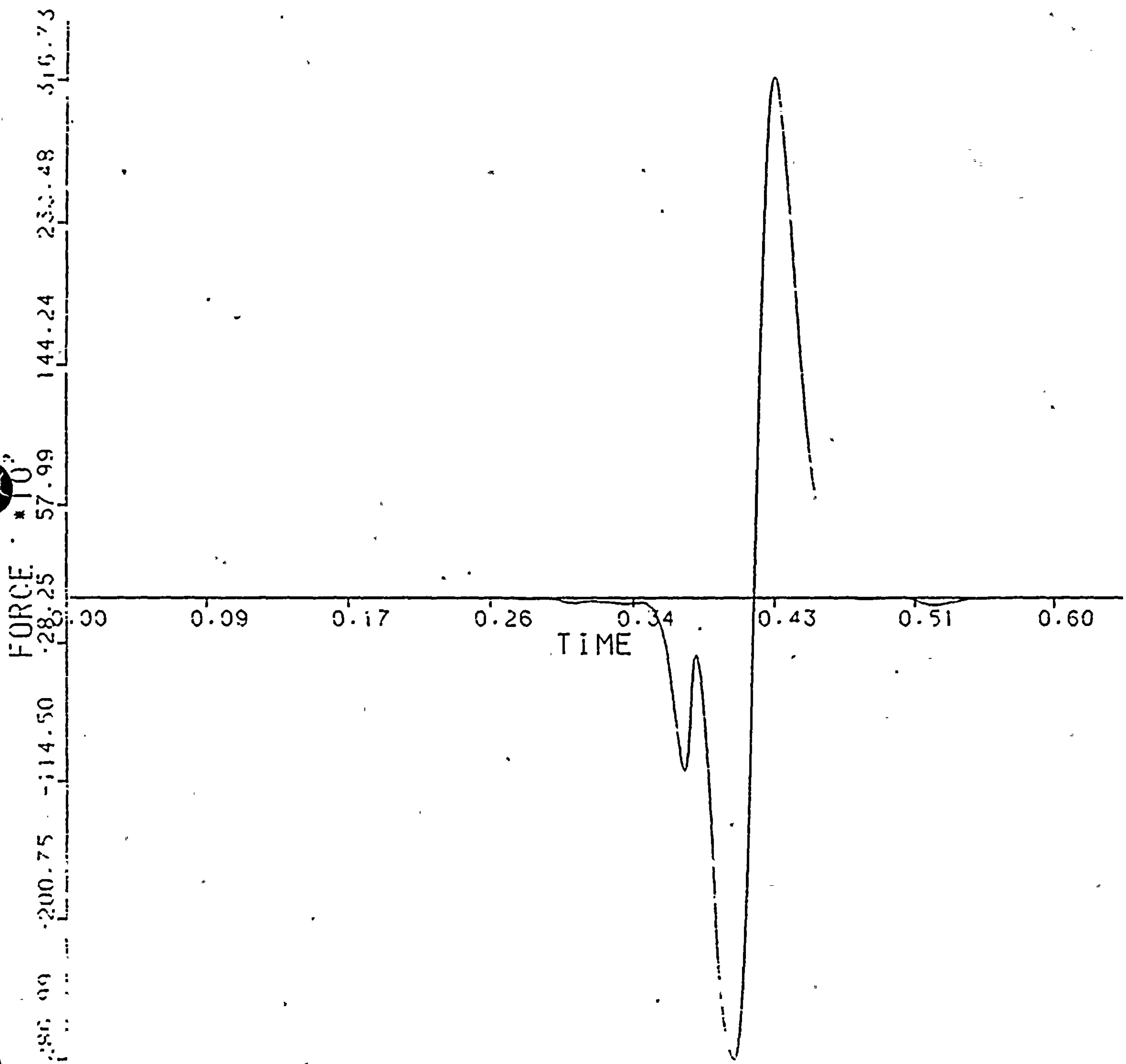
SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 24, MAGNITUDE AT NODE POINT 21



DONE BY: DATE: 5-26-83
CHKD BY: DATE: 5-27-83

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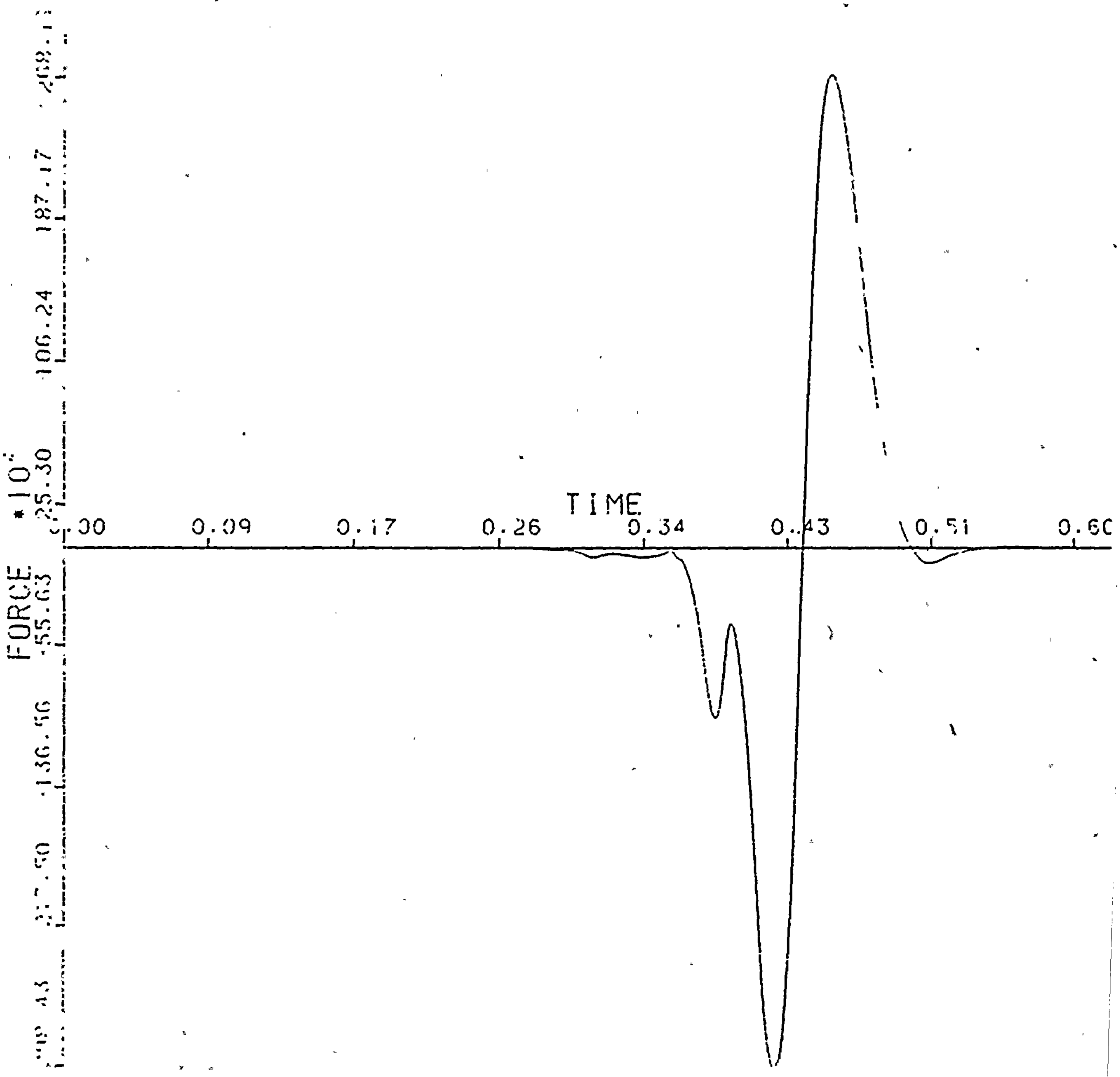
SAP2SAP VERIFICATION 5364 24-MAY-83
QUARTER MODEL UNIT 2 LOOPSEAL
TIME HISTORY TABLE ... MAGNITUDE AT NODE POINT 12



DONE BY DATE: 5-26-83
CHKD BY DATE: 5-27-83

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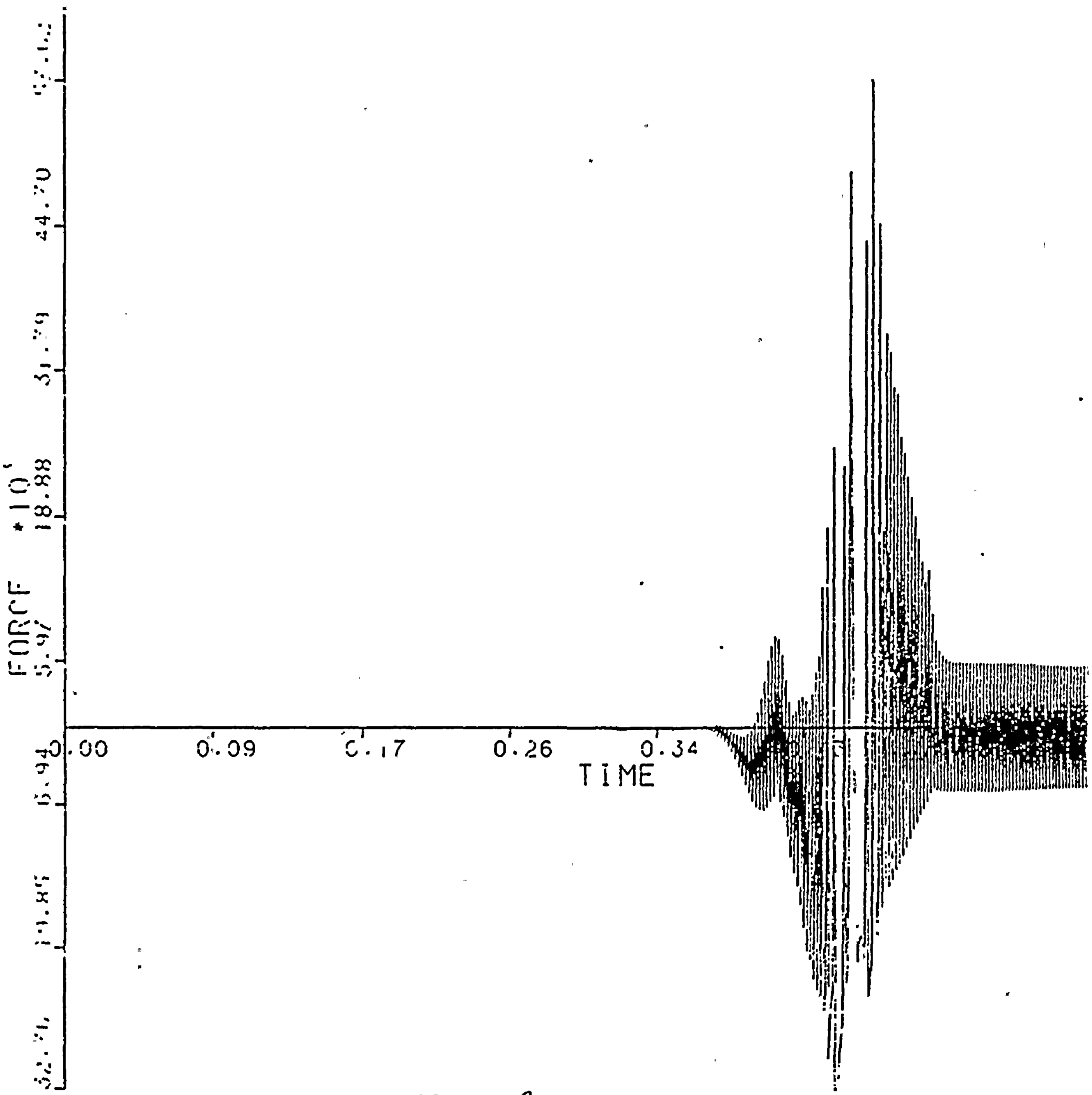
SAP2SAP VERIFICATION 5364 24-MAY-83.
QUARTER MODEL UNIT 2 LOOPSEAL
TIME/FORCE TABLE 26. MAGNITUDE AT NODE POINT



DONE BY: DATE: 5-26-83
CHKD BY: DATE: 5-27-83

4.9 RELAP Input

The RELAP5 MOD1 input listings are included for each of the transient conditions.

Input Listing	Unit	Transient Case
4.9.1	1	PORV Condensate/Steam 0-200 msec
4.9.2	1	Condensate/Steam Restart 200-400 msec 400-600 msec
4.9.3	1	PORV Solid 400° Liquid 0-200 msec
4.9.4	1	PORV Solid 400° Liquid Restart 200-600 msec
4.9.5	2	SV Cold Loop Seal (Quarter Model)

The PORV model has:

- 396 volumes
- 397 junctions
- 7 tee branches

The SRV model has:

- 190 volumes
- 191 junctions

Heat structures were not included in the RELAP model because of the program capacity. Including heat structures would have further reduced the number of available control volumes. This is a conservative assumption, ITI (Reference 18) showed higher loads were computed without heat structures.

4.9.1 PORV Condensate/Steam

LISTING OF INPUT DATA FOR CASE 1

```
=D.C.COOK UNIT1 PORV OPEN
*
*  DISCHARGE PIPING
*  THIS IS THE NUMBERING SYSTEM FOR UNIT1'S RELAP MODEL
*  WHERE COMPONENTS NUMBERED IN THE:
*        100'S ARE VALVE SV-45C AND ARC 1 LEVEL  669'-2"
*        200'S ARE VALVE SV-45B AND ARC 2 LEVEL  670'-10"
*        300'S ARE VALVE SV-45A ARN ARC 3 LEVEL  672'-6"
*        400'S ARE PORV NRV-151 AND ARC "A"
*        500'S ARE PORV NRV-153 AND ARC "B"
*        600'S ARE PORV NRV-152 AND ARC "C"
*        700'S AND 800'S ARE 6" AND 12" MAIN DISCHARGE PIPING
*        900'S QUENCH TANK PORTION
*        999  ATMOSPHERE
*
*
*
100      NEW  TRANSNT
101        RUN
102        BRITISH   BRITISH
104      NOACTION
*
*****************************************
*     TIME STEP CONTROL                 *
*****************************************
*
201        0.200,1.-7,2.-4,11001,5,50,250
*
*
*****************************************
*          MINOR EDITS                  *
*****************************************
*
301  MFLOWJ  410000000
302  MFLOWJ  510000000
303  MFLOWJ  610000000
304  MFLOWJ  402000000
305  MFLOWJ  811140000
306  MFLOWJ  811570000
307  MFLOWJ  308000000
308  MFLOWJ  208000000
309  MFLOWJ  108000000
*
310  QUALS  411010000
311  QUALS  511010000
312  QUALS  611010000
313  QUALS  409260000
314  QUALS  509120000
315  QUALS  609110000
316  QUALS  401280000
317  QUALS  811140000
318  QUALS  811570000
319  QUALS  307010000
320  QUALS  307180000
321  QUALS  207010000
322  QUALS  207260000
```

BY CNM DATE 4-12-83
CHKD. BY JBM DATE 4-20-83

```
323  QUALS  107010000
324  QUALS  107330000
*
325  P      411010000
326  P      511010000
327  P      611010000
328  P      409260000
329  P      509120000
330  P      609110000
331  P      401280000
332  P      811140000
333  P      811570000
334  P      307010000
335  P      307180000
336  P      207010000
337  P      207260000
338  P      107010000
339  P      107330000
*
*
****************************************
*  FORCE CARDS  FOR REPIPE             *
****************************************
*
*****************************************************************
*THIS RELAP RUN INCLUDES FORCE CARDS OF THE MAIN HEADER, DOWNSTREAM
*DISCHARGE TOWARDS THE QUENCH TANK AS WELL AS THE SEGEMENTS DOWNSTREAM
*OF THE SAFETY VALVES AND ARC "2" ENTIRE MODEL
*****************************************************************
*
*
*****ARC-2*****
*
*
2001  5,178,207010000,207020000,207030000,207040000,207050000
2019  207060000,207070000,207080000,207090000,207100000
2020  207110000,207120000,207130000,207140000,207150000
2021  207160000,207170000,207180000,207190000,207200000
2022  207210000,207220000,207230000,207240000,207250000
2023  207260000,307010000,307020000,307030000,307040000
2024  307050000,107010000,107020000,107030000,107040000
2025  107050000
*
*  MAIN HEADER 6 BY 12 IN
*
2033  703020000,703030000,703040000,703050000,703060000
2034  703070000,703080000,703090000,703100000,703110000
2035  703120000,703130000,703140000,801010000,803010000
2036  805010000,807010000,703010000
2037  809010000,811010000,811020000,811030000,811040000
2038  811050000,811060000,811070000,811080000,811090000
2039  811100000,811110000,811120000,811130000,811140000
2040  811150000,307180000,107330000
2042  811260000
*
*
*  MAIN DISHARGE DOWSTREAM TOWARDS QUENCH TANK
*
```

```
2013 811270000,811280000,811290000,811300000,811310000
2014 811320000,811330000,811340000,811350000,811360000
2015 811370000,811380000,811390000,811400000,811410000
2016 811420000,811430000,811440000,811450000,811460000
2017 811470000,811480000,811490000,811500000,811510000
2018 811520000,811530000,811540000,811550000,811560000
2043 811570000,811580000,811590000,811600000,811610000
2044 811620000,811630000,811640000,811650000,811660000
2045 811670000,811680000,811690000,811700000,811710000
2046 811720000,811730000,811740000,811750000,811760000
2047 811770000,811780000,811790000,811800000,811810000
2048 811820000,811830000,811840000,811850000,811860000
2049 811870000,811880000,811890000,811900000,811910000
2026 811920000,811930000,811940000,811950000,811960000
2027 811970000,813010000,813020000,813030000,813040000
2028 813050000,813060000,813070000,813080000,813090000
2029 813100000,813110000,813120000,813130000,813140000
2030 813150000,813160000,813170000,813180000,813190000
2031 813200000,813210000,813220000,813230000,813240000
2032 813250000,813260000,978010000,978020000,978030000
2050  978040000,978050000,978060000,978070000,978080000
*
****************************************
*          TRIPS                       *
****************************************
*
*
501  TIME  0 GE NULL 0  0.0  L   * VALVE OPENING TRIP
502  TIME  0 GE NULL  0  5.0  L   *  JOB TERMINATION TRIP
515  P  982010000  GE  NULL 0 114.7   L *  QUENCH TANK RUPTURE PRESS.
600        502
*
*********************************************************
*         ***************************************       *
*         *  HYDRODYNAMIC COMPONENTS           *       *
*         ***************************************       *
*********************************************************
*
*
*        PRESSURIZER   COMPONENT
3990000     "PRESS"   TMDPVOL
3990101  0.0  20.0  500.0  0.0  0.0  0.0  0.00005  0.0  11
3990200  2
3990201  0.0  2349.7  1.0  0.8  2420.0  1.0  1.2  2498.7  1.0
*
4000000     "PORV"  SNGLJUN
4000101     399000000  401000000  0.0  0.0  0.0  1100
4000201     1   0.0  0.0  0.0
*
4010000     "PORV"  PIPE
4010001     28
4010101     0.1465     28
4010301     .4375      4
4010302     .5104      12
4010303     .5         19
4010304     .5         27
4010305  0.72   28
4010401     0.0      28
```


TELEDYNE ENGINEERING SERVICES

```
4010601   45.      4
4010602   90.       12
4010603   0.0     19
4010604   90.     27
4010605  0.0  28
4010801   1.51E-4   0.0  28
4010901   0.0        0.0      3
4010902   .092       .092     4
4010903   0.0        0.0      11
4010904   .1836      .1836    12
4010905   0.0        0.0      18
4010906   .1836      .1836    19
4010907   0.0        0.0      26
4010908  0.1836  0.1836  27
4011001   00      28
4011101   1000      27
4011201  2  2349.7  1.0  0.0  0.0  28
4011300   1
4011301   0.0  0.0  0.0     27
*
4020000   "PORV"  SNGLJUN
4020101   401010000  403000000  0.0  0.0  0.0  1000
4020201   1  0.0  0.0  0.0
*
4030000   "PORV"  BRANCH
4030001   0
4030101   0.1465  0.5  0.0  0.0  0.0  0.0  1.51E-4  0.0  00
4030200  2  2349.7  1.0  0.0  0.0  0.0
*
4040000   "PORV"  SNGLJUN
4040101   403010000  405000000  0.1465  0.0  0.0  1000
4040201   1  0.0  0.0  0.0
*
4050000   "PORV"  PIPE
4050001   16
4050101   0.1465    1
4050102   0.0716    16
4050301   0.698   1
4050302   0.471  7
4050303   0.451  16
4050401   0.0       16
4050601   0.0       16
4050801   1.51E-4   0.0  1
4050802   1.33E-4   0.0   16
4050901   0.0577  0.0961  1
4050902  0.0  0.0  15
4051001   00       16
4051101   1000     15
4051201  2  2349.7  1.0  0.0  0.0  16
4051300   1
4051301   0.0  0.0  0.0       15
*
4060000   "PORV"  SNGLJUN
4060101   405010000  407000000  0.0  0.0  0.0  1000
4060201   1  0.0  0.0  0.0
*
4070000   "PORV"  BRANCH
4070001   0
```

```
4070101   0.0716   0.451  0.0  0.0  0.0  0.0  1.33E-4  0.0  00
4070200  2  2349.7  1.0  0.0  0.0  0.0
*
4080000   "PORV"   SNGLJUN
4080101   407010000  409000000   0.0  0.0  0.0  1000
4080201   1  0.0  0.0  0.0
*
4090000   "PORV"   PIPE
4090001   26
4090101   0.0716       1
4090102   0.03757     22
4090103   0.03388     23
4090104   0.02650     24
4090105   0.01912     25
4090106   0.01175     26
4090301   0.53         1
4090302   .30        2
4090303  0.493  10
4090304   0.55      14
4090305   0.510      22
4090306  0.255    26
4090401   0.0      26
4090601   0.0      26
4090801   1.33E-4   0.0      1
4090802   1.53E-4   0.0      26
4090901   0.0       0.0      13
4090902   0.585      0.585      14
4090903   0.0        0.0     25
4091001   00       26
4091102  1000  25
4091201  2  2349.7  1.0  0.0  0.0  17
4091202  2  2349.7  0.0  0.0  0.0  26
4091300   1
4091301   0.0  0.0  0.0     25
*
4100000   "PORV151"   VALVE
4100101   409010000  411000000  0.00808  0.0  0.0  0100
4100201   1  0.0  0.0  0.0
4100300   MTRVLV
4100301   501   502  1.0   0.0
*
5080000   "PORV"  SNGLJUN
5080101   407010000  509000000  0.0  0.2172  0.2172  1000
5080201   1  0.0  0.0  0.0
*
5090000   "PORV"  PIPE
5090001   12
5090101   0.03757    8
5090102  0.03388     9
5090103   0.02650    10
5090104   0.01912    11
5090105    0.01175   12
5090301   0.4089       2
5090302   0.5078     8
5090303    0.2539     12
5090401   0.0        12
5090601   0.0        12
5090801   1.53E-4   0.0    12
```

```
5090901  0.0  0.0  1
5090902  0.2172   0.2172 2
5090903  0.0      0.0    11
5091001  00     12
5091101  1000    11
5091201  2  2349.7  1.0  0.0  0.0  3
5091202  2  2349.7  0.0  0.0  0.0  12
5091300  1
5091301  0.0  0.0  0.0    11
*
5100000  "PORV152"  VALVE
5100101  509010000  511000000  0.00806  0.0  0.0  0100
5100201  1   0.0  0.0  0.0
5100300  MTRVLV
5100301  501  502   1.0  0.0
*
6080000  "PORV"  SNGLJUN
6080101  403010000  609000000  0.0  0.1836  0.1836  1000
6080201  1   0.0  0.0  0.0
*
6090000  "PORV"  PIPE
6090001  11
6090101  0.03757     7
6090102  0.03388     8
6090103  0.02650     9
6090104  0.01912     10
6090105  0.01175     11
6090301  0.4089      2
6090302  0.5699      7
6090303  .2850       11
6090401  0.0         11
6090601  0.0         11
6090801  1.53E-4   0.0   11
6090901  0.0  0.0  1
6090902  0.2172   0.2172   2
6090903  0.0      0.0      10
6091001  00       11
6091101  1000      10
6091201  2  2349.7  1.0  0.0  0.0   4
6091202  2  2349.7  0.0  0.0  0.0  11
6091300  1
6091301  0.0  0.0  0.0   10
*
6100000  "PORV153"  VALVE
6100101  609010000  611000000   0.00806  0.0  0.0  0100
6100201  1    0.0 0.0  0.0
6100300  MTRVLV
6100301  501  502   1.0     0.0
****************************************
*
*   VALVE  DOWNSTREAM  PIPING
1070000  "DWNSTRM#1"   PIPE
1070001      33
*
1070101  0.20069        33
*
1070301  0.5261          4
1070302  0.9943          15
```


TELEDYNE ENGINEERING SERVICES

```
1070303   0.9132         21
1070304   0.8472         30
1070305   1.085          33
*
1070401   0.0            33
*
1070601   0.0            4
1070602   -90.           15
1070603   0.0            33
*
1070801   1.52-4    0.   33
1070901   0.0       0.0       3
1070902   0.18      0.18      4
1070903   0.0       0.0       14
1070904   0.18      0.18      15
1070905   0.0       0.0       32
*
1071001   00        33
1071101   1000      32
*
1071201   4   17.7   120.   0.8284   0.   33
*
1071300   1
1071301   0.0  0.0  0.0  32
*
*
*
*
*************************************************************************
*
*     VALVE DOWNSTREAM PIPING
2070000   "DWNSTRM#2"   PIPE
*
2070001              26
2070101   0.20069    26
*
2070301   0.5261     4
2070302   0.9271     14
2070303   0.8852     23
2070304   1.085      26
*
2070401   0.0        26
*
2070601   0.0        4
2070602   -90.       14
2070603   0.0        26
*
2070801   1.52-4    0.    26
*
2070901   0.0       0.0       3
2070902   0.18      0.18      4
2070903   0.0       0.0       13
2070904   0.18      0.18      14
2070905   0.0       0.0       25
*
2071001   00        26
*
2071101   1000      25
```

```
*
2071201  4  17.7  120.  0.9284  0.  26
*
2071300  1
2071301  0.0  0.0  0.0  25
*
*
**********************************************************************
*
*     VALVE DOWNSTREAM PIPING
3070000   "DWNSTRM#3"   PIPE
3070001   18
*
3070101   0.20069    18
*
3070301   0.5261      4
3070302   1.0339     12
3070303   0.801      15
3070304   1.085      18
*
3070401   0.0        18
*
3070601   0.0         4
3070602   -90.       12
3070603   0.0        18
*
3070801   1.52-4   0.   18
*
3070901   0.0        0.0        3
3070902   0.18       0.18       4
3070903   0.0        0.0       11
3070904   0.18       0.18      12
3070905   0.0        0.0       17
*
3071001   00         18
3071101   1000       17
*
3071201   4   17.7   120.   0.9284   0.   18
*
3071300   1
3071301   0.0  0.0  0.0        17
*
*
*****************************************
*     PORV DISCHARGE SECTION            *
*****************************************
*
*
*****************************************************
*   PORV NRV-151 DISCHARGE LINE ARC "A"             *
*****************************************************
*
*
4110000   "PORV1"   PIPE
4110001       19
*
4110101   0.05132    17
4110102   0.20069    19
```

```
*
4110301   0.3724      4
4110302   0.3802      8
4110303   0.561       17
4110304   0.349       19
*
4110401   0.0         19
*
4110601   0.0         4
4110602   -90.        8
4110603   0.0         19
*
4110801   1.53-4 .0 17
4110802   1.52-4 .0 19
*
4110901   0.0         0.0         3
4110902   0.2088      0.2088      4
4110903   0.0         0.0         7
4110904   0.2088      0.2088      8
4110905   0.0         0.0         16
4110906   0.3784      0.1565      17
4110907   0.0         0.0         18
*
4111001   00          19
4111101   1000        18
*
4111201   4    17.7    120.   0.9284   0.0    19
*
4111300   1
4111301   0.0  0.0  0.0    18
*
4120000   "ENTERMAIN"  SNGLJUN
4120101   411010000  701000000  0.0  0.1800  0.1800   1100
4120201   1   0.0  0.0  0.0
*
*
*****************************************************
*    PORV NRV-153 DISCHARGE LINE ARC "B"             *
*****************************************************
*
*
*
5110000   "PORV2LINE"  PIPE
5110001          19
*
5110101   0.05132     18
5110102   0.08840     19
*
5110301   0.4303      3
5110302   0.3620      7
5110303   0.3529         9
5110304   0.6058      18
5110305   0.371       19
*
5110401   0.0         19
*
5110601   0.0         3
5110602   -90.        7
```

```
5110603  0.0          19
*
5110801  1.53-4 .0 18
5110802  1.34-4 .0 19
*
5110901  0.0          0.0         2
5110902  0.2088       0.2088      3
5110903  0.0          0.0         6
5110904  0.2088       0.2088      7
5110905  0.0          0.0         17
5110906  0.0544       0.0399      18
*
5111001  00           19
*
5111101  1000         18
*
5111201  4  17.7  120.  0.9284  0.0  19
*
5111300  1
5111301  0.0  0.0  0.0   18
*
5120000  "JUNC."   SNGLJUN
5120101  511010000  513000000  0.0  0.0  0.0  1000
5120201  1  0.0  0.0  0.0
*
*
*
5130000  "4X4X3TEE"   BRANCH
5130001  0
5130101  0.08840  0.3524  0.0 0.0 0.0 0.0  1.34-4  0.0   00
5130200  4  17.7  120.  0.9284  0.0  0.0
*
*
5140000  "4IN JUNC"  SNGLJUN
5140101  513010000  515000000  0.0  0.0  0.0   1000
5140201  1  0.0  0.0  0.0
*
5150000  "4INSCH40"  PIPE
5150001             12
*
5150101  0.0884     10
5150102  0.20069    12
*
5150301  0.3524     1
5150302  0.6963     10
5150303  0.349      12
*
5150401  0.0        12
*
5150601  0.0        12
*
5150801  1.34-4 0.0  10
5150802  1.52-4 0.0  12
*
5150901  0.0          0.0         9
5150902  0.1483       0.0815      10
5150903  0.0          0.0         11
*
```

```
5151001   00          12
*
5151101   1000        11
*
5151201   4  17.7  120.  0.9284  0.0   12
*
5151300   1
5151301   0.0  0.0  0.0   11
*
5160000   "ENTERMAIN"  SNGLJUN
5160101   515010000  701000000  0.0  0.0  0.0   1000
5160201   1  0.0  0.0  0.0
*
*
*************************************************
*   PORV NRV-152 DISCHARGE LINE  ARC "C"        *
*************************************************
*
*
*
6110000   "PORVDISC3"  PIPE
6110001             8
*
6110101   0.05132   8
*
6110301   0.3723    4
6110302   0.3648    8
*
6110401   0.0       8
*
6110601   0.0       4
6110602   -90.      8
*
6110801   1.53-4 .0 8
*
6110901   0.0       0.0      3
6110902   0.211    0.211    4
6110903   0.0       0.0      7
*
6111001   00        8
6111101   1000      7
*
6111201   4  17.7  120.  0.9284  0.0  8
*
6111300   1
6111301   0.0  0.0  0.0   7
*
6120000   "PORVLINE"   SNGLJUN
6120101   611010000  513000000  0.0  0.0  0.0   1000
6120201   1  0.0  0.0  0.0
*
***************************************
*   MAIN DISCHARGE LINE SECTION       *
***************************************
*
*
*    MAIN  DISCHARGE  LINE
7010000   "ENTERMAIN"   BRANCH
```

```
7010001  0
7010101  0.20069  0.7035 0.0 0.0 0.0 0.0 1.52-4 0.0  00
7010200  4   17.7  120.  0.9284  0.0  0.0
*
7020000  "MAINLINE"  SNGLJUN
7020101  701010000  703000000 0.0  0.0  0.0  1000
7020201  1   0.0  0.0  0.0
*
7030000  "MAINLINE"  PIPE
*
7030001        14
*
7030101  0.20069    12
7030102  0.77708    14  * 12 IN LINE STARTS HERE
*
7030301  0.7035     1
7030302  1.0076    12
7030303  0.5834     14   * 12 IN LINE STARTS HERE
*
7030401  0.0        14
*
7030601  0.0        1
7030602  -90.       14
*
7030801    1.52-4   0.     12
7030802  1.69-4  0.  14
*
7030901  0.180      0.180      1
7030902  0.0        0.0        11
7030903  0.493      0.2045     12
7030904  0.0        0.0        13
*
7031001  00         14
7031101  1000       13
*
7031201  4   17.7   120.   0.9284   0.0   14
*
7031300  1
7031301  0.0  0.0  0.0   13
*
*
7040000   "MAINLINE"  SNGLJUN
7040101   703010000  801000000   0.0  0.0  0.0   1000
7040201   1  0.0  0.0  0.0
*
3080000   "CON.1"  SNGLJUN
3080101   307010000  801000000   0.0  0.1560  0.1560  1000
3080201   1   0.0  0.0  0.0
*
*
*
*
*   CONNECTION  TO MAIN LINE AT ELEV. 672'-8"
*
*
8010000   "12-BRANC1"   BRANCH
8010001   0
```

```
8010101   0.77708  0.8334  0.0  0.0 -90.  -0.8334  1.69-4  0.0  00
8010200   4   17.7  120.  0.9284  0.0  0.0
*
8020000   "MAINLINE"  SNGLJUN
8020101   801010000  803000000  0.0  0.0  0.0   1000
8020201   1   0.0  0.0  0.0
*
8030000   "MAINLINE"  SNGLVOL
8030101   0.77708  0.8334  0.0  0.0 -90.  -0.8334  1.69-4  0.0  00
8030200   4  17.7  120.  0.9284  0.0  0.0
*
*   CONNECTION TO MAIN LINE AT ELEV. 670'-10"
*
*
8040000   "MAINLINE"  SNGLJUN
8040101   803010000  805000000  0.0  0.0  0.0   1000
8040201   1   0.0  0.0  0.0
*
2080000   "CON.2"   SNGLJUN
2080101   207010000  805000000  0.0  0.1560  0.1560   1000
2080201   1   0.0  0.0  0.0
*
8050000   "MAINBR.3"  BRANCH
8050001   0
8050101   0.77708  0.8334 0.0 0.0 -90. -0.8334  1.69-4  0.0  00
8050200   4   17.7  120.  0.9284  0.0  0.0
*
8060000   "MAINLINE"  SNGLJUN
8060101   805010000  807000000  0.0  0.0  0.0   1000
8060201   1   0.0  0.0  0.0
*
8070000   "MAINLINE"  SNGLVOL
8070101   0.77708  0.8334  0.0  0.0 -90.  -0.8334  1.69-4  0.0  00
8070200   4  17.7  120.  0.9284  0.0  0.0
*
*
*   CONNECTION TO MAIN LINE AT ELEV. 669'-2"
*
*
*
8080000   "MAINLINE"  SNGLJUN
8080101   807010000  809000000  0.0  0.0  0.0   1000
8080201   1   0.0  0.0  0.0
*
1080000   "CON.3"  SNGLJUN
1080101   107010000  809000000  0.0  0.1560  0.1560   1000
1080201   1   0.0  0.0  0.0
*
8090000   "MAINBR4"  BRANCH
8090001   0
8090101   0.77708  0.8334  0.0 0.0 -90. -0.8334  1.69-4  0.0  00
8090200   4  17.7  120.  0.9284 0.0  0.0
*
8100000   "MAINLINE"  SNGLJUN
8100101   809010000  811000000  0.0  0.0  0.0   1000
8100201   1  0.0  0.0  0.0
*
*
```

```
8110000   "MAINLINE"   PIPE
*
8110001              97
*
8110101   0.77708    97
*
8110301   1.0149     14
8110302   0.5303     18
8110303   0.5        22
8110304   0.5303     26
8110305   0.9908     56
8110306   0.5        64
8110307   0.8750     72
8110308   0.5104     80
8110309   0.5000     88
8110310   1.0558     97
*
8110401   0.0        97
*
8110601   -90.       14
8110602   -45.       18
8110603   -90.       22
8110604   -45.       26
8110605   -90.       56
8110606   0.0        80
8110607   -90.       88
8110608   0.0        97
*
8110801   1.69-4     0.   97
*
8110901   0.0        0.0        13
8110902   0.078      0.078      14
8110903   0.0        0.0        17
8110904   0.078      0.078      18
8110905   0.0        0.0        21
8110906   0.078      0.078      22
8110907   0.0        0.0        25
8110908   0.078      0.078      26
8110909   0.0        0.0        55
8110910   0.156      0.156      56
8110911   0.0        0.0        63
8110912   0.026      0.026      64
8110913   0.0        0.0        71
8110914   0.13       0.13       72
8110915   0.0        0.0        79
8110916   0.156      0.156      80
8110917   0.0        0.0        87
8110918   0.156      0.156      88
8110919   0.0        0.0        96
*
8111001   00         97
*
8111101   1000       96
*
8111201   4  17.7  120.  0.9296  0.0     97
*
8111300   1
8111301   0.0  0.0  0.0     96
```

```
*
*
8120000  "MAINDISC"  SNGLJUN
8120101  811010000  813000000  0.0  0.156  0.156  1000
8120201  1  0.0  0.0  0.0
*
8130000  "MAINLINE"  PIPE
*
8130001            26
*
8130101  0.77708   26
*
8130301  1.0       14
8130302  0.5      24
8130303  1.20833   26
*
8130401  0.0       26
*
8130601  0.0       24
8130602  -90.      26
*
8130801  1.89-4    0.  26
*
8130901  0.0       0.0       13
8130902  0.156     0.156     14
8130903  0.0       0.0       23
8130904  0.156     0.156     24
8130905  0.0       0.0       25
*
8131001  00        26
*
8131101  1000      25
*
8131201  4  17.7  120.  0.9284 0.0  26
*
8131300  1
8131301  0.0  0.0  0.0       25
*
*
*
****************************************
*      QUENCH TANK                     *
****************************************
*
*
*
9770000  "QTANK-IN"  SNGLJUN
9770101  813010000  978000000  0.  0.  0.  1000
9770201  1  0.  0.  0.
*
*    SPARGER  12 IN SCH40  PIPE
*
9780000  "SPARGER"  PIPE
*    NO OF VOLUMES
9780001  18
*    FLOW AREA
9780101  0.7773  18
*    VOL. LENGTHS
```

4-436

TELEDYNE
ENGINEERING SERVICES

```
9780301   1.125      2
9780302   1.1333     7
9780303   1.0       18
*     VOL. VOLS.
9780401   0.0       18
*
*     VERTICAL ANGLES
9780601   -90.       7
9780602   0.0       18
*     PIPE  ROUGHNESS
9780801   1.69-4    0.0       18
*     JUNCTION  LOSS COEFF.
9780901   0.0       0.0       6
9780902   0.156     0.158     7
9780903   0.0       0.0       17
*     VOL. CONTROL FLAG
9781001   00        18
*     JUN. CONTROL FLAG
9781101   1000      17
*     INITIAL COND.
9781201   4    17.7    120.    0.9284    0.   2
9781202   3    17.7    120.    0.0       0.   18
*         JUN. INITIAL COND.
9781300   1
9781301   0.0  0.0  0.0       17
*     SPARGER    EXIT
9790000 "EXIT" SNGLJUN
9790101   978010000   980000000    0.0    1.0    1.0      1100
9790201   1    0.    0.    0.
*         QUENCH TANK
*
*         WATER  VOL.
9800000  "QT. WATER" SNGLVOL
9800101   260.4706   5.6667   0.0   0.0   90.  5.6667  0.003  0.0   01
9800200   3    17.7      120.
*         INTERFACE
9810000   "INTERFACE"  SNGLJUN
9810101   980010000  982000000   0.0     0.0     0.0      1000
9810201   1    0.0  0.0  0.0
*         AIR  VOLUME
9820000   "QT.AIR"   SNGLVOL
9820101   260.4706  1.2439    0.0   0.0   90.   1.2439  0.003  0.0  01
9820200   4    17.7    120.    0.9284
*
*         RUPTURE DISC
9830000   "RUP.DISC"   VALVE
9830101   982010000    999000000     1.77  0.   0.    1100
9830201   1    0.    0.    0.
9830300   TRPVLV
9830301   515        *     VALVE OPENING TRIP
*
*
****************************************
*     PIPE OUTSIDE ENVIROMENT          *
****************************************
*
*
9990000   "ATMOSPHERE"    TMDPVOL
```

```
9990101   10000.    10000.    0.0  0.0  0.0  0.0  .00001  0.0  11
9990200   4
9990201   0.0  17.7  120.  0.9284
*
*
****************************************
*  PLOT CARDS                          *
****************************************
*
*
*
20300100  MFLOWJ  410000000
20300200  MFLOWJ  510000000
20300300  MFLOWJ  610000000
20300400  MFLOWJ  402000000
20300500  MFLOWJ  811140000
20300600  MFLOWJ  811570000
20300700  MFLOWJ  308000000
20300800  MFLOWJ  208000000
20300900  MFLOWJ  108000000
*
20301000  QUALS  411010000
20301100  QUALS  511010000
20301200  QUALS  611010000
20301300  QUALS  409240000
20301400  QUALS  509100000
20301500  QUALS  609090000
20301600  QUALS  401280000
20301700  QUALS  811140000
20301800  QUALS  811570000
20301900  QUALS  307010000
20302000  QUALS  307180000
20302100  QUALS  207010000
20302200  QUALS  207260000
20302300  QUALS  107010000
20302400  QUALS  107330000
*
20302500  P      411010000
20302600  P      511010000
20302700  P      611010000
20302800  P      409240000
20302900  P      509100000
20303000  P      609090000
20303100  P      401280000
20303200  P      811140000
20303200  P      811570000
CARD ABOVE IS REPLACEMENT CARD.
20303400  P      307010000
20303500  P      307180000
20303600  P      207010000
20303700  P      207260000
20303800  P      107010000
20303900  P      107330000
*
*
*
*
. END OF CASE
```

4.9.2 Condensate/Steam Restart

LISTING OF INPUT DATA FOR CASE 1

```
=THIS RESTARTS RELAP,3PORVS OPENING ON LOOPSEALS UP/DWN 2 ARCS
*
100  RESTART TRANSNT
101  RUN
*
103 1102
104  NOACTION
201  0.600  1.-7  2.-4  11001  5  50  250
*
*  MINOR EDITS
*
301  MFLOWJ  410000000
302  MFLOWJ  510000000
303  MFLOWJ  610000000
304  MFLOWJ  402000000
305  MFLOWJ  811140000
306  MFLOWJ  811570000
307  MFLOWJ  308000000
308  MFLOWJ  208000000
309  MFLOWJ  108000000
*
310  QUALS  411010000
311  QUALS  511010000
312  QUALS  611010000
313  QUALS  409260000
314  QUALS  509120000
315  QUALS  609110000
316  QUALS  401280000
317  QUALS  811140000
318  QUALS  811570000
319  QUALS  307010000
320  QUALS  307180000
321  QUALS  207010000
322  QUALS  207260000
323  QUALS  107010000
324  QUALS  107330000
*
325  P      411010000
326  P      511010000
327  P      611010000
328  P      409260000
329  P      509120000
330  P      609110000
331  P      401280000
332  P      811140000
333  P      811570000
334  P      307010000
335  P      307180000
336  P      207010000
337  P      207260000
338  P      107010000
339  P      107330000
*
*
*
4000000  "PORV"  SNGLJUN
```

BY CMM DATE 4-14-83

CHKD. BY JBM DATE 4-20-83

```
4000101  399000000  401000000  0.0  0.0  0.0  1100
4000201  1  0.0  0.0  0.0
***************************************
*  FORCE CARDS  FOR REPIPE            *
***************************************
*
****************************************************************
* THIS RELAP RUN INCLUDES ENTIRE ARCS 1 AND 3, PORV UPSTREAM AND
* DOWN AS WELL AS THE MAIN HEADER AND SOME DISHCHARGE PIPING
****************************************************************
*
*
*****ARC-1*****
*
*
2001  5,247,509110000,509120000,609100000,107040000
2002  107050000,107060000,107070000,107080000,107090000
2003  107100000,107110000,107120000,107130000,107140000
2004  107150000,107160000,107170000,107180000,107190000
2005  107200000,107210000,107220000,107230000,107240000
2006  107250000,107260000,107270000,107280000,107290000
2007  107300000,107310000,107320000,107330000
*
*
*****ARC-2*****
*
*
*
*
*****ARC-3*****
*
*
2014  609110000,409250000,409260000,307040000
2015  307050000,307060000,307070000,307080000,307090000
2016  307100000,307110000,307120000,307130000,307140000
2017  307150000,307160000 307170000,307180000
*
*
*
*
***   PORV'S  DOWNSTREAM   ***
*
*
*
2046 611010000,611020000,611030000,611040000,611050000
2047 611060000,611070000,611080000,511010000,511020000
2048 511030000,511040000,511050000,511060000,511070000
2049 511080000,511090000,511100000,511110000,511120000
2050 511130000,511140000,511150000,511160000,511170000
2051 511180000,511190000,513010000,515010000,515020000
2052 515030000,515040000,515050000,515060000,515070000
2053 515080000,515090000,515100000,515110000,515120000
2054 411010000,411020000,411030000,411040000,411050000
2055 411060000,411070000,411080000,411090000,411100000
2056 411110000,411120000,411130000,411140000,411150000
2057 411160000,411170000,411180000,411190000,701010000
2058 703010000
*
```

```
*
*****MAIN DISCHARGE LINE*****
*
*
2018  703020000,703030000,703040000,703050000,703060000
2019  703070000,703080000,703090000,703100000,703110000
2020  703120000,703130000,703140000,801010000,803010000
2021  805010000,807010000
2022  809010000,811010000,811020000,811030000,811040000
2023  811050000,811060000,811070000,811080000,811090000
2024  811100000,811110000,811120000,811130000,811140000
2025  811150000,811160000,811170000,811180000,811190000
2026  811200000,811210000,811220000,811230000,811240000
2027  811250000,811260000,811270000
*
*
***  PORV UPSTREAM  ***
*
*
2028  399010000,401010000,401020000,401030000,401040000
2029  401050000,401060000,401070000,401080000,401090000
2030  401100000,401110000,401120000,401130000,401140000
2031  401150000,401160000,401170000,401180000,401190000
2032  401200000,401210000,401220000,401230000,401240000
2033  401250000,401260000,401270000,401280000,403010000
2034  405010000,405020000,405030000,405040000,405050000
2035  405060000,405070000,405080000,405090000,405100000
2036  405110000,405120000,405130000,405140000,405150000
2037  405160000,407010000,409010000,409020000,409030000
2038  409040000,409050000,409060000,409070000,409080000
2039  409090000,409100000,409110000,409120000,409130000
2040  409140000,409150000,409160000,409170000,409180000
2041  409190000,409200000,409210000,409220000,409230000
2042  409240000,609010000,609020000,609030000,609040000
2043  609050000,609060000,609070000,609080000,609090000
2044  509010000,509020000,509030000,509040000,509050000
2045  509060000,509070000,509080000,509090000,509100000
*
*
****************************************
*  PLOT CARDS                          *
****************************************
*
*
*
20300100   MFLOWJ   410000000
20300200   MFLOWJ   510000000
20300300   MFLOWJ   610000000
20300400   MFLOWJ   402000000
20300500   MFLOWJ   811140000
20300600   MFLOWJ   811570000
20300700   MFLOWJ   308000000
20300800   MFLOWJ   208000000
20300900   MFLOWJ   108000000
*
20301000   QUALS   411010000
20301100   QUALS   511010000
20301200   QUALS   611010000
```

```
20301300  QUALS  409240000
20301400  QUALS  509100000
20301500  QUALS  609090000
20301600  QUALS  401280000
20301700  QUALS  811140000
20301800  QUALS  811570000
20301900  QUALS  307010000
20302000  QUALS  307180000
20302100  QUALS  207010000
20302200  QUALS  207260000
20302300  QUALS  107010000
20302400  QUALS  107330000
*
20302500  P      411010000
20302600  P      511010000
20302700  P      611010000
20302800  P      409240000
20302900  P      509100000
20303000  P      609090000
20303100  P      401280000
20303200  P      811140000
20303300  P      811570000
20303400  P      307010000
20303500  P      307180000
20303600  P      207010000
20303700  P      207260000
20303800  P      107010000
20303900  P      107330000
*
*
*
*
. END OF CASE
```

LISTING OF INPUT DATA FOR CASE 1

```
=THIS RESTARTS RELAP,3PORVS OPENING ON LOOPSEALS UP/DWN 2 ARCS
*
100  RESTART TRANSNT
101  RUN
*
103 3791
104  NOACTION
201  1.0  1.-7  2.-4  11001  5  50  250
*
*  MINOR EDITS
*
301  MFLOWJ  410000000
302  MFLOWJ  510000000
303  MFLOWJ  610000000
304  MFLOWJ  402000000
305  MFLOWJ  811140000
306  MFLOWJ  811570000
307  MFLOWJ  308000000
308  MFLOWJ  208000000
309  MFLOWJ  108000000
*
310  QUALS  411010000
311  QUALS  511010000
312  QUALS  611010000
313  QUALS  409260000
314  QUALS  509120000
315  QUALS  609110000
316  QUALS  401280000
317  QUALS  811140000
318  QUALS  811570000
319  QUALS  307010000
320  QUALS  307180000
321  QUALS  207010000
322  QUALS  207260000
323  QUALS  107010000
324  QUALS  107330000
*
325  P      411010000
326  P      511010000
327  P      611010000
328  P      409260000
329  P      509120000
330  P      609110000
331  P      401280000
332  P      811140000
333  P      811570000
334  P      307010000
335  P      307180000
336  P      207010000
337  P      207260000
338  P      107010000
339  P      107330000
*
*
*
4000000  "PORV"  SNGLJUN
```

BY CHM DATE 4-14-83
CHKD. BY JRM DATE 4-20-83

```
4000101  399000000  401000000  0.0  0.0  0.0  1100
4000201  1  0.0  0.0  0.0
***********************************************
*  FORCE CARDS  FOR REPIPE                    *
***********************************************
*
*********************************************************************************
* THIS RELAP RUN INCLUDES ENTIRE ARCS 1 AND 3, PORV UPSTREAM AND
* DOWN AS WELL AS THE MAIN HEADER AND SOME DISHCHARGE PIPING
*********************************************************************************
*
*
*****ARC-1*****
*
*
2001  5,247,509110000,509120000,609100000,107040000
2002  107050000,107060000,107070000,107080000,107090000
2003  107100000,107110000,107120000,107130000,107140000
2004  107150000,107160000,107170000,107180000,107190000
2005  107200000,107210000,107220000,107230000,107240000
2006  107250000,107260000,107270000,107280000,107290000
2007  107300000,107310000,107320000,107330000
*
*
*****ARC-2*****
*
*
*
*
*****ARC-3*****
*
*
2014  609110000,409250000,409260000,307040000
2015  307050000,307060000,307070000,307080000,307090000
2016  307100000,307110000,307120000,307130000,307140000
2017  307150000,307160000 307170000,307180000
*
*
*
*
***   PORV'S  DOWNSTREAM   ***
*
*
*
2046 611010000,611020000,611030000,611040000,611050000
2047 611060000,611070000,611080000,511010000,511020000
2048 511030000,511040000,511050000,511060000,511070000
2049 511080000,511090000,511100000,511110000,511120000
2050 511130000,511140000,511150000,511160000,511170000
2051 511180000,511190000,513010000,515010000,515020000
2052 515030000,515040000,515050000,515060000,515070000
2053 515080000,515090000,515100000,515110000,515120000
2054 411010000,411020000,411030000,411040000,411050000
2055 411060000,411070000,411080000,411090000,411100000
2056 411110000,411120000,411130000,411140000,411150000
2057 411160000,411170000,411180000,411190000,701010000
2058 703010000
*
```

```
*
*****MAIN DISCHARGE LINE*****
*
*
2018  703020000,703030000,703040000,703050000,703060000
2019  703070000,703080000,703090000,703100000,703110000
2020  703120000,703130000,703140000,801010000,803010000
2021  805010000,807010000
2022  809010000,811010000,811020000,811030000,811040000
2023  811050000,811060000,811070000,811080000,811090000
2024  811100000,811110000,811120000,811130000,811140000
2025  811150000,811160000,811170000,811180000,811190000
2026  811200000,811210000,811220000,811230000,811240000
2027  811250000,811260000,811270000
*
*
***  PORV UPSTREAM  ***
*
*
2028  399010000,401010000,401020000,401030000,401040000
2029  401050000,401060000,401070000,401080000,401090000
2030  401100000,401110000,401120000,401130000,401140000
2031  401150000,401160000,401170000,401180000,401190000
2032  401200000,401210000,401220000,401230000,401240000
2033  401250000,401260000,401270000,401280000,403010000
2034  405010000,405020000,405030000,405040000,405050000
2035  405060000,405070000,405080000,405090000,405100000
2036  405110000,405120000,405130000,405140000,405150000
2037  405160000,407010000,409010000,409020000,409030000
2038  409040000,409050000,409060000,409070000,409080000
2039  409090000,409100000,409110000,409120000,409130000
2040  409140000,409150000,409160000,409170000,409180000
2041  409190000,409200000,409210000,409220000,409230000
2042  409240000,609010000,609020000,609030000,609040000
2043  609050000,609060000,609070000,609080000,609090000
2044  509010000,509020000,509030000,509040000,509050000
2045  509060000,509070000,509080000,509090000,509100000
*
*
****************************************
*  PLOT CARDS                          *
****************************************
*
*
*
20300100  MFLOWJ  410000000
20300200  MFLOWJ  510000000
20300300  MFLOWJ  610000000
20300400  MFLOWJ  402000000
20300500  MFLOWJ  811140000
20300600  MFLOWJ  811570000
20300700  MFLOWJ  308000000
20300800  MFLOWJ  208000000
20300900  MFLOWJ  108000000
*
20301000  QUALS  411010000
20301100  QUALS  511010000
20301200  QUALS  611010000
```

```
20301300  QUALS  409240000
20301400  QUALS  509100000
20301500  QUALS  609090000
20301600  QUALS  401280000
20301700  QUALS  811140000
20301800  QUALS  811570000
20301900  QUALS  307010000
20302000  QUALS  307180000
20302100  QUALS  207010000
20302200  QUALS  207260000
20302300  QUALS  107010000
20302400  QUALS  107330000
*
20302500  P      411010000
20302600  P      511010000
20302700  P      611010000
20302800  P      409240000
20302900  P      509100000
20303000  P      609090000
20303100  P      401280000
20303200  P      811140000
20303300  P      811570000
20303400  P      307010000
20303500  P      307180000
20303600  P      207010000
20303700  P      207260000
20303800  P      107010000
20303900  P      107330000
*
*
*
*
. END OF CASE
```

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

4.9.3 PORV Solid 400° Liquid

LISTING OF INPUT DATA FOR CASE 1

```
=D.C.COOK UNIT1 PORV OPEN
*
*  DISCHARGE PIPING
*  THIS IS THE NUMBERING SYSTEM FOR UNIT1'S RELAP MODEL
*  WHERE COMPONENTS NUMBERED IN THE:
*         100'S ARE VALVE SV-45C AND ARC 1 LEVEL  669'-2"
*         200'S ARE VALVE SV-45B AND ARC 2 LEVEL  670'-10"
*         300'S ARE VALVE SV-45A ARN ARC 3 LEVEL  672'-6"
*         400'S ARE PORV NRV-151 AND ARC "A"
*         500'S ARE PORV NRV-153 AND ARC "B"
*         600'S ARE PORV NRV-152 AND ARC "C"
*         700'S AND 800'S ARE 6" AND 12" MAIN DISCHARGE PIPING
*         900'S QUENCH TANK PORTION
*         999  ATMOSPHERE
*
*
*
100       NEW  TRANSNT
101         RUN
102         BRITISH   BRITISH
104       NOACTION
*
******************************************
*      TIME STEP CONTROL                  *
******************************************
*
201         0.200,1.-7,2.-4,11001,5,50,250
*
*
******************************************
*           MINOR EDITS                   *
******************************************
*
301  MFLOWJ  410000000
302  MFLOWJ  510000000
303  MFLOWJ  610000000
304  MFLOWJ  402000000
305  MFLOWJ  811140000
306  MFLOWJ  811570000
307  MFLOWJ  308000000
308  MFLOWJ  208000000
309  MFLOWJ  108000000
*
310  QUALS  411010000
311  QUALS  511010000
312  QUALS  611010000
313  QUALS  409260000
314  QUALS  509120000
315  QUALS  609110000
316  QUALS  401280000
317  QUALS  811140000
318  QUALS  811570000
319  QUALS  307010000
320  QUALS  307180000
321  QUALS  207010000
322  QUALS  207260000
```

BY CMM DATE 4-21-83
CHKD. BY KJG DATE 5-20-83

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

```
323  QUALS   107010000
324  QUALS   107330000
*
325  P       411010000
326  P       511010000
327  P       611010000
328  P       409260000
329  P       509120000
330  P       609110000
331  P       401280000
332  P       811140000
333  P       811570000
334  P       307010000
335  P       307180000
336  P       207010000
337  P       207260000
338  P       107010000
339  P       107330000
*
*
****************************************
*  FORCE CARDS  FOR REPIPE             *
****************************************
*
************************************************************
* THIS RELAP RUN INCLUDES ENTIRE ARCS 1 AND 3, PORV UPSTREAM AND
* DOWN AS WELL AS THE MAIN HEADER AND SOME DISHCHARGE PIPING
************************************************************
*
*
*****ARC-1*****
*
*
2001  5,247,509110000,509120000,609100000,107040000
2002   107050000,107060000,107070000,107080000,107090000
2003   107100000,107110000,107120000,107130000,107140000
2004   107150000,107160000,107170000,107180000,107190000
2005   107200000,107210000,107220000,107230000,107240000
2006   107250000,107260000,107270000,107280000,107290000
2007   107300000,107310000,107320000,107330000
*
*
*****ARC-2*****
*
*
*
*
*****ARC-3*****
*
*
2014  809110000,409250000,409260000,307040000
2015  307050000,307060000,307070000,307080000,307090000
2016  307100000,307110000,307120000,307130000,307140000
2017  307150000,307160000 307170000,307180000
*
*
*
*
```

```
***   PORV'S  DOWNSTREAM   ***
*
*
*
2046 611010000,611020000,611030000,611040000,611050000
2047 611060000,611070000,611080000,511010000,511020000
2048 511030000,511040000,511050000,511060000,511070000
2049 511080000,511090000,511100000,511110000,511120000
2050 511130000,511140000,511150000,511160000,511170000
2051 511180000,511190000,513010000,515010000,515020000
2052 515030000,515040000,515050000,515060000,515070000
2053 515080000,515090000,515100000,515110000,515120000
2054 411010000,411020000,411030000,411040000,411050000
2055 411060000,411070000,411080000,411090000,411100000
2056 411110000,411120000,411130000,411140000,411150000
2057 411160000,411170000,411180000,411190000,701010000
2058 703010000
*
*
*****MAIN DISCHARGE LINE*****
*
*
2018  703020000,703030000,703040000,703050000,703060000
2019  703070000,703080000,703090000,703100000,703110000
2020  703120000,703130000,703140000,801010000,803010000
2021  805010000,807010000
2022  809010000,811010000,811020000,811030000,811040000
2023  811050000,811060000,811070000,811080000,811090000
2024  811100000,811110000,811120000,811130000,811140000
2025  811150000,811160000,811170000,811180000,811190000
2026  811200000,811210000,811220000,811230000,811240000
2027  811250000,811260000,811270000
*
*
***  PORV UPSTREAM  ***
*
*
2028  399010000,401010000,401020000,401030000,401040000
2029  401050000,401060000,401070000,401080000,401090000
2030  401100000,401110000,401120000,401130000,401140000
2031  401150000,401160000,401170000,401180000,401190000
2032  401200000,401210000,401220000,401230000,401240000
2033  401250000,401260000,401270000,401280000,403010000
2034  405010000,405020000,405030000,405040000,405050000
2035  405060000,405070000,405080000,405090000,405100000
2036  405110000,405120000,405130000,405140000,405150000
2037  405160000,407010000,409010000,409020000,409030000
2038  409040000,409050000,409060000,409070000,409080000
2039  409090000,409100000,409110000,409120000,409130000
2040  409140000,409150000,409160000,409170000,409180000
2041  409190000,409200000,409210000,409220000,409230000
2042  409240000,609010000,609020000,609030000,609040000
2043  609050000,609060000,609070000,609080000,609090000
2044  509010000,509020000,509030000,509040000,509050000
2045  509060000,509070000,509080000,509090000,509100000
*
*
***************************************
```

```
*        TRIPS                                 *
*****************************************
*
*
501  TIME   0 GE NULL 0  0.0  L    * VALVE OPENING TRIP
502  TIME   0 GE NULL  0  5.0  L    *  JOB TERMINATION TRIP
515  P  982010000  GE  NULL 0 114.7   L *  QUENCH TANK RUPTURE PRESS.
600       502
*
***********************************************************
*         ***************************************         *
*         *  HYDRODYNAMIC COMPONENTS              *       *
*         ***************************************         *
***********************************************************
*
*
*          PRESSURIZER   COMPONENT
3990000     "PRESS"    TMDPVOL
3990101  0.0  20.0  500.0  0.0  0.0  0.0  0.00005  0.0  11
3990200  3
3990201  0.0  2349.7  400.0  0.8  2420.0  400.0  1.2  2498.7  400.0
*
4000000      "PORV"  SNGLJUN
4000101       399000000  401000000  0.0  0.0  0.0  1100
4000201       1   0.0  0.0  0.0
*
4010000      "PORV"   PIPE
4010001      28
4010101      0.1465     28
4010301      .4375       4
4010302      .5104      12
4010303      .5         19
4010304      .5         27
4010305  0.72  28
4010401      0.0        28
4010601      45.         4
4010602      90.        12
4010603      0.0      19
4010604      90.      27
4010605  0.0  28
4010801      1.51E-4    0.0   28
4010901      0.0         0.0       3
4010902      .092        .092      4
4010903      0.0         0.0      11
4010904      .1836       .1836    12
4010905      0.0         0.0      18
4010906      .1836       .1836    19
4010907      0.0         0.0      26
4010908  0.1836   0.1836   27
4011001      00      28
4011101      1000      27
4011201  3  2349.7  400.0  0.0  0.0  28
4011300      1
4011301      0.0  0.0  0.0     27
*
4020000      "PORV"  SNGLJUN
4020101      401010000  403000000  0.0  0.0  0.0   1000
4020201      1   0.0  0.0  0.0
```

```
*
4030000   "PORV"  BRANCH
4030001   0
4030101   0.1465  0.5   0.0  0.0  0.0  0.0  1.51E-4  0.0  00
4030200 3  2349.7  400.0  0.0  0.0  0.0
*
4040000   "PORV"  SNGLJUN
4040101   403010000  405000000  0.1465  0.0  0.0  1000
4040201   1   0.0  0.0  0.0
*
4050000   "PORV"  PIPE
4050001   16
4050101   0.1465    1
4050102   0.0716   16
4050301   0.698  1
4050302   0.471  7
4050303   0.451  16
4050401   0.0     16
4050601   0.0     16
4050801   1.51E-4   0.0  1
4050802   1.33E-4   0.0   16
4050901   0.0577  0.0961  1
4050902 0.0  0.0   15
4051001   00     16
4051101   1000     15
4051201  3  2349.7  400.0  0.0  0.0  16
4051300   1
4051301   0.0  0.0  0.0       15
*
4060000   "PORV"  SNGLJUN
4060101   405010000  407000000  0.0  0.0  0.0  1000
4060201   1   0.0  0.0  0.0
*
4070000   "PORV"  BRANCH
4070001   0
4070101   0.0716   0.451  0.0  0.0  0.0  0.0  1.33E-4  0.0  00
4070200 3  2349.7  400.0  0.0  0.0  0.0
*
4080000   "PORV"   SNGLJUN
4080101   407010000  409000000   0.0  0.0  0.0  1000
4080201   1   0.0  0.0  0.0
*
4090000   "PORV"   PIPE
4090001   26
4090101   0.0716      1
4090102   0.03757      22
4090103   0.03388      23
4090104   0.02650      24
4090105   0.01912      25
4090106   0.01175      26
4090301   0.53         1
4090302   .30       2
4090303 0.493  10
4090304   0.55       14
4090305   0.510       22
4090306  0.255     26
4090401   0.0       26
4090601   0.0       26
```

```
4090801   1.33E-4   0.0   1
4090802   1.53E-4   0.0   26
4090901   0.0   0.0   13
4090902   0.585   0.585   14
4090903   0.0   0.0   25
4091001   00   26
4091102   1000   25
4091201   3   2349.7   400.0   0.0   0.0   26
4091300   1
4091301   0.0   0.0   0.0   25
*
4100000   "PORV151"   VALVE
4100101   409010000   411000000   0.00806   0.0   0.0   0100
4100201   1   0.0   0.0   0.0
4100300   MTRVLV
4100301   501   502   1.0   0.0
*
5080000   "PORV"   SNGLJUN
5080101   407010000   509000000   0.0   0.2172   0.2172   1000
5080201   1   0.0   0.0   0.0
*
5090000   "PORV"   PIPE
5090001   12
5090101   0.03757   8
5090102   0.03388   9
5090103   0.02650   10
5090104   0.01912   11
5090105   0.01175   12
5090301   0.4089   2
5090302   0.5078   8
5090303   0.2539   12
5090401   0.0   12
5090601   0.0   12
5090801   1.53E-4   0.0   12
5090901   0.0   0.0   1
5090902   0.2172   0.2172   2
5090903   0.0   0.0   11
5091001   00   12
5091101   1000   11
5091201   3   2349.7   400.0   0.0   0.0   12
5091300   1
5091301   0.0   0.0   0.0   11
*
5100000   "PORV152"   VALVE
5100101   509010000   511000000   0.00806   0.0   0.0   0100
5100201   1   0.0   0.0   0.0
5100300   MTRVLV
5100301   501   502   1.0   0.0
*
6080000   "PORV"   SNGLJUN
6080101   403010000   609000000   0.0   0.1836   0.1836   1000
6080201   1   0.0   0.0   0.0
*
6090000   "PORV"   PIPE
6090001   11
6090101   0.03757   7
6090102   0.03388   8
6090103   0.02650   9
```

```
6090104  0.01912     10
6090105  0.01175     11
6090301    0.4089      2
6090302    0.5699      7
6090303    .2850      11
6090401    0.0        11
6090601    0.0        11
6090801    1.53E-4   0.0   11
6090901  0.0  0.0   1
6090902    0.2172    0.2172    2
6090903    0.0       0.0      10
6091001    00          11
6091101    1000        10
6091201  3  2349.7  400.0  0.0  0.0   11
6091300    1
6091301    0.0  0.0  0.0   10
*
6100000    "PORV153"  VALVE
6100101    609010000  611000000   0.00808  0.0  0.0  0100
6100201    1     0.0 0.0  0.0
6100300    MTRVLV
6100301    501  502   1.0       0.0
*********************************************
*
*   VALVE  DOWNSTREAM  PIPING
1070000    "DWNSTRM#1"   PIPE
1070001        33
*
1070101    0.20069           33
*
1070301    0.5281             4
1070302    0.9943            15
1070303    0.9132            21
1070304    0.8472            30
1070305    1.085             33
*
1070401    0.0               33
*
1070601    0.0                4
1070602    -90.              15
1070603    0.0               33
*
1070801    1.52-4     0.     33
1070901    0.0          0.0         3
1070902    0.18         0.18        4
1070903    0.0          0.0        14
1070904    0.18         0.18       15
1070905    0.0          0.0        32
*
1071001    00          33
1071101    1000       32
*
1071201    4    17.7    120.    0.9284   0.    33
*
1071300    1
1071301    0.0  0.0  0.0  32
*
*
```


TELEDYNE ENGINEERING SERVICES

```
*
*
*******************************************************************
*
*    VALVE DOWNSTREAM PIPING
2070000   "DWNSTRM#2"   PIPE
*
2070001              26
2070101  0.20069     26
*
2070301   0.5261     4
2070302   0.9271    14
2070303   0.8852    23
2070304   1.085     26
*
2070401   0.0       26
*
2070601   0.0        4
2070602   -90.      14
2070603   0.0       26
*
2070801   1.52-4    0.    26
*
2070901   0.0       0.0        3
2070902   0.18      0.18       4
2070903   0.0       0.0       13
2070904   0.18      0.18      14
2070905   0.0       0.0       25
*
2071001   00        26
*
2071101   1000      25
*
2071201   4   17.7   120.   0.9284   0.   26
*
2071300   1
2071301   0.0  0.0  0.0  25
*
*
*******************************************************************
*
*    VALVE DOWNSTREAM PIPING
3070000   "DWNSTRM#3"   PIPE
3070001   18
*
3070101   0.20069    18
*
3070301   0.5261      4
3070302   1.0339     12
3070303   0.801      15
3070304   1.085      18
*
3070401   0.0        18
*
3070601   0.0         4
3070602   -90.       12
3070603   0.0        18
*
```

```
3070801   1.52-4   0.   18
*
3070901   0.0      0.0      3
3070902   0.18     0.18     4
3070903   0.0      0.0      11
3070904   0.18     0.18     12
3070905   0.0      0.0      17
*
3071001   00       18
3071101   1000     17
*
3071201   4   17.7   120.   0.9284   0.   18
*
3071300   1
3071301   0.0  0.0  0.0       17
*
*
******************************************
*     PORV DISCHARGE SECTION             *
******************************************
*
*
****************************************************
*   PORV NRV-151 DISCHARGE LINE ARC "A"            *
****************************************************
*
*
4110000   "PORV1"  PIPE
4110001       19
*
4110101   0.05132   17
4110102   0.20069   19
*
4110301   0.3724    4
4110302   0.3802    8
4110303   0.561     17
4110304   0.349     19
*
4110401   0.0       19
*
4110601   0.0       4
4110602   -90.      8
4110603   0.0       19
*
4110801   1.53-4 .0 17
4110802   1.52-4 .0 19
*
4110901   0.0       0.0       3
4110902   0.2088    0.2088    4
4110903   0.0       0.0       7
4110904   0.2088    0.2088    8
4110905   0.0       0.0       16
4110906   0.3784    0.1565    17
4110907   0.0       0.0       18
*
4111001   00        19
4111101   1000      18
*
```

```
4111201   4   17.7   120.   0.9284   0.0   19
*
4111300   1
4111301   0.0  0.0  0.0    18
*
4120000   "ENTERMAIN"  SNGLJUN
4120101   411010000  701000000  0.0  0.1800  0.1800  1100
4120201   1  0.0  0.0  0.0
*
*
**************************************************
*   PORV NRV-153 DISCHARGE LINE ARC "B"          *
**************************************************
*
*
*
5110000   "PORV2LINE"  PIPE
5110001            19
*
5110101   0.05132    18
5110102   0.08840    19
*
5110301   0.4303     3
5110302   0.3620     7
5110303   0.3529       9
5110304   0.6058     18
5110305   0.371      19
*
5110401   0.0        19
*
5110601   0.0        3
5110602   -90.       7
5110603   0.0        19
*
5110801   1.53-4  .0  18
5110802   1.34-4  .0  19
*
5110901   0.0        0.0       2
5110902   0.2088     0.2088    3
5110903   0.0        0.0       6
5110904   0.2088     0.2088    7
5110905   0.0        0.0       17
5110906   0.0544     0.0399    18
*
5111001   00         19
*
5111101   1000       18
*
5111201   4   17.7   120.   0.9284   0.0   19
*
5111300   1
5111301   0.0  0.0  0.0    18
*
5120000   "JUNC."    SNGLJUN
5120101   511010000  513000000  0.0  0.0  0.0   1000
5120201   1  0.0  0.0  0.0
*
*
```

```
*
5130000   "4X4X3TEE"   BRANCH
5130001   0
5130101   0.08840  0.3524  0.0 0.0 0.0 0.0  1.34-4  0.0   00
5130200   4  17.7  120.  0.9284  0.0  0.0
*
*
5140000   "4IN JUNC"  SNGLJUN
5140101   513010000  515000000  0.0  0.0  0.0   1000
5140201   1  0.0  0.0  0.0
*
5150000   "4INSCH40"  PIPE
5150001               12
*
5150101   0.0884      10
5150102   0.20069     12
*
5150301   0.3524      1
5150302   0.6963      10
5150303   0.349       12
*
5150401   0.0         12
*
5150601   0.0         12
*
5150801   1.34-4 0.0  10
5150802   1.52-4  0.0    12
*
5150901   0.0          0.0         9
5150902   0.1483       0.0815      10
5150903   0.0          0.0         11
*
5151001   00          12
*
5151101   1000        11
*
5151201   4  17.7  120.  0.9284  0.0   12
*
5151300   1
5151301   0.0  0.0  0.0   11
*
5160000   "ENTERMAIN"  SNGLJUN
5160101   515010000  701000000  0.0  0.0  0.0   1000
5160201   1  0.0  0.0  0.0
*
*
***************************************************
*   PORV NRV-152 DISCHARGE LINE  ARC "C"          *
***************************************************
*
*
*
6110000   "PORVDISC3"  PIPE
6110001               8
*
6110101   0.05132     8
*
6110301   0.3723      4
```

```
6110302  0.3646    8
*
6110401  0.0       8
*
6110601  0.0       4
6110602  -90.      8
*
6110801  1.53-4 .0 8
*
6110901  0.0       0.0      3
6110902  0.211     0.211    4
6110903  0.0       0.0      7
*
6111001  00        8
6111101  1000      7
*
6111201  4  17.7  120.  0.9284  0.0  8
*
6111300  1
6111301  0.0  0.0  0.0  7
*
6120000  "PORVLINE"  SNGLJUN
6120101  611010000  513000000  0.0  0.0  0.0  1000
6120201  1  0.0  0.0  0.0
*
*******************************************
*   MAIN DISCHARGE LINE SECTION           *
*******************************************
*
*
*   MAIN  DISCHARGE  LINE
7010000   "ENTERMAIN"   BRANCH
7010001  0
7010101  0.20069  0.7035 0.0 0.0 0.0 0.0 1.52-4 0.0  00
7010200  4    17.7  120.  0.9284  0.0  0.0
*
7020000  "MAINLINE"  SNGLJUN
7020101  701010000  703000000 0.0  0.0  0.0  1000
7020201  1    0.0  0.0  0.0
*
7030000  "MAINLINE"  PIPE
*
7030001       14
*
7030101  0.20069   12
7030102  0.77708   14  * 12 IN LINE STARTS HERE
*
7030301  0.7035    1
7030302  1.0076   12
7030303  0.5834    14  * 12 IN LINE STARTS HERE
*
7030401  0.0       14
*
7030601  0.0       1
7030602  -90.      14
*
7030801  1.52-4   0.   12
7030802  1.69-4  0.  14
```

```
*
7030901  0.180  0.180  1
7030902  0.0  0.0  11
7030903  0.493  0.2045  12
7030904  0.0  0.0  13
*
7031001  00  14
7031101  1000  13
*
7031201  4  17.7  120.  0.9284  0.0  14
*
7031300  1
7031301  0.0  0.0  0.0  13
*
*
7040000  "MAINLINE"  SNGLJUN
7040101  703010000  801000000  0.0  0.0  0.0  1000
7040201  1  0.0  0.0  0.0
*
3080000  "CON.1"  SNGLJUN
3080101  307010000  801000000  0.0  0.1560  0.1560  1000
3080201  1  0.0  0.0  0.0
*
*
*
*
*
*  CONNECTION  TO MAIN LINE AT ELEV. 672'-6"
*
*
8010000  "12-BRANC1"  BRANCH
8010001  0
8010101  0.77708  0.8334  0.0  0.0 -90. -0.8334  1.69-4  0.0  00
8010200  4  17.7  120.  0.9284  0.0  0.0
*
8020000  "MAINLINE"  SNGLJUN
8020101  801010000  803000000  0.0  0.0  0.0  1000
8020201  1  0.0  0.0  0.0
*
8030000  "MAINLINE"  SNGLVOL
8030101  0.77708  0.8334  0.0  0.0 -90.  -0.8334  1.69-4  0.0  00
8030200  4  17.7  120.  0.9284  0.0  0.0
*
*  CONNECTION TO MAIN LINE AT ELEV. 670'-10"
*
*
8040000  "MAINLINE"  SNGLJUN
8040101  803010000  805000000  0.0  0.0  0.0  1000
8040201  1  0.0  0.0  0.0
*
2080000  "CON.2"  SNGLJUN
2080101  207010000  805000000  0.0  0.1560  0.1560  1000
2080201  1  0.0  0.0  0.0
*
8050000  "MAINBR.3"  BRANCH
8050001  0
8050101  0.77708  0.8334 0.0 0.0 -90. -0.8334  1.69-4  0.0  00
8050200  4  17.7  120.  0.9284  0.0  0.0
```

```
*
8060000   "MAINLINE"  SNGLJUN
8060101   805010000  807000000  0.0  0.0  0.0    1000
8060201   1   0.0  0.0  0.0
*
8070000   "MAINLINE"  SNGLVOL
8070101   0.77708  0.8334  0.0  0.0 -90.  -0.8334  1.69-4  0.0  00
8070200   4  17.7  120.  0.9284  0.0  0.0
*
*
*   CONNECTION TO MAIN LINE AT ELEV. 669'-2"
*
*
*
8080000   "MAINLINE"  SNGLJUN
8080101   807010000  809000000  0.0  0.0  0.0    1000
8080201   1   0.0  0.0  0.0
*
1080000   "CON.3"  SNGLJUN
1080101   107010000  809000000  0.0  0.1560  0.1560   1000
1080201   1   0.0  0.0  0.0
*
8090000   "MAINBR4"  BRANCH
8090001   0
8090101   0.77708  0.8334  0.0 0.0 -90.  -0.8334  1.69-4  0.0  00
8090200   4  17.7  120.  0.9284 0.0  0.0
*
8100000   "MAINLINE"  SNGLJUN
8100101   809010000  811000000  0.0  0.0  0.0    1000
8100201   1   0.0  0.0  0.0
*
*
8110000   "MAINLINE"   PIPE
*
8110001              97
*
8110101   0.77708   97
*
8110301   1.0149    14
8110302   0.5303    18
8110303   0.5       22
8110304   0.5303    26
8110305   0.9908    56
8110306   0.5       64
8110307   0.8750    72
8110308   0.5104    80
8110309   0.5000    88
8110310   1.0556    97
*
8110401   0.0       97
*
8110601   -90.      14
8110602   -45.      18
8110603   -90.      22
8110604   -45.      26
8110605   -90.      56
8110606   0.0       80
8110607   -90.      88
```

```
8110608   0.0         97
*
8110801   1.69-4      0.   97
*
8110901   0.0         0.0       13
8110902   0.078       0.078     14
8110903   0.0         0.0       17
8110904   0.078       0.078     18
8110905   0.0         0.0       21
8110906   0.078       0.078     22
8110907   0.0         0.0       25
8110908   0.078       0.078     26
8110909   0.0         0.0       55
8110910   0.156       0.156     56
8110911   0.0         0.0       63
8110912   0.026       0.026     64
8110913   0.0         0.0       71
8110914   0.13        0.13      72
8110915   0.0         0.0       79
8110916   0.156       0.156     80
8110917   0.0         0.0       87
8110918   0.156       0.156     88
8110919   0.0         0.0       96
*
8111001   00          97
*
8111101   1000        96
*
8111201   4   17.7   120.   0.9296   0.0      97
*
8111300   1
8111301   0.0  0.0  0.0    96
*
*
8120000   "MAINDISC"  SNGLJUN
8120101   811010000  813000000  0.0  0.156  0.156    1000
8120201   1   0.0  0.0  0.0
*
8130000   "MAINLINE"  PIPE
*
8130001               26
*
8130101   0.77708     26
*
8130301   1.0          14
8130302   0.5         24
8130303   1.20833      26
*
8130401   0.0         26
*
8130601   0.0         24
8130602   -90.        26
*
8130801   1.69-4      0.   26
*
8130901   0.0         0.0       13
8130902   0.156       0.156     14
8130903   0.0         0.0       23
```

```
8130904   0.156      0.156      24
8130905   0.0        0.0        25
*
8131001   00         26
*
8131101   1000       25
*
8131201   4  17.7  120.  0.9284 0.0  26
*
8131300   1
8131301   0.0  0.0  0.0         25
*
*
*
*************************************
*     QUENCH TANK                    *
*************************************
*
*
*
9770000   "QTANK-IN"  SNGLJUN
9770101   813010000  978000000  0.  0.  0.   1000
9770201   1   0.  0.   0.
*
*    SPARGER  12 IN SCH40  PIPE
*
9780000   "SPARGER"  PIPE
*    NO OF VOLUMES
9780001   18
*    FLOW AREA
9780101   0.7773     18
*    VOL. LENGTHS
9780301   1.125       2
9780302   1.1333      7
9780303   1.0        18
*    VOL. VOLS.
9780401   0.0        18
*
*    VERTICAL ANGLES
9780601  -90.         7
9780602   0.0        18
*    PIPE  ROUGHNESS
9780801   1.69-4     0.0        18
*    JUNCTION  LOSS COEFF.
9780901   0.0        0.0        6
9780902   0.156      0.156      7
9780903   0.0        0.0        17
*    VOL. CONTROL FLAG
9781001   00         18
*    JUN. CONTROL FLAG
9781101   1000       17
*    INITIAL COND.
9781201   4    17.7   120.    0.9284     0.   2
9781202   3    17.7   120.    0.0        0.   18
*         JUN. INITIAL COND.
9781300   1
9781301   0.0  0.0  0.0         17
*    SPARGER   EXIT
```


TELEDYNE ENGINEERING SERVICES

```
9790000 "EXIT" SNGLJUN
9790101 978010000 980000000 0.0 1.0 1.0 1100
9790201 1 0. 0. 0.
*       QUENCH TANK
*
*       WATER VOL.
9800000 "QT. WATER" SNGLVOL
9800101 260.4706 5.6667 0.0 0.0 90. 5.6667 0.003 0.0 01
9800200 3 17.7 120.
*       INTERFACE
9810000 "INTERFACE" SNGLJUN
9810101 980010000 982000000 0.0 0.0 0.0 1000
9810201 1 0.0 0.0 0.0
*       AIR VOLUME
9820000 "QT.AIR" SNGLVOL
9820101 260.4706 1.2439 0.0 0.0 90. 1.2439 0.003 0.0 01
9820200 4 17.7 120. 0.9284
*
*       RUPTURE DISC
9830000 "RUP.DISC" VALVE
9830101 982010000 999000000 1.77 0. 0. 1100
9830201 1 0. 0. 0.
9830300 TRPVLV
9830301 515 * VALVE OPENING TRIP
*
*
****************************************
*    PIPE OUTSIDE ENVIROMENT           *
****************************************
*
*
9990000 "ATMOSPHERE" TMDPVOL
9990101 10000. 10000. 0.0 0.0 0.0 0.0 .00001 0.0 11
9990200 4
9990201 0.0 17.7 120. 0.9284
*
*
****************************************
*  PLOT CARDS                          *
****************************************
*
*
*
20300100 MFLOWJ 410000000
20300200 MFLOWJ 510000000
20300300 MFLOWJ 610000000
20300400 MFLOWJ 402000000
20300500 MFLOWJ 811140000
20300600 MFLOWJ 811570000
20300700 MFLOWJ 308000000
20300800 MFLOWJ 208000000
20300900 MFLOWJ 108000000
*
20301000 QUALS 411010000
20301100 QUALS 511010000
20301200 QUALS 611010000
20301300 QUALS 409240000
20301400 QUALS 509100000
```

```
20301500  QUALS  609090000
20301600  QUALS  401280000
20301700  QUALS  811140000
20301800  QUALS  811570000
20301900  QUALS  307010000
20302000  QUALS  307180000
20302100  QUALS  207010000
20302200  QUALS  207260000
20302300  QUALS  107010000
20302400  QUALS  107330000
*
20302500  P      411010000
20302600  P      511010000
20302700  P      611010000
20302800  P      409240000
20302900  P      509100000
20303000  P      609090000
20303100  P      401280000
20303200  P      811140000
20303200  P      811570000
CARD ABOVE IS REPLACEMENT CARD.
20303400  P      307010000
20303500  P      307180000
20303600  P      207010000
20303700  P      207260000
20303800  P      107010000
20303900  P      107330000
*
*
*
*
 END OF CASE
```

4.9.4 PORV Solid 400° Liquid Restart

LISTING OF INPUT DATA FOR CASE 1

```
=THIS RESTARTS RELAP,3PORVS OPENING ON LOOPSEALS UP/DWN 2 ARCS
*
100  RESTART TRANSNT
101  RUN
*
103 1010
104  NOACTION
201  0.600  1.-7  2.-4  11001  5  50  250
*
*  MINOR EDITS
*
301  MFLOWJ  410000000
302  MFLOWJ  510000000
303  MFLOWJ  610000000
304  MFLOWJ  402000000
305  MFLOWJ  811140000
306  MFLOWJ  811570000
307  MFLOWJ  308000000
308  MFLOWJ  208000000
309  MFLOWJ  108000000
*
310  QUALS  411010000
311  QUALS  511010000
312  QUALS  611010000
313  QUALS  409260000
314  QUALS  509120000
315  QUALS  609110000
316  QUALS  401280000
317  QUALS  811140000
318  QUALS  811570000
319  QUALS  307010000
320  QUALS  307180000
321  QUALS  207010000
322  QUALS  207260000
323  QUALS  107010000
324  QUALS  107330000
*
325  P  411010000
326  P  511010000
327  P  611010000
328  P  409260000
329  P  509120000
330  P  609110000
331  P  401280000
332  P  811140000
333  P  811570000
334  P  307010000
335  P  307180000
336  P  207010000
337  P  207260000
338  P  107010000
339  P  107330000
*
*
*
4000000  "PORV"  SNGLJUN
```

BY CMM DATE 5-13-83
CHKD. BY KJG DATE 5-13-83

```
4000101  399000000  401000000  0.0  0.0  0.0  1100
4000201  1  0.0  0.0  0.0
****************************************
*  FORCE CARDS  FOR REPIPE             *
****************************************
*
****************************************************************
* THIS RELAP RUN INCLUDES ENTIRE ARCS 1 AND 3, PORV UPSTREAM AND
* DOWN AS WELL AS THE MAIN HEADER AND SOME DISHCHARGE PIPING
****************************************************************
*
*
*****ARC-1*****
*
*
2001  5,247,509110000,509120000,609100000,107040000
2002  107050000,107060000,107070000,107080000,107090000
2003  107100000,107110000,107120000,107130000,107140000
2004  107150000,107160000,107170000,107180000,107190000
2005  107200000,107210000,107220000,107230000,107240000
2006  107250000,107260000,107270000,107280000,107290000
2007  107300000,107310000,107320000,107330000
*
*
*****ARC-2*****
*
*
*
*
*****ARC-3*****
*
*
2014  609110000,409250000,409260000,307040000
2015  307050000,307060000,307070000,307080000,307090000
2016  307100000,307110000,307120000,307130000,307140000
2017  307150000,307160000 307170000,307180000
*
*
*
*
***   PORV'S  DOWNSTREAM   ***
*
*
*
2046 611010000,611020000,611030000,611040000,611050000
2047 611060000,611070000,611080000,511010000,511020000
2048 511030000,511040000,511050000,511060000,511070000
2049 511080000,511090000,511100000,511110000,511120000
2050 511130000,511140000,511150000,511160000,511170000
2051 511180000,511190000,513010000,515010000,515020000
2052 515030000,515040000,515050000,515060000,515070000
2053 515080000,515090000,515100000,515110000,515120000
2054 411010000,411020000,411030000,411040000,411050000
2055 411060000,411070000,411080000,411090000,411100000
2056 411110000,411120000,411130000,411140000,411150000
2057 411160000,411170000,411180000,411190000,701010000
2058 703010000
*
```

```
*
*****MAIN DISCHARGE LINE*****
*
*
2018  703020000,703030000,703040000,703050000,703060000
2019  703070000,703080000,703090000,703100000,703110000
2020  703120000,703130000,703140000,801010000,803010000
2021  805010000,807010000
2022  809010000,811010000,811020000,811030000,811040000
2023  811050000,811060000,811070000,811080000,811090000
2024  811100000,811110000,811120000,811130000,811140000
2025  811150000,811160000,811170000,811180000,811190000
2026  811200000,811210000,811220000,811230000,811240000
2027  811250000,811260000,811270000
*
*
***  PORV UPSTREAM  ***
*
*
2028  399010000,401010000,401020000,401030000,401040000
2029  401050000,401060000,401070000,401080000,401090000
2030  401100000,401110000,401120000,401130000,401140000
2031  401150000,401160000,401170000,401180000,401190000
2032  401200000,401210000,401220000,401230000,401240000
2033  401250000,401260000,401270000,401280000,403010000
2034  405010000,405020000,405030000,405040000,405050000
2035  405060000,405070000,405080000,405090000,405100000
2036  405110000,405120000,405130000,405140000,405150000
2037  405160000,407010000,409010000,409020000,409030000
2038  409040000,409050000,409060000,409070000,409080000
2039  409090000,409100000,409110000,409120000,409130000
2040  409140000,409150000,409160000,409170000,409180000
2041  409190000,409200000,409210000,409220000,409230000
2042  409240000,609010000,609020000,609030000,609040000
2043  609050000,609060000,609070000,609080000,609090000
2044  509010000,509020000,509030000,509040000,509050000
2045  509060000,509070000,509080000,509090000,509100000
*
*
****************************************
*  PLOT CARDS                          *
****************************************
*
*
*
20300100  MFLOWJ  410000000
20300200  MFLOWJ  510000000
20300300  MFLOWJ  610000000
20300400  MFLOWJ  402000000
20300500  MFLOWJ  811140000
20300600  MFLOWJ  811570000
20300700  MFLOWJ  308000000
20300800  MFLOWJ  208000000
20300900  MFLOWJ  108000000
*
20301000  QUALS   411010000
20301100  QUALS   511010000
20301200  QUALS   611010000
```

```
20301300 QUALS 409240000
20301400 QUALS 509100000
20301500 QUALS 609090000
20301600 QUALS 401280000
20301700 QUALS 811140000
20301800 QUALS 811570000
20301900 QUALS 307010000
20302000 QUALS 307180000
20302100 QUALS 207010000
20302200 QUALS 207260000
20302300 QUALS 107010000
20302400 QUALS 107330000
*
20302500 P 411010000
20302600 P 511010000
20302700 P 611010000
20302800 P 409240000
20302900 P 509100000
20303000 P 609090000
20303100 P 401280000
20303200 P 811140000
20303300 P 811570000
20303400 P 307010000
20303500 P 307180000
20303600 P 207010000
20303700 P 207260000
20303800 P 107010000
20303900 P 107330000
*
*
*
*
. END OF CASE
```

4.9.5 SV Cold Loop Seal (Quarter Model)

LISTING OF INPUT DATA FOR CASE 1

```
=AEP UNIT2  1 LINE  RELAP5
100 NEW TRANSNT
101 RUN
102 BRITISH BRITISH
104 NOACTION
* TIME STEP CONTROL
*
201  0.6000  1.0-7  2.0-4  11001  5  25  250
* MINOR EDITS
*
301  QUALS  007010000
302  QUALS  005200000
303  QUALS  013200000
304  P      005200000
305  P      007010000
306  P      007380000
307  MFLOWJ 006000000
308  MFLOWJ 005070000
309  MFLOWJ 014000000
310  P      007140000
311  P      011560000
312  P      013300000
313  MFLOWJ 007140000
314  MFLOWJ 007380000
315  MFLOWJ 011560000
*
*
2001  5,192,001010000,003010000,005010000
2002  005020000,005030000,005040000,005050000,005060000
2003  005070000,005080000,005090000,005100000,005110000
2004  005120000,005130000,005140000,005150000,005160000
2005  005170000,005180000,005190000,005200000,007010000
2006  007020000,007030000,007040000,007050000,007060000,007070000
2007  007080000,007090000,007100000,007110000,007120000
2008  007130000,007140000,007150000,007160000,007170000
2009  007180000,007190000,007200000,007210000,007220000
2010  007230000,007240000,007250000,007260000,007270000
2011  007280000,007290000,007300000,007310000,007320000
2012  007330000,007340000,007350000,007360000,007370000
2013  007380000,007380000,009010000,011010000,011020000
2014  011030000,011040000,011050000,011060000,011070000
2015  011080000,011090000,011100000,011110000,011120000
2016  011130000,011140000,011150000,011160000,011170000
2017  011180000,011190000,011200000,011210000,011220000
2018  011230000,011240000,011250000,011260000,011270000
2019  011280000,011290000,011300000,011310000,011320000
2020  011330000,011340000,011350000,011360000,011370000
2021  011380000,011390000,011400000,011410000,011420000
2022  011430000,011440000,011450000,011460000,011470000
2023  011480000,011490000,011500000,011510000,011520000
2024  011530000,011540000,011550000,011560000,011570000
2025  011580000,011590000,011600000,011610000,011620000
2026  011630000,011640000,011650000,011660000,011670000
2027  011680000,011690000,011700000,011710000,011720000
2028  011730000,011740000,011750000,011760000,011770000
2029  011780000,011790000,011800000,011810000,011820000
```

BY CMM DATE 2-9-83

CHKD. BY LOS DATE 2-9-83

4-473

TELEDYNE ENGINEERING SERVICES

```
2030  011830000,011840000,011850000,011860000,011870000
2031  011880000,011890000,011900000,011910000,011920000
2032  011930000,011940000,011950000,011960000,011970000
2033  011980000,011990000,013010000,013020000,013030000
2034  013040000,013050000,013060000,013070000,013080000
2035  013090000,013100000,013110000,013120000,013130000
2036  013140000,013150000,013160000,013170000,013180000
2037  013190000,013200000,013210000,013220000,013230000
2038  013240000,013250000,013260000,013270000,013280000
2039  013290000,013300000,015010000
*
*TRIPS
*
502  TIME  0  GT NULL 0  1.500  L  * JOB TERMINATION TRIP
503  TIME  0  GE NULL 0  0.0    L  *  VALVE OPEN
504  TIME  0  GE  NULL  0  5.0  L  *  VALVE CLOSED
600  502
*
*  HYDRODYNAMIC COMPONENTS
*
*
* PRESSURIZER
*
0010000  "PRESS1"  TMDPVOL
0010101  0.0  20.0  500.0  0.0  0.0  0.0  0.00005  0.0  11
0010200  2
0010201  0.0  2500.0  1.0  0.1  2514.0  1.0  0.3  2555.0  1.0  0.5  2600.0  1.0
0010202  0.7  2687.0  1.0  0.9  2700.0  1.0  1.1  2740.0  1.0  1.3  2745.0  1.0
0010203  1.5  2747.0  1.0  1.7  2748.0  1.0  1.9  2750.0  1.0  2.0  2750.0  1.0
0010204  2.5  2750.0  1.0
*
*  LOOP SEAL GEOMETRY
*
0020000  "LPSL"  SNGLJUN
0020101  001000000  003000000  0.0  0.0  0.0  1000  * THIS IS A SHORT RADIUS ELBOW LEAVING
0020201  1  0.0  0.0  0.0
*
0030000  "LPSL" SNGLVOL
0030101  0.1465  1.0  0.0  90.0  0.0  0.0  0.000151  0.0  00
0030200     2  2500.0  1.0
*
0040000  "LPSL"  SNGLJUN
0040101  003010000  005000000  0.0  0.1836  0.1836  1000
0040201  1  0.0  0.0  0.0
*
0050000  "LPSL"  PIPE
0050001  20
0050101  0.1465  20
0050301  0.50  10
0050302  0.574  20
0050401  0.0  20
0050601  -90.0  7
0050602  0.0  10
0050603  90.0  20
0050801  0.000151  0.0  20
0050901  0.0  0.0  6
0050902  0.1836  0.1836  7
0050903  0.0  0.0  9
```

```
0050904  0.1838  0.1838  10
0050905  0.0  0.0  19
0051001  00  20
0051101  1000  19
0051201  3  2500.0  584.4  0.0  0.0  1
0051202  3  2500.0  451.1  0.0  0.0  2
0051203  3  2500.0  352.1  0.0  0.0  3
0051204  3  2500.0  276.8  0.0  0.0  4
0051205  3  2500.0  218.1  0.0  0.0  5
0051206  3  2500.0  169.3  0.0  0.0  6
0051207  3  2500.0  141.1  0.0  0.0  20
0051300  1
0051301  0.0  0.0  0.0  19
*
******************************
*  VALVE  6M6  CROSBY SAFETY
******************************
0060000  "SRV"  VALVE
0060101  005010000  007000000  0.022   0.0  0.0  0100
0060201  1  0.0  0.0  0.0
0060300  MTRVLV
0060301  503  504  100.0  0.0  *  CROSBY 6M6  OPENING IN 10 MSEC
*
*  DISCHARBE PIPING
0070000  "DISCHA1"  PIPE
0070001  39
0070101  0.20069  39
0070301  0.526  4
0070302  1.094  14
* ARC STARTS HERE LEVEL 669-2"
0070303  0.84167  17
0070304  0.942  20
0070305  0.8425  23
0070306  0.844  26
0070307  0.8433  29
0070308  0.8333  32
0070309  0.8333  35
* ARC ENDS
0070310  0.91750  39
0070401  0.0  39
0070601  0.0  4
0070602  -90.0  14
0070603  0.0  39
0070801  0.000152  0.0  39
0070901  0.0  0.0  3
0070902  0.1800  0.1800  4
0070903  0.0  0.0  13
0070904  0.1800  0.1800  14
0070905  0.0  0.0  38
0071001  00  39
0071101  1000  38
0071201  4  14.7  120.0  0.9284  0.0  39
0071300  1
0071301  0.0  0.0  0.0  38
*
0080000  "DISCHA1"  SNGLJUN
0080101  007010000  008000000  0.0  0.1560  0.1560  1000  *LOSSES FOR A 12 IN ELBOW
0080201  1  0.0  0.0  0.0
```

```
*
* INPUT A BRANCH HERE FOR A COMPLETE MODEL
*
0090000  "DISCHA1"  SNGLVOL
0090101  0.7771  0.5  0.0  0.0  -90.0  -0.5  0.000169  0.0  00
0090200  4  14.7  120.0  0.9284
*
0100000  "DISCHA1"  SNGLJUN
0100101  009010000  011000000  0.0  0.0  0.0  1000
0100201  1  0.0  0.0  0.0
*
0110000  "DISCH1A"  PIPE
0110001  99
0110101  0.7771  99
0110301  1.039  14
0110302  0.53025  18
0110303  0.5  22
0110304  0.53025  26
0110305  0.9875  56
0110306  0.475  66
0110307  0.49359  79
0110308  0.46875  87
0110309  0.51172  95
0110310  0.95  99
0110401  0.0  99
0110601  -90.0  14
0110602  -45.0  18
0110603  -90.0  22
0110604  -45.0  26
0110605  -90.0  56
0110606  0.0  87
0110607  -90.0  95
0110608  0.0  99
0110801  0.000169  0.0  99
0110901  0.0  0.0  13
0110902  0.078  0.078  14
0110903  0.0  0.0  17
0110904  0.078  0.078  18
0110905  0.0  0.0  21
0110906  0.078  0.078  22
0110907  0.0  0.0  25
0110908  0.078  0.078  26
0110909  0.0  0.0  55
0110910  0.156  0.156  56
0110911  0.0  0.0  65
0110912  0.156  0.156  66
0110913  0.0  0.0  78
0110914  0.156  0.156  79
0110915  0.0  0.0  86
0110916  0.156  0.156  87
0110917  0.0  0.0  94
0110918  0.156  0.156  95
0110919  0.0  0.0  98
0111001  00  99
0111101  1000  98
0111201  4  14.7  120.0  0.9284  0.0  99
0111300  1
0111301  0.0  0.0  0.0  98
```

```
*
0120000  "DISCHA1"  SNGLJUN
0120101  011010000  013000000  0.0  0.0  0.0  1000
0120201  1  0.0  0.0  0.0
*
0130000  "DISCHA1" PIPE
0130001  30
0130101  0.7771  30
0130301  0.95  6
0130302  1.0  20
0130303  0.5  30
0130401  0.0  30
0130601  0.0  30
0130801  0.000169  0.0  30
0130901  0.0  0.0  5
0130902  0.156  0.156  6
0130903  0.0  0.0  19
0130904  0.156  0.156  20
0130905  0.0  0.0  29
0131001  00  30
0131101  1000  29
0131201  4  14.7  120.0  0.9284  0.0  30
0131300  1
0131301  0.0  0.0  0.0  29
*
0140000  "DISCH1A"  SNGLJUN
0140101  013010000  015000000  0.0  0.0  0.0  0100
0140201  1  0.0  0.0  0.0
*
0150000  "ATMOS"  TMDPVOL
0150101  10000.0  10000.0  0.0  0.0  0.0  0.0  0.00001  0.0  11
0150200  4
0150201  0.0  14.7  120.0  0.9284
*
* PLOT CARDS
*
20300100  QUALS  007010000
20300200  QUALS  005200000
20300300  QUALS  013200000
20300400  P      005200000
20300500  P      007010000
20300600  P      007380000
20300700  MFLOWJ 006000000
20300800  MFLOWJ 005070000
20300900  MFLOWJ 014000000
20301000  P     007140000
20301100  P     011560000
20301200  P     013300000
20301300  MFLOWJ  007140000
20301400   MFLOWJ  007380000
20301500  MFLOWJ  011560000
.END OF CASE
```

4.10 REPIPE Input.

These are input listings of Control Data Corporation's RELAP post-processor, REPIPE. Each set represents direction cosines of the RELAP model as well as structural node assignments. On the Unit 1 PORV model, it was necessary to break up the model in two sections because of REPIPE's size limitations.

Input Set	Model Section	Unit
4.10.1	A	1
4.10.2	B	1
4.10.3	-	2 (Quarter Model)

4.10.1 Unit 1 - Model Section A

```
$PIPES
INLINE=10,KBLOCK=280,KPIPE=10,KPLOT(1)=1,KWAVE=1,
KPRINT=-1,KPNV=1,KSTEP=3,
NDROPV=399010000,811270000,307040000,107040000,805010000,811010000,
511010000,411010000,609110000,509120000,409260000$
 112      107040000  0.       -1.0     0./
 112      107050000  0.       -1.0     0./
 112      107060000  0.       -1.0     0./
 112      107070000  0.       -1.0     0./
 112      107080000  0.       -1.0     0./
 112      107090000  0.       -1.0     0./
 112      107100000  0.       -1.0     0./
 112      107110000  0.       -1.0     0./
 112      107120000  0.       -1.0     0./
 112      107130000  0.       -1.0     0./
 112      107140000  0.       -1.0     0./
 108     -107050000  0.       -1.0     0./
 108     -107060000  0.       -1.0     0./
 108     -107070000  0.       -1.0     0./
 108     -107080000  0.       -1.0     0./
 108     -107090000  0.       -1.0     0./
 108     -107100000  0.       -1.0     0./
 108     -107110000  0.       -1.0     0./
 108     -107120000  0.       -1.0     0./
 108     -107130000  0.       -1.0     0./
 108     -107140000  0.       -1.0     0./
 108     -107150000  0.       -1.0     0./
 104      107150000  0.7723   0.       0.6353/
 104      107160000  0.7723   0.       0.6353/
 104      107170000  0.7723   0.       0.6353/
 10301   -107160000   0.7723   0.        0.6353/
 10301   -107170000   0.7723   0.        0.6353/
 10301   -107180000   0.7723   0.        0.6353/
 10302    107180000   0.9948   0.        0.1018/
 10302    107190000   0.9948   0.        0.1018/
 10302    107200000   0.9948   0.        0.1018/
 10201   -107190000   0.9948     0.      0.1018/
 10201   -107200000   0.9948     0.      0.1018/
 10201   -107210000   0.9948     0.      0.1018/
 10202    107210000   0.8945     0.     -0.4470/
 10202    107220000   0.8945     0.     -0.4470/
 10202    107230000   0.8945     0.     -0.4470/
 10001   -107220000   0.8945     0.     -0.4470/
 10001   -107230000   0.8945     0.     -0.4470/
 10001   -107240000   0.8945     0.     -0.4470/
 10002    107240000   0.8454     0.    -0.5342/
 10002    107250000   0.8454   0.     -0.5342/
 10002    107260000   0.8454   0.     -0.5342/
 9901    -107250000   0.8454   0.     -0.5342/
 9901    -107260000   0.8454   0.     -0.5342/
 9901    -107270000   0.8454   0.     -0.5342/
 9902   107270000   0.0195     0.     -0.9998/
 9902   107280000   0.0195     0.     -0.998/
 9902   107290000   0.0195     0.     -0.998/
 9801  -107280000   0.0195     0.     -0.998/
 9801  -107290000   0.0195     0.     -0.998/
 9801  -107300000   0.0195     0.     -0.998/
 9802   107300000  -0.2497     0.     -0.9683/
 9802   107310000  -0.2497     0.     -0.9683/
 9802   107320000  -0.2497     0.     -0.9683/
```

BY CHM DATE 4-26-83
CHKD. BY MR DATE 4-26-83

TELEDYNE ENGINEERING SERVICES

97	-107310000	-0.2497	0.	-0.9683/
97	-107320000	-0.2497	0.	-0.9683/
97	-108000000	-0.2497	0.	-0.9683/
222	307040000	0.	-1.0	0./
222	307050000	0.	-1.0	0./
222	307060000	0.	-1.0	0./
222	307070000	0.	-1.0	0./
222	307080000	0.	-1.0	0./
222	307090000	0.	-1.0	0./
222	307100000	0.	-1.0	0./
222	307110000	0.	-1.0	0./
216	-307050000	0.	-1.0	0./
216	-307060000	0.	-1.0	0./
216	-307070000	0.	-1.0	0./
216	-307080000	0.	-1.0	0./
216	-307090000	0.	-1.0	0./
216	-307100000	0.	-1.0	0./
216	-307110000	0.	-1.0	0./
216	-307120000	0.	-1.0	0./
214	307120000	0.0047	0.	-0.99999/
214	307130000	0.0047	0.	-0.99999/
214	307140000	0.0047	0.	-0.99999/
20801	-307130000	0.0047	0.	-0.99999/
20801	-307140000	0.0047	0.	-0.99999/
20801	-307150000	0.0047	0.	-0.99999/
20802	307150000	-0.2497	0.	-0.9683/
20802	307160000	-0.2497	0.	-0.9683/
20802	307170000	-0.2497	0.	-0.9683/
208	-307160000	-0.2497	0.	-0.9683/
208	-307170000	-0.2497	0.	-0.9683/
208	-308000000	-0.2497	0.	-0.9683/
285	703010000	0.	-1.0	0./
285	703020000	0.	-1.0	0./
285	703030000	0.	-1.0	0./
285	703040000	0.	-1.0	0./
285	703050000	0.	-1.0	0./
285	703060000	0.	-1.0	0./
285	703070000	0.	-1.0	0./
285	703080000	0.	-1.0	0./
285	703090000	0.	-1.0	0./
285	703100000	0.	-1.0	0./
285	703110000	0.	-1.0	0./
260	703120000	0.	-1.0	0./
260	703130000	0.	-1.0	0./
260	704000000	0.	-1.0	0./
260	802000000	0.	-1.0	0./
260	804000000	0.0	-1.0	0.0/
260	806000000	0.0	-1.0	0.0/
260	808000000	0.	-1.0	0./
260	810000000	0.	-1.0	0./
260	811010000	0.	-1.0	0./
260	811020000	0.	-1.0	0./
260	811030000	0.	-1.0	0./
260	811040000	0.	-1.0	0./
260	811050000	0.	-1.0	0./
260	811060000	0.	-1.0	0./
260	811070000	0.	-1.0	0./
260	811080000	0.	-1.0	0./
260	811090000	0.	-1.0	0./
260	811100000	0.	-1.0	0./

750	401010000	0.6890	0.7071	-0.1591/
750	401020000	0.6890	0.7071	-0.1591/
750	401030000	0.6890	0.7071	-0.1591/
725	-401010000	0.6890	0.7071	-0.1591/
725	-401020000	0.6890	0.7071	-0.1591/
725	-401030000	0.6890	0.7071	-0.1591/
725	-401040000	0.6890	0.7071	-0.1591/
720	401040000	0.0	1.0	0.0/
720	401050000	0.0	1.0	0.0/
720	401060000	0.0	1.0	0.0/
720	401070000	0.0	1.0	0.0/
720	401080000	0.0	1.0	0.0/
720	401090000	0.0	1.0	0.0/
720	401100000	0.0	1.0	0.0/
720	401110000	0.0	1.0	0.0/
715	-401050000	0.0	1.0	0.0/
715	-401060000	0.0	1.0	0.0/
715	-401070000	0.0	1.0	0.0/
715	-401080000	0.0	1.0	0.0/
715	-401090000	0.0	1.0	0.0/
715	-401100000	0.0	1.0	0.0/
715	-401110000	0.0	1.0	0.0/
715	-401120000	0.0	1.0	0.0/
710	401120000	1.0	0.0	0.0/
710	401130000	1.0	0.0	0.0/
710	401140000	1.0	0.0	0.0/
710	401150000	1.0	0.0	0.0/
710	401160000	1.0	0.0	0.0/
710	401170000	1.0	0.0	0.0/
710	401180000	1.0	0.0	0.0/
700	-401130000	1.0	0.0	0.0/
700	-401140000	1.0	0.0	0.0/
700	-401150000	1.0	0.0	0.0/
700	-401160000	1.0	0.0	0.0/
700	-401170000	1.0	0.0	0.0/
700	-401180000	1.0	0.0	0.0/
700	-401190000	1.0	0.0	0.0/
690	401190000	0.0	1.0	0.0/
690	401200000	0.0	1.0	0.0/
690	401210000	0.0	1.0	0.0/
690	401220000	0.0	1.0	0.0/
690	401230000	0.0	1.0	0.0/
690	401240000	0.0	1.0	0.0/
690	401250000	0.0	1.0	0.0/
690	401260000	0.0	1.0	0.0/
675	-401200000	0.0	1.0	0.0/
675	-401210000	0.0	1.0	0.0/
675	-401220000	0.0	1.0	0.0/
675	-401230000	0.0	1.0	0.0/
675	-401240000	0.0	1.0	0.0/
675	-401250000	0.0	1.0	0.0/
675	-401260000	0.0	1.0	0.0/
675	-401270000	0.0	1.0	0.0/
670	401270000	-0.935	0.0	-0.3561/
670	402000000	-0.935	0.0	-0.3561/
670	404000000	-0.935	0.0	-0.3561/
595	-402000000	-0.935	0.0	-0.3561/
595	-404000000	-0.935	0.0	-0.3561/
595	-405010000	-0.935	0.0	-0.3561/
6951	405010000	-.9994	0.0	-.0341/

260	811110000	0.	-1.0	0./
260	811120000	0.	-1.0	0./
260	811130000	0.	-1.0	0./
2601	-703020000	0.	-1.0	0./
2601	-703030000	0.	-1.0	0./
2601	-703040000	0.	-1.0	0./
2601	-703050000	0.	-1.0	0./
2601	-703060000	0.	-1.0	0./
2601	-703070000	0.	-1.0	0./
2601	-703080000	0.	-1.0	0./
2601	-703090000	0.	-1.0	0./
2601	-703100000	0.	-1.0	0./
2601	-703110000	0.	-1.0	0./
2601	-703120000	0.	-1.0	0./
90	-703130000	0.	-1.0	0./
90	-704000000	0.	-1.0	0./
90	-802000000	0.	-1.0	0./
90	-804000000	0.0	-1.0	0.0/
90	-806000000	0.0	-1.0	0.0/
90	-808000000	0.	-1.0	0./
90	-810000000	0.	-1.0	0./
90	-811010000	0.	-1.0	0./
90	-811020000	0.	-1.0	0./
90	-811030000	0.	-1.0	0./
90	-811040000	0.	-1.0	0./
90	-811050000	0.	-1.0	0./
90	-811060000	0.	-1.0	0./
90	-811070000	0.	-1.0	0./
90	-811080000	0.	-1.0	0./
90	-811090000	0.	-1.0	0./
90	-811100000	0.	-1.0	0./
90	-811110000	0.	-1.0	0./
90	-811120000	0.	-1.0	0./
90	-811130000	0.	-1.0	0./
90	-811140000	0.	-1.0	0./
88	811140000	-0.6667	-0.7071	0.2356/
88	811150000	-0.6667	-0.7071	0.2356/
88	811160000	-0.6667	-0.7071	0.2356/
88	811170000	-0.6667	-0.7071	0.2356/
86	-811150000	-0.6667	-0.7071	0.2356/
86	-811160000	-0.6667	-0.7071	0.2356/
86	-811170000	-0.6667	-0.7071	0.2356/
86	-811180000	-0.6667	-0.7071	0.2356/
84	811180000	0.	-1.0	0./
84	811190000	0.	-1.0	0./
84	811200000	0.	-1.0	0./
84	811210000	0.	-1.0	0./
82	-811190000	0.	-1.0	0./
82	-811200000	0.	-1.0	0./
82	-811210000	0.	-1.0	0./
82	-811220000	0.	-1.0	0./
80	811220000	-0.2356	-0.7071	-0.6667/
80	811230000	-0.2356	-0.7071	-0.6667/
80	811240000	-0.2356	-0.7071	-0.6667/
80	811250000	-0.2356	-0.7071	-0.6667/
78	-811230000	-0.2356	-0.7071	-0.6667/
78	-811240000	-0.2356	-0.7071	-0.6667/
78	-811250000	-0.2356	-0.7071	-0.6667/
78	-811260000	-0.2356	-0.7071	-0.6667/
750	400000000	0.6890	0.7071	-0.1591/

5951	405020000	-.9994	0.0	-.0341/
5951	405030000	-.9994	0.0	-.0341/
590	-405020000	-.9994	0.0	-.0341/
590	-405030000	-.9994	0.0	-.0341/
590	-405040000	-.9994	0.0	-.0341/
5901	405040000	-.9703	0.0	.2420/
5901	405050000	-.9703	0.0	.2420/
5901	405060000	-.9703	0.0	.2420/
585	-405050000	-.9703	0.0	.2420/
585	-405060000	-.9703	0.0	.2420/
585	-405070000	-.9703	0.0	.2420/
5851	405070000	-.8217	0.0	.570/
5851	405080000	-.8217	0.0	.570/
5851	405090000	-.8217	0.0	.570/
5851	405100000	-.8217	0.0	.570/
5851	405110000	-.8217	0.0	.570/
575	-405080000	-.8217	0.0	.570/
575	-405090000	-.8217	0.0	.570/
575	-405100000	-.8217	0.0	.570/
575	-405110000	-.8217	0.0	.570/
575	-405120000	-.8217	0.0	.570/
5751	405120000	-.4962	0.0	.8682/
5751	405130000	-.4962	0.0	.8682/
5751	405140000	-.4962	0.0	.8682/
5751	405150000	-.4962	0.0	.8682/
5751	406000000	-.4962	0.0	.8682/
435	-405130000	-.4962	0.0	.8682/
435	-405140000	-.4962	0.0	.8682/
435	-405150000	-.4962	0.0	.8682/
435	-406000000	-.4962	0.0	.8682/
435	-408000000	-.4962	0.0	.8682/
4351	408000000	-.24165	0.0	.97036/
440	-409010000	-.24165	0.0	.97036/
4401	409010000	-.1623	0.0	.9867/
450	-409020000	-.1623	0.0	.9867/
4501	409020000	.0623	0.0	.9981/
4501	409030000	.0623	0.0	.9981/
4501	409040000	.0623	0.0	.9981/
4501	409050000	.0623	0.0	.9981/
460	-409030000	.0623	0.0	.9981/
460	-409040000	.0623	0.0	.9981/
460	-409050000	.0623	0.0	.9981/
460	-409060000	.0623	0.0	.9981/
4601	409060000	.4362	0.0	.8999/
4601	409070000	.4362	0.0	.8999/
4601	409080000	.4362	0.0	.8999/
4001	409090000	.4362	0.0	.8999/
465	-409070000	.4362	0.0	.8999/
465	-409080000	.4362	0.0	.8999/
465	-409090000	.4362	0.0	.8999/
465	-409100000	.4362	0.0	.8999/
4651	409100000	.76	0.0	.6500/
4651	409110000	.76	0.0	.6500/
4651	409120000	.76	0.0	.6500/
4651	409130000	.76	0.0	.6500/
475	-409110000	.76	0.0	.6500/
475	-409120000	.76	0.0	.6500/
475	-409130000	.76	0.0	.6500/
475	-409140000	.76	0.0	.6500/
480	409140000	0.9263	-0.044	-.3742/

480	409150000	0.9263	-0.044	-.3742/
480	409160000	0.9263	-0.044	-.3742/
480	409170000	0.9263	-0.044	-.3742/
480	409180000	0.9263	-0.044	-.3742/
480	409190000	0.9263	-0.044	-.3742/
480	409200000	0.9263	-0.044	-.3742/
480	409210000	0.9263	-0.044	-.3742/
480	409220000	0.9263	-0.044	-.3742/
480	409230000	0.9263	-0.044	-.3742/
480	409240000	0.9263	-0.044	-.3742/
525	411010000	0.9263	-0.044	-.3742/
525	411020000	0.9263	-0.044	-.3742/
525	411030000	0.9263	-0.044	-.3742/
510	-409150000	0.9263	-0.044	-.3742/
510	-409160000	0.9263	-0.044	-.3742/
510	-409170000	0.9263	-0.044	-.3742/
510	-409180000	0.9263	-0.044	-.3742/
510	-409190000	0.9263	-0.044	-.3742/
510	-409200000	0.9263	-0.044	-.3742/
510	-409210000	0.9263	-0.044	-.3742/
510	-409220000	0.9263	-0.044	-.3742/
510	-409230000	0.9263	-0.044	-.3742/
510	-409240000	0.9263	-0.044	-.3742/
510	-409250000	0.9263	-0.044	-.3742/
530	-411020000	0.9263	-0.044	-.3742/
530	-411030000	0.9263	-0.044	-.3742/
530	-411040000	0.9263	-0.044	-.3742/
600	608000000	-0.292	-0.0464	0.9563/
600	609010000	-0.292	-0.0464	0.9563/
665	-609010000	-0.292	-0.0464	0.9563/
665	-609020000	-0.292	-0.0464	0.9563/
660	609020000	-0.9262	-0.0464	0.3742/
660	609030000	-0.9262	-0.0464	0.3742/
660	609040000	-0.9262	-0.0464	0.3742/
660	609050000	-0.9262	-0.0464	0.3742/
660	609060000	-0.9262	-0.0464	0.3742/
660	609070000	-0.9262	-0.0464	0.3742/
660	609080000	-0.9262	-0.0464	0.3742/
660	609090000	-0.9262	-0.0464	0.3742/
625	611010000	-0.9262	-0.0464	0.3742/
625	611020000	-0.9262	-0.0464	0.3742/
625	611030000	-0.9262	-0.0464	0.3742/
635	-609030000	-0.9262	-0.0464	0.3742/
635	-609040000	-0.9262	-0.0464	0.3742/
635	-609050000	-0.9262	-0.0464	0.3742/
635	-609060000	-0.9262	-0.0464	0.3742/
635	-609070000	-0.9262	-0.0464	0.3742/
635	-609080000	-0.9262	-0.0464	0.3742/
635	-609090000	-0.9262	-0.0464	0.3742/
635	-609100000	-0.9262	-0.0464	0.3742/
615	-611020000	-0.9262	-0.0464	0.3742/
615	-611030000	-0.9262	-0.0464	0.3742/
615	-611040000	-0.9262	-0.0464	0.3742/
435	508000000	0.9670	-0.2548	0.0/
435	509010000	0.9670	-0.2548	0.0/
430	-509010000	0.9670	-0.2548	0.0/
430	-509020000	0.9670	-0.2548	0.0/
429	509020000	0.3745	-0.0292	0.9268/
429	509030000	0.3745	-0.0292	0.9268/
429	509040000	0.3745	-0.0292	0.9268/

```
429   509050000   0.3745   -0.0292   0.9268/
429   509060000   0.3745   -0.0292   0.9268/
429   509070000   0.3745   -0.0292   0.9268/
429   509080000   0.3745   -0.0292   0.9268/
429   509090000   0.3745   -0.0292   0.9268/
429   509100000   0.3745   -0.0292   0.9268/
385   511010000   0.3745   -0.0292   0.9268/
385   511020000   0.3745   -0.0292   0.9268/
400   -509030000   0.3745   -0.0292   0.9268/
400   -509040000   0.3745   -0.0292   0.9268/
400   -509050000   0.3745   -0.0292   0.9268/
400   -509060000   0.3745   -0.0292   0.9268/
400   -509070000   0.3745   -0.0292   0.9268/
400   -509080000   0.3745   -0.0292   0.9268/
400   -509090000   0.3745   -0.0292   0.9268/
400   -509100000   0.3745   -0.0292   0.9268/
400   -509110000   0.3745   -0.0292   0.9268/
380   -511020000   0.3745   -0.0292   0.9268/
380   -511030000   0.3745   -0.0292   0.9268/
610   611040000   0.0 -1.0  0.0/
610   611050000   0.0 -1.0  0.0/
610   611060000   0.0 -1.0  0.0/
610   611070000   0.0 -1.0  0.0/
335   -611050000   0.0 -1.0  0.0/
335   -611060000   0.0 -1.0  0.0/
335   -611070000   0.0 -1.0  0.0/
335   -612000000   0.0 -1.0  0.0/
535   411040000   0.0 -1.0  0.0/
535   411050000   0.0 -1.0  0.0/
535   411060000   0.0 -1.0  0.0/
535   411070000   0.0 -1.0  0.0/
540   -411050000   0.0 -1.0  0.0/
540   -411060000   0.0 -1.0  0.0/
540   -411070000   0.0 -1.0  0.0/
540   -411080000   0.0 -1.0  0.0/
545   411080000   .285  0.0 -.9585/
545   411090000   .285  0.0 -.9585/
545   411100000   .285  0.0 -.9585/
55001   -411090000   .285  0.0 -.9585/
55001   -411100000   .285  0.0 -.9585/
55001   -411110000   .285  0.0 -.9585/
55002   411110000   -.107  0.0 -.9943/
55002   411120000   -.107  0.0 -.9943/
55002   411130000   -.107  0.0 -.9943/
55501   -411120000   -.107  0.0 -.9943/
55501   -411130000   -.107  0.0 -.9943/
55501   -411140000   -.107  0.0 -.9943/
55502   411140000   -.483  0.0 -.876/
55502   411150000   -.483  0.0 -.876/
55502   411160000   -.483  0.0 -.876/
56001   -411150000   -.483  0.0 -.876/
56001   -411160000   -.483  0.0 -.876/
56001   -411170000   -.483  0.0 -.876/
56002   411170000   -.7064  0.0 -.7078/
56002   411180000   -.7064  0.0 -.7078/
295   -411180000   -.7064  0.0 -.7078/
295   -412000000   -.7064  0.0 -.7078/
375   511030000   0.0 -1.0  0.0/
375   511040000   0.0 -1.0  0.0/
375   511050000   0.0 -1.0  0.0/
```

375	511060000	0.0	-1.0	0.0/
370	-511040000	0.0	-1.0	0.0/
370	-511050000	0.0	-1.0	0.0/
370	-511060000	0.0	-1.0	0.0/
370	-511070000	0.0	-1.0	0.0/
365	511070000	-.826	0.0	-.563/
365	511080000	-.826	0.0	-.563/
36001	-511080000	-.826	0.0	-.563/
36001	-511090000	-.826	0.0	-.563/
36002	511090000	-.633	0.0	-.7745/
36002	511100000	-.633	0.0	-.7745/
36002	511110000	-.633	0.0	-.7745/
35501	-511100000	-.633	0.0	-.7745/
35501	-511110000	-.633	0.0	-.7745/
35501	-511120000	-.633	0.0	-.7745/
35502	511120000	-.264	0.0	-.967/
35502	511130000	-.264	0.0	-.967/
35502	511140000	-.264	0.0	-.967/
35001	-511130000	-.264	0.0	-.967/
35001	-511140000	-.264	0.0	-.967/
35001	-511150000	-.264	0.0	-.967/
35002	511150000	.169	0.0	-.9856/
35002	511160000	.169	0.0	-.9856/
35002	511170000	.169	0.0	-.9856/
34001	-511160000	.169	0.0	-.9856/
34001	-511170000	.169	0.0	-.9856/
34001	-511180000	.169	0.0	-.9856/
34002	511180000	.415	0.0	-.9099/
33501	-512000000	.415	0.0	-.9099/
33502	512000000	.525	0.0	-.851/
33502	612000000	0.525	0.0	-0.851/
33502	514000000	.525	0.0	-.851/
32501	-514000000	.525	0.0	-.851/
32501	-515010000	.525	0.0	-.851/
32502	515010000	.773	0.0	-.635/
32502	515020000	.773	0.0	-.835/
32502	515030000	.773	0.0	-.635/
32001	-515020000	.773	0.0	-.635/
32001	-515030000	.773	0.0	-.835/
32001	-515040000	.773	0.0	-.635/
32002	515040000	.981	0.0	-.195/
32002	515050000	.981	0.0	-.195/
32002	515060000	.981	0.0	-.195/
31001	-515050000	.981	0.0	-.195/
31001	-515060000	.981	0.0	-.195/
31001	-515070000	.981	0.0	-.185/
31002	515070000	.957	0.0	.290/
31002	515080000	.957	0.0	.290/
31002	515090000	.957	0.0	.290/
30001	-515080000	.957	0.0	.290/
30001	-515090000	.957	0.0	.290/
30001	-515100000	.957	0.0	.290/
30002	515100000	.812	0.0	.583/
30002	515110000	.812	0.0	.583/
295	-515110000	.812	0.0	.583/
295	-516000000	.812	0.0	.583/
2951	516000000	-0.648	0.0	-.761/
2951	412000000	-0.648	0.0	-.761/
2951	702000000	-0.648	0.0	-.761/
290	-702000000	-0.648	0.0	-.761/

```
290  -703010000  -0.648  0.0  -.781/
99999/
 $STEPS TSTEP(1)=0.001,1.0$
```

4.10.2 Unit 1 - Model Section B

```
$PIPES
INLINE=3,KBLOCK=200,KPIPE=10,KPLOT(1)=1,KWAVE=1,
KPRINT=-1,KPNV=1,KSTEP=3,
NDROPV=811260000,307050000,107050000,703010000,811150000,
307180000,107330000,811260000,978080000$
115   106000000  0.3498   0.     0.9368/
115   107010000  0.3498   0.     0.9368/
115   107020000  0.3498   0.     0.9368/
115   107030000  0.3498   0.     0.9368/
114  -107010000  0.3498   0.     0.9368/
114  -107020000  0.3498   0.     0.9368/
114  -107030000  0.3498   0.     0.9368/
114  -107040000  0.3498   0.     0.9368/
164   206000000  0.9966   0.     0.0819/
164   207010000  0.9966   0.     0.0819/
164   207020000  0.9966   0.     0.0819/
164   207030000  0.9966   0.     0.0819/
162  -207010000  0.9966   0.     0.0819/
162  -207020000  0.9966   0.     0.0819/
162  -207030000  0.99660  0.     0.0819/
162  -207040000  0.9966   0.     0.0819/
160   207040000  0.      -1.0    0./
160   207050000  0.      -1.0    0./
160   207060000  0.      -1.0    0./
160   207070000  0.      -1.0    0./
160   207080000  0.      -1.0    0./
160   207090000  0.      -1.0    0./
160   207100000  0.      -1.0    0./
160   207110000  0.      -1.0    0./
160   207120000  0.      -1.0    0./
160   207130000  0.      -1.0    0./
152  -207050000  0.      -1.0    0./
152  -207060000  0.      -1.0    0./
152  -207070000  0.      -1.0    0./
152  -207080000  0.      -1.0    0./
152  -207090000  0.      -1.0    0./
152  -207100000  0.      -1.0    0./
152  -207110000  0.      -1.0    0./
152  -207120000  0.      -1.0    0./
152  -207130000  0.      -1.0    0./
152  -207140000  0.      -1.0    0./
150   207140000  0.9202   0.    -0.3915/
150   207150000  0.9202   0.    -0.3915/
150   207160000  0.9202   0.    -0.3915/
14801  -207150000  0.9202   0.    -0.3915/
14801  -207160000  0.9202   0.    -0.3915/
14801  -207170000  0.9202   0.    -0.3915/
14802   207170000  0.5647   0.    -0.8253/
14802   207180000  0.5647   0.    -0.8253/
14802   207190000  0.5647   0.    -0.8253/
14601  -207180000  0.5647   0.    -0.8253/
14601  -207190000  0.5647   0.    -0.8253/
14601  -207200000  0.5647   0.    -0.8253/
14602   207200000  0.0318   0.    -0.9995/
14602   207210000  0.0318   0.    -0.9995/
14602   207220000  0.0318   0.    -0.9995/
14401  -207210000  0.0318   0.    -0.9995/
14401  -207220000  0.0318   0.    -0.9995/
14401  -207230000  0.0318   0.    -0.9995/
14402   207230000 -0.2497   0.    -0.9683/
```

BY CMM DATE 4-26-83
CHKD. BY MJL DATE 4-26-83

14402	207240000	-0.2497	0.	-0.9683/
14402	207250000	-0.2497	0.	-0.9683/
142	-207240000	-0.2497	0.	-0.9683/
142	-207250000	-0.2497	0.	-0.9683/
142	-208000000	-0.2497	0.	-0.9683/
224	306000000	-0.4621	0.	-0.8868/
224	307010000	-0.4621	0.	-0.8868/
224	307020000	-0.4621	0.	-0.8868/
224	307030000	-0.4621	0.	-0.8868/
223	-307010000	-0.4621	0.	-0.8868/
223	-307020000	-0.4621	0.	-0.8868/
223	-307030000	-0.4621	0.	-0.8868/
223	-307040000	-0.4621	0.	-0.8868/
285	703010000	0.	-1.0	0./
285	703020000	0.	-1.0	0./
285	703030000	0.	-1.0	0./
285	703040000	0.	-1.0	0./
285	703050000	0.	-1.0	0./
285	703060000	0.	-1.0	0./
285	703070000	0.	-1.0	0./
285	703080000	0.	-1.0	0./
285	703090000	0.	-1.0	0./
285	703100000	0.	-1.0	0./
285	703110000	0.	-1.0	0./
285	703120000	0.	-1.0	0./
285	703130000	0.	-1.0	0./
285	704000000	0.	-1.0	0./
285	308000000	0.0	-1.0	0.0/
285	802000000	0.	-1.0	0./
285	804000000	0.	-1.0	0./
285	208000000	0.0	-1.0	0.0/
285	806000000	0.	-1.0	0./
285	808000000	0.	-1.0	0./
285	108000000	0.0	-1.0	0.0/
285	810000000	0.	-1.0	0./
285	811010000	0.	-1.0	0./
285	811020000	0.	-1.0	0./
285	811030000	0.	-1.0	0./
285	811040000	0.	-1.0	0./
285	811050000	0.	-1.0	0./
285	811060000	0.	-1.0	0./
285	811070000	0.	-1.0	0./
285	811080000	0.	-1.0	0./
285	811090000	0.	-1.0	0./
285	811100000	0.	-1.0	0./
285	811110000	0.	-1.0	0./
285	811120000	0.	-1.0	0./
285	811130000	0.	-1.0	0./
90	-703020000	0.	-1.0	0./
90	-703030000	0.	-1.0	0./
90	-703040000	0.	-1.0	0./
90	-703050000	0.	-1.0	0./
90	-703060000	0.	-1.0	0./
90	-703070000	0.	-1.0	0./
90	-703080000	0.	-1.0	0./
90	-703090000	0.	-1.0	0./
90	-703100000	0.	-1.0	0./
90	-703110000	0.	-1.0	0./
90	-703120000	0.	-1.0	0./
90	-703130000	0.	-1.0	0./

90	-704000000	0.	-1.0	0./
90	-802000000	0.	-1.0	0./
90	-804000000	0.	-1.0	0./
90	-806000000	0.	-1.0	0./
90	-808000000	0.	-1.0	0./
90	-810000000	0.	-1.0	0./
90	-811010000	0.	-1.0	0./
90	-811020000	0.	-1.0	0./
90	-811030000	0.	-1.0	0./
90	-811040000	0.	-1.0	0./
90	-811050000	0.	-1.0	0./
90	-811060000	0.	-1.0	0./
90	-811070000	0.	-1.0	0./
90	-811080000	0.	-1.0	0./
90	-811090000	0.	-1.0	0./
90	-811100000	0.	-1.0	0./
90	-811110000	0.	-1.0	0./
90	-811120000	0.	-1.0	0./
90	-811130000	0.	-1.0	0./
90	-811140000	0.	-1.0	0./
74	811260000	0.0	-1.0	0.0/
74	811270000	0.0	-1.0	0.0/
74	811280000	0.0	-1.0	0.0/
74	811290000	0.0	-1.0	0.0/
74	811300000	0.0	-1.0	0.0/
74	811310000	0.0	-1.0	0.0/
74	811320000	0.0	-1.0	0.0/
74	811330000	0.0	-1.0	0.0/
74	811340000	0.0	-1.0	0.0/
74	811350000	0.0	-1.0	0.0/
74	811360000	0.0	-1.0	0.0/
74	811370000	0.0	-1.0	0.0/
74	811380000	0.0	-1.0	0.0/
74	811390000	0.0	-1.0	0.0/
74	811400000	0.0	-1.0	0.0/
74	811410000	0.0	-1.0	0.0/
74	811420000	0.0	-1.0	0.0/
74	811430000	0.0	-1.0	0.0/
74	811440000	0.0	-1.0	0.0/
74	811450000	0.0	-1.0	0.0/
74	811460000	0.0	-1.0	0.0/
74	811470000	0.0	-1.0	0.0/
74	811480000	0.0	-1.0	0.0/
74	811490000	0.0	-1.0	0.0/
74	811500000	0.0	-1.0	0.0/
74	811510000	0.0	-1.0	0.0/
74	811520000	0.0	-1.0	0.0/
74	811530000	0.0	-1.0	0.0/
74	811540000	0.0	-1.0	0.0/
74	811550000	0.0	-1.0	0.0/
62	-811270000	0.0	-1.0	0.0/
62	-811280000	0.0	-1.0	0.0/
62	-811290000	0.0	-1.0	0.0/
62	-811300000	0.0	-1.0	0.0/
62	-811310000	0.0	-1.0	0.0/
62	-811320000	0.0	-1.0	0.0/
62	-811330000	0.0	-1.0	0.0/
62	-811340000	0.0	-1.0	0.0/
62	-811350000	0.0	-1.0	0.0/
62	-811360000	0.0	-1.0	0.0/

62	-811370000	0.0	-1.0	0.0/
62	-811380000	0.0	-1.0	0.0/
62	-811390000	0.0	-1.0	0.0/
62	-811400000	0.0	-1.0	0.0/
62	-811410000	0.0	-1.0	0.0/
62	-811420000	0.0	-1.0	0.0/
62	-811430000	0.0	-1.0	0.0/
62	-811440000	0.0	-1.0	0.0/
62	-811450000	0.0	-1.0	0.0/
62	-811460000	0.0	-1.0	0.0/
62	-811470000	0.0	-1.0	0.0/
62	-811480000	0.0	-1.0	0.0/
62	-811490000	0.0	-1.0	0.0/
62	-811500000	0.0	-1.0	0.0/
62	-811510000	0.0	-1.0	0.0/
62	-811520000	0.0	-1.0	0.0/
62	-811530000	0.0	-1.0	0.0/
62	-811540000	0.0	-1.0	0.0/
62	-811550000	0.0	-1.0	0.0/
62	-811560000	0.0	-1.0	0.0/
60	811560000	0.0	0.0	-1.0/
60	811570000	0.0	0.0	-1.0/
60	811580000	0.0	0.0	-1.0/
60	811590000	0.0	0.0	-1.0/
60	811600000	0.0	0.0	-1.0/
60	811610000	0.0	0.0	-1.0/
60	811620000	0.0	0.0	-1.0/
60	811630000	0.0	0.0	-1.0/
58	-811570000	0.0	0.0	-1.0/
58	-811580000	0.0	0.0	-1.0/
58	-811590000	0.0	0.0	-1.0/
58	-811600000	0.0	0.0	-1.0/
58	-811610000	0.0	0.0	-1.0/
58	-811620000	0.0	0.0	-1.0/
58	-811630000	0.0	0.0	-1.0/
58	-811640000	0.0	0.0	-1.0/
56	811640000	-.259	0.0	-.966/
56	811650000	-.259	0.0	-.966/
56	811660000	-.259	0.0	-.966/
56	811670000	-.259	0.0	-.966/
56	811680000	-.259	0.0	-.966/
56	811690000	-.259	0.0	-.966/
56	811700000	-.259	0.0	-.966/
56	811710000	-.259	0.0	-.966/
52	-811650000	-.259	0.0	-.966/
52	-811660000	-.259	0.0	-.966/
52	-811670000	-.259	0.0	-.966/
52	-811680000	-.259	0.0	-.966/
52	-811690000	-.259	0.0	-.966/
52	-811700000	-.259	0.0	-.966/
52	-811710000	-.259	0.0	-.966/
52	-811720000	-.259	0.0	-.966/
50	811720000	-1.0	0.0	0.0/
50	811730000	-1.0	0.0	0.0/
50	811740000	-1.0	0.0	0.0/
50	811750000	-1.0	0.0	0.0/
50	811760000	-1.0	0.0	0.0/
50	811770000	-1.0	0.0	0.0/
50	811780000	-1.0	0.0	0.0/
50	811790000	-1.0	0.0	0.0/

46	-811730000	-1.0	0.0	0.0/
46	-811740000	-1.0	0.0	0.0/
46	-811750000	-1.0	0.0	0.0/
46	-811760000	-1.0	0.0	0.0/
46	-811770000	-1.0	0.0	0.0/
46	-811780000	-1.0	0.0	0.0/
46	-811790000	-1.0	0.0	0.0/
46	-811800000	-1.0	0.0	0.0/
44	811800000	0.0	-1.0	0.0/
44	811810000	0.0	-1.0	0.0/
44	811820000	0.0	-1.0	0.0/
44	811830000	0.0	-1.0	0.0/
44	811840000	0.0	-1.0	0.0/
44	811850000	0.0	-1.0	0.0/
44	811860000	0.0	-1.0	0.0/
44	811870000	0.0	-1.0	0.0/
40	-811810000	0.0	-1.0	0.0/
40	-811820000	0.0	-1.0	0.0/
40	-811830000	0.0	-1.0	0.0/
40	-811840000	0.0	-1.0	0.0/
40	-811850000	0.0	-1.0	0.0/
40	-811860000	0.0	-1.0	0.0/
40	-811870000	0.0	-1.0	0.0/
40	-811880000	0.0	-1.0	0.0/
38	811880000	-1.0	0.0	0.0/
38	811890000	-1.0	0.0	0.0/
38	811900000	-1.0	0.0	0.0/
38	811910000	-1.0	0.0	0.0/
38	811920000	-1.0	0.0	0.0/
38	811930000	-1.0	0.0	0.0/
38	811940000	-1.0	0.0	0.0/
38	811950000	-1.0	0.0	0.0/
38	811960000	-1.0	0.0	0.0/
32	-811890000	-1.0	0.0	0.0/
32	-811900000	-1.0	0.0	0.0/
32	-811910000	-1.0	0.0	0.0/
32	-811920000	-1.0	0.0	0.0/
32	-811930000	-1.0	0.0	0.0/
32	-811940000	-1.0	0.0	0.0/
32	-811950000	-1.0	0.0	0.0/
32	-811960000	-1.0	0.0	0.0/
32	-812000000	-1.0	0.0	0.0/
30	812000000	0.0	0.0	1.0/
30	813010000	0.0	0.0	1.0/
30	813020000	0.0	0.0	1.0/
30	813030000	0.0	0.0	1.0/
30	813040000	0.0	0.0	1.0/
30	813050000	0.0	0.0	1.0/
30	813060000	0.0	0.0	1.0/
30	813070000	0.0	0.0	1.0/
30	813080000	0.0	0.0	1.0/
30	813090000	0.0	0.0	1.0/
30	813100000	0.0	0.0	1.0/
30	813110000	0.0	0.0	1.0/
30	813120000	0.0	0.0	1.0/
30	813130000	0.0	0.0	1.0/
12	-813010000	0.0	0.0	1.0/
12	-813020000	0.0	0.0	1.0/
12	-813030000	0.0	0.0	1.0/
12	-813040000	0.0	0.0	1.0/

```
12    -813050000    0.0   0.0   1.0/
12    -813060000    0.0   0.0   1.0/
12    -813070000    0.0   0.0   1.0/
12    -813080000    0.0   0.0   1.0/
12    -813090000    0.0   0.0   1.0/
12    -813100000    0.0   0.0   1.0/
12    -813110000    0.0   0.0   1.0/
12    -813120000    0.0   0.0   1.0/
12    -813130000    0.0   0.0   1.0/
12    -813140000    0.0   0.0   1.0/
10     813140000    1.0   0.0   0.0/
10     813150000    1.0   0.0   0.0/
10     813160000    1.0   0.0   0.0/
10     813170000    1.0   0.0   0.0/
10     813180000    1.0   0.0   0.0/
10     813190000    1.0   0.0   0.0/
10     813200000    1.0   0.0   0.0/
10     813210000    1.0   0.0   0.0/
10     813220000    1.0   0.0   0.0/
10     813230000    1.0   0.0   0.0/
6     -813150000    1.0   0.0   0.0/
6     -813160000    1.0   0.0   0.0/
6     -813170000    1.0   0.0   0.0/
6     -813180000    1.0   0.0   0.0/
6     -813190000    1.0   0.0   0.0/
6     -813200000    1.0   0.0   0.0/
6     -813210000    1.0   0.0   0.0/
6     -813220000    1.0   0.0   0.0/
6     -813230000    1.0   0.0   0.0/
6     -813240000    1.0   0.0   0.0/
4      813240000    0.0  -1.0   0.0/
4      813250000    0.0  -1.0   0.0/
4      977000000  0.0  -1.0  0.0/
4      978010000  0.0  -1.0  0.0/
4      978020000  0.0  -1.0  0.0/
4      978030000  0.0  -1.0  0.0/
4      978040000  0.0  -1.0  0.0/
4      978050000  0.0  -1.0  0.0/
4      978060000  0.0  -1.0  0.0/
1     -813250000    0.0  -1.0   0.0/
1     -977000000    0.0  -1.0   0.0/
1      -978010000  0.0  -1.0  0.0/
1     -978020000  0.0  -1.0  0.0/
1     -978030000  0.0  -1.0  0.0/
1     -978040000  0.0  -1.0  0.0/
1     -978050000  0.0  -1.0  0.0/
1     -978060000  0.0  -1.0  0.0/
1     -978070000  0.0  -1.0  0.0/
99999/
 $STEPS TSTEP(1)=0.001,1.0$
```

4.10.3 Unit 2 - (Quarter Model)

```
$PIPES
INLINE=3,KBLOCK=601,KPIPE=0,KPLOT(1)=1,KWAVE=1,
KPRINT=-1,KPNV=1,KSTEP=3,NDROPV=1010000,15010000$
 1   002000000  -1.0  0.0  0.0/
 2  -004000000  -1.0  0.0  0.0/
 3   004000000   0.0 -1.0  0.0/
 3   005010000   0.0 -1.0  0.0/
 3   005020000   0.0 -1.0  0.0/
 3   005040000   0.0 -1.0  0.0/
 3   005050000   0.0 -1.0  0.0/
 3   005060000   0.0 -1.0  0.0/
 4  -005010000   0.0 -1.0  0.0/
 4  -005020000   0.0 -1.0  0.0/
 4  -005030000   0.0 -1.0  0.0/
 4  -005040000   0.0 -1.0  0.0/
 4  -005050000   0.0 -1.0  0.0/
 4  -005060000   0.0 -1.0  0.0/
 4  -005070000   0.0 -1.0  0.0/
 5   005070000  -1.0  0.0  0.0/
 5   005080000  -1.0  0.0  0.0/
 5   005090000  -1.0  0.0  0.0/
 6  -005080000  -1.0  0.0  0.0/
 6  -005090000  -1.0  0.0  0.0/
 6  -005100000  -1.0  0.0  0.0/
 7   005100000   0.0  1.0  0.0/
 7   005110000   0.0  1.0  0.0/
 7   005120000   0.0  1.0  0.0/
 7   005130000   0.0  1.0  0.0/
 7   005140000   0.0  1.0  0.0/
 7   005150000   0.0  1.0  0.0/
 7   005160000   0.0  1.0  0.0/
 7   005170000   0.0  1.0  0.0/
 7   005180000   0.0  1.0  0.0/
 7   005190000   0.0  1.0  0.0/
 8  -005110000   0.0  1.0  0.0/
 8  -005120000   0.0  1.0  0.0/
 8  -005130000   0.0  1.0  0.0/
 8  -005140000   0.0  1.0  0.0/
 8  -005150000   0.0  1.0  0.0/
 8  -005160000   0.0  1.0  0.0/
 8  -005170000   0.0  1.0  0.0/
 8  -005180000   0.0  1.0  0.0/
 8  -005190000   0.0  1.0  0.0/
 8  -006000000   0.0  1.0  0.0/
 9   006000000  -1.0  0.0  0.0/
 9   007010000  -1.0  0.0  0.0/
 9   007020000  -1.0  0.0  0.0/
 9   007030000  -1.0  0.0  0.0/
10  -007010000  -1.0  0.0  0.0/
10  -007020000  -1.0  0.0  0.0/
10  -007030000  -1.0  0.0  0.0/
10  -007040000  -1.0  0.0  0.0/
11   007040000   0.0 -1.0  0.0/
11   007050000   0.0 -1.0  0.0/
11   007060000   0.0 -1.0  0.0/
11   007070000   0.0 -1.0  0.0/
11   007080000   0.0 -1.0  0.0/
11   007090000   0.0 -1.0  0.0/
11   007100000   0.0 -1.0  0.0/
11   007110000   0.0 -1.0  0.0/
```

BY CMM DATE 2-9-83
CHKD. BY LOS DATE 2-9-83

11	007120000	0.0	-1.0	0.0/
11	007130000	0.0	-1.0	0.0/
12	-007050000	0.0	-1.0	0.0/
12	-007060000	0.0	-1.0	0.0/
12	-007070000	0.0	-1.0	0.0/
12	-007080000	0.0	-1.0	0.0/
12	-007090000	0.0	-1.0	0.0/
12	-007100000	0.0	-1.0	0.0/
12	-007110000	0.0	-1.0	0.0/
12	-007120000	0.0	-1.0	0.0/
12	-007130000	0.0	-1.0	0.0/
12	-007140000	0.0	-1.0	0.0/
14	007140000	-.258	0.0	-.966/
14	007150000	-.258	0.0	-.966/
14	007160000	-.258	0.0	-.966/
15	-007150000	-.258	0.0	-.966/
15	-007160000	-.258	0.0	-.966/
15	-007170000	-.258	0.0	-.966/
16	007170000	.337	0.0	-.942/
16	007180000	.337	0.0	-.942/
16	007190000	.337	0.0	-.942/
17	-007180000	.337	0.0	-.942/
17	-007190000	.337	0.0	-.942/
17	-007200000	.337	0.0	-.942/
18	007200000	.793	0.0	-.609/
18	007210000	.793	0.0	-.609/
18	007220000	.793	0.0	-.609/
19	-007210000	.793	0.0	-.609/
19	-007220000	.793	0.0	-.609/
19	-007230000	.793	0.0	-.609/
20	007230000	.994	0.0	-.1132/
20	007240000	.994	0.0	-.1132/
20	007250000	.994	0.0	-.1132/
21	-007240000	.994	0.0	-.1132/
21	-007250000	.994	0.0	-.1132/
21	-007260000	.994	0.0	-.1132/
22	007260000	.910	0.0	.415/
22	007270000	.910	0.0	.415/
22	007280000	.910	0.0	.415/
23	-007270000	.910	0.0	.415/
23	-007280000	.910	0.0	.415/
23	-007290000	.910	0.0	.415/
24	007290000	.555	0.0	.8321/
24	007300000	.555	0.0	.8321/
24	007310000	.555	0.0	.8321/
25	-007300000	.555	0.0	.8321/
25	-007310000	.555	0.0	.8321/
25	-007320000	.555	0.0	.8321/
26	007320000	.0183	0.0	.9998/
26	007330000	.0183	0.0	.9998/
26	007340000	.0183	0.0	.9998/
27	-007330000	.0183	0.0	.9998/
27	-007340000	.0183	0.0	.9998/
27	-007350000	.0183	0.0	.9998/
28	007350000	-.264	0.0	.965/
28	007360000	-.264	0.0	.965/
28	007370000	-.264	0.0	.965/
28	007380000	-.264	0.0	.965/
29	-007360000	-.264	0.0	.965/
29	-007370000	-.264	0.0	.965/

29	-007380000	-.264	0.0	.965/
29	-008000000	-.264	0.0	.965/
30	008000000	0.0	-1.0	0.0/
30	010000000	0.0	-1.0	0.0/
30	011010000	0.0	-1.0	0.0/
30	011020000	0.0	-1.0	0.0/
30	011030000	0.0	-1.0	0.0/
30	011040000	0.0	-1.0	0.0/
30	011050000	0.0	-1.0	0.0/
30	011060000	0.0	-1.0	0.0/
30	011070000	0.0	-1.0	0.0/
30	011080000	0.0	-1.0	0.0/
30	011090000	0.0	-1.0	0.0/
30	011100000	0.0	-1.0	0.0/
30	011110000	0.0	-1.0	0.0/
30	011120000	0.0	-1.0	0.0/
30	011130000	0.0	-1.0	0.0/
31	-010000000	0.0	-1.0	0.0/
31	-011010000	0.0	-1.0	0.0/
31	-011020000	0.0	-1.0	0.0/
31	-011030000	0.0	-1.0	0.0/
31	-011040000	0.0	-1.0	0.0/
31	-011050000	0.0	-1.0	0.0/
31	-011060000	0.0	-1.0	0.0/
31	-011070000	0.0	-1.0	0.0/
31	-011080000	0.0	-1.0	0.0/
31	-011090000	0.0	-1.0	0.0/
31	-011100000	0.0	-1.0	0.0/
31	-011110000	0.0	-1.0	0.0/
31	-011120000	0.0	-1.0	0.0/
31	-011130000	0.0	-1.0	0.0/
31	-011140000	0.0	-1.0	0.0/
32	011140000	.316	-.707	-.948/
32	011150000	.316	-.707	-.948/
32	011160000	.316	-.707	-.948/
32	011170000	.316	-.707	-.948/
33	-011150000	.316	-.707	-.948/
33	-011160000	.316	-.707	-.948/
33	-011170000	.316	-.707	-.948/
33	-011180000	.316	-.707	-.948/
34	011180000	0.0	-1.0	0.0/
34	011190000	0.0	-1.0	0.0/
34	011200000	0.0	-1.0	0.0/
34	011210000	0.0	-1.0	0.0/
35	-011200000	0.0	-1.0	0.0/
35	-011210000	0.0	-1.0	0.0/
35	-011220000	0.0	-1.0	0.0/
36	011220000	-.316	-.707	.948/
36	011230000	-.316	-.707	.948/
36	011240000	-.316	-.707	.948/
36	011250000	-.316	-.707	.948/
37	-011230000	-.316	-.707	.948/
37	-011240000	-.316	-.707	.948/
37	-011250000	-.316	-.707	.948/
37	-011260000	-.316	-.707	.948/
38	011260000	0.0	-1.0	0.0/
38	011270000	0.0	-1.0	0.0/
38	011280000	0.0	-1.0	0.0/
38	011290000	0.0	-1.0	0.0/
38	011300000	0.0	-1.0	0.0/

```
38   011310000   0.0 -1.0  0.0/
38   011320000   0.0 -1.0  0.0/
38   011330000   0.0 -1.0  0.0/
38   011340000   0.0 -1.0  0.0/
38   011350000   0.0 -1.0  0.0/
38   011360000   0.0 -1.0  0.0/
38   011370000   0.0 -1.0  0.0/
38   011380000   0.0 -1.0  0.0/
38   011390000   0.0 -1.0  0.0/
38   011400000   0.0 -1.0  0.0/
38   011410000   0.0 -1.0  0.0/
38   011420000   0.0 -1.0  0.0/
38   011430000   0.0 -1.0  0.0/
38   011440000   0.0 -1.0  0.0/
38   011450000   0.0 -1.0  0.0/
38   011460000   0.0 -1.0  0.0/
38   011470000   0.0 -1.0  0.0/
38   011480000   0.0 -1.0  0.0/
38   011490000   0.0 -1.0  0.0/
38   011500000   0.0 -1.0  0.0/
38   011510000   0.0 -1.0  0.0/
38   011520000   0.0 -1.0  0.0/
38   011530000   0.0 -1.0  0.0/
38   011540000   0.0 -1.0  0.0/
38   011550000   0.0 -1.0  0.0/
39  -011270000   0.0 -1.0  0.0/
39  -011280000   0.0 -1.0  0.0/
39  -011290000   0.0 -1.0  0.0/
39  -011300000   0.0 -1.0  0.0/
39  -011310000   0.0 -1.0  0.0/
39  -011320000   0.0 -1.0  0.0/
39  -011330000   0.0 -1.0  0.0/
39  -011340000   0.0 -1.0  0.0/
39  -011350000   0.0 -1.0  0.0/
39  -011360000   0.0 -1.0  0.0/
39  -011370000   0.0 -1.0  0.0/
39  -011380000   0.0 -1.0  0.0/
39  -011390000   0.0 -1.0  0.0/
39  -011400000   0.0 -1.0  0.0/
39  -011410000   0.0 -1.0  0.0/
39  -011420000   0.0 -1.0  0.0/
39  -011430000   0.0 -1.0  0.0/
39  -011440000   0.0 -1.0  0.0/
39  -011450000   0.0 -1.0  0.0/
39  -011460000   0.0 -1.0  0.0/
39  -011470000   0.0 -1.0  0.0/
39  -011480000   0.0 -1.0  0.0/
39  -011490000   0.0 -1.0  0.0/
39  -011500000   0.0 -1.0  0.0/
39  -011510000   0.0 -1.0  0.0/
39  -011520000   0.0 -1.0  0.0/
39  -011530000   0.0 -1.0  0.0/
39  -011540000   0.0 -1.0  0.0/
39  -011550000   0.0 -1.0  0.0/
39  -011560000   0.0 -1.0  0.0/
40   011560000   0.0  0.0 -1.0/
40   011570000   0.0  0.0 -1.0/
40   011580000   0.0  0.0 -1.0/
40   011590000   0.0  0.0 -1.0/
40   011600000   0.0  0.0 -1.0/
```

40	011610000	0.0	0.0	-1.0/
40	011620000	0.0	0.0	-1.0/
40	011630000	0.0	0.0	-1.0/
40	011640000	0.0	0.0	-1.0/
40	011650000	0.0	0.0	-1.0/
41	-011570000	0.0	0.0	-1.0/
41	-011580000	0.0	0.0	-1.0/
41	-011590000	0.0	0.0	-1.0/
41	-011600000	0.0	0.0	-1.0/
41	-011610000	0.0	0.0	-1.0/
41	-011620000	0.0	0.0	-1.0/
41	-011630000	0.0	0.0	-1.0/
41	-011640000	0.0	0.0	-1.0/
41	-011650000	0.0	0.0	-1.0/
41	-011660000	0.0	0.0	-1.0/
42	011660000	-.259	0.0	.966/
42	011670000	-.259	0.0	.966/
42	011680000	-.259	0.0	.966/
42	011690000	-.259	0.0	.966/
42	011700000	-.259	0.0	.966/
42	011710000	-.259	0.0	.966/
42	011720000	-.259	0.0	.966/
42	011730000	-.259	0.0	.966/
42	011740000	-.259	0.0	.966/
42	011750000	-.259	0.0	.966/
42	011760000	-.259	0.0	.966/
42	011770000	-.259	0.0	.966/
42	011780000	-.259	0.0	.966/
43	-011670000	-.259	0.0	.966/
43	-011680000	-.259	0.0	.966/
43	-011690000	-.259	0.0	.966/
43	-011700000	-.259	0.0	.966/
43	-011710000	-.259	0.0	.966/
43	-011720000	-.259	0.0	.966/
43	-011730000	-.259	0.0	.966/
43	-011740000	-.259	0.0	.966/
43	-011750000	-.259	0.0	.966/
43	-011760000	-.259	0.0	.966/
43	-011770000	-.259	0.0	.966/
43	-011780000	-.259	0.0	.966/
43	-011790000	-.259	0.0	.966/
44	011790000	-1.0	0.0	0.0/
44	011800000	-1.0	0.0	0.0/
44	011810000	-1.0	0.0	0.0/
44	011820000	-1.0	0.0	0.0/
44	011830000	-1.0	0.0	0.0/
44	011840000	-1.0	0.0	0.0/
44	011850000	-1.0	0.0	0.0/
44	011860000	-1.0	0.0	0.0/
45	-011800000	-1.0	0.0	0.0/
45	-011810000	-1.0	0.0	0.0/
45	-011820000	-1.0	0.0	0.0/
45	-011830000	-1.0	0.0	0.0/
45	-011840000	-1.0	0.0	0.0/
45	-011850000	-1.0	0.0	0.0/
45	-011860000	-1.0	0.0	0.0/
45	-011870000	-1.0	0.0	0.0/
46	011870000	0.0	-1.0	0.0/
46	011880000	0.0	-1.0	0.0/
46	011890000	0.0	-1.0	0.0/

```
48   011900000   0.0 -1.0  0.0/
48   011910000   0.0 -1.0  0.0/
48   011920000   0.0 -1.0  0.0/
48   011930000   0.0 -1.0  0.0/
48   011940000   0.0 -1.0  0.0/
47  -011880000   0.0 -1.0  0.0/
47  -011890000   0.0 -1.0  0.0/
47  -011900000   0.0 -1.0  0.0/
47  -011910000   0.0 -1.0  0.0/
47  -011920000   0.0 -1.0  0.0/
47  -011930000   0.0 -1.0  0.0/
47  -011940000   0.0 -1.0  0.0/
47  -011950000   0.0 -1.0  0.0/
48   011950000  -1.0  0.0  0.0/
48   011960000  -1.0  0.0  0.0/
48   011970000  -1.0  0.0  0.0/
48   011980000  -1.0  0.0  0.0/
48   011990000  -1.0  0.0  0.0/
48   012000000  -1.0  0.0  0.0/
48   013010000  -1.0  0.0  0.0/
48   013020000  -1.0  0.0  0.0/
48   013030000  -1.0  0.0  0.0/
48   013040000  -1.0  0.0  0.0/
48   013050000  -1.0  0.0  0.0/
49  -011960000  -1.0  0.0  0.0/
49  -011970000  -1.0  0.0  0.0/
49  -011980000  -1.0  0.0  0.0/
49  -011990000  -1.0  0.0  0.0/
49  -012000000  -1.0  0.0  0.0/
49  -013010000  -1.0  0.0  0.0/
49  -013020000  -1.0  0.0  0.0/
49  -013030000  -1.0  0.0  0.0/
49  -013040000  -1.0  0.0  0.0/
49  -013050000  -1.0  0.0  0.0/
49  -013060000  -1.0  0.0  0.0/
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50   013070000   0.0  0.0 -1.0/
50   013080000   0.0  0.0 -1.0/
50   013090000   0.0  0.0 -1.0/
50   013100000   0.0  0.0 -1.0/
50   013110000   0.0  0.0 -1.0/
50   013120000   0.0  0.0 -1.0/
50   013130000   0.0  0.0 -1.0/
50   013140000   0.0  0.0 -1.0/
50   013150000   0.0  0.0 -1.0/
50   013160000   0.0  0.0 -1.0/
50   013170000   0.0  0.0 -1.0/
50   013180000   0.0  0.0 -1.0/
50   013190000   0.0  0.0 -1.0/
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51  -013090000   0.0  0.0 -1.0/
51  -013100000   0.0  0.0 -1.0/
51  -013110000   0.0  0.0 -1.0/
51  -013120000   0.0  0.0 -1.0/
51  -013130000   0.0  0.0 -1.0/
51  -013140000   0.0  0.0 -1.0/
51  -013150000   0.0  0.0 -1.0/
51  -013160000   0.0  0.0 -1.0/
51  -013170000   0.0  0.0 -1.0/
```

```
51  -013180000  0.0  0.0 -1.0/
51  -013190000  0.0  0.0 -1.0/
51  -013200000  0.0  0.0 -1.0/
52   013200000  1.0  0.0  0.0/
52   013210000  1.0  0.0  0.0/
52   013220000  1.0  0.0  0.0/
52   013230000  1.0  0.0  0.0/
52   013240000  1.0  0.0  0.0/
52   013250000  1.0  0.0  0.0/
52   013260000  1.0  0.0  0.0/
52   013270000  1.0  0.0  0.0/
52   013280000  1.0  0.0  0.0/
52   013290000  1.0  0.0  0.0/
53  -013210000  1.0  0.0  0.0/
53  -013220000  1.0  0.0  0.0/
53  -013230000  1.0  0.0  0.0/
53  -013240000  1.0  0.0  0.0/
53  -013250000  1.0  0.0  0.0/
53  -013260000  1.0  0.0  0.0/
53  -013270000  1.0  0.0  0.0/
53  -013280000  1.0  0.0  0.0/
53  -013290000  1.0  0.0  0.0/
53  -014000000  1.0  0.0  0.0/
99999/
 $STEPS TSTEP(1)=0.001,0.600$
```

4.11 APPENDIX A

TELEDYNE ENGINEERING SERVICES

BY JBM DATE 8-24-82
CHKD. BY SGC DATE 8-25-82
JGK 6-1-83

AMERICAN ELECTRIC POWER
DC. COOK UNITS 1 & 2
PIPE PROPERTIES

SHEET NO. 1 OF 1
PROJ. NO. 5364

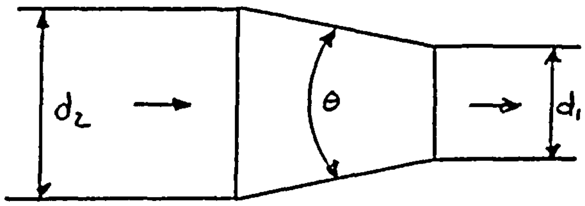
PIPE PROPERTIES

SIZE	SCHEDULE	I. D. (in.)	FLOW AREA (ft^2)	FRICTION FACTOR f	ϵ/d	ROUGHNESS ϵ (ft)	K_{ELBOW}* $12f$
3"	40	3.068	.05132	.0174	.0006	1.53×10^{-4}	.2088
3"	160	2.624	.03757	.0181	.0007	1.53×10^{-4}	.2172
4"	40	4.026	.08840	.0161	.0004	1.34×10^{-4}	.1932
4"	120	3.624	.07160	.0162	.00044	1.33×10^{-4}	.1944
6"	40	6.065	.20069	.015	.0003	1.52×10^{-4}	.1800
6"	160	5.189	.14653	.0153	.00035	1.51×10^{-4}	.1836
12"	40	11.938	.77708	.013	.00017	1.69×10^{-4}	.1560

* RESISTANCE DUE TO BEND ONLY FOR 1.5d BENDS

REF: CRANE TECHNICAL PAPER No. 410

BY JBM DATE 12-8-82 | AMERICAN ELECTRIC POWER | SHEET NO. 1 OF 1
CHKD. BY JEY DATE 12-8-82 | D.C. COOK UNITS 1 & 2 | PROJ. NO. 5364
JBT 6-1-83 | LOSSES IN REDUCERS |



$$\beta = \frac{d_1}{d_2}$$

IF: $\theta \leq 45°$

FORWARD LOSS COEFFICIENTS

$$K = 0.8\left(\sin\frac{\theta}{2}\right)(1-\beta^2)$$

REVERSE LOSS COEFFICIENTS

$$K = 2.6\left(\sin\frac{\theta}{2}\right)(1-\beta^2)^2$$

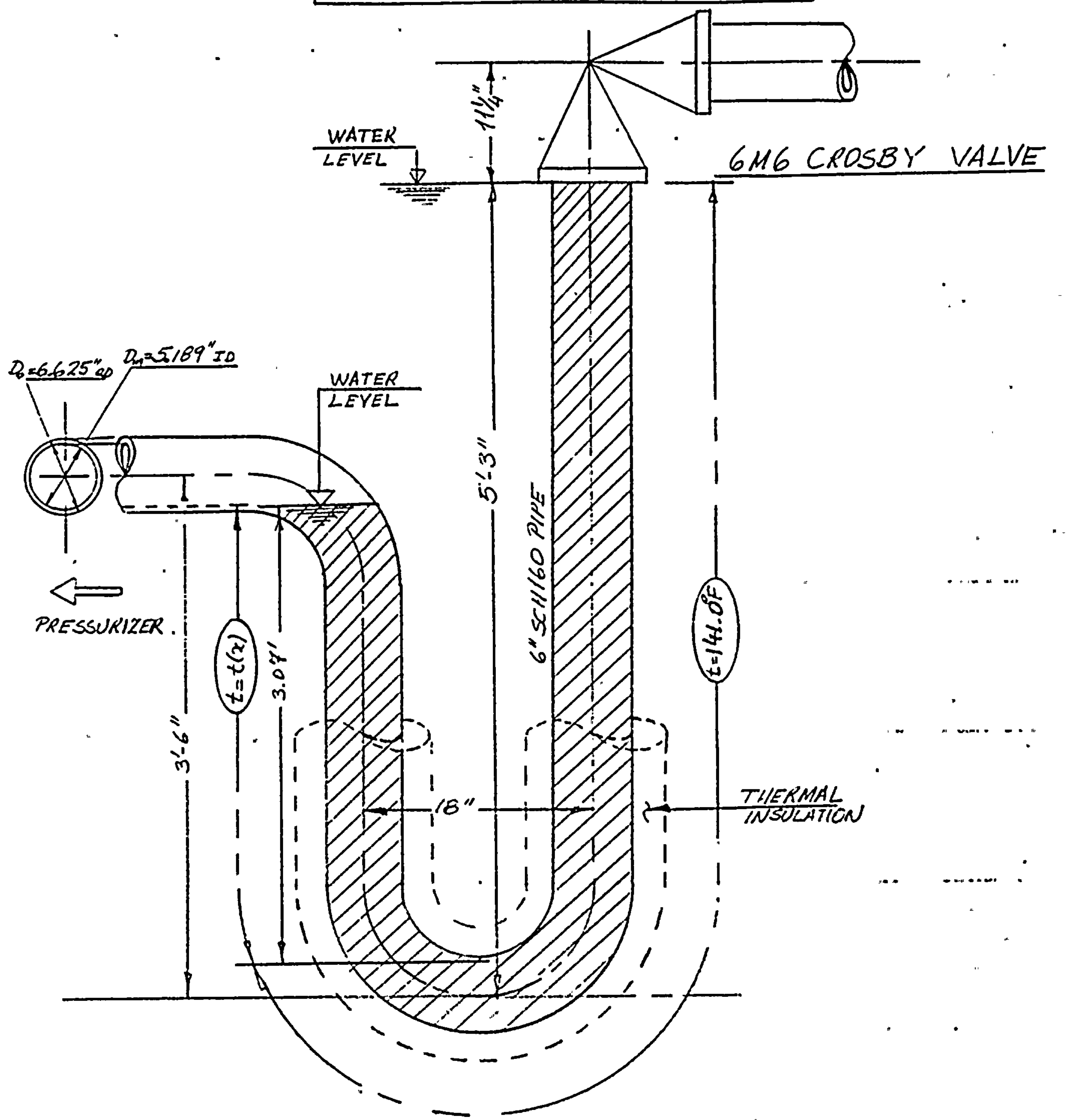
SIZE	d_1	d_2	β	θ	K, FORWARD	K, REVERSE
12" SCH 40 × 6" SCH 40S	6.065"	11.938"	.5080	40.3°	.2045	.4930
6" SCH 40S × 4" SCH 40S	4.026"	6.065	.6638	21°	.0815	.1483
4" SCH 40S × 3" SCH 40	3.068"	4.026"	.7620	13.66°	.0399	.0544
3" SCH 160 × 4" SCH 120	2.624"	3.624"	.7241	14.25°	.0472	.0730
4" SCH 120 × 6" SCH 160	3.624"	5.189"	.6984	16.19°	.0577	.0961
6" SCH 40S × 3" SCH 40	3.068"	6.065"	.5059	30.48°	.1565	.3784

REFERENCE: CRANE TECHNICAL PAPER 410 p. A-26

K IS TAKEN WITH RESPECT TO THE SMALLER DIAMETER PIPE.

BY BAT DATE 12-17-82
CHKD. BY JNM DATE 1-7-84

AEP D.C. COOK UNIT 1
SV LINE LOOP SEAL TEMP DISTRIBUTION



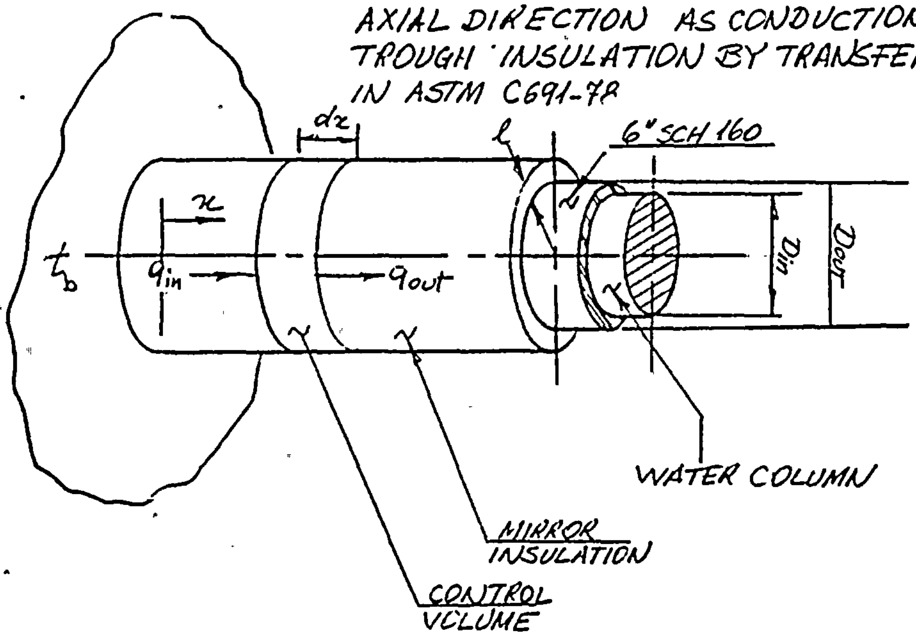
D.C. COOK UNIT 1
SAFETY VALVE LINE-LOOP SEAL
GEOMETRY

BY BAI DATE 12-17-82
CHKD. BY CMM DATE 1-7-83

A E P D.C. COOK UNIT 1
SV LINE LOOP SEAL TEMP. DISTRIBUTION

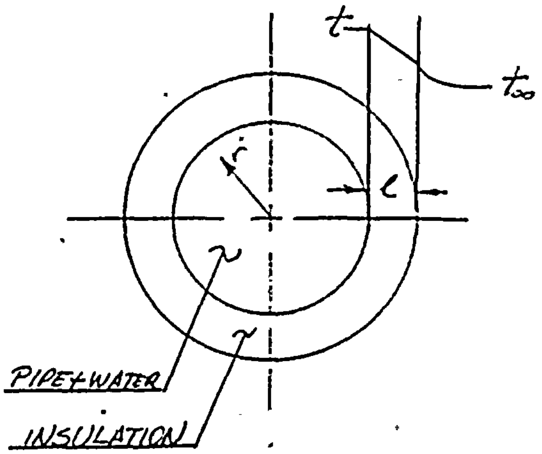
DERIVATION OF ENERGY EQUATION

ASSUMPTION 1: LOOP SEAL PIPING IS MODELED AS STRAIGHT PIPE WITH FINITE LENGTH WITH BOUNDARY CONDITIONS DESCRIBED BELOW. HEAT IS TRANSFERED BOTH IN AXIAL DIRECTION AS CONDUCTION AND IN RADIAL DIRECTION TROUGH INSULATION BY TRANSFERENCE EQUATION AS DESCRIBED IN ASTM C691-78



PIPE MODEL

ASSUMPTION 2: TEMPERATURE ACROSS CROSS-SECTION OF THE PIPE INCLUDING WATER AND WALL IS CONSTANT.



$$q_{in} \text{ (CONDUCTED INTO ELEMENT)} = \left[(KA)_{PIPE} + (KA)_{water}\right] \frac{dt}{dx}$$

$$q_{in} = -(KA)_{eff} \frac{dt}{dx} \qquad \text{WHERE } (KA)_{eff} = (KA)_{Pipe} + (KA)_{water}$$

$$q_{out} \text{ (CONDUCTED OUT OF ELEMENT)} = q_{in} + \Delta q$$

$$q_{out} = \left[-(KA)_{eff} \frac{dt}{dx} + \frac{d}{dx}\left(-KA_{eff} \frac{dt}{dx}\right) dx\right]$$

TEMPERATURE DISTRIBUTION ACROSS THE CROSS-SECTION OF PIPE

BY BAT DATE 12-17-82
CHKD. BY CHM DATE 1-7-83

AEP D.C.COOK UNIT 1
SV LINE LOOP SEAL TEMP. DISTRIBUTION

SHEET NO. 3 OF 12
PROJ. NO. 5364

$(KA)_{eff}$ = EQUIVALENT THERMAL CONDUCTANCE OF PIPE IN AXIAL DIRECTION

t = TEMPERATURE AS A FUNCTION OF x

q_s (TRANSFERED OUT OF SURFACE OF THE PIPE) $= T_r A_s (t_{in} - t_\infty)$

(REF: ASTM C691-78)

WHERE: A_s = SURFACE AREA OF PIPE $(ft^2) = \pi D_o dx$

t_{in} = TEMPERATURE OF PIPE & WATER (ASSUMED EQUAL)

t_∞ = PIPE ENVIROMENT TEMPERATURE = 120 °F

T_r = THERMAL TRANSFERENCE $\frac{Btu}{hr\text{-}ft^2\text{-}F}$

ENERGY EQUATION FOR THE CONTROL VOLUME

$$q_{in} = q_{out} + q_s$$

$$-(kA)_{eff}\frac{dt}{dx} = \left\{-(kA)_{eff}\frac{dt}{dx} + \frac{d}{dx}\left[-(kA)_{eff}\frac{dt}{dx}\right]dx\right\} + T_r \pi D_o dx (t - t_\infty)$$

$$(KA)_{eff}\frac{d^2t}{dx^2} = T_r \pi D_o (t - t_\infty)$$

LET $\theta = t - t_\infty$ THEN $\frac{d\theta}{dx} = \frac{dt}{dx}$ AND $\frac{d^2\theta}{dx^2} = \frac{d^2t}{dx^2}$

LET $m^2 = \frac{T_r \pi D_o}{(KA)_{eff}}$

THEREFORE:

$$\frac{d^2\theta}{dx^2} = m^2\theta$$

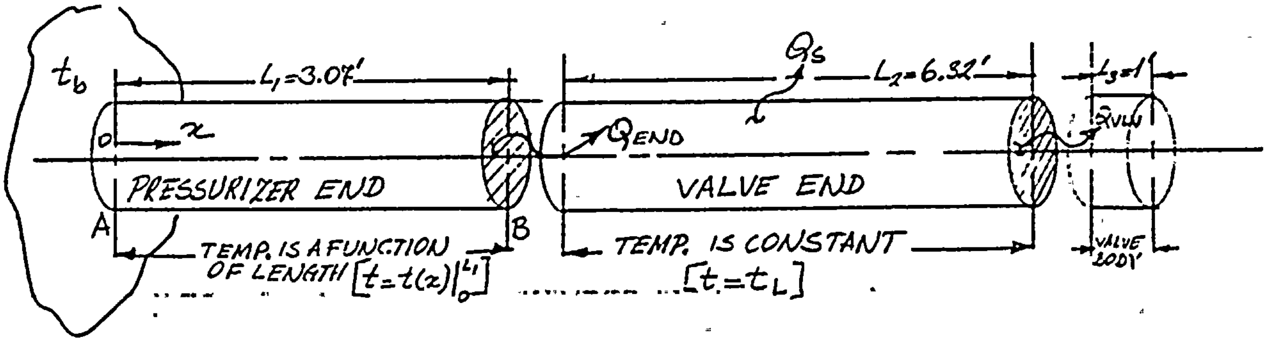
$$\theta = C_1 e^{mx} + C_2 e^{-mx}$$

$$\boxed{t = C_1 e^{mx} + C_2 e^{-mx} + 120}$$

EQUATION-(1)
GENERAL TEMPERATURE DISTRIBUTION EQN.

BY BAT DATE 12-20-82 | AEP D.C. COOK UNIT 1 S.V. LINE LOOP SEAL TEMP. DISTRIBUTION | SHEET NO. 4 OF 12
CHKD. BY MH DATE 1-7-83 | | PROJ. NO. 5364

ASSUMPTION 3.- TEMPERATURE VARIES ONLY IN THE PRESSURIZER END OF THE LOOP SEAL AND REMAINS CONSTANT AT THE VALVE END OF THE LOOP SEAL. THIS IS DUE TO THE CIRCULATION OF WATER IN THE VALVE END OF LOOP SEAL BECAUSE OF NATURAL CONVECTION (REF. PAGE 1 OF THIS ANALYSIS).



LOOP SEAL MODEL

BOUNDARY CONDITIONS FOR EQN 1

1- $x=0$ $\quad t=t_b=668°F$ (SAT. STEAM TEMP. @ 2500 psia)

2- $x=3.07$ ft $\quad -(kA)_{eff}\left.\frac{dt}{dx}\right|_{x=3.07} = Q_{END}$

$$-(kA)_{eff}\left[mC_1e^{mx}-mC_2e^{-mx}\right]=Q_{END} \quad \text{EQN. (2)}$$

C_1 AND C_2 ARE FOUND FROM EQN. 1 AND EQN. 2

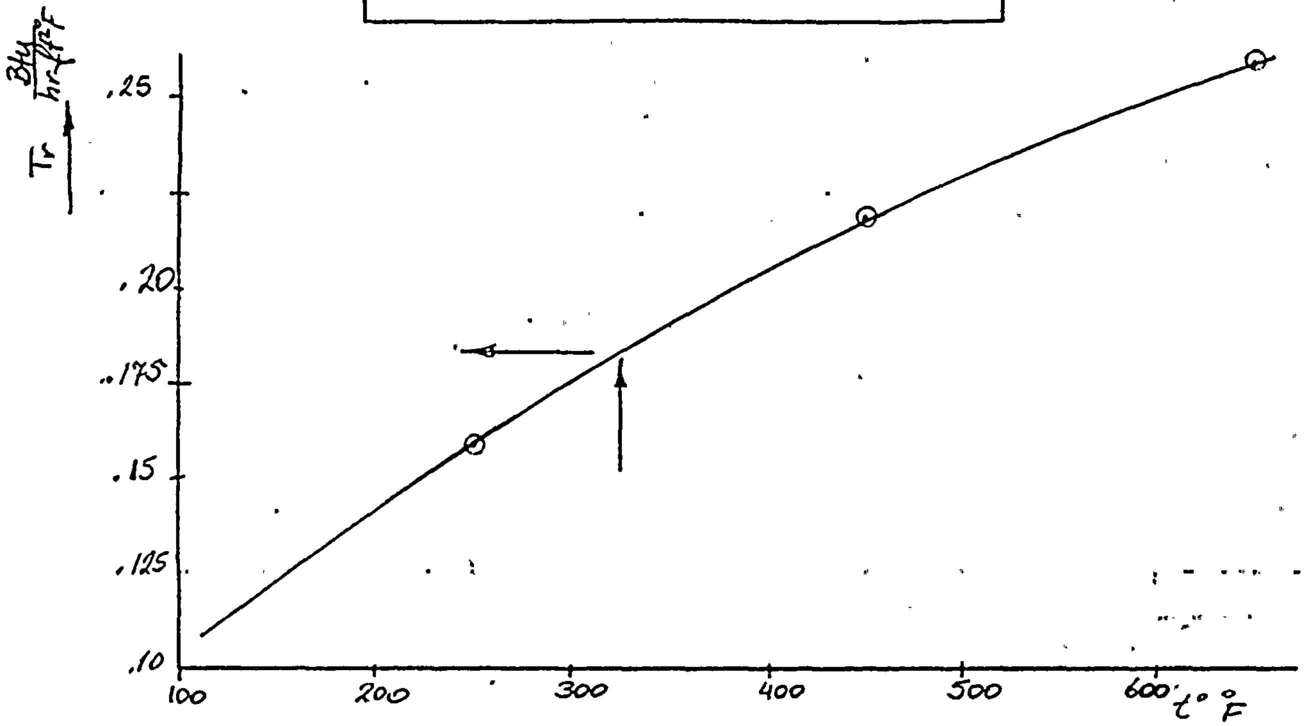
T_r (TRANSMISSIVITY) IS A FUNCTION OF TEMPERATURE AND FROM THE TELECON BETWEEN "TES" AND "DIAMOND POWER" DATED (12-16-82)

T_r $\frac{Btu}{hr\,ft^2\,°F}$	TEMP °F
0.259	650
0.219	450
0.75B	250

BY BAI DATE 12-20-82 CHKD. BY CMM DATE 1-7-83

AEP D.C. COOK UNIT 1
S.V. LINE LOOP SEAL TEMP. DISTRIBUTION

SHEET NO. 5 OF 12
PROJ. NO. 5364



PLOT OF TRANSMISSIVITY VS TEMPERATURE FROM DATA ON TELECON BETWEEN "TES" AND "DIAMOND POWER" DATED (12-16-82)

ASSUMED AVERAGE FLUID TEMPERATURE = 325 °F

FROM PLOT $T_r = 0.182 \frac{Btu}{hr\,ft^2\,°F}$ @ $t = 325°F$

$$(KA)_{eff} = (KA)_{PIPE} + (KA)_{WATER}$$

$A_{PIPE} = 13.22 \ in^2$

$A_{WATER} = 21.1 \ in^2$

ESTIMATED AVERAGE VALUES

$K_{PIPE} \simeq 7.9 \frac{Btu}{hr\text{-}ft\text{-}F}$ (REF*: PIPE MAT. SPECT DCCPM104QCS PROVIDED BY AEP AND ASME III BOILER & PRESSURE VESSEL CODE)

$K_{WATER} = 0.38 \frac{Btu}{hr\text{-}ft\,F}$ (REF = HEAT TRANSFER ; J. P. HOLMAN Fig 1.5) FIRST EDITION

$$(KA)_{eff} = 0.78 \ \frac{Btu\text{-}ft}{hr\text{-}F}$$

(*NOTE: PIPE IS MADE OF ASTM A-376 GRADE TP316 SEAMLESS AUSTENITIC STEEL)

BY BAI DATE 12-21-82
CHKD. BY CMM DATE 1-7-83

AEP D.C. COOK UNIT 1
S.V. LINE LOOPSEAL TEMP. DISTRIBUTION

ASSUME $t = 145°F$ AT VALVE END OF LOOPSEAL

$$Q_{END} = Q_S + Q_{VLV}$$

Q_S = HEAT LOSS ACROSS INSULATION FROM VALVE END OF LOOP-SEAL

$$Q_S = T_r A_S (t_L - t_\infty)$$

WHERE $A_S = D_o \pi L_2$ SURFACE AREA OF VALVE END OF LOOPSEAL

$T_r = 0.120 \frac{Btu}{ft^2 \cdot hr \cdot F}$ @ 145°F (FROM PLOT AT PAGES OF THIS ANALYSIS)

(NOTE: DIFFERENT T_r IS USED IN EQN. 1 AND Q_S SINCE MEAN TEMPERATURES ARE DIFFERENT)

$$Q_S = (0.120)(0.55 \times \pi \times 6.32)[145 - 120]$$

$$Q_S = 32.76 \ \frac{Btu}{hr}$$

VALVE END HEAT LOSS IS ASSUMED AS HEAT FLOWING TROUGH A SOLID VALVE BODY WITH $L_3 = 1'$ EQUIVALENT LENGTH AND D_o DIAMETER.

$$Q_{VLV} = (kA)_{steel} \frac{t_L - t_\infty}{L_3}$$

$$Q_{VLV} = (7.9)(0.24) \frac{145 - 120}{1.0}$$

$$Q_{VLV} = 47.28 \ \frac{Btu}{hr}$$

$$Q_{END} = Q_S + Q_{VLV}$$

$$Q_{END} = 80.04 \ \frac{Btu}{hr}$$

BY BAI DATE 12-21-82
CHKD. BY CMM DATE 1-7-83

A EP D.C. COOK UNIT 1
S.V LINE LOOP SEAL TEMP. DISTRIBUTION

SHEET NO. 7 OF 12
PROJ. NO. 5364

TEMPERATURE DISTRIBUTION EQUATION @ $0 < x < L_1 = 3.07$

$$t = C_1 e^{mx} + C_2 e^{-mx} + 120$$

SOLVE FOR C_1 AND C_2 USING BOUNDARY CONDITIONS:

$x = 0$ $\quad t = t_b = 668\ °F$ BOUNDARY CON. 1

$$-(kA)_{eff} \left.\frac{dt}{dx}\right|_{x=L_1} = Q_{END}$$ BOUNDARY CON. 2

$$-m \times 0.78 \left[C_1 e^{mL_1} - C_2 e^{-mL_1}\right] = 80.04$$

$$m = \left[\frac{T_r \pi D_o}{(KA)_{eff}}\right]^{1/2}$$

$$m = \left[\frac{0.182 \cdot \pi \cdot 0.55}{0.78}\right]^{1/2}$$

$m = 0.64$

SUBSTITUTING BOUNDARY CONDITIONS:

FROM B.C. 1 $\quad C_1 e^{0.64(0)} + C_2 e^{-0.64(0)} = 548$ ———— EQN. (2)

FROM B.C. 2 $\quad -C_1 e^{0.64L_1} + C_2 e^{-0.64L_1} = (2.)[Q_s + Q_{NV}]$ ———— EQN. (3)

AFTER SUBSTITUTING

$C_1 + C_2 = 548$

$-7.13\, C_1 + 0.14\, C_2 = 160.08$

TWO EQUATIONS WITH TWO UNKNOWNS. AFTER SOLVING

$C_1 = -11.5$ AND $C_2 = 559.50$

[illegible]

TEMPERATURE DISTRIBUTION EQUATION BECOMES

$$t = -11.5\, e^{0.64x} + 559.5\, e^{-0.64x} + 120 \quad @ \quad 0 < x < 3.07$$

CHECKING ASSUMED $t = t_L = 145°$ @ $x = 3.07$ ft

PROCEDURE: FIND A(t) BY SUBSTITUTING $x = 3.07$ AND COMPORE THIS (t) BY ASSUMED $t = 145°F$

$$t = -11.5\, e^{(0.64)(3.07)} + 559.5\, e^{-(0.64)(3.07)} + 120$$

$$t_{found} = 116.44\ °F < t_{ass} = 145°\ F$$

ASSUME: $t = t_L = 135°F$

EQN.S (2) AND (3) BECOMES :

$$\begin{cases} C_1 + C_2 = 54.8 \\ -7.13\, C_1 + 0.14\, C_2 = 96.20 \end{cases}$$

$Q_{VLV} = 28.44$ Btu/hr
$Q_S = 19.66$ Btu/hr
$Q_{END} = 48.10$

AFTER SOLVING

$C_1 = -2.68$

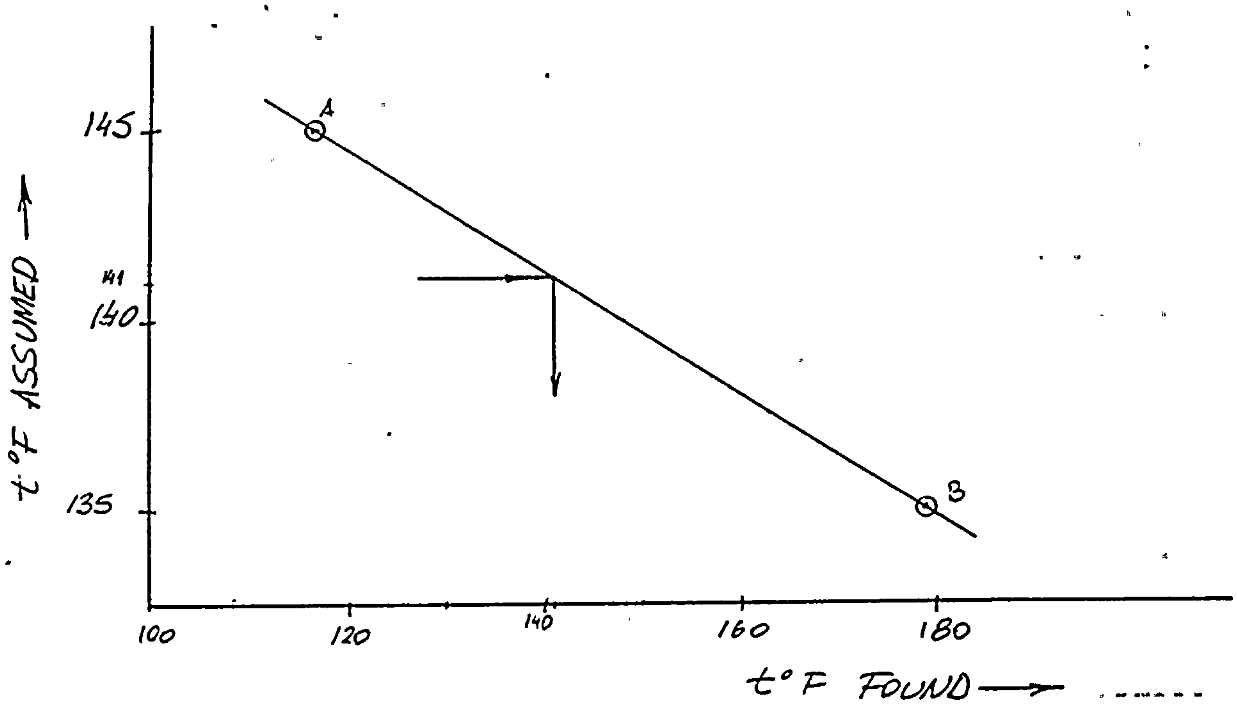
$C_2 = 550.68$ AND TEMP. DISTRIBUTION:

$$t = -2.68\, e^{0.64x} + 550.68\, e^{-0.64x} + 120$$

@ $x = 3.07$ $t_{found} = 178.08\ °F > t_{ass} = 135°\ F$

[illegible]

BY BAI DATE 12-21-82 | A E P D. C. COOK UNIT 1 | SHEET NO. 9 OF 12
CHKD. BY CLM DATE 1-7-83 | S. V. LINE LOOP SEAL TEMP. DISTRIBUTION | PROJ. NO. 5364



AFTER PLOTING t_{ass} VS. t_{FOUND} AND BY VISUAL INTERPOLATION
(PROCEDURE: FIND $t_{ass} = t_{found}$ ON LINE A-B)
NEW $t_{ass} = 141\,°F$

SUBSTITUTING $t_{ass} = 141\,°F$, INTO EQN (2) AND EQN (3)

$$Q_S = 27.52\ \frac{Btu}{hr}$$

$$Q_{VLV} = 39.82\ \frac{Btu}{hr}$$

$$Q_{END} = 67.34\ Btu/hr$$

$$\begin{cases} C_1 + C_2 = 548 \\ -7.13C_1 + 0.14C_2 = 134.67 \end{cases}$$

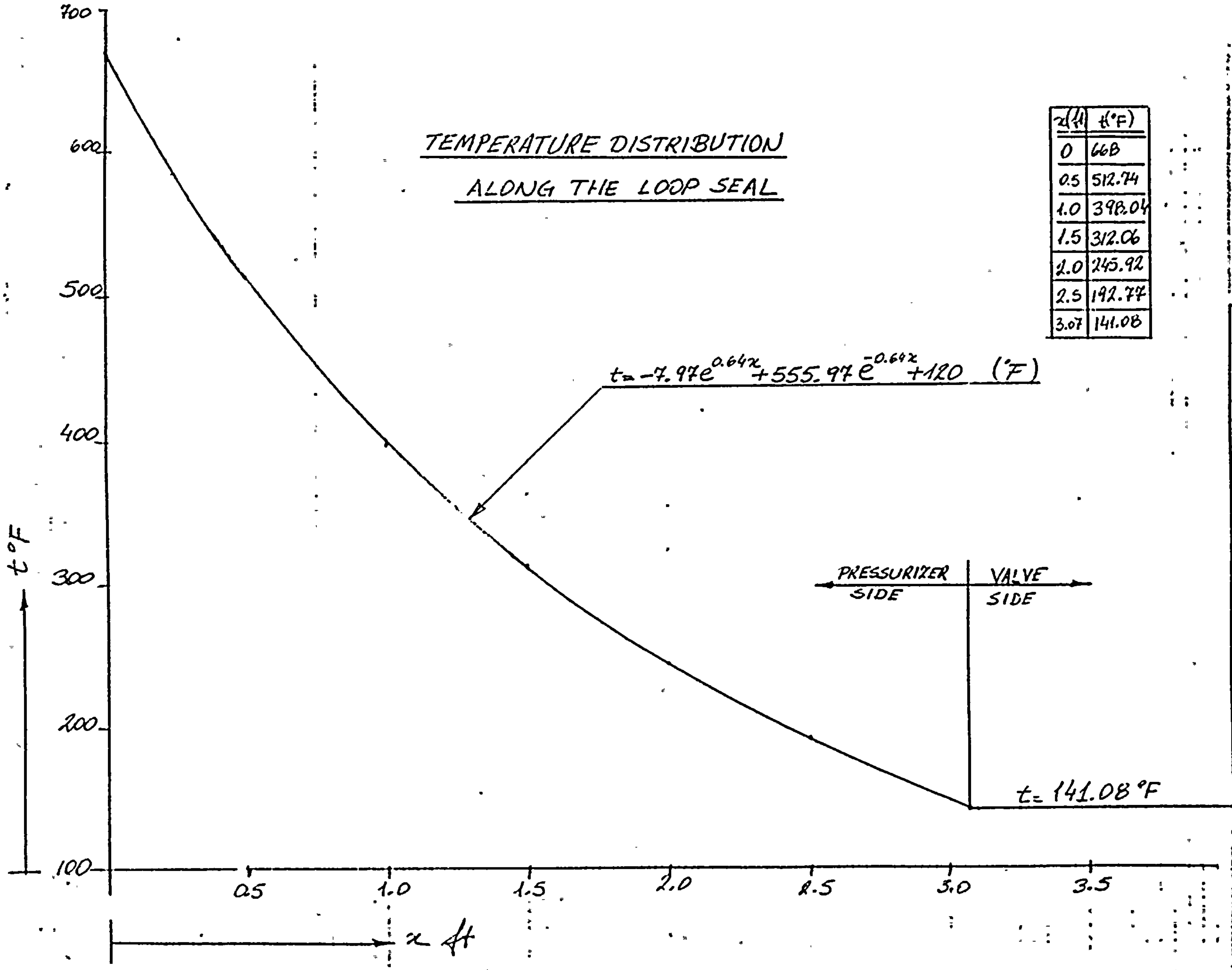
$$C_1 = -7.97 \qquad C_2 = 555.97$$

$$t = -7.97e^{0.64x} + 555.97e^{-0.64x} + 120$$

$@\ x = 3.07$; $t_{FOUND} = 141.08\ °F \approx t_{ass} = 141.00$

TEMPERATURE DISTRIBUTION ALONG THE LOOP SEAL

x (ft)	t (°F)
0	668
0.5	512.74
1.0	398.04
1.5	312.06
2.0	245.92
2.5	192.77
3.07	141.08



[illegible]

CHECKING $T_r = 0.182 \frac{Btu}{hr\,ft^2\,°F}$ FOR $T_{AVE} = 325°F$ (PAGE 5)

AREA UNDER $t = t(x)$ CURVE @ $0 < x < L_1 = 3.07'$

$$AREA = \int_0^{L_1} t(x)\,dx$$

$$= \int_0^{L_1} \left[-7.97e^{(0.64)x} + 555.97e^{-(.64)x} + 120\right] dx$$

$$= -\frac{7.97}{0.64} e^{0.64x}\Big|_{x=0}^{3.07} - \frac{555.97}{0.64} e^{-(.64)x}\Big|_{x=0}^{3.07} + 120x\Big|_{x=0}^{3.07}$$

$$= (-88.83 + 12.45) - (121.78 - 868.70) + (368.4)$$

$$AREA = 1038.94 \; °F\,ft$$

$$\bar{t}_{AVE} = \frac{1038.94}{3.07}$$

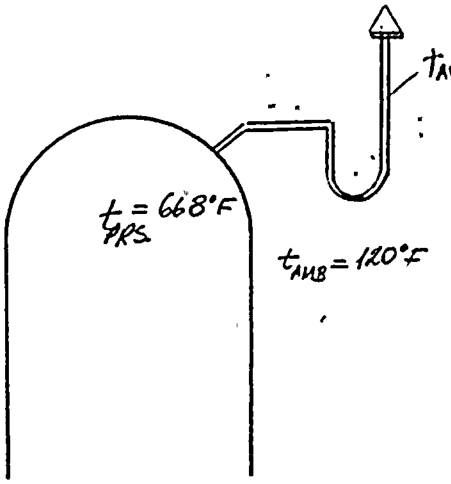
$t_{AVE} = 338.42°F$ — 4% DIFFERENCE FROM THE ASSUMED $t_{AVE} = 325°F$ WHICH IS ACCEPTABLE

[illegible]

TELEDYNE ENGINEERING SERVICES

BY BAI DATE 12-22-82 | AEP D.C. COOK UNIT 1 S.V. LINE LOOPSEAL TEMP. DISTRIBUTION | SHEET NO. 12 OF 12
CHKD. BY MU DATE 1-7-83 | PROJ. NO. 5364

CHEKING THE RADIATION EFFECTS ON LOOP SEAL BY TAKING CONSERVATIVE VALUES FOR THE WORST CASE ...



ASSUME THE LOOPSEAL AS LUMPED VOL.

AVERAGE TEMPERATURE OF LOOP SEAL ......

$$t_{AVE}\Big)_{L.S} = \frac{C\rho A L_1 (338.42) + C\rho A L_2 (141.08)}{C\rho A (L_1 + L_2)} = 205.6$$

$t_{AVE} = 205.60°F = 665.60 °R$ $L_1 = 3.07'$

WHERE = ρ : DENSITY $L_2 = 6.32'$
A : CROSS-SECTIONAL AREA
C_p : HEAT CAPACITY

FROM PAGE 5 $T_r = .145 \frac{Btu}{hr\, ft^2 °F}$ @ $t = 212.71 °F$

$$\frac{q}{A} = (.145)(205.6 - 120) = 12.41 \frac{Btu}{hr\, ft^2}$$

T_S – SURFACE TEMP. OF LOOP SEAL USING NEWTON'S LAW OF COOLING ; $h = 5 \frac{Btu}{hr\, F\, ft^2}$

$12.41 = 5(T_S - 120)$
$t_S = 122.48 °F$

PRESSURIZER :

MAX. HEAT LOSS FROM PRESSURIZER $\frac{q}{A} = 80 \frac{Btu}{ft^2 F\, hr}$ (REF: METALLIC INSULATION AEP SPEC. NO. DCCSG102QCS

t_p SURFACE TEMP. OF PRESSURIZER $80 = 5(t_p - 120)$

$t_p = 136°$

ASSUMING : RADIATION SHAPE FACTORS = 0.5
EMISSIVITY $\epsilon \cong 0.03$ (SINCE SURFACES ARE MIRROR)
(REF: MARKS MECH. ENG. HANDBOOK 6th EDITION)

STEFAN-BOLTZMANN CONST. $\sigma = 0.1714 \times 10^{-8} \frac{Btu}{hr\, ft^2 R^4}$

$$\frac{q}{A}\Big)_{RAD} = \sigma \epsilon F_{12} (T_p^4 - T_S^4) = (0.03)(0.5)(.1714 \times 10^{-8})[596^4 - 582^4]$$

$$\frac{q}{A}\Big)_{RAD.} = 0.294 \frac{Btu}{hr - ft^2}$$

RADIATION HEAT TRANSFER HAS NEGLIGIBLE EFFECT ON LOOP SEAL TEMP. DISTRIBUTION

TELEDYNE ENGINEERING SERVICES

BY CMM DATE 1-11-82
CHKD. BY KG DATE 5-24-83

TEMPERATURE DISTRIBUTION DETERMINATION – UNIT 2

SHEET NO. 1 OF 1
PROJ. NO. 5364

USING THE EQUATION:

$$t = -7.97e^{0.64x} + 555.97e^{-0.64x} + 120 \ (°F).$$

WHERE x = AXIAL DISTANCE AWAY FROM PRESSURIZER ALONG LOOP SEAL

ACCURATE $0 \leq x \leq 3.07$ (FT)

FOR VALUES $x > 3.07$ $t = 141.08$ °F

REF: BAI HAND CALC 12-22-82

CONTROL VOLUME	x VALUE (FT)	t (DETERMINED) (°F)
501	0.25	584.4
502	0.75	451.1
503	1.25	352.1
504	1.75	276.8
505	2.25	218.1
506	2.75	169.3
507	3.25	141.1
↓		↓
520	VALVE	

TELEDYNE ENGINEERING SERVICES

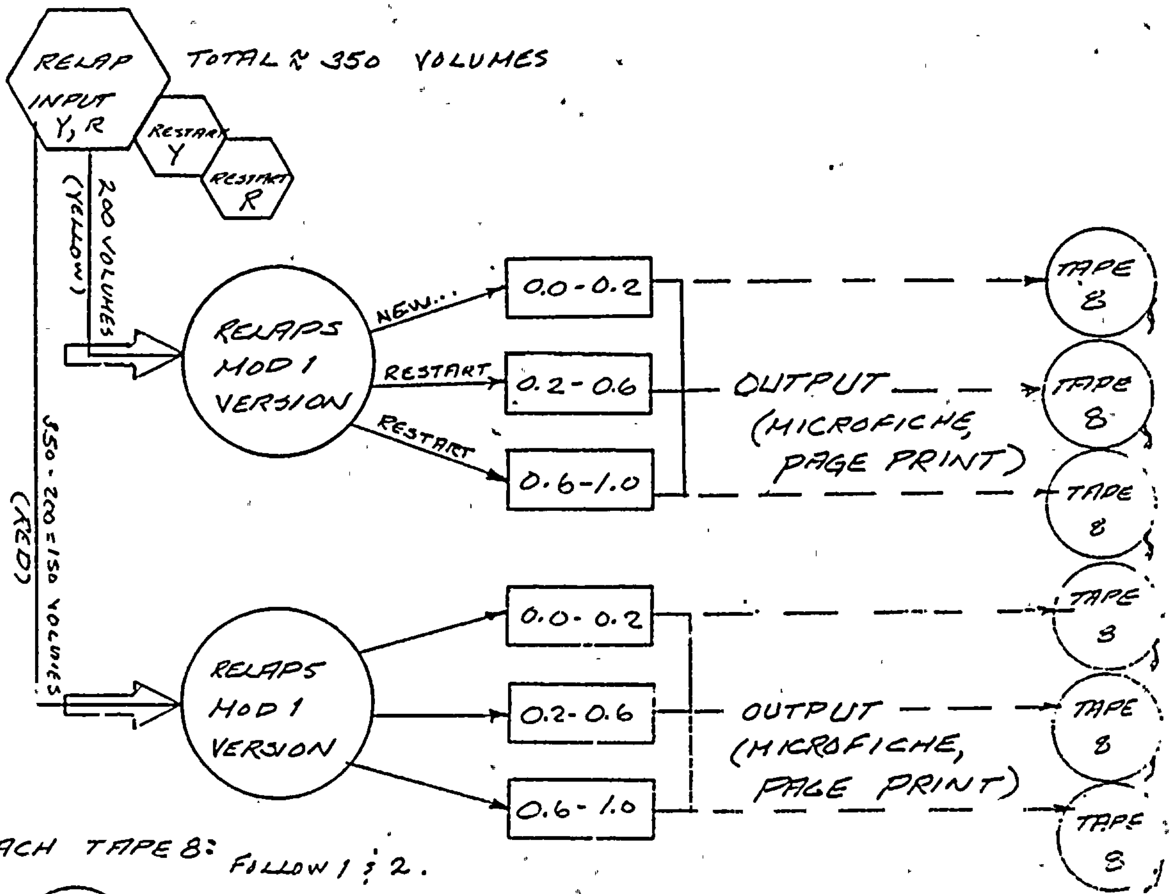
BY CHM DATE 5-4-83
CHKD. BY KYG DATE 5-24-83

COMPUTER USAGE FOR THERMAL ANALYSIS

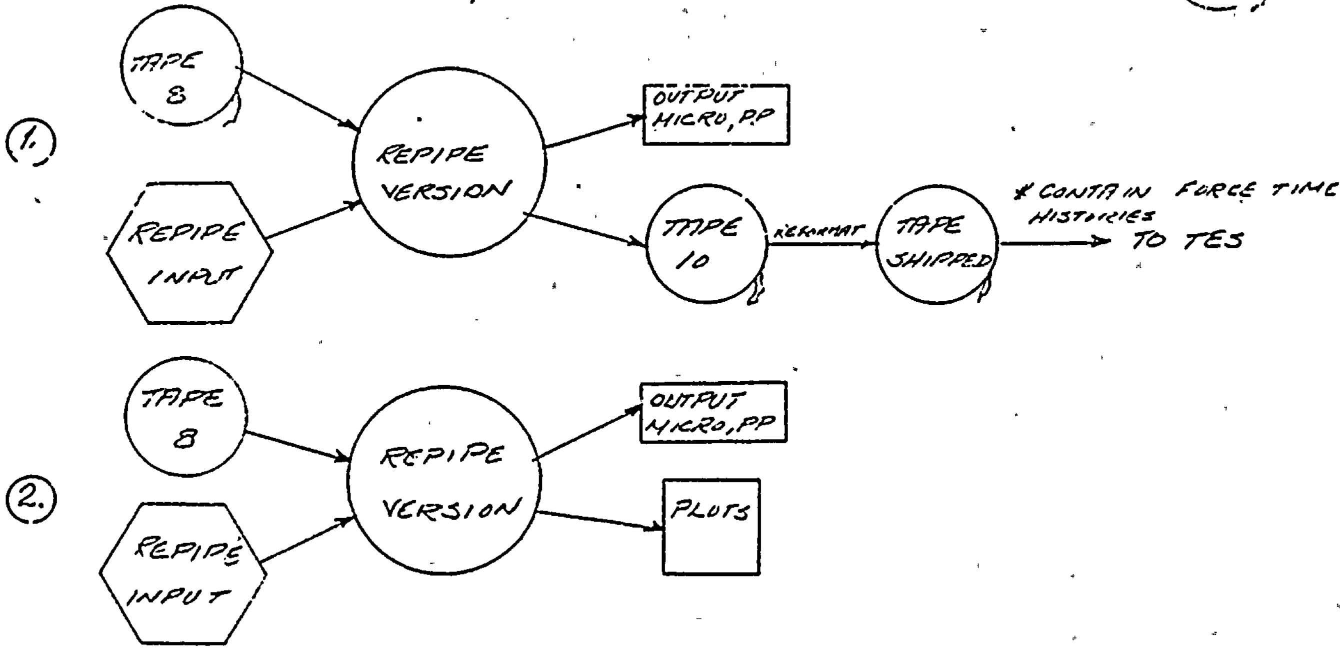
SHEET NO. 1 OF 2
PROJ. NO. 5364

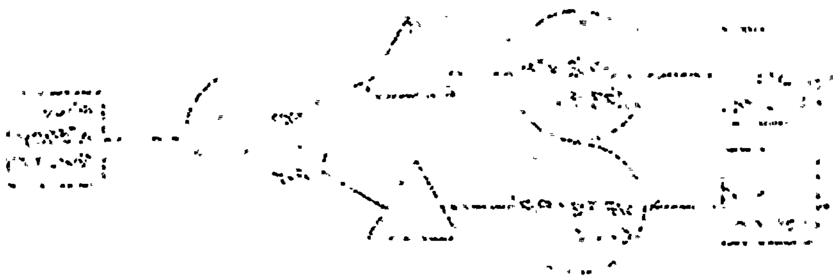
TRANSIENTS:

1. LOOPSEAL (SATURATED) STEAM CASE @CDC
2. SOLID 400° WATER CASE



FOR EACH TAPE 8: FOLLOW 1 & 2.



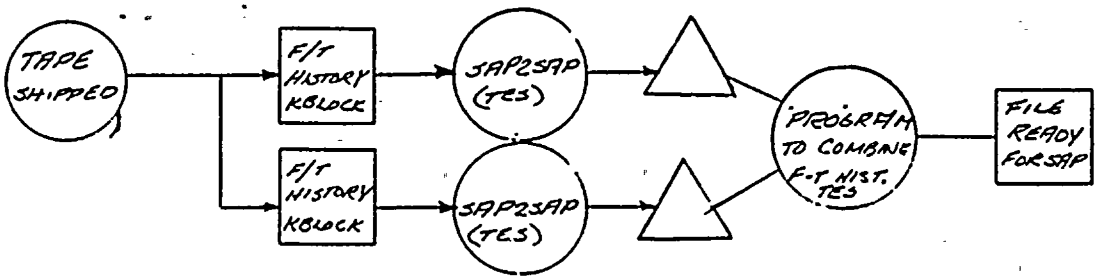


TELEDYNE ENGINEERING SERVICES

BY CHM DATE 5-4-83
CHKD. BY KJG DATE 5-24-83

COMPUTER USAGE FOR THERMAL ANALYSIS.

SHEET NO. 2 OF 2
PROJ. NO. 5364



BY CMM DATE 3-28-83
CHKD. BY KJG DATE 5-9-83

PORV UNIT 1 BOUNDARY CONDITIONS

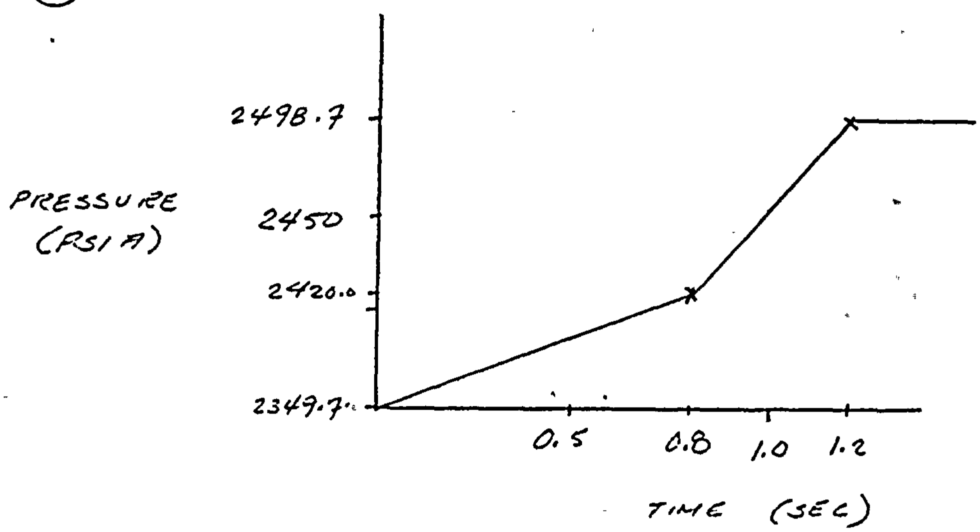
SHEET NO. 1 OF 1
PROJ. NO. 5364

(1.) VALVE OPENING TIME, PORV : 1.0 SEC

MASONEILAN : REF :

(TIME) REF: TABLE 4.5.2-1 PG 4-50 EPRI SAFETY & RELIEF VALVE TEST REPORT (RP-V102)

(2.) PRESSURIZER CONDITIONS :



REF : AEP LETTER TO LGS 11-29-82 / CURVE PG 6 OF 7

(3) VALVE FLOW AREA CALCULATED KNOWING ASME FLOW RATE = 199,000 lbm/HR. REF: PG 4-53 EPRI SAFETY AND RELIEF VALVE TEST REPORT (RP-V102) AND RUN BAICDRD AREA = 0.00806 FT²

(4.) QUALITY USED IN UPSTREAM PIPING TO SIMULATE CONDENSATE SEE KJG CALC

TELEDYNE ENGINEERING SERVICES

BY CHM DATE 5-24-83 | NON-CONDENSIBLE GAS QUALITY CALCULATION FOR INITIAL COND. UNITS 1 & 2 | SHEET NO. 1 OF 1
CHKD. BY [initials] DATE 5-26-83 | | PROJ. NO. 5364

FOR INITIAL CONDITIONS OF:

$P_T = 17.7$ psia

$T = 120°$ F $\qquad P_V = 1.6924$ psia

SPECIFIC HUMIDITY $\quad \gamma = \frac{M_w}{M_a} = \frac{\text{MASS OF WATER VAPOR}}{\text{MASS OF AIR}} = \frac{V_a}{V_w}$

$$\gamma = \frac{R_a T / P_a}{R_w T / P_w} = 0.622 \frac{P_w}{P_a}$$

$$\gamma = 0.622 \frac{1.6924 \text{ psia}}{16.008 \text{ psia}}$$

$$\gamma = 0.06576$$

NONCONDENSIBLE GAS (AIR) QUALITY $= 1 - \gamma = 0.93424$

m

TECHNICAL REPORT TR-5364-1
REVISION 0

BOOK 3 OF 15

DONALD C. COOK NUCLEAR GENERATING PLANT

ANALYSIS OF PRESSURIZER SAFETY/RELIEF VALVES DISCHARGE PIPING SYSTEM PER NUREG 0737, II.D.1, UNIT 1

JUNE 6, 1983

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

AMERICAN ELECTRIC POWER SERVICE CORPORATION
2 BROADWAY
NEW YORK, NEW YORK 10004

TECHNICAL REPORT TR-5364-1
REVISION 0

BOOK 3 OF 15

DONALD C. COOK NUCLEAR GENERATING STATION

ANALYSIS OF PRESSURIZER SAFETY/RELIEF VALVES DISCHARGE PIPING SYSTEM PER NUREG 0737, II. D.1, UNIT 1

JUNE 6, 1983

TELEDYNE ENGINEERING SERVICES

130 SECOND AVENUE
WALTHAM, MASSACHUSETTS 02254
617-890-3350

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

TABLE OF CONTENTS

TELEDYNE ENGINEERING SERVICES

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

5.0 STRUCTURAL ANALYSIS

Deadweight, thermal, seismic and force/time history analyses were performed for the pressurizer safety and relief valve discharge piping using the TMRSAP computer program; a modified version of SAPIV. The computer model used was based on TES isometric drawing E-5763, Revision 2 which is shown in Section 7.0. In general, the structural analysis was done in accordance with AEP letter dated November 29, 1982 from Mr. Sam Ulan of AEP to Mr. L. B. Semprucci of TES (Reference 2) and AEP letter dated March 15, 1983 from Mr. Sam Ulan of AEP to Mr. Pat Harrison of TES (Reference 3). Section 6.0 contains all of the results for the analyses performed.

Only the piping shown on drawing E-5763 was included in the analysis. Branch lines not in the scope of work were decoupled in accordance with the procedure outlined in TES letter 5364-21 dated February 2, 1983 (Reference 8); that is if the moment of inertia of the main run of pipe is greater than or equal to 40 times the moment of inertia of the branch, the branch line was decoupled.

Valve drawing 88405-1 listed the weight of valves NMO-151, 152 and 153 as being 352 pounds and this value was used by TES in the deadweight and seismic analyses. However, per Reference 7, TES was informed by AEP that the valve weight was actually 400 pounds. TES immediately reran the deadweight and seismic analyses and observed a minor increase in seismic results, which were offset by a decrease in deadweight results. The decrease in deadweight results, in the opinion of TES, indicates the constant force supports near the valves are over supporting the pipe. The net result of the valve weight change was considered negligible and since pipe stresses and support loads had already been extracted and calculated based on the 352 pound valve weight, it was decided not to revise the deadweight and seismic analyses. The valve weight was changed to 400 pounds prior to executing the force/time history analysis.

5.1 Deadweight Analysis

The effects of pipe weight, water weight and insulation weight were considered in the deadweight analysis. In addition, concentrated weights were located wherever branch lines were decoupled, at flanges, and at valve cg's. The weights used for decoupled branch lines were calculated in accordance with the procedure defined in TES letter 5364-25, dated February 14, 1983 (Reference 9). Per Reference 3, only the normal operation deadweight case was analyzed.

A summary of the weights and forces applied in the deadweight analysis are shown in Table 5-1.

5.2 Thermal Analysis

Two thermal cases were analyzed; normal operation and PORV operation. Temperature distributions for the PORV case were obtained from the RELAP5 output. Throughout this report, thermal case 1 refers to normal operation and thermal case 2 refers to PORV operation.

Boundary displacements were calculated for the quench tank nozzle, pressurizer nozzles and support 1-GRC-R-616, which connects to the pressurizer, for both thermal conditions analyzed. These calculations are shown in Section 6.6.

5.3 Seismic Analysis

Seismic analysis was performed for both the operating basis earthquake (OBE) and design basis earthquake (DBE). For each of these conditions, two analyses were made; one considering response spectra applied in the X and Y directions and one considering response spectra applied in the Y and Z directions. The results in Section 6 will be based on the greater of these two analyses for all values reported.

BY ____ DATE ____

CHKD ____ DATE ____

PAGE ____ OF ____

COMMENTS	INSULATION/WATER
W	I
W	I
W	I

TEST WEIGHT

WEIGHT LBS
122
[illegible]

REMARKS AT THE ... DIRECTION

... IS TYPICAL

COMMENTS	INSULATION/WATER
W	I
W	(I)
(W)	(I)
W	(I)

WEIGHT LBS.
19
565
[illegible]

TECHNICAL REPORT TR - 5364 - 1
REV. NO. 0

TELEDYNE ENGINEERING SERVICES

PROJECT: 5364 6 JUNE 1983
D. C. COOK UNIT 1
DEADWEIGHT DATA TABLE 5-1

BY DMD DATE 6/6/83
CHKD PDA DATE 6/6/83
SHEET NO.____ OF ________

MAIN RISER

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER		
1	12" SCH. 40	34.748 *	(P)	I	W
4 THRU 206	12" SCH. 40	4.458	(P)	I	W
260 THRU 295	6" SCH. 40S	1.582	(P)	I	W

* FLANGE WEIGHT DISTRIBUTED OVER 2.042' ADDED TO PIPE WEIGHT.

APPLIED FORCES

NODE	FORCE LBS.
48	426
70	1200

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
1000	122
1001	20

NOTE; APPLIED FORCES REPRESENT THE SETTINGS OF CONSTANT FORCE SUPPORTS AT THE NODES INDICATED. ALL FORCES ARE APPLIED IN THE +Y GLOBAL DIRECTION.

SRV LOOP C (REFERS TO SRV LOOP CONTAINING VALVE SV-45C, THIS NOTATION IS TYPIC OF LOOPS B AND A ALSO.)

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER		
97 THRU 109	6" SCH. 40S	1.582	(P)	I	W
110 THRU 115	6" SCH. 40S	2.632	(P)	(I)	W
120 THRU 130	6" SCH. 160	5.575	(P)	(I)	(W)
132 THRU 138	6" SCH. 160	4.904	(P)	(I)	W

APPLIED FORCES

NODE	FORCE LBS.
101	142
111	1067

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
116	.81
1170	685
118	164

TECHNICAL REPORT TR - 5364 - 1
REV. NO. 0

TELEDYNE ENGINEERING SERVICES

PROJECT: 5364 6 JUNE 1983
D. C. COOK UNIT 1
DEADWEIGHT DATA Table 5-1 (Cont)

BY DMD DATE 6/6/83
CHKD RDH DATE 6/6/83
SHEET NO.____ OF ____

SRV LOOP B

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER
142 THRU 157	6" SCH. 40S	1.582	(P) I W
158 THRU 165	6" SCH. 40S	2.632	(P) (I) W
170 THRU 180	6" SCH. 160	5.575	(P) (I) (W)
181 THRU 185	6" SCH. 160	4.904	(P) (I) W

APPLIED FORCES

NODE	FORCE LBS.
159	1074

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
164	81
1660	685
168	164

SRV LOOP A

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER
206 THRU 216	6" SCH. 40S	1.582	(P) I W
220 THRU 225	6" SCH. 40S	2.632	(P) (I) W
229 THRU 237	6" SCH. 160	5.575	(P) (I) (W)
238 THRU 244	6" SCH. 160	4.904	(P) (I) W

APPLIED FORCES

NODE	FORCE LBS.
221	1025

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
224	81
2260	685
228	164

TELEDYNE ENGINEERING SERVICES

PROJECT: 5364 6 JUNE 1983
D. C. COOK UNIT 1
DEADWEIGHT DATA Table 5-1 (Cont)

BY Dmb DATE 6/6/83
CHKD PDH DATE 6/6/83
SHEET NO. ____ OF ____

PORV LOOP 153 (REFERS TO PORV LOOP CONTAINING VALVES NMO-153 AND NRV-153, THIS NOTATION IS TYPICAL OF LOOPS 152 AND 151 ALSO.)

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER		
295	6" SCH. 40S	1.58	P	I	W
560 THRU 534	3" SCH. 40S	.632	(P)	I	W
533 THRU 525	3" SCH. 40S	1.190	(P)	(I)	W
510 THRU 480	3" SCH. 160	1.948	(P)	(I)	(W)
475 THRU 450	3" SCH. 160	1.753	(P)	(I)	W
440 THRU 590	4" SCH. 120	2.200	(P)	(I)	W
595 THRU 750	6" SCH. 160	4.825	(P)	(I)	W

APPLIED FORCES

NODE	FORCE LBS.
529	658
485	811
668	1159

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
516	480
496	352
1002	14
1003	14

TELEDYNE ENGINEERING SERVICES

PROJECT: 5364 6 JUNE 1983
D. C. COOK UNIT 1
DEADWEIGHT DATA Table 5-1 (Cont)

BY DmD DATE 6/6/83
CHKD PDH DATE 6/6/83
SHEET NO._____ OF __________

PORV LOOP 152

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER		
300 THRU 335	4" SCH. 40S	.899	(P)	I	W
340 THRU 370	3" SCH. 40S	.632	(P)	I	W
375 THRU 385	3" SCH. 40S	1.190	(P)	(I)	W
400 THRU 435	3" SCH. 160	1.948	(P)	(I)	(W)

APPLIED FORCES

NODE	FORCE LBS.
382	638
431	930

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
391	480
411	352

PORV LOOP 151

NODES	PIPE SIZE	DIST.WEIGHT LBS/IN	CONTENTS PIPE/INSULATION/WATER		
335	3" SCH. 40S	.632	(P)	I	W
610 THRU 625	3" SCH. 40S	1.190	(P)	(I)	W
635 THRU 660	3" SCH. 160	1.948	(P)	(I)	(W)

APPLIED FORCES

NODE	FORCE LBS.
620	783

CONCENTRATED WEIGHTS

NODE	WEIGHT LBS.
631	480
651	352

NOTE: THE VALVE WEIGHTS OF 352 LBS. LISTED FOR THE THREE PORV LOOPS I KNOWN TO BE INCORRECT. PER AMENDED INFORMATION, THESE WEIGHTS WERE CHANGED TO 400 LBS. THE 48 LB. DIFFERENCE WAS, HOWEVER, DETERMINED T HAVE NEGLIGIBLE AFFECT ON THE ANALYSIS. (SEE SECTION 5)

For the OBE analysis, the horizontal spectra was obtained by enveloping Containment Crane Wall Figures for elevations 651'-3", 663'-4", 675'-4" and 687'-6". The figures used were based on .5% equipment damping and 2% structural damping. Prior to enveloping the figures, the peaks of each curve were broadened +/-15%, in accordance with NRC Regulatory Guide 1.122.

For the vertical direction Containment Base Slab, elevation 597'6" was used with .5% equipment damping and 2% structural damping. The peaks of this curve were also broadened +/-15% and two-thirds of the value obtained from the figure was used in the spectra.

For the OBE analysis, the spectra were obtained for the horizontal and vertical directions in the same manner as for the horizontal direction; except that 5% structural damping was used rather than 2%.

The procedures described above are in accordance with the November 29, 1982 letter from AEP (Reference 2) and TES letter 5364-33, dated April 8, 1983 (Reference 10).

The peak broadened figures used and spectra obtained are detailed in Section 6.6.

5.4 Force/Time History Analysis

5.4.1 PORV Transient

Two potential PORV transients exist, condensate and solid water. Based on a preliminary analysis by TES, it was determined that the solid water case was the dominating condition throughout the piping system. Based on these results, only the solid water case was analyzed.

The solid water analysis was performed at one millisecond intervals for a length of one second. All loads peaked previous to one second, indicating that the analysis was performed for a sufficient length of time.

5.4.2 SV Transient

The SV transient condition was not analyzed for Unit 1 based on the quarter model SV transient analysis performed for Unit 2. That analysis, which considered the opening of only one SV valve, resulted in catastrophic failure of the piping system. Due to the similarity of the Unit 1 and Unit 2 piping systems, it was considered not justifiable economically to analyze the SV transient for Unit 1 until the system was modified. The results of the 1/4 model SV analysis are given in TES Technical Report TR-5364-2, Revision 0 (Reference 6).

6.0 ANALYTICAL RESULTS

6.1 Stress Summary

Stress calculations were based on the 1967 Edition of the ANSI B31.1 Code (Reference 11), the AEP letter dated November 29, 1982 (Reference 2), and the AEP letter dated March 15, 1983 (Reference 3). The stress combinations performed were:

A1 normal pressure stress + deadweight stress $< S_h$

A2 normal thermal stress range $< (1.25\ S_c + .25\ S_h)$

B1 normal pressure stress + deadweight stress + OBE stress $< 1.2\ S_h$

B2 PORV transient pressure stress + deadweight stress + $\left[(\text{OBE stress})^2 + (\text{PORV transient shock stress})^2\right]^{1/2} < 1.2\ S_h$

B3 PORV transient thermal stress range $< (1.25\ S_c + .25\ S_h)$

C1 normal pressure stress + deadweight stress + DBE stress $< 1.8\ S_h$

Stresses were not calculated for equation A3 since all node points passed the equation A2 stress criteria. The equation C2 stresses were not calculated since the SV transient shock analysis was not performed, based on the Unit 2 Quarter model analysis (see Section 5.4.2). Equation C3 stresses do not exist since TES did not analyze for the SV transient thermal condition, see Section 5.2.

The TMRPASS computer program was used, when possible, to aid in the stress calculations. The program; however, does not allow for intensification factors to be omitted in the torsional direction as does the B31.1 code. Therefore, the stresses presented consider, at any intensified nodes, all moments

to be intensified. For equation B2, three nodes, (540, 533 and 435B), originally failed this more conservative method. In order to not exceed the stress criteria at these nodes, the intensification factor was removed, by hand calculations, in the torsional direction for as many of the loading conditions as necessary. The revised stress values are presented in the appropriate Table.

Allowable stresses were obtained by using the maximum temperature the piping experienced during any loading case to determine Sh. The value of Sc was based on 70°F per Reference 2. A summary of the allowable stresses is given in Table 6.1-1.

Section 119.6.1 of the B31.1 code indicates that the thermal stress range stress calculations shall be based on the range between the minimum and maximum temperature. Neither equation A2 or B3 allows for this criteria, however, the worst thermal moments due to both conditons analyzed, plus the case of no expansion, was analyzed and found to be satisfactory.

Stresses were calculated as follows:

Pressure

$$\frac{Pd^2}{D^2-d^2}$$

Deadweight

$$\frac{.75i\ M_A}{Z}$$

Thermal

$$\frac{i\ M_C}{Z}$$

[illegible]

Seismic

$$\frac{.75i\ M_B}{Z}$$

Force/Time History

$$\frac{.75i\ M_D}{Z}$$

where:

- d = inside diameter of pipe
- D = outside diameter of pipe
- i = intensification factor
- M_A = resultant moment due to deadweight loadings
- M_B = resultant moment due to seismic loadings
- M_C = range of resultant moments due to thermal loadings
- M_D = resultant moment due to force/time history analysis

TELEDYNE ENGINEERING SERVICES

PROJECT: 5364 28 MAY 1983
D. C. COOK UNIT 1
SUMMARY OF ALLOWABLES

BY ______ DATE ______
CHKD ______ DATE ______
SHEET NO. ______ OF ______

TABLE 6.1-1

MAIN RISER

NODES	MATERIAL	TEMPERATURE (F)	Sh (PSI)
1 THRU 30	SA-358-316 CL 1	430	16210
32 THRU 52	"	324	16744
56 THRU 72	"	337	16678
74 THRU 93	"	354	16576
97 THRU 206	"	348	16612
260	SA-312-304	348	15262
280 THRU 285	"	390	15070
290 THRU 295	"	410	14898

SRV LOOPS

NODES LOOP C	NODES LOOP B	NODES LOOP A	MATERIAL	TEMPERATURE (F)	Sh (PSI)
90 THRU 100	144 THRU 146	208	SA-312-304	348	15262
102 THRU 109	148 THRU 155	214 THRU 216	"	390	15130
110 THRU 112	157 THRU 160	220 THRU 222	"	430	14830
114 THRU 114D	162 THRU 163	223 THRU 223D	"	460	14710
115	165	225	"	460	11740 *
120	170	229	SA-376-316	653	11600 *
122 THRU 138	172 THRU 185	233 THRU 244	SA-376-316	653	16000

NOTE: LOOP C REFERS TO THE SRV LOOP CONTAINING VALVE SV-45C THIS NOTATION IS TYPICAL OF LOOPS B AND A ALSO.
* ALLOWABLE AS PER NOTE (6), TABLE A-1 OF B 31.1.0, 1967 CODE.

TELEDYNE ENGINEERING SERVICES

PROJECT: 5364 23 MAY 1983
D. C. COOK UNIT 1
SUMMARY OF ALLOWABLES

BY DMB DATE 5-28-83
CHKD DMB DATE 5/28/83
SHEET NO._____ OF __________

TABLE 6.1-1 (cont.)

PORV LOOP 153

NODES	MATERIAL	TEMPERATURE (°F)	Sh (PSI)
560 THRU 555	SA-312-304	413	14898
550 THRU 529	•	480	14630
525 THRU 515	•	653	14300
510 THRU 450	SA-376-304	653	14300
440 THRU 750	SA-376-316	653	16000

PORV LOOP 152

NODES	MATERIAL	TEMPERATURE (F)	Sh (PSI)
300 THRU 382	SA-312-304	413	14898
385 THRU 390	SA-312-304	653	14300
400 THRU 431	SA-376-304	653	14300

PORV LOOP 151

NODES	MATERIAL	TEMPERATURE (F)	Sh (PSI)
610 THRU 620	SA-312-304	480	14630
625 THRU 630	SA-312-304	653	14300
635 THRU 665	SA-376-304	653	14300

NOTE: PORV LOOP 151 REFERS TO THE PORV LOOP CONTAINING VALVES NMO-151 AND NRV-151. THIS IS TYPICAL OF LOOPS 152 AND 153.

6.1.1 Equation A-1 Stresses

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-3-83
CHECKED BY: DmD DATE: 5/3/83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
1	0	.1	.1	16.2
4		.9	.9	
6		.3	.3	
7		.2	.2	
8		.1	.1	
10		.2	.2	
12		.5	.5	
18		.4	.4	
30		.4	.4	↓
32		.7	.7	16.7
33		.4	.4	
34		.4	.4	
36		.5	.5	
38		.2	.2	
40		.2	.2	
42		.1	.1	
44		.2	.2	
46		.2	.2	
48		.1	.1	
50	↓	.2	.2	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-3-83
CHECKED BY: [signature] DATE: 5/3/83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
52	0	.3	.3	16.7
56		.4	.4	
58		.4	.4	
60		.3	.3	
62		.4	.4	
66		.2	.2	
68		.2	.2	
70		.2	.2	
72		.1	.1	
74		.3	.3	16.6
76		.2	.2	
80		.3	.3	
82		.5	.5	
83		.2	.2	
84		.5	.5	
86		.3	.3	
88		.3	.3	
90		.5	.5	
93		.4	.4	
97R		.8	.8	16.6

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-3-83
CHECKED BY: [signature] DATE: 5/3/83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
97R	0	.7	.7	16.6
195		.5	.5	
142R		.7	.7	
142R		.6	.6	
200		.4	.4	
206R		.3	.3	
206R		.3	.3	↓
260		1.0	1.0	15.3
280		1.5	1.5	15.1
285		4.5	4.5	15.1
290		5.3	5.3	14.9
295B		3.7	3.7	↓
97B		.7	.7	15.3
98		.8	.8	
99		.7	.7	
100		.4	.4	↓
102		.3	.3	15.1
103		.3	.3	
104		.8	.8	
106	↓	1.0	1.0	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [illegible] DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
108	0	.6	.6	15.1
109		.9	.9	15.1
110		1.2	1.2	14.8
112		.5	.5	14.8
114		1.2	1.2	14.7
1140		.7	.7	14.7
115		.7	.7	11.7
120	3.5	0.9	4.4	11.6
122		1.1	4.6	16.0
124		.9	4.4	
126		.9	4.4	
128		.7	4.2	
130		.6	4.1	
132		.9	4.4	
134		1.0	4.5	
136		1.2	4.7	
138		1.3	4.8	
142E	0	.6	.6	15.3
144		.4	.4	
146		.2	.2	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-3-83
CHECKED BY: [signature] DATE: 5/3/83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
148	0	.3	.3	15.1
150		1.0	1.0	
152		1.4	1.4	
156		.8	.8	↓
157		1.1	1.1	14.8
158		1.3	1.3	
160		.7	.7	↓
162		1.2	1.2	14.7
163		.7	.7	14.7
165	↓	.7	.7	11.7
170	3.5	.9	4.4	11.6
172		1.0	4.5	16.0
174		.8	4.3	
176		.8	4.3	
178		.5	4.0	
180		.5	4.0	
181		.8	4.3	
182		.9	4.4	
184		1.1	4.6	
185	↓	1.2	4.7	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [illegible] DATE: 5-3-83
CHECKED BY: DmD DATE: 5/3/83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
206B	0	1.1	1.1	15.3
208		.3	.3	15.3
214		1.0	1.0	15.1
216		1.5	1.5	15.1
220		1.3	1.3	14.8
222		.6	.6	14.8
223		1.0	1.0	14.7
2230		.6	.6	14.7
225		.6	.6	11.7
229	3.5	.7	4.2	11.6
233		.8	4.3	16.0
234		.5	4.0	
235		.5	4.0	
236		.3	3.8	
237		.2	3.7	
238		.7	4.2	
240		.8	4.3	
242		1.1	4.6	
244		1.1	4.6	
295R	0	3.2	3.2	14.9

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [illegible] DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
560	0	9.9	9.9	14.9
555		5.6	5.6	14.9
550		3.5	3.5	14.6
545		3.7	3.7	
540		3.8	3.8	
536		3.7	3.7	
535		4.1	4.1	
534		4.7	4.7	
533		5.6	5.6	
530		6.4	6.4	
529		4.2	4.2	↓
525	↓	4.6	4.6	14.3
510	2.9	3.0	5.9	
505		2.5	5.4	
490		1.7	4.6	
485		2.8	5.7	
480		2.7	5.6	
475		2.5	5.4	
465		4.2	7.1	
460	↓	2.7	5.6	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-3-83
CHECKED BY: [signature] DATE: 5/3/83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
450	2.9	5.0	7.9	14.3
440	4.1	5.4	9.5	14.3
435R		3.4	7.5	16.0
435R		1.1	5.2	16.0
575		3.5	7.6	16.0
585		5.5	9.6	
590		6.3	10.4	
595	↓	7.0	11.1	
600R	3.5	2.1	5.6	
600R	3.5	2.5	6.0	
668	3.5	2.6	6.1	
670		2.6	6.1	
675		2.9	6.4	
680		2.9	6.4	
690		2.6	6.1	
700		2.1	5.6	
710		1.1	4.6	
715		.8	4.3	
717		.5	4.0	
720	↓	.4	3.9	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
725	3.5	.4	3.9	16.0
750	3.5	.3	3.8	16.0
295R	0	2.7	2.7	14.9
300	↓	5.2	5.2	↓
310	↓	4.1	4.1	↓
320	↓	2.8	2.8	↓
325	↓	1.6	1.6	↓
335R	↓	1.2	1.2	↓
335R	↓	2.9	2.9	↓
340	↓	4.7	4.7	14.6
350	↓	2.8	2.8	↓
355	↓	1.0	1.0	↓
360	↓	1.9	1.9	↓
365	↓	3.1	3.1	↓
370	↓	3.7	3.7	↓
375	↓	3.6	3.6	↓
380	↓	3.4	3.4	↓
382	↓	2.4	2.4	↓
385	↓	2.5	2.5	14.3
400	2.9	1.7	4.6	14.3

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: TMB DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION A1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	EQUATION A1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
405	2.9	2.1	5.0	14.3
420		2.6	5.5	
429		4.1	7.0	
430		4.6	7.5	
431		4.7	7.6	
435B	↓	5.0	7.9	↓
335B	0	3.0	3.0	14.9
610		3.6	3.6	14.6
615		3.5	3.5	
620		2.6	2.6	↓
625	↓	2.8	2.8	14.3
635	2.9	2.9	5.8	
645		3.7	6.6	
657		3.8	6.7	
660		3.2	6.1	
665		3.0	5.9	
600B	↓	3.0	5.9	↓

6.1.2 Equation A-2 Stresses

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: SMB DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
1	.7	27.5
4	7.6	↓
6	6.8	↓
7	2.5	↓
8	2.5	↓
10	7.0	↓
12	7.6	↓
18	3.1	↓
30	9.5	↓
32	8.8	27.6
33	3.3	↓
34	3.1	↓
36	3.0	↓
38	4.6	↓
40	6.9	↓
42	2.7	↓
44	7.2	↓
46	9.5	↓
48	3.8	↓
50	11.2	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
52	11.7	27.6
56	11.0	↓
58	11.3	↓
60	13.0	↓
62	12.8	↓
66	2.5	↓
68	2.4	↓
70	2.3	↓
72	1.2	↓
74	2.1	↓
76	2.1	↓
80	2.3	↓
82	2.5	↓
83	.9	↓
84	2.4	↓
86	2.2	↓
88	2.4	↓
90	2.9	↓
93	1.4	↓
97R	3.5	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: SMB DATE: 5-3-83
CHECKED BY: SMD DATE: 5/3/83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
97R	2.1	27.6
195	1.1	
142R	2.8	
142R	1.7	
200	.8	
206R	2.2	
206R	2.8	
260	6.0	27.3
280	3.6	27.2
285	8.9	
290	8.3	
295B	5.8	
97B	7.5	27.3
98	3.1	
99	2.0	
100	1.9	
102	2.4	27.2
103	3.0	
104	7.4	
106	7.1	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
108	3.1	27.2
109	1.0	27.2
110	1.3	27.1
112	4.7	
114	5.3	
1140	2.3	
115	2.3	26.4
120	.8	26.3
122	.8	27.4
124	1.2	
126	1.2	
128	1.4	
130	1.3	
132	1.4	
134	1.4	
136	1.4	
138	1.3	
142B	9.8	27.3
144	3.6	
146	2.3	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: RWB DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
148	2.7	27.2
150	8.1	
152	8.3	
156	3.5	
157	.6	27.1
158	2.1	
160	5.6	
162	5.6	
163	2.4	
165	2.4	26.4
170	.8	26.3
172	1.6	27.4
174	2.2	
176	2.2	
178	2.4	
180	2.0	
181	1.9	
182	1.9	
184	2.0	
185	1.8	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: JMB DATE: 5-3-83
CHECKED BY: BMD DATE: 5/3/83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
206 B	17.6	27.3
208	4.0	27.3
214	4.6	27.2
216	6.6	27.2
220	2.4	27.1
222	7.5	↓
223	5.1	↓
2230	2.2	↓
225	2.2	26.4
229	1.7	26.3
233	3.3	27.4
234	4.5	↓
235	4.5	↓
236	5.2	↓
237	4.6	↓
238	4.1	↓
240	4.1	↓
242	4.2	↓
244	3.8	↓
295 R	2.9	27.2

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [illegible] DATE: 5-3-83
CHECKED BY: [illegible] DATE: 5/3/83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
560	7.0	27.2
555	3.8	27.2
550	1.8	27.1
545	4.3	
540	4.6	
536	2.5	
535	2.5	
534	2.6	
533	4.6	
530	5.2	
529	2.9	↓
525	2.9	27.0
510	1.7	
505	1.7	
490	1.7	
485	1.8	
480	1.9	
475	1.7	
465	2.0	
460	1.6	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [illegible] DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
450	2.0	27.0
440	2.1	27.0
435R	1.2	27.4
435R	2.7	
575	2.1	
585	.8	
590	.7	
595	.5	
600R	.1	
600R	1.8	
668	1.8	
670	2.0	
675	1.9	
680	1.7	
690	1.5	
700	1.7	
710	2.0	
715	2.6	
717	3.5	
720	4.2	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DWB DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
725	4.5	27.4
750	4.4	27.4
295 R	4.6	27.2
300	6.1	
310	3.2	
320	2.3	
325	5.5	
335R	10.0	
335R	1.7	↓
340	2.1	27.1
350	2.5	
355	2.8	
360	2.9	
365	5.4	
370	4.8	
375	3.0	
380	2.3	
382	1.1	
385	.9	
400	.2	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: JWB DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION A2

NODE #	NORMAL THERMAL STRESS (KSI)	ALLOWABLE STRESS (KSI)
405	.7	27.0
420	1.2	↓
429	1.8	↓
430	2.1	↓
431	2.2	↓
435B	3.0	↓
335B	15.1	27.2
610	16.3	27.1
615	12.7	↓
620	6.7	↓
625	5.0	27.0
635	2.0	↓
645	4.1	↓
657	6.5	↓
660	9.1	↓
665	10.0	↓
600B	13.0	↓
		↓
		↓
		↓

6.1.3 Equation B-1 Stresses

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-3-83
CHECKED BY: DmD DATE: 5/3/83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
1	0	.1	.1	.2 (YZ)	19.5
4	↓	.9	.8	1.7 YZ	↓
6		.3	.5	.8 YZ	
7		.2	.2	.4 YZ	
8		.1	.1	.2 YZ	
10		.2	.2	.4 YZ	
12		.5	.4	.9 YZ	
18		.4	.1	.5 YZ	
30		.4	.2	.6 YZ	↓
32		.7	.2	.9 YZ	20.1
33		.4	.1	.5 YZ	↓
34		.4	.2	.6 YZ	
36		.5	.1	.6 YZ	
38		.2	.3	.5 YZ	
40		.2	.2	.4 YZ	
42		.1	.1	.2 YZ	
44		.2	.2	.4 YZ	
46		.2	.2	.4 YZ	
48		.1	.1	.2 YZ	
50	↓	.2	.2	.4 YZ	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-3-83
CHECKED BY: DHD DATE: 5/3/83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
52	0	.3	.3	.6 YZ	20.1
56	↓	.4	.2	.6 XY	20.0
58		.4	.2	.6 XY	↓
60		.3	.2	.5 YZ	
62		.4	.2	.6 XY	
66		.2	.3	.5 YZ	
68		.2	.2	.4 YZ	
70		.2	.2	.4 YZ	
72		.1	.4	.5 YZ	
74		.3	.1	.4 XY	19.9
76		.2	.2	.4 XY	↓
80		.3	.2	.5 XY	
82		.5	.2	.7 XY	
83		.2	.2	.4 XY	
84		.5	.2	.7 XY	
86		.3	.2	.5 XY	
88		.3	.2	.5 XY	
90		.5	.2	.7 XY	
93		.4	.2	.6 XY	
97B		.8	.4	1.2 XY	19.9

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: AWB DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
97R	0	.7	.4	1.1 XY	19.9
195		.5	.3	.8 XY	
142R		.7	.4	1.1 XY	
142R		.6	.4	1.0 XY	
200		.4	.2	.6 XY	
206R		.3	.4	.7 XY	
206R		.3	.3	.6 XY	↓
260		1.0	.8	1.8 XY	18.3
280		1.5	2.1	3.6 XY	18.1
285		4.5	1.5	6.0 XY	18.1
290		5.3	2.0	7.3 XY	17.9
295B		3.7	1.7	5.4 XY	17.9
97B		.7	1.1	1.8 XY	18.3
98		.8	.3	1.1 XY	
99		.7	.4	1.1 XY	
100		.4	.7	1.1 XY	↓
102		.3	.8	1.1 XY	18.2
103		.3	1.0	1.3 XY	
104		.8	1.8	2.6 XY	
106	↓	1.0	1.9	2.9 XY	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-3-83
CHECKED BY: [signature] DATE: 5/3/83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
108	0	.6	1.1	1.7 XY	18.2
109		.9	1.2	2.1 XY	18.2
110		1.2	1.3	2.5 XY	17.8
112		.5	2.4	2.9 XY	17.8
114		1.2	2.6	3.8 XY	17.7
1140		.7	1.5	2.2 XY	17.7
115	↓	.7	1.5	2.2 XY	14.1
120	3.5	.9	.4	4.8 YZ	13.9
122		1.1	2.5	7.1 XY	19.2
124		.9	2.9	7.3 XY	
126		.9	2.9	7.3 XY	
128		.7	2.6	6.8 XY	
130		.6	1.6	5.7 XYZ	
132		.9	1.3	5.7 YZ	
134		1.0	1.4	5.9 YZ	
136		1.2	1.7	6.4 YZ	
138	↓	1.3	1.6	6.4 YZ	↓
142B	0	.6	.7	1.3 YZ	18.3
144		.4	.4	.8 XY	
146	↓	.2	.7	.9 YZ	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DWB DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
148	0	.3	1.0	1.3 YZ	18.2
150		1.0	2.1	3.1 YZ	
152		1.4	2.2	3.6 YZ	
156		.8	1.4	2.2 YZ	
157		1.1	1.2	2.3 YZ	17.8
158		1.3	1.2	2.5 YZ	
160		.7	2.0	2.7 YZ	
162		1.2	2.1	3.3 YZ	17.7
163		.7	1.3	2.0 YZ	17.7
165		.7	1.3	2.0 YZ	14.1
170	3.5	.9	.3	4.7 XY	13.9
172		1.0	2.3	6.8 YZ	19.2
174		.8	2.7	7.0 YZ	
176		.8	2.7	7.0 YZ	
178		.5	2.4	6.4 YZ	
180		.5	1.5	5.5 YZ	
181		.8	1.1	5.4 XY YZ	
182		.9	1.2	5.6 XY	
184		1.1	1.5	6.1 XY	
185		1.2	1.4	6.1 XY	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
206B	0	1.1	1.3	2.4 XY	18.3
208		.3	1.0	1.3 XY	18.3
214		1.0	2.1	3.1 XY	18.2
216		1.5	2.2	3.7 XY	18.2
220		1.3	.8	2.1 XY	17.8
222		.6	1.3	1.9 XY	17.8
223		1.0	1.4	2.4 XY	17.7
2230		.6	.8	1.4 XY	17.7
225		.6	.8	1.4 XY	14.1
229	3.5	.7	.4	4.6 XY	13.9
233		.8	2.0	6.3 XY	19.2
234		.5	2.2	6.2 XY	
235		.5	2.2	6.2 XY	
236		.3	1.8	5.6 XY	
237		.2	1.3	5.0 XY	
238		.7	1.1	5.3 XY	
240		.8	1.1	5.4 XY	
242		1.1	1.3	5.9 YZ	
244		1.1	1.3	5.9 YZ	
295R	0	3.2	1.5	4.7 YZ	17.9

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DWB DATE: 5-3-83
CHECKED BY: DHD DATE: 5/3/83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
560	0	9.9	4.1	14.0 YZ	17.9
555		5.6	1.9	7.5 YZ	17.9
550		3.5	4.8	8.3 YZ	17.6
545		3.7	9.9	13.6 YZ	17.6
540		3.8	11.4	15.2 YZ	
536		3.7	8.6	12.3 YZ	
535		4.1	8.0	12.1 YZ	
534		4.7	7.2	11.9 YZ	
533		5.6	9.6	15.2 YZ	
530		6.4	8.2	14.6 YZ	
529		4.2	6.2	10.4 YZ	↓
525	↓	4.6	6.3	10.9 YZ	17.2
510	2.9	3.0	3.6	9.5 XY	
505		2.5	4.0	9.4 XY	
490		1.7	4.5	9.1 YZ	
485		2.8	4.2	9.9 YZ	
480		2.7	4.2	9.8 YZ	
475		2.5	4.2	9.6 YZ	
465		4.2	4.1	11.2 YZ	
460	↓	2.7	4.7	10.3 YZ	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: KMB DATE: 5-3-83
CHECKED BY: DMD DATE: 5/3/83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
450	2.9	5.0	5.9	13.8 YZ	17.2
440	4.1	5.4	5.8	15.3 YZ	17.2
435R		3.4	3.3	10.8 YZ	19.2
435R		1.1	6.0	11.2 YZ	
575		3.5	3.9	11.5 YZ	
585		5.5	5.0	14.6 YZ	
590		6.3	4.2	14.6 YZ	
595	↓	7.0	4.5	15.6 YZ	
600R	3.5	2.1	1.5	7.1 YZ	
600R	3.5	2.5	1.7	7.7 YZ	
668		2.6	1.7	7.8 YZ	
670		2.6	1.8	7.9 YZ	
675		2.9	1.6	8.0 YZ	
680		2.9	1.6	8.0 YZ	
690		2.6	1.3	7.4 XY	
700		2.1	1.2	6.8 XY	
710		1.1	1.4	6.0 XY	
715		.8	1.5	5.8 XY	
717		.5	1.8	5.8 XY	
720	↓	.4	1.9	5.8 XY	↓

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-3-83
CHECKED BY: [signature] DATE: 5/3/83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
725	3.5	.4	2.0	5.9 XY	19.2
750	3.5	.3	2.7	6.5 XY	19.2
295R	0	2.7	2.1	4.8 YZ	17.9
300		5.2	4.1	9.3 YZ	
310		4.1	3.7	7.8 YZ	
320		2.8	3.8	6.6 YZ	
325		1.6	4.1	5.7 YZ	
335R		1.2	4.4	5.6 YZ	
335R		2.9	5.3	8.1 YZ	↓
340		4.7	8.4	13.1 YZ	17.6
350		2.8	6.5	9.3 YZ	
355		1.0	4.6	5.6 YZ	
360		1.9	3.4	5.3 YZ	
365		3.1	4.1	7.2 YZ	
370		3.7	2.8	6.5 YZ	
375		3.6	2.0	5.6 YZ	
380		3.4	3.3	6.7 YZ	
382		2.4	2.7	5.1 YZ	↓
385	↓	2.5	3.0	5.5 YZ	17.2
400	2.9	1.7	5.1	9.7 YZ	17.2

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-3-83
CHECKED BY: [signature] DATE: 5/3/83

STRESS SUMMARY - EQUATION B1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	EQUATION B1-STRESS (KSI)	ALLOWABLE STRESS (KSI)
405	2.9	2.1	5.3	10.3 YZ	17.2
420	↓	2.6	6.9	12.4 YZ	↓
429	↓	4.1	8.1	15.1 YZ	↓
430	↓	4.6	8.6	16.1 YZ	↓
431	↓	4.7	8.7	16.3 YZ	↓
435 B	↓	5.0	10.5	18.4 YZ	19.2
335 B	0	3.0	5.7	8.7 YZ	17.9
610	↓	3.6	5.7	9.3 YZ	17.6
615	↓	3.5	5.5	9.0 YZ	↓
620	↓	2.6	4.2	6.8 YZ	↓
625	↓	2.8	4.3	7.1 YZ	17.2
635	2.9	2.9	3.5	9.3 YZ	↓
645	↓	3.7	3.4	10.0 YZ	↓
657	↓	3.8	3.8	10.5 YZ	↓
660	↓	3.2	4.3	10.4 YZ	↓
665	↓	3.0	4.5	10.4 YZ	↓
600 B	↓	3.0	5.7	11.6 YZ	17.2

6.1.4 Equation B-2 Stresses

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DmD DATE: 5/23/83
CHECKED BY: JMB DATE: 5-25-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
1	.6	.1	.1	0	.8	19.5
4	↓	.9	.8	.3	2.4	↓
6	↓	.3	.5	2.2	3.2	↓
7	↓	.2	.2	.1	1.0	↓
8	↓	.1	.1	.1	.8	↓
10	↓	.2	.2	.1	1.0	↓
12	↓	.5	.4	.2	1.5	↓
18	↓	.4	.1	.1	1.1	↓
30	↓	.4	.2	.2	1.3	↓
32	.7	.7	.2	.2	1.7	20.1
33	↓	.4	.1	.1	1.2	↓
34	↓	.4	.2	.1	1.3	↓
36	↓	.5	.1	.1	1.3	↓
38	↓	.2	.3	.5	1.5	↓
40	↓	.2	.2	.3	1.3	↓
42	↓	.1	.1	.1	.9	↓
44	↓	.2	.2	.3	1.3	↓
46	↓	.2	.2	.2	1.2	↓
48	↓	.1	.1	.1	.9	↓
50	↓	.2	.2	.2	1.2	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMD DATE: May 23, 1983
CHECKED BY: DMB DATE: 5-25-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
52	.7	.3	.3	.3	1.4	20.1
56	↓	.4	.2	.3	1.5	20.0
58	↓	.4	.2	.3	1.5	↓
60	↓	.3	.2	.4	1.4	↓
62	↓	.4	.2	.3	1.5	↓
66	↓	.2	.3	.5	1.5	↓
68	↓	.2	.2	.4	1.3	↓
70	↓	.2	.2	.4	1.3	↓
72	↓	.1	.4	.5	1.4	↓
74	↓	.3	.1	.3	1.3	19.9
76	↓	.2	.2	.2	1.2	↓
80	↓	.3	.2	.3	1.4	↓
82	↓	.5	.2	.5	1.7	↓
83	↓	.2	.2	.2	1.2	↓
84	↓	.5	.2	.4	1.6	↓
86	↓	.3	.2	.2	1.4	↓
88	↓	.3	.2	.3	1.4	↓
90	↓	.5	.2	.4	1.6	↓
93	↓	.4	.2	.4	1.5	↓
97R	.9	.8	.4	.4	2.3	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMD DATE: 5/23/83
CHECKED BY: JMB DATE: 5-25-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
97R	.9	.7	.4	.4	2.2	19.9
195	↓	.5	.3	.3	1.8	↓
142R	↓	.7	.4	.4	2.2	↓
142R	↓	.6	.4	.4	2.1	↓
200	↓	.4	.2	.2	1.6	↓
206R	↓	.3	.4	.3	1.7	↓
206R	↓	.3	.3	.3	1.6	↓
260	↓	1.0	.8	.8	3.0	18.3
280	1.0	1.5	2.1	2.1	5.5	18.1
285	1.0	4.5	1.5	1.1	7.4	18.1
290	1.5	5.3	2.0	1.6	9.4	17.9
295B	1.5	3.7	1.7	1.3	7.3	17.9
97B	.3	.7	1.1	.9	2.4	18.3
98	↓	.8	.3	.3	1.5	↓
99	↓	.7	.4	.5	1.6	↓
100	↓	.4	.7	.6	1.6	↓
102	↓	.3	.8	.5	1.5	18.2
103	↓	.3	1.0	.2	1.6	↓
104	↓	.8	1.8	.2	2.9	↓
106	↓	1.0	1.9	.3	3.2	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DmD DATE: 5/23/83

CHECKED BY: DMB DATE: 5-25-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
108	.3	.6	1.1	.2	2.0	18.2
109	↓	.9	1.2	.2	2.4	18.2
110	↓	1.2	1.3	.2	2.8	17.8
112	↓	.5	2.4	.5	3.3	17.8
114	.1	1.2	2.6	.6	4.0	17.7
1140	↓	.7	1.5	.3	2.3	17.7
115	↓	.7	1.5	.3	2.3	14.1
120	3.5	.9	.4	.1	4.8	13.9
122	↓	1.1	2.5	.1	7.1	19.2
124	↓	.9	2.9	.1	7.3	↓
126	↓	.9	2.9	.1	7.3	↓
128	↓	.7	2.6	.1	6.8	↓
130	↓	.6	1.6	.1	5.7	↓
132	↓	.9	1.3	.2	5.7	↓
134	↓	1.0	1.4	.2	5.9	↓
136	↓	1.2	1.7	.2	6.4	↓
138	↓	1.3	1.6	.2	6.4	↓
142 B	.7	.6	.7	.6	2.2	18.3
144	↓	.4	.4	.5	1.7	↓
146	↓	.2	.7	.3	1.7	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMD DATE: 5/23/83
CHECKED BY: DMB DATE: 5-25-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI).	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
148	.3	.3	1.0	.1	1.6	18.2
150	↓	1.0	2.1	.1	3.4	↓
152	↓	1.4	2.2	.3	3.9	↓
156	↓	.8	1.4	.2	2.5	↓
157	↓	1.1	1.2	.1	2.6	17.8
158	↓	1.3	1.2	.1	2.8	↓
160	↓	.7	2.0	.2	3.0	↓
162	.1	1.2	2.1	.2	3.4	17.7
163	↓	.7	1.3	.1	2.1	17.7
165	↓	.7	1.3	.1	2.1	14.1
170	3.5	.9	.3	.1	4.7	13.9
172	↓	1.0	2.3	.1	6.8	19.2
174	↓	.8	2.7	.1	7.0	↓
176	↓	.8	2.7	.1	7.0	↓
178	↓	.5	2.4	.1	6.4	↓
180	↓	.5	1.5	.1	5.5	↓
181	↓	.8	1.1	.1	5.4	↓
182	↓	.9	1.2	.1	5.6	↓
184	↓	1.1	1.5	.1	6.1	↓
185	↓	1.2	1.4	.1	6.1	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DHD DATE: 5/23/83
CHECKED BY: [illegible] DATE: 5-25-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
206B	.7	1.1	1.3	.7	3.3	18.3
208	.7	.3	1.0	.2	2.0	18.3
214	.3	1.0	2.1	.4	3.4	18.2
216	.3	1.5	2.2	.5	4.1	18.2
220	.3	1.3	.8	.2	2.4	17.8
222	.3	.6	1.3	.5	2.3	17.8
223	.1	1.0	1.4	.5	2.6	17.7
2230	.1	.6	.8	.3	1.6	17.7
225	.1	.6	.8	.3	1.6	14.1
229	3.5	.7	.4	.1	4.6	13.9
233	↓	.8	2.0	.1	6.3	19.2
234		.5	2.2	.1	6.2	↓
235		.5	2.2	.1	6.2	
236		.3	1.8	.1	5.6	
237		.2	1.3	.1	5.0	
238		.7	1.1	.2	5.3	
240		.8	1.1	.2	5.4	
242		1.1	1.3	.2	5.9	
244	↓	1.1	1.3	.2	5.9	↓
295R	1.5	3.2	1.5	.9	6.4	17.9

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMD DATE: 5/23/83
CHECKED BY: [illegible] DATE: 5-25-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
560	1.5	9.9	4.1	2.8	16.4	17.9
555	1.0	5.6	1.9	1.6	9.1	17.9
550	1.9	3.5	4.8	2.0	10.6	17.6
545		3.7	9.9	3.1	16.0	17.6
540		3.8	11.4	3.5	17.6	
536		3.7	8.6	2.6	14.6	
535		4.1	8.0	2.4	14.4	
534		4.7	7.2	2.3	14.2	
533		5.6	9.6	3.1	17.5	
530		6.4	8.2	3.0	17.0	
529		4.2	6.2	4.0	13.5	
525		4.6	6.3	5.8	15.1	17.2
510	2.9	3.0	3.6	4.0	11.3	
505		2.5	4.0	4.0	11.1	
490		1.7	4.5	4.6	11.0	
485		2.3	4.2	3.0	10.9	
480		2.7	4.2	3.0	10.8	
475		2.5	4.2	2.7	10.4	
465		4.2	4.1	3.3	12.4	
460		2.7	4.7	2.5	10.9	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5/23/83
CHECKED BY: [signature] DATE: 5-25-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
450	2.9	5.0	5.9	4.3	15.2	17.2
440	4.1	5.4	5.8	4.5	16.8	17.2
435R		3.4	3.3	2.8	11.8	19.2
436R		1.1	6.0	3.1	12.0	
575		3.5	3.9	1.8	11.9	
585		5.5	5.0	2.7	15.3	
590		6.3	4.2	2.0	15.1	
595		7.0	4.5	2.5	16.2	
600R		2.1	1.5	.9	7.9	
600R	3.5	2.5	1.7	.9	7.9	
668		2.6	1.7	1.0	8.1	
670		2.6	1.8	1.1	8.2	
675		2.9	1.6	1.2	8.4	
680		2.9	1.6	1.2	8.4	
690		2.6	1.3	1.1	7.8	
700		2.1	1.2	1.4	7.4	
710		1.1	1.4	2.5	7.5	
715		.8	1.5	2.9	7.6	
717		.5	1.8	1.4	6.3	
720		.4	1.9	2.0	6.7	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMD DATE: 5/23/83
CHECKED BY: DMB DATE: 5-25-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
725	3.5	.4	2.0	2.7	7.3	19.2
750	3.5	.3	2.7	4.6	9.1	19.2
295R	1.5	2.7	2.1	1.3	6.7	17.9
300	1.5	5.2	4.1	2.1	11.3	
310	1.2	4.1	3.7	2.1	9.6	
320	1.2	2.8	3.8	2.9	8.8	
325	1.2	1.6	4.1	3.6	8.3	
335R	2.3	1.2	4.4	3.3	9.0	
335R	2.3	2.9	5.3	1.8	10.8	
340	2.3	4.7	8.4	2.7	15.8	17.6
350	1.9	2.8	6.5	2.0	11.5	
355		1.0	4.6	1.9	7.9	
360		1.9	3.4	1.8	7.6	
365		3.1	4.1	2.4	9.8	
370		3.7	2.8	2.3	9.2	
375		3.6	2.0	2.7	8.9	
380		3.4	3.3	3.5	10.1	
382		2.4	2.7	2.6	8.0	
385		2.5	3.0	2.6	8.4	17.2
400	2.9	1.7	5.1	4.2	11.2	17.2

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMD DATE: 5/23/83
CHECKED BY: [illegible] DATE: 5-25-83

STRESS SUMMARY - EQUATION B2

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	OBE STRESS (KSI)	PORV TRANSIENT SHOCK STRESS(KSI)	EQUATION B2 STRESS (KSI)	ALLOWABLE STRESS (KSI)
405	2.9	2.1	5.3	4.0	11.6	17.2
420	↓	2.6	6.9	3.2	13.1	↓
429	↓	4.1	8.1	3.0	15.6	↓
430	↓	4.6	8.6	3.1	16.6	↓
431	↓	4.7	8.7	3.1	16.8	↓
435B	↓	5.0	10.5	3.6	19.0	19.2
335B	2.3	3.0	5.7	5.5	13.2	17.9
610	1.9	3.6	5.7	2.7	11.8	17.6
615	1.9	3.5	5.5	3.2	11.8	↓
620	1.9	2.6	4.2	2.5	9.4	↓
625	1.9	2.8	4.3	4.7	11.1	17.2
635	2.9	2.9	3.5	9.6	16.0	↓
645	↓	3.7	3.4	5.4	13.0	↓
657	↓	3.8	3.8	3.2	11.7	↓
660	↓	3.2	4.3	2.2	10.9	↓
665	↓	3.0	4.5	2.7	11.1	↓
600B	↓	3.0	5.7	5.4	13.8	↓

6.1.5 Equation B-3 Stresses

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMD DATE: 5/25/83
CHECKED BY: DWB DATE: 5-25-83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE (KSI)	ALLOWABLE STRESS (KSI)
1	.2	27.5
4	2.0	
6	2.0	
7	.8	
8	.8	
10	2.2	
12	2.3	
18	.9	
30	2.5	
32	2.5	27.6
33	.9	
34	.9	
36	.9	
38	1.4	
40	1.4	
42	.5	
44	1.4	
46	1.7	
48	.7	
50	2.0	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [illegible] DATE: 5/25/83
CHECKED BY: [illegible] DATE: 5-25-83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE (KSI)	ALLOWABLE STRESS (KSI)
52	2.2	27.6
56	2.5	
58	2.5	
60	2.9	
62	3.3	
66	1.4	
68	1.3	
70	1.3	
72	.7	
74	.9	
76	.8	
80	.8	
82	.8	
83	.3	
84	.8	
86	.7	
88	.7	
90	.8	
93	.4	
97R	1.2	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: Dmd DATE: 5/25/83
CHECKED BY: SMB DATE: 5-25-83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE (KSI)	ALLOWABLE STRESS (KSI)
97R	1.6	27.6
195	.8	
142R	1.6	
142R	2.1	
200	.9	
206R	1.8	
206R	2.5	
260	4.3	27.3
280	9.7	27.2
285	6.0	
290	5.6	
295B	4.7	
97B	4.7	27.3
98	2.3	
99	1.7	
100	1.2	
102	1.0	27.2
103	1.2	
104	3.3	
106	3.3	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMD DATE: 5/25/83
CHECKED BY: DMB DATE: 5-25-83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE (KSI)	ALLOWABLE STRESS (KSI)
108	1.5	27.2
109	.7	27.2
110	.5	27.1
112	1.7	27.1
114	1.4	27.1
1140	.6	27.1
115	.6	26.4
120	.2	26.3
122	.4	27.4
124	.6	
126	.6	
128	.7	
130	.5	
132	.5	
134	.5	
136	.5	
138	.5	
142 B	6.1	27.3
144	2.8	
146	1.8	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: *[signature]* DATE: 5/23/83
CHECKED BY: *[signature]* DATE: 5-25-83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE (KSI)	ALLOWABLE STRESS (KSI)
148	1.0	27.2
150	2.5	
152	2.9	
156	1.2	
157	.5	27.1
158	.3	
160	.7	
162	.4	
163	.2	
165	.2	26.4
170	.5	26.3
172	.8	27.4
174	1.0	
176	1.0	
178	1.2	
180	1.1	
181	.9	
182	.9	
184	.9	
185	.8	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMD DATE: 5/25/83
CHECKED BY: SDMB DATE: 5-25-83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE (KSI)	ALLOWABLE STRESS (KSI)
206B	12.1	27.3
208	3.9	27.3
214	4.5	27.2
216	3.7	27.2
220	.5	27.1
222	2.0	27.1
223	3.3	27.1
2230	1.5	27.1
225	1.5	26.4
229	1.5	26.3
233	1.6	27.4
234	2.2	↓
235	2.2	↓
236	2.7	↓
237	2.7	↓
238	2.6	↓
240	2.6	↓
242	2.5	↓
244	2.3	↓
295 R	6.3	27.2

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: SmS DATE: 5/25/83
CHECKED BY: DWB DATE: 5-25-83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE (KSI)	ALLOWABLE STRESS (KSI)
560	13.3	27.2
555	4.1	27.2
550	2.1	27.1
545	5.0	
540	3.9	
536	2.5	
535	2.8	
534	3.3	
533	5.9	
530	7.1	
529	3.9	
525	3.8	27.0
510	2.0	
505	1.8	
490	1.7	
485	1.4	
480	1.4	
475	1.2	
465	2.2	
460	1.5	

TELEDYNE
ENGINEERING SERVICES

Technical Report
TR-5364-1
Revision 0

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: SmS DATE: 5/25/83
CHECKED BY: [illegible] DATE: 5-25-83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE (KSI)	ALLOWABLE STRESS (KSI)
450	2.2	27.0
440	2.3	27.0
435 R	1.4	27.4
435 R	3.0	
575	2.9	
585	1.9	
590	2.7	
595	3.2	
600 R	.9	
600 R	1.5	
668	1.5	
670	1.7	
675	1.8	
680	1.6	
690	1.9	
700	1.9	
710	1.6	
715	1.7	
717	2.3	
720	2.7	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMD DATE: 5/25/83
CHECKED BY: [signature] DATE: 5-25-83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE (KSI)	ALLOWABLE STRESS (KSI)
725	2.9	27.4
750	2.9	27.4
295R	2.1	27.2
300	2.4	
310	.8	
320	2.1	
325	2.8	
335R	4.1	
335R	3.9	
340	4.7	27.1
350	3.1	
355	1.6	
360	1.9	
365	2.9	
370	1.6	
375	.6	
380	1.7	
382	1.0	
385	1.2	
400	1.1	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DmD DATE: 5/25/83
CHECKED BY: [signature] DATE: 5-25-83

STRESS SUMMARY - EQUATION B3

NODE #	PORV TRANSIENT THERMAL STRESS RANGE (KSI)	ALLOWABLE STRESS (KSI)
405	1.7	27.0
420	2.3	
429	2.9	
430	3.1	
431	3.1	
435 B	3.9	
335 B	2.6	27.2
610	6.1	27.1
615	6.8	
620	3.8	
625	3.7	27.0
635	2.2	
645	2.7	
657	3.2	
660	3.8	
665	3.9	
600 B	4.4	

6.1.6 Equation C-1 Stresses

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-3-83
CHECKED BY: DHD DATE: 5/3/83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
1	0	.1	.2	.3 YZ	29.2
4		.9	1.3	2.2 YZ	
6		.3	.8	1.1 YZ	
7		.2	.3	.5 YZ	
8		.1	.2	.3 YZ	
10		.2	.3	.5 YZ	
12		.5	.7	1.2 YZ	
18		.4	.2	.6 YZ	
30		.4	.3	.7 YZ	↓
32		.7	.4	1.1 YZ	30.1
33		.4	.1	.5 YZ	
34		.4	.2	.6 YZ	
36		.5	.2	.7 YZ	
38		.2	.5	.7 YZ	
40		.2	.4	.6 YZ	
42		.1	.2	.3 YZ	
44		.2	.3	.5 YZ	
46		.2	.3	.5 YZ	
48		.1	.2	.3 YZ	
50	↓	.2	.4	.6 YZ	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-3-83
CHECKED BY: [signature] DATE: 5/3/83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
52	0.	.3	.5	.8 YZ	30.1
56	↓	.4	.4	.8 XY	30.0
58	↓	.4	.4	.8 XY	↓
60	↓	.3	.4	.7 YZ	↓
62	↓	.4	.3	.7 XY	↓
66	↓	.2	.4	.6 YZ	↓
68	↓	.2	.4	.6 YZ	↓
70	↓	.2	.3	.5 YZ	↓
72	↓	.1	.6	.7 YZ	↓
74	↓	.3	.3	.6 XY	29.8
76	↓	.2	.3	.5 XY	↓
80	↓	.3	.3	.6 XY	↓
82	↓	.5	.4	.9 XY	↓
83	↓	.2	.3	.5 XY	↓
84	↓	.5	.4	.9 XY	↓
86	↓	.3	.3	.6 XY	↓
88	↓	.3	.3	.6 XY	↓
90	↓	.5	.4	.9 XY	↓
93	↓	.4	.3	.7 XY	↓
97B	↓	.8	.6	1.4 XY	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DWB DATE: 5-3-83
CHECKED BY: DWD DATE: 5/3/83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
97R	0	.7	.7	1.4 XY	29.9
195		.5	.4	.9 XY	
142R		.7	.6	1.3 XY	
142R		.6	.7	1.3 XY	
200		.4	.4	.8 XY	
206R		.3	.6	.9 XY	
206R		.3	.4	.7 XY	
260		1.0	1.3	2.3 XY	27.5
280		1.5	3.2	4.7 XY	27.1
285		4.5	2.2	6.7 XY	27.1
290		5.3	3.0	8.3 XY	26.8
295B		3.7	2.5	6.2 XY	26.8
97B		.7	1.8	2.5 XY	27.5
98		.8	.6	1.4 XY	
99		.7	.7	1.4 XY	
100		.4	1.1	1.5 XY	
102		.3	1.4	1.7 XY	27.2
103		.3	1.7	2.0 XY	
104		.8	3.1	3.9 XY	
106		1.0	3.3	4.3 XY	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-3-83
CHECKED BY: Dmd DATE: 5/3/83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
108	0	.6	2.0	2.6 XY	27.2
109		.9	2.0	2.9 XY	27.2
110		1.2	2.3	3.5 XY	26.7
112		.5	4.3	4.8 XY	26.7
114		1.2	4.5	5.7 XY	26.5
1140		.7	2.6	3.3 XY	26.5
115		.7	2.7	3.4 XY	21.2
120	3.5	.9	.7	5.1 YZ	20.9
122		1.1	4.3	8.9 XY	28.8
124		.9	5.1	9.5 XY	
126		.9	5.1	9.5 XY	
128		.7	4.5	8.7 XY	
130		.6	2.8	6.9 XY	
132		.9	2.1	6.5 YZ	
134		1.0	2.3	6.8 YZ	
136		1.2	2.8	7.5 YZ	
138		1.3	2.7	7.5 YZ	
142B	0	.6	1.2	1.8 YZ	27.5
144		.4	.7	1.1 YZ	
146		.2	1.2	1.4 YZ	

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DWB DATE: 5-3-83
CHECKED BY: DMD DATE: 5-3-83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
148	0	.3	1.8	2.1 YZ	27.2
150		1.0	3.6	4.6 YZ	27.2
152		1.4	3.9	5.3 YZ	27.2
156		.8	2.3	3.1 YZ	27.2
157		1.1	2.0	3.1 YZ	26.7
158		1.3	2.0	3.3 YZ	26.7
160		.7	3.5	4.2 YZ	26.7
162		1.2	3.7	4.9 YZ	26.5
163		.7	2.2	2.9 YZ	26.5
165		.7	2.2	2.9 YZ	21.1
170	3.5	.9	.6	5.0 XY	20.9
172		1.0	4.0	8.5 YZ	28.8
174		.8	4.7	9.0 YZ	28.8
176		.8	4.7	9.0 YZ	
178		.5	4.2	8.2 YZ	
180		.5	2.6	6.6 YZ	
181		.8	2.0	6.3 YZ	
182		.9	2.0	6.4 XY	
184		1.1	2.4	7.0 XY	
185		1.2	2.4	7.1 XY	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: RMB DATE: 5-3-83
CHECKED BY: Dms DATE: 5/4/83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
206B	0	1.1	2.2	3.3 XY	27.5
208		.3	1.6	1.9 XY	27.5
214		1.0	3.5	4.5 XY	27.2
216		1.5	3.8	5.3 XY	27.2
220		1.3	1.4	2.7 XY	26.7
222		.6	2.3	2.9 XY	26.7
223		1.0	2.4	3.4 XY	26.5
2230		.6	1.4	2.0 XY	26.5
225		.6	1.4	2.0 XY	21.1
229	3.5	.7	.7	4.9 XY	20.9
233		.8	3.4	7.7 XY	28.8
234		.5	3.7	7.7 XY	
235		.5	3.7	7.7 XY	
236		.3	3.1	6.9 XY	
237		.2	2.2	5.9 XY	
238		.7	1.8	6.0 XY	
240		.8	1.9	6.2 XY	
242		1.1	2.2	6.8 YZ	
244		1.1	2.2	6.8 YZ	
295R	0	3.2	2.0	5.2 YZ	26.8

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: AMB DATE: 5-3-83
CHECKED BY: DMD DATE: 5/4/83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
560	0	9.9	5.5	15.4 YZ	26.8
555		5.6	2.7	8.3 YZ	26.8
550		3.5	6.6	10.1 YZ	26.3
545		3.7	13.5	17.2 YZ	
540		3.8	15.5	19.3 YZ	
536		3.7	11.6	15.3 YZ	
535		4.1	10.8	14.9 YZ	
534		4.7	9.8	14.5 YZ	
533		5.6	13.0	18.6 YZ	
530		6.4	11.2	17.6 YZ	
529		4.2	8.4	12.6 YZ	
525		4.6	8.5	13.1 YZ	25.7
510	2.9	3.0	5.6	11.5 XY	
505		2.5	6.0	11.4 XY	
490		1.7	6.6	11.2 XY	
485		2.8	5.8	11.5 YZ	
480		2.7	5.8	11.4 YZ	
475		2.5	5.8	11.2 YZ	
465		4.2	5.6	12.7 YZ	
460		2.7	6.4	12.0 YZ	

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-3-83
CHECKED BY: DMS DATE: 5/4/83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
450	2.9	5.0	8.2	16.1 YZ	25.7
440	4.1	5.4	8.1	17.6 YZ	25.7
435R		3.4	4.8	12.3 XY	28.8
435R		1.1	8.3	13.5 YZ	
575		3.5	5.4	13.0 YZ	
585		5.5	6.8	16.4 YZ	
590		6.3	5.7	16.1 YZ	
595	↓	7.0	6.3	17.4 YZ	
600R	3.5	2.1	2.0	7.6 YZ	
600R		2.5	2.4	8.4 YZ	
668		2.6	2.4	8.5 YZ	
670		2.6	2.4	8.5 YZ	
675		2.9	2.3	8.7 YZ	
680		2.9	2.3	8.7 YZ	
690		2.6	1.8	7.9 XY	
700		2.1	1.7	7.3 XY	
710		1.1	2.0	6.6 XY	
715		.8	2.3	6.6 XY	
717		.5	2.7	6.7 XY	
720	↓	.4	2.9	6.8 XY	↓

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DWB DATE: 5-3-83
CHECKED BY: DMD DATE: 5/4/83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
725	3.5	.4	3.0	6.9 XY	28.8
750	3.5	.3	3.8	7.6 XY	28.8
295R	0	2.7	2.9	5.6 YZ	26.8
300		5.2	5.6	10.8 YZ	
310		4.1	5.0	9.1 YZ	
320		2.8	5.3	8.1 YZ	
325		1.6	5.9	7.5 YZ	
335R		1.2	6.3	7.5 YZ	
335R		2.9	7.3	10.2 YZ	↓
340		4.7	11.7	16.4 YZ	26.3
350		2.8	9.1	11.9 YZ	
355		1.0	6.6	7.6 YZ	
360		1.9	5.1	7.0 YZ	
365		3.1	6.1	9.2 YZ	
370		3.7	4.2	7.9 YZ	
375		3.6	3.1	6.7 YZ	
380		3.4	4.8	8.2 YZ	
382		2.4	4.0	6.4 YZ	↓
385	↓	2.5	4.4	6.9 YZ	25.7
400	2.9	1.7	7.7	12.3 YZ	25.7

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [illegible] DATE: 5-3-83
CHECKED BY: [illegible] DATE: 5/4/83

STRESS SUMMARY - EQUATION C1

NODE #	PRESSURE STRESS (KSI)	DEADWEIGHT STRESS (KSI)	DBE STRESS (KSI)	EQUATION C1 STRESS (KSI)	ALLOWABLE STRESS (KSI)
405	2.9	2.1	8.0	13.0 YZ	25.7
420		2.6	10.2	15.7 YZ	
429		4.1	11.8	18.8 YZ	
430		4.6	12.5	20.0 YZ	
431		4.7	12.6	20.2 YZ	↓
435B	↓	5.0	15.1	23.0 YZ	25.7
335B	0	3.0	9.0	12.0 YZ	26.8
610		3.6	8.5	12.1 YZ	26.3
615		3.5	8.2	11.7 YZ	
620		2.6	6.2	8.8 YZ	↓
625	↓	2.8	6.5	9.3 YZ	25.7
635	2.9	2.9	5.5	11.3 YZ	
645		3.7	5.1	11.7 YZ	
657		3.8	5.9	12.6 YZ	
660		3.2	6.7	12.8 YZ	
665		3.2	6.8	12.9 YZ	↓
600B	↓	3.0	8.8	14.7 YZ	25.7

6.2 Support Loads

Support loads are given for each support on the pressurizer relief line piping. Support load combinations were calculated in accordance with Table II, Reference 2. Combination E2 was not considered since the SV analysis was not performed. Thermal-1 refers to the normal thermal operating case and thermal-2 refers to the PORV transient thermal loading.

The support load combinations considered are as follows:

D1 = deadweight + normal thermal +/- OBE

D2 = deadweight + PORV transient thermal +/- $\left[(\text{OBE})^2 + (\text{PORV transient shock})^2\right]^{1/2}$

E1 = deadweight + normal thermal +/- DBE

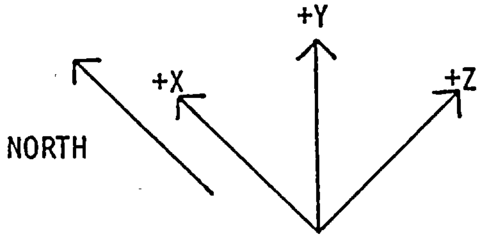
TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-11-83
CHECKED BY: DMD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-R-585
NODE NUMBER 33

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	0	.002	-.001	-60					
THERMAL-1	0	-.153	.069	2060					
THERMAL-2	0	-.045	-.393	-180					
SEISMIC-OBE	0	0	±.013	±221.					
SEISMIC-DBE	0	±.001	±.021	±376.					
BLOWDOWN-SRV									
BLOWDOWN-PORV	0	0	±.005	±423					

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET	+2221 -717		
EMERGENCY	+2376 -436		

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)	16613		
DESIGN (-)	15571		

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

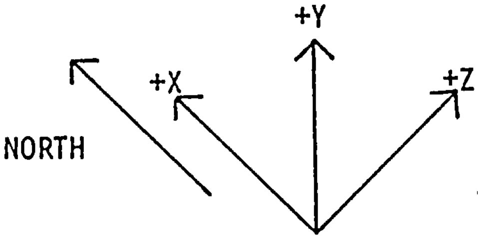
TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DWB DATE: 5-11-83
CHECKED BY: DMD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-R-586
NODE NUMBER 36

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	0	0	-.001		-1020				
THERMAL-1	.002	0	.118		+2170				
THERMAL-2	.037	0	-.377		+370				
SEISMIC-OBE	0	0	±.013		±143				
SEISMIC-DBE	0	0	±.021		±254				
BLOWDOWN-SRV									
BLOWDOWN-PORV	0	0	±.006		±201				

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+1293 -1163	
EMERGENCY		+1404 -1274	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		7621	
DESIGN (-)		5856	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

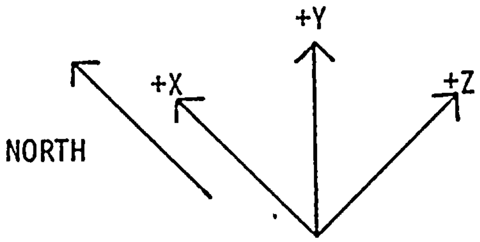
TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: AMS DATE: 5-11-83
CHECKED BY: DMD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-S-587
NODE NUMBER 42

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.006	-.016	.003						
THERMAL-1	-.266	.855	.296						
THERMAL-2	.140	.329	-.326						
SEISMIC-OBE	±.004	0	±.011		±170				
SEISMIC-DBE	±.006	0	±.018		±281				
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.008 -.006	0	+.014 -.010		±324				

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+ 366 - 366	
EMERGENCY		+ 281 - 281	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		12009	
DESIGN (-)		12009	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

TELEDYNE ENGINEERING SERVICES

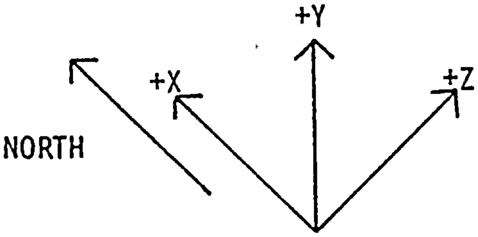
SUPPORT LOAD SUMMARY SHEET

BY: [signature] DATE: 5-25-83

CHECKED BY: [signature] DATE: 5/26/83

DONALD C. COOK
UNIT #1
PROJECT 5364

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-C-588

NODE NUMBER 48

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.009	-.021	.004		426				
RMAL-1	-.419	1.08	.218						
THERMAL-2	.151	.453	-.324						
SEISMIC-OBE	±.006	±.004	±.010						
SEISMIC-DBE	±.010	±.008	±.016						
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.013 -.011	+.007 -.008	+.016 -.010						

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+426	
EMERGENCY		+426	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		426	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE — THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

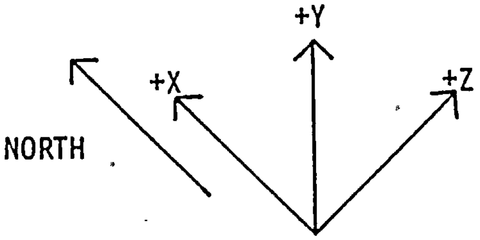
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: SIKS DATE: 5-11-83

CHECKED BY: DnD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-R-589

NODE NUMBER 66

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	0.	-.008	0	+70		+50			
THERMAL-1	0	2.26	0	-1360		-1119			
THERMAL-2	0	.964	0	+390		+100			
SEISMIC-OBE	0	±.002	0	±284		±384			
SEISMIC-DBE	0	±.004	0	±466		±637			
BLOWDOWN-SRV									
BLOWDOWN-PORV	0	+.005 -.006	0	±161		±623			

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET	+786 -1574		+882 -1453
EMERGENCY	+536 -1756		+687 -1706

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)	4246		10089
DESIGN (-)	5595		10770

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

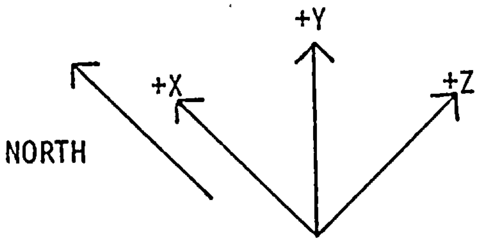
TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [illegible] DATE: 5-25-83
CHECKED BY: DmD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-C-590
NODE NUMBER 70

DESIGN LOADINGS	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	0	-.008	-.001		1200				
ERMAL-1	-.027	2.26	-.022						
THERMAL-2	-.018	1.03	-.015						
SEISMIC-OBE	±.004	±.002	±.002						
SEISMIC-DBE	±.006	±.005	±.007						
BLOWDOWN-SRV									
BLOWDOWN-PORV	±.004	+.005 -.006	+.004 -.006						

	TES COMBINED LOADS FX	FY	FZ
NORMAL/UPSET		+1200	
EMERGENCY		+1200	

	SUPPORT DRAWING LOADS FX	FY	FZ
DESIGN (+)		1200	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE ______ THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

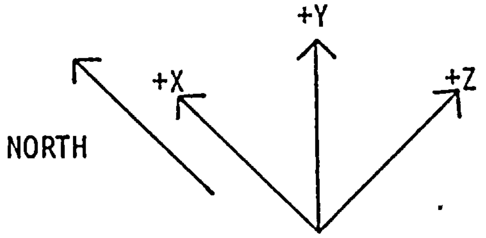
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [illegible] DATE: 5-11-83

CHECKED BY: [illegible] DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-R-591

NODE NUMBER 83

DESIGN LOADINGS	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	0	-.007	0	-60		+50			
THERMAL-1	0	2.30	0	-210		-140			
THERMAL-2	0	1.74	0	-150		-10			
SEISMIC-OBE	0	±.002	0	±276		±218			
SEISMIC-DBE	0	±.003	0	±468		±364			
BLOWDOWN-SRV									
BLOWDOWN-PORV	0	+.006 -.005	0	±354		±331			

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET	+239 -659		+436 -356
EMERGENCY	+408 -738		+414 -454

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)	2257		5339
DESIGN (-)	1935		5348

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

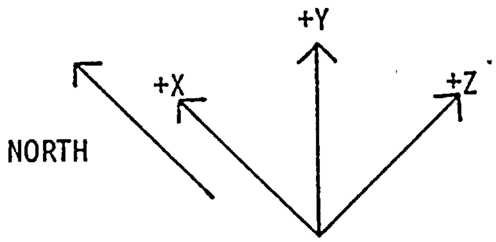
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [illegible] DATE: 5-11-83
CHECKED BY: DmD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-S-592
NODE NUMBER 1140

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.034	.032	-.076						
THERMAL-1	-.185	2.82	.185						
THERMAL-2	-.207	2.83	.161						
SEISMIC-OBE	±.228	0	±.055		±1280				
SEISMIC-DBE	±.397	0	±.091		±2122				
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.003 -.002	0	±.002		±142				

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		±1288	
EMERGENCY		±2122	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		20531	
DESIGN (-)		20531	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

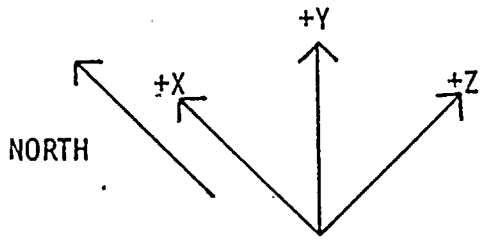
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-25-83

CHECKED BY: [signature] DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-C-593

NODE NUMBER 111

	DESIGN LOADINGS								
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.002	.068	-.036		1067				
THERMAL-1	-.113	2.81	.144						
THERMAL-2	-.182	2.78	.185						
SEISMIC-OBE	±.171	±.016	±.042						
SEISMIC-DBE	±.248	±.028	±.070						
BLOWDOWN-SRV									
BLOWDOWN-PORV	±.006	±.001	+.004 -.005						

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+1067	
EMERGENCY		+1067	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		1067	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE ——— THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

6-82

TELEDYNE
ENGINEERING SERVICES

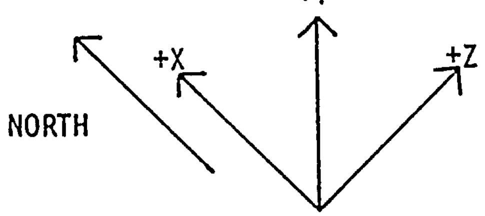
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [illegible] DATE: 5-11-83

CHECKED BY: DmD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-S-594

NODE NUMBER 163

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.076	.030	-.006						
THERMAL-1	.178	2.78	.218						
THERMAL-2	.110	2.81	.249						
SEISMIC-OBE	±.056	0	±.202		±1131				
SEISMIC-DBE	±.097	0	±.350		±1872				
BLOWDOWN-SRV									
BLOWDOWN-PORV	±.001	0	±.002		±162				

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		±1143	
EMERGENCY		±1872	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		19734	
DESIGN (-)		19734	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

6-83

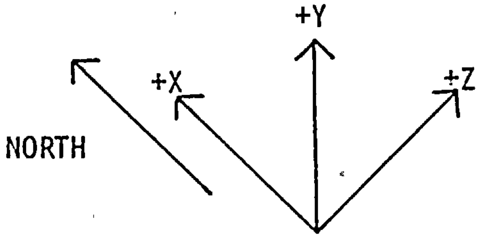
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: AMB DATE: 5-25-83
CHECKED BY: DMD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-C-595
NODE NUMBER 159

	DESIGN LOADINGS								
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.050	.062	.008		1074				
THERMAL-1	.167	2.76	.159						
THERMAL-2	.123	2.76	.241						
SEISMIC-OBE	±.046	±.014	±.175						
SEISMIC-DBE	±.079	±.023	±.303						
BLOWDOWN-SRV									
BLOWDOWN-PORV	±.001	±.001	±.003						

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+1074	
EMERGENCY		+1074	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		1074	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE ——— THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

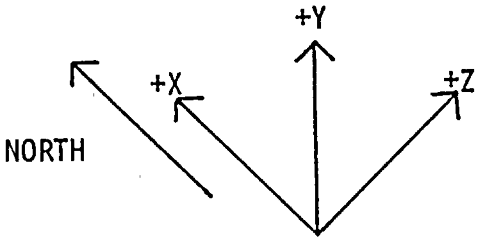
SUPPORT LOAD SUMMARY SHEET

BY: [illegible] DATE: 5-11-83

CHECKED BY: [illegible] DATE: 5/26/83

DONALD C. COOK
UNIT #1
PROJECT 5364

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-S-596

NODE NUMBER 2230

	DESIGN LOADINGS								
	DISPLACEMENTS			FORCES			MOMENTS		
	δX	δY	δZ	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.009	.015	.05						
THERMAL-1	.391	2.66	-.271						
THERMAL-2	.323	2.75	-.105						
SEISMIC-OBE	±.127	0	±.099		±1052.				
SEISMIC-DBE	±.217	0	±.168		±1734				
BLOWDOWN-SRV									
BLOWDOWN-PORV	±.003	.0	±.003		± 206				

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		±1072	
EMERGENCY		±1734	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		11811	
DESIGN (-)		11811	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #1
PROJECT 5364

SUPPORT LOAD SUMMARY SHEET

BY: [signature] DATE: 5-25-83

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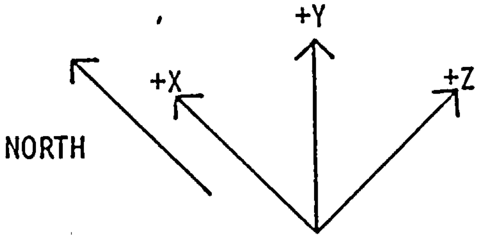
GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-C-597

NODE NUMBER 221

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.001	.036	.027		1025				
THERMAL-1	.283	2.57	-.216						
THERMAL-2	.253	2.63	-.078						
SEISMIC-OBE	±.094	±.013	±.071						
SEISMIC-DBE	±.160	±.022	±.122						
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.005 -.006	±.002	+.003 -.002						

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+1025	
EMERGENCY		+1025	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		1025	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE — THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

6-86

TELEDYNE ENGINEERING SERVICES

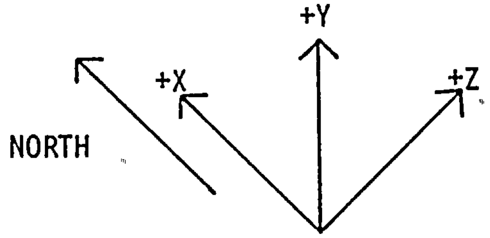
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [illegible] DATE: 5-20-83

CHECKED BY: [illegible] DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-S-598

NODE NUMBER 108

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.053	.049	.086						
THERMAL-1	.035	2.79	.105						
THERMAL-2	-.202	2.59	.193						
SEISMIC-OBE	±.021	±.006	±.017	±37		±46			
SEISMIC-DBE	±.034	±.010	±.027	±61		±76			
BLOWDOWN-SRV									
BLOWDOWN-PORV	±.022	±.001	+.017 -.018	±58		±72.			

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET	±69		±85
EMERGENCY	±61		±76

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)	2763		4152
DESIGN (-)	2763		4152

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

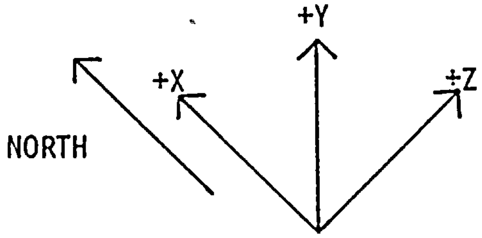
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: AMB DATE: 5-20-83
CHECKED BY: DmD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-S-599
NODE NUMBER 156

DESIGN LOADINGS	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.052	.045	.014						
THERMAL-1	.155	2.75	.066						
THERMAL-2	-.014	2.60	.274						
SEISMIC-OBE	±.001	±.009	±.008	±97	±17	±12			
SEISMIC-DBE	±.002	±.016	±.015	±166	±29	±20			
BLOWDOWN-SRV									
BLOWDOWN-PORV	±.001	0	+.007 -.008	±97	±17	±12			

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET	±137	±24	±17
EMERGENCY	±166	±29	±20

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)	3610		545
DESIGN (-)	3610		545

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

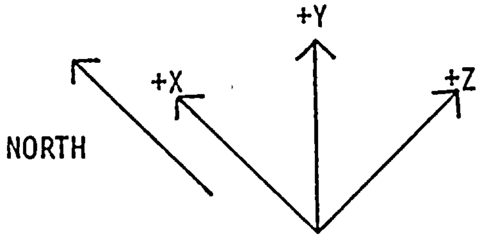
TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [signature] DATE: 5-11-83
CHECKED BY: DmD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-R-600
NODE NUMBER 195

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	0	-.003	0	+100		-120			
THERMAL-1	0	2.34	0	-1110		+1830			
THERMAL-2	0	2.30	0	-720		+1470			
SEISMIC-OBE	0	±.001	0	±376		±269			
SEISMIC-DBE	0	±.002	0	±599		±436			
BLOWDOWN-SRV									
BLOWDOWN-PORV	0	±.002	0	±458		±718			

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET	+476 -1386		+2117 -389
EMERGENCY	+699 -1609		+2146 -556

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)	7047		19475
DESIGN (-)	6179		20488

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

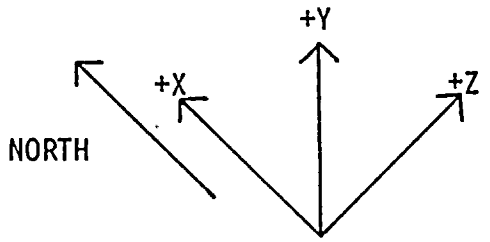
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: KMB DATE: 5-11-83
CHECKED BY: DMD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-R-601
NODE NUMBER 280

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	0	-.003	0	-320		+720			
THERMAL-1	0	2.36	0	+300		-1050			
THERMAL-2	0	2.63	0	+1320		-2700			
SEISMIC-OBE	0	±.001	0	±642		±308			
SEISMIC-DBE	0	±.001	0	±983		±424			
BLOWDOWN-SRV									
BLOWDOWN-PORV	0	±.002	0	±698		±265			

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET	+1948 -962		+1028 -2386
EMERGENCY	+963 -1303		+1144 -754

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)	1223		1106
DESIGN (-)	8757		2740

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS * THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

* EXCEPT +Fx LOAD

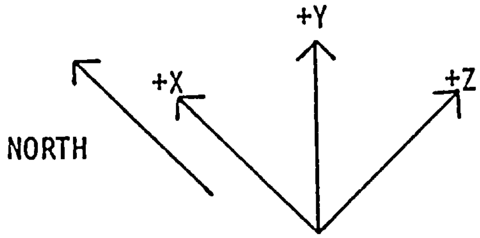
SUPPORT LOAD SUMMARY SHEET

BY: ZWB DATE: 5-25-83

CHECKED BY: DMD DATE: 5/26/83

DONALD C. COOK
UNIT #1
PROJECT 5364

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-C-602

NODE NUMBER 668

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.104	.001	-.043		1159				
THERMAL-1	.422	3.19	-.176						
THERMAL-2	.311	3.24	-.172						
SEISMIC-OBE	±.141	±.047	±.088						
SEISMIC-DBE	±.209	±.072	±.128						
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.099 -.127	+.059 -.040	+.085 -.062						

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+1159	
EMERGENCY		+1159	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		1159	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE ——— THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

TELEDYNE ENGINEERING SERVICES

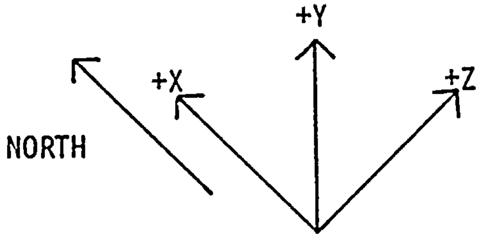
SUPPORT LOAD SUMMARY SHEET

BY: AMB DATE: 5-20-83

CHECKED BY: DMD DATE: 5/26/83

DONALD C. COOK
UNIT #1
PROJECT 5364

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-R-603

NODE NUMBER 585

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.103	.211	-.042	-121		-298			
THERMAL-1	.163	3.33	-.067	-173		-428			
THERMAL-2	.056	3.37	-.023	-270.		-650.			
SEISMIC-OBE	±.141	±.077	±.057	±614		±1519			
SEISMIC-DBE	±.208	±.106	±.085	±855		±2117			
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.099 -.128	+.045 -.044	+.052 -.040	±511.		±1266			

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET	+493 -1190		+1221 -2925
EMERGENCY	+734 -1149		+1819 -2843

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)	1833		4540
DESIGN (-)	1560		3863

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

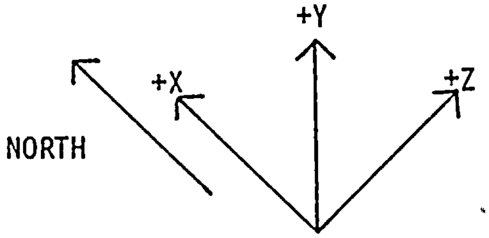
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: [illegible] DATE: 5-11-83
CHECKED BY: [illegible] DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-S-604
NODE NUMBER 450

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.052	.816	-.075						
[illegible]RMAL-1	.120	3.36	.334						
THERMAL-2	.106	3.52	.445						
SEISMIC-OBE	±.093	0	±.202		±653.				
SEISMIC-DBE	±.127	0	±.293		±952.				
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.059 -.058	0	+.150 -.147		±868				

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		±1086	
EMERGENCY		±952	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		1629	
DESIGN (-)		1629	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

TELEDYNE ENGINEERING SERVICES

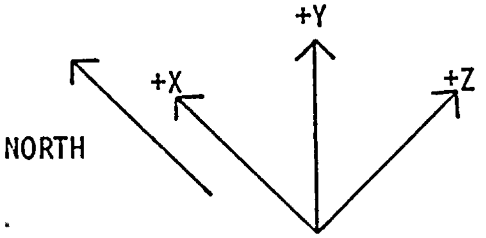
SUPPORT LOAD SUMMARY SHEET

BY: [signature] DATE: 5-20-83

CHECKED BY: [signature] DATE: 5/26/83

DONALD C. COOK
UNIT #1
PROJECT 5364

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-R-605

NODE NUMBER 465

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.039	1.22	-.053	+673.		-507.			
THERMAL-1	.402	3.20	.534	-414.		+312.			
THERMAL-2	.470	3.59	.630	-530.		+400			
SEISMIC-OBE	±.138	±.362	±.182	±680		±512			
SEISMIC-DBE	±.199	±.487	±.263	±1021		±769			
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.100 -.105	+.128 -.167	+.132 -.137	±1217		±918			

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET	+1537 -1251		+944 -1158
EMERGENCY	+1694 -762		+574 -1276

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)	3150		1635
DESIGN (-)	2286		2337

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

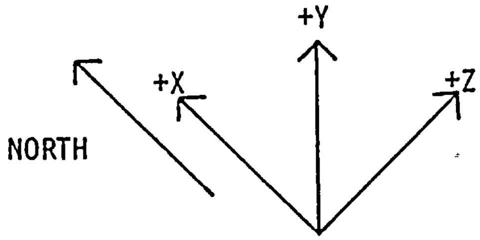
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: RWB DATE: 5-25-83
CHECKED BY: Dmb DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-C-606
NODE NUMBER 485

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.043	1.25	-.050		811				
RMAL-1	.608	3.02	.514						
THERMAL-2	.699	3.57	.571						
SEISMIC-OBE	±.167	±.523	±.160						
SEISMIC-DBE	±.243	±.704	±.216						
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.123 -.131	+.194 -.231	+.101 -.104						

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+811	
EMERGENCY		+811	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		811	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE —
THAN THE LOAD SHOWN
ON THE SUPPORT DRAWING

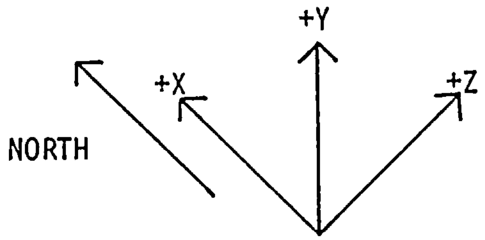
TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-25-83
CHECKED BY: DMD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-C-607
NODE NUMBER 529

DESIGN LOADINGS	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.065	.465	-.105		658				
THERMAL-1	.819	2.54	.039						
THERMAL-2	.879	3.28	.006						
SEISMIC-OBE	±.122	± 045	±.122						
SEISMIC-DBE	±.177	±.085	±.165						
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.085 -.098	+.028 -.031	+.025 -.024						

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+658	
EMERGENCY		+658	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		658	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE ——— THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

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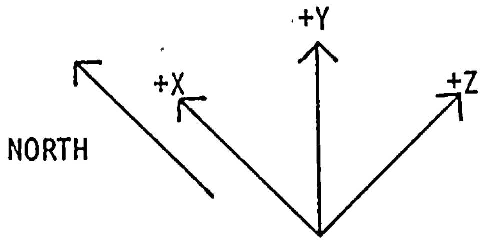
DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-11-83
CHECKED BY: DMD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-S-608
NODE NUMBER 534

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.093	.373	-.064						
THERMAL-1	.758	2.46	-.010						
THERMAL-2	.863	3.21	-.046						
SEISMIC-OBE	±.110	0	±.064		±639.				
SEISMIC-DBE	±.160	0	±.087		±876.				
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.084 -.087	0	+.018 -.020		±1025				

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		±1208	
EMERGENCY		±876	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		1288	
DESIGN (-)		1288	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

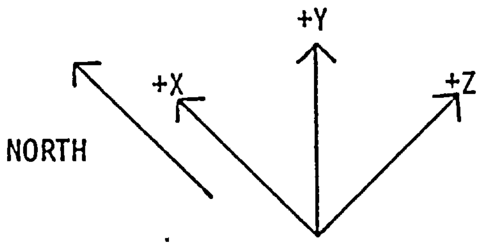
TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: AWB DATE: 5-11-83
CHECKED BY: DmD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-R-609
NODE NUMBER 536

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	-.129	.373	0			-280.			
THERMAL-1	.691	2.46	0			+10.			
THERMAL-2	.821	3.18	0			+900.			
SEISMIC-OBE	±.106	0	0			±527.			
SEISMIC-DBE	±.154	0	0			±711.			
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.031 -.079	±.001	0			±518			

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET			+1359 -807
EMERGENCY			+441 -991

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)			1916
DESIGN (-)			2543

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

TELEDYNE ENGINEERING SERVICES

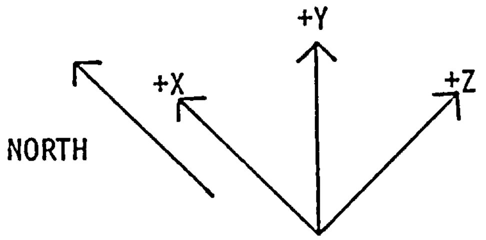
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DWB DATE: 5-25-83

CHECKED BY: DMD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-C-610

NODE NUMBER 620

	DESIGN LOADINGS								
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.098	.404	-.057		783				
[illegible]RMAL-1	.258	3.08	.376						
THERMAL-2	.104	3.37	.310						
SEISMIC-OBE	±.055	±.027	±.151						
SEISMIC-OBE	±.088	±.041	±.219						
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.054 -.056	+.023 -.029	+.136 -.094						

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+783	
EMERGENCY		+783	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		783	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE ——— THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

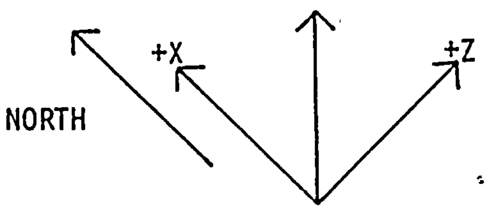
TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DWB DATE: 5-25-83
CHECKED BY: Dmd DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-C-611
NODE NUMBER 431

DESIGN LOADINGS	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.063	.693	-.066		930				
[illegible]RMAL-1	.137	3.34	.250						
THERMAL-2	.108	3.48	.344						
SEISMIC-OBE	±.081	±.017	±.173						
SEISMIC-OBE	±.111	±.027	±.251						
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.055 -.042	+.015 -.017	+.128 -.127						

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+930	
EMERGENCY		+930	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		930	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE ——— THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

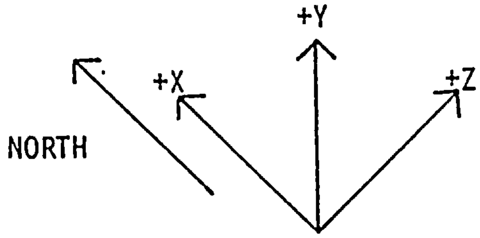
SUPPORT LOAD SUMMARY SHEET

BY: DMB DATE: 5-25-83

CHECKED BY: DmD DATE: 5/26/83

DONALD C. COOK
UNIT #1
PROJECT 5364

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-C-612

NODE NUMBER 382

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.113	.918	-.085		638				
ERMAL-1	.564	3.08	.425						
THERMAL-2	.698	3.46	.455						
SEISMIC-OBE	±.219	±.650	±.119						
SEISMIC-DBE	±.316	±.874	±.172						
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.157 -.124	+.125 -.093	+.073 -.092						

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+638	
EMERGENCY		+638	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		638	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE ______ THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

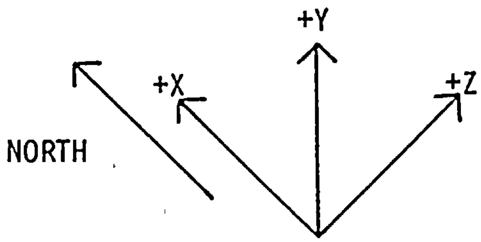
SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-20-83

CHECKED BY: DmD DATE: 5/26/83

GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-R-613

NODE NUMBER 360

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.049	.928	.039	-136		+171			
THERMAL-1	.500	3.08	.397	-78		+97			
THERMAL-2	.638	3.40	.508	-220		+280			
SEISMIC-OBE	±.204	±.625	±.162	±276		±347			
SEISMIC-DBE	±.292	±.843	±.232	±407		±512			
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.152 -.123	+.133 -.087	+.120 -.048	±296		±372			

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET	+140 -761		+960 -176
EMERGENCY	+271 -621		+780 -341

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)	787		658
DESIGN (-)	772		670

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS* THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

* EXCEPT + FZ LOAD

Technical Report
TR-5364-1
Revision 0

6-102

TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-20-83

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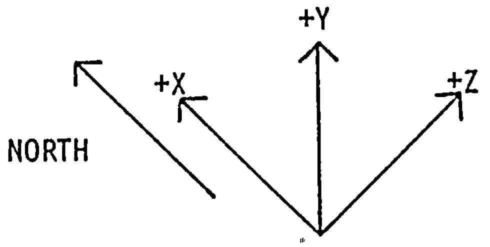
GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-S-614

NODE NUMBER 325

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.011	.380	.041						
[illegible]RMAL-1	.181	3.02	.423						
THERMAL-2	-.008	3.28	.341						
SEISMIC-OBE	±.027	±.041	±.192	±99	±368	±73			
SEISMIC-DBE	±.045	±.058	±.277	±156	±580	±115			
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.042 -.033	+.026 -.030	+.158 -.110	±295	±1101	±218			

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET	±311	±1161	±230
EMERGENCY	±156	±580	±115

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)	288	953	104
DESIGN (-)	288	953	104

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE GREATER* THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

* EXCEPT -FX LOAD AND -FY LOAD

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

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UNIT #1
PROJECT 5364

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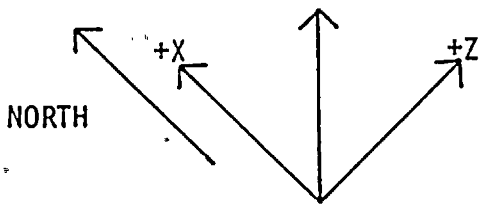
GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-C-615
NODE NUMBER 101

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.085	.065	.037		142				
[illegible]RMAL-1	.082	2.66	.036						
THERMAL-2	-.099	2.46	.277						
SEISMIC-OBE	±.018	±.023	±.004						
SEISMIC-DBE	±.029	±.038	±.007						
BLOWDOWN-SRV									
BLOWDOWN-PORV	±.015	±.010	±.004						

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+142	
EMERGENCY		+142	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		142	
DESIGN (-)			

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE ——— THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

SUPPORT LOAD SUMMARY SHEET

DONALD C. COOK
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PROJECT 5364

BY: DMB DATE: 5-20-83
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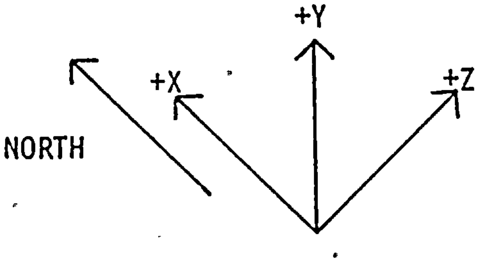
GLOBAL COORDINATE SYSTEM



MARK NUMBER 1-GRC-R-616
NODE NUMBER 203

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	.004	0	-.002		-1950.				
THERMAL-1	.013	2.35	-.003		+1451.				
THERMAL-2	-.016	2.35	.023		+1490.				
SEISMIC-OBE	±.003	0	±.002		±606.3				
SEISMIC-DBE	±.004	0	±.002		±946.9				
BLOWDOWN-SRV									
BLOWDOWN-PORV	+.003 -.004	0	±.002		±1070				

	TES COMBINED LOADS		
	FX	FY	FZ
NORMAL/UPSET		+770 -2556	
EMERGENCY		+448 -2897	

	SUPPORT DRAWING LOADS		
	FX	FY	FZ
DESIGN (+)		8315	
DESIGN (-)		3272	

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TES COMBINED LOADS ARE LESS THAN THE LOAD SHOWN ON THE SUPPORT DRAWING

6.3 Valve Accelerations

Valve accelerations were calculated for both the DBE seismic condition and the PORV transient shock condition. The horizontal allowable was taken as 3g and the vertical allowable as 2g based on the attachments to AEP letter dated September 16, 1982 from Mr. J. L. Williams of AEP to Mr. L. B. Semprucci of TES (Reference 12). For the seismic acclerations, the resultant horizontal acceleration was compared against the 3g allowable. Weights for valves NMO-151, 152 and 153 were taken as 352 pounds, in determining the seismic acceleration, since this is the value used in the seismic analysis, see Section 5.0.

For the PORV transient shock accelerations, the updated valve weight of 400 pounds was used in both the analysis and the acceleration calculations. It should be noted that valves NRV-151, NRV-152, NMO-151, NMO-152 and NMO-153 all fail the vertical acceleration criteria of 2g (see Section 2.0).

6.3.1 DBE Seismic Valve Accelerations

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

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UNIT #1
PROJECT 5364

BY: DMD DATE: 5/12/83
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VALVE NO.		NMO-15			NMO-152			NMO-15		
NODE NO.		651			411			41[illegible]		
		ACCELERATION			ACCELERATION			ACCELERATION		
		A_x	A_y	A_z	A_x	A_y	A_z	A_x	A_y	A_z
SHOCK DIRECTION	X	.76	41	.41	.73	.36	.56	.67	.73	.61
	Y	.17	.15	.15	.27	25	.24	.24	.33	.34
	Z	.36	.27	.66	.70	52	69	.51	.64	.78
SRSS RESULTS	A_{xT}	.86 g			1.05 g			.88 g		
	A_{yT}	.51 g			.68 g			1.18 g		
	A_{zT}	.79 g			.92 g			1.05 g		

	ACCEL.	ALLOWABLE	ACCEL.	ALLOWABLE	ACCEL.	ALLOWABLE
VERTICAL A_{vT}	.51 g	2 g	.68 g	2 g	1.18 g	2 g
HORIZONTAL *	1.17 g	3 g	1.40 g	3 g	1.37 g	3 g

$$\text{* HORIZONTAL ACCELERATION} = \sqrt{(A_{xT})^2 + (A_{zT})^2}$$

Technical Report
TR-5364-1
Revision 0

6-108

TELEDYNE ENGINEERING SERVICES

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMD DATE: 5/12/83
CHECKED BY: [illegible] DATE: 5-12-83

VALVE NO.		SV-45A			SV-45B			SV-45C		
NODE NO.		2260			1660			1170		
		ACCELERATION			ACCELERATION			ACCELERATION		
		A_x	A_y	A_z	A_x	A_y	A_z	A_x	A_y	A_z
SHOCK DIRECTION	X	.99	.3	.38	.96	.16	.46	1.46	.10	.24
	Y	.05	.02	.05	.05	.02	.04	.04	.01	.04
	Z	.84	.15	.92	.51	.11	1.35	.29	.17	1.09
SRSS RESULTS	A_{xT}	1.30 g			1.09 g			1.49 g		
	A_{yT}	.20 g			.20 g			.20 g		
	A_{zT}	1.20 g			1.43 g			1.12 g		

	ACCEL.	ALLOWABLE	ACCEL.	ALLOWABLE	ACCEL.	ALLOWABLE
VERTICAL A_{yT}	.2 g	2 g	.20 g	2 g	.20 g	2 g
HORIZONTAL *	1.77 g	3 g	1.80 g	3 g	1.86 g	3 g

$$* \text{ HORIZONTAL ACCELERATION} = \sqrt{(A_{xT})^2 + (A_{zT})^2}$$

TELEDYNE
ENGINEERING SERVICES

BY: SmD DATE: 5/12/83
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VALVE NO.		NRV-15[illegible]			NRV-152			NRV-15[illegible]		
NODE NO.		631			391			516		
		ACCELERATION			ACCELERATION			ACCELERATION		
		A_x	A_y	A_z	A_x	A_y	A_z	A_x	A_y	A_z
SHOCK DIRECTION	X	.13	.32	.34	1.16	.60	.84	.97	.42	.67
	Y	.17	.14	.16	.46	.51	.35	.26	.14	.51
	Z	.54	.30	1.24	1.21	1.00	1.08	.51	.30	1.02
SRSS RESULTS	A_{xT}	1.09 g			1.74 g			1.13 g		
	A_{yT}	.46 g			1.27 g			.53 g		
	A_{zT}	1.30 g			1.41 g			1.32 g		

	ACCEL.	ALLOWABLE	ACCEL.	ALLOWABLE	ACCEL.	ALLOWABLE
VERTICAL A_{yT}	.46 g	2 g	1.27 g	2 g	.53 g	2 g
HORIZONTAL *	1.69 g	3 g	2.24 g	3 g	1.74 g	3 g

$$\text{* HORIZONTAL ACCELERATION} = \sqrt{(A_{xT})^2 + (A_{zT})^2}$$

6.3.2. PORV Transient Shock Valve Accelerations

TELEDYNE ENGINEERING SERVICES

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PROJECT 5364

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VALVE ACCELERATIONS

VALVE	SV-45A			SV-45B		
NODE NUMBER	2260			1660		
VALVE WEIGHT	685 LBS			685 LBS		
DIRECTION	X	Y	Z	X	Y	Z
FORCE (LBS)	48	43	31	32	36	49
ACCELERATION	.07g	.06g	.05g	.05g	.05g	.07g
ALLOWABLE	3g	2g	3g	3g	2g	3g

VALVE	SV-45C					
NODE NUMBER	1170					
VALVE WEIGHT	685 LBS					
DIRECTION	X	Y	Z	X	Y	Z
FORCE (LBS)	47	33	41			
ACCELERATION	.07g	.05g	.06g			
ALLOWABLE	3g	2g	3g			

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-24-83
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VALVE ACCELERATIONS

VALVE	NMO-151			NMO-152		
NODE NUMBER	651			411		
VALVE WEIGHT	400 LBS			400 LBS		
DIRECTION	X	Y	Z	X	Y	Z
FORCE (LBS)	1116	999	835	783	960	899
ACCELERATION	2.79g	2.50g	2.09g	1.96g	2.40g	2.25g
ALLOWABLE	3g	2g	3g	3g	2g	3g

VALVE	NMO-153					
NODE NUMBER	496					
VALVE WEIGHT	400 LBS					
DIRECTION	X	Y	Z	X	Y	Z
FORCE (LBS)	1194	1083	399			
ACCELERATION	2.99g	2.71g	1.00g			
ALLOWABLE	3g	2g	3g			

Technical Report
TR-5364-1
Revision 0

6-113

TELEDYNE
ENGINEERING SERVICES

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DWB DATE: 5-24-83
CHECKED BY: DMD DATE: 5/24/83

VALVE ACCELERATIONS

VALVE	NRV-151			NRV-152		
NODE NUMBER	631			391		
VALVE WEIGHT	480 LBS			480 LBS		
DIRECTION	X	Y	Z	X	Y	Z
FORCE (LBS)	658	1579	369	387	766	639
ACCELERATION	1.37g	3.29g	.77g	.81g	1.60g	1.33g
ALLOWABLE	3g	2g	3g	3g	2g	3g

VALVE	NRV-153					
NODE NUMBER	516					
VALVE WEIGHT	480 LBS					
DIRECTION	X	Y	Z	X	Y	Z
FORCE (LBS)	454	1269	307			
ACCELERATION	.95g	2.63g	.64g			
ALLOWABLE	3g	2g	3g			

6.4 Nozzle Loads

Forces and Moments for the four pressurizer nozzles and the quench tank nozzles are given in this section for each loading condition analyzed.

Technical Report
TR-5364-1
Revision 0

6-115

TELEDYNE ENGINEERING SERVICES

NOZZLE LOAD SUMMARY SHEET

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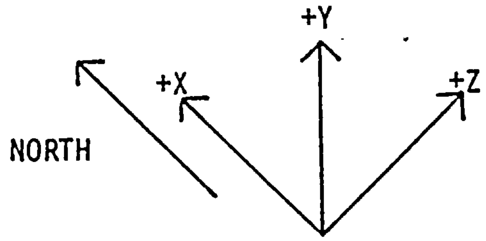
UNIT #1
PROJECT 5364

GLOBAL COORDINATE SYSTEM



NODE NUMBER 1

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	—	—	—	0	-1000	-20	-1200	-870	20090
THERMAL-1	—	—	—	-450	340	1479	31540	62080	121840
THERMAL-2	—	—	—	-20	80	10	-8120	-9000	33650
SEISMIC-OBE	—	—	—	±50	±147	±510	±7676	±18535	±6030
SEISMIC-DBE	—	—	—	±94	±259	±840	±12081	±30537	±10427
BLOWDOWN-SRV									
BLOWDOWN-PORV	—	—	—	±495	±10369	±222	±3354	±1814	±8140

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

Technical Report
TR-5364-1
Revision 0

TELEDYNE ENGINEERING SERVICES

NOZZLE LOAD SUMMARY SHEET

BY: Smb DATE: 5/26/83

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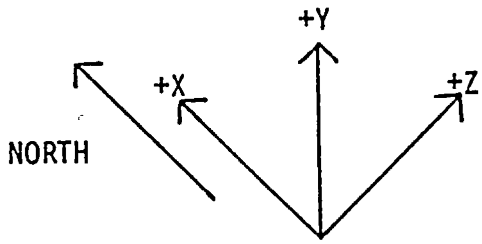
UNIT #1
PROJECT 5364

GLOBAL COORDINATE SYSTEM



NODE NUMBER 750

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	—	—	—	-100	470	250	9220	-1790	-3810
THERMAL-1	—	—	—	820	-579	170	17250	4720	-83830
THERMAL-2	—	—	—	390	-50	400	33520	9870	-45740
SEISMIC-OBE	—	—	—	±375	±500	±389	±19183	±26696	±34854
SEISMIC-DBE	—	—	—	±527	±806	±537	±26283	±33635	±52040
BLOWDOWN-SRV									
BLOWDOWN-PORV	—	—	—	±2083	±2803	± 886	±36134	± 37970	± 81181

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

TELEDYNE
ENGINEERING SERVICES

NOZZLE LOAD SUMMARY SHEET

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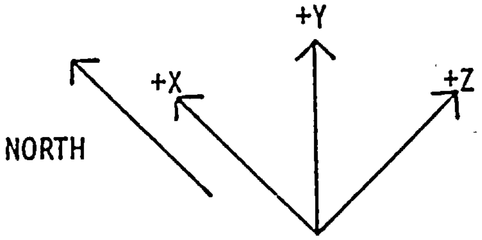
DONALD C. COOK
UNIT #1
PROJECT 5364

GLOBAL COORDINATE SYSTEM



NODE NUMBER 244

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	—	—	—	20	-1040	60	18230	-950	-11150
THERMAL-1	—	—	—	-140	-2069	-690	-28480	26920	-64200
THERMAL-2	—	—	—	-260	-1180	-120	-19920	10250	-39240
SEISMIC-OBE	—	—	—	±611	±921	±501	±10864	±10964	±20444
SEISMIC-DBE	—	—	—	±1031	±1523	±852	±18491	±18177	±33944
BLOWDOWN-SRV									
BLOWDOWN-PORV	—	—	—	±94	±105	±130	±3725	±1966	±3188

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

NOZZLE LOAD SUMMARY SHEET

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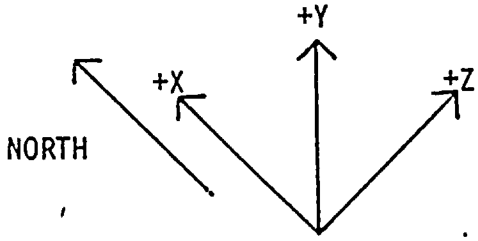
UNIT #1
PROJECT 5364

GLOBAL COORDINATE SYSTEM



NODE NUMBER 185

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	—	—	—	-50	-910	0	13930	440	16830
THERMAL-1	—	—	—	360	-820	-440	20890	22100	-17600
THERMAL-2	—	—	—	80	-430	-100	7080	5680	-12980
SEISMIC-OBE	—	—	—	±681	±1191	±810	±24668	±13523	±7006
SEISMIC-DBE	—	—	—	±1132	±1982	±1401	±40909	±22405	±12079
BLOWDOWN-SRV									
BLOWDOWN-PORV	—	—	—	±77	±113	±75	±2215	±1205	±2071

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

Technical Report
TR-5364-1
Revision 0

TELEDYNE
ENGINEERING SERVICES

NOZZLE LOAD SUMMARY SHEET

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UNIT #1
PROJECT 5364

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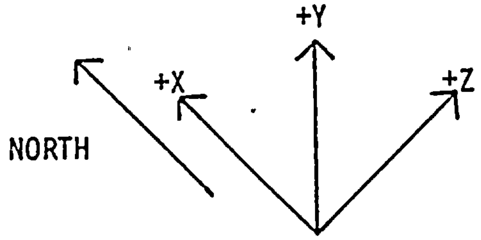

NODE NUMBER 138

DESIGN LOADINGS									
	DISPLACEMENTS			FORCES			MOMENTS		
	X	Y	Z	FX	FY	FZ	MX	MY	MZ
DEADWEIGHT-1	—	—	—	-20	-880	-60	-10330	850	21360
THERMAL-1	—	—	—	400	-480	-30	15060	15000	12520
THERMAL-2	—	—	—	150	-280	30	6850	4950	3270
SEISMIC-OBE	—	—	—	±920	±1350	±820	±16050	±15834	±23448
SEISMIC-DBE	—	—	—	±1600	±2241	±1361	±26601	±26287	±38971
BLOWDOWN-SRV	—	—	—						
BLOWDOWN-PORV	—	—	—	±127	±87	±50	±995	±1598	±2876

UNITS: DISPLACEMENTS : INCHES
FORCES : POUNDS
MOMENTS : INCH-POUNDS

6.5 Valve Loads

Section 6.5 gives the moments on each end of all valves in the piping system for each loading condition analyzed.

TELEDYNE
ENGINEERING SERVICES

Technical Report
TR-5364-1
Revision 0

6-121

VALVE END MOMENTS

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UNIT #1
PROJECT 5364

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VALVE NUMBER SV-45C

NODE NUMBER	115			120		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	5364	-2369	-1525	16095	-2363	-5536
THERMAL 1	-1913	-3627	-20154	-8605	-9858	-10136
THERMAL 2	2673	23	-4907	-2185	-2115	-514
SEISMIC OBE	±2418	±3067	±12929	±6421	±1098	±5189
SEISMIC DBE	±4087	±5324	±22508	±10645	±1821	±8610
BLOWDOWN PORV	±1858	±806	±2466	±1460	±793	±1894

VALVE NUMBER SV-45B

NODE NUMBER	165			170		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	2426	-1606	-5606	3252	-1550	-16289
THERMAL 1	-16818	-3639	-13166	-9819	-11254	6586
THERMAL 2	-246	-1464	596	1062	-3237	9045
SEISMIC OBE	±10449	±3248	±2078	±2403	±1044	±6396
SEISMIC DBE	±18079	±5616	±3593	±4037	±1730	±10582
BLOWDOWN PORV	±1117	±544	±849	±1046	±706	±911

UNITS: INCH-POUNDS

Technical Report
TR-5364-1
Revision 0

DONALD C. COOK
UNIT #1
PROJECT 5364

6-122

VALVE END MOMENTS

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VALVE NUMBER SV-45A

NODE NUMBER	225			229		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	-2525	-909	-4675	-10304	-269	-7910
THERMAL 1	-17623	-4471	6022	24503	-11620	18857
THERMAL 2	3133	-3765	12510	22174	-8404	16514
SEISMIC OBE	±4649	±2775	±4870	±6046	±1853	±4509
SEISMIC DBE	±7941	±4736	±8259	±10129	±3152	±7664
BLOWDOWN PORV	±1064	±904	±2528	±672	±511	±1856

VALVE NUMBER ________

NODE NUMBER						
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT						
THERMAL 1						
THERMAL 2						
SEISMIC OBE						
SEISMIC DBE						
BLOWDOWN PORV						

UNITS: INCH-POUNDS

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-1
Revision 0

6-123

VALVE END MOMENTS

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-25-83

CHECKED BY: Dmd DATE: 5/27/83

VALVE NUMBER NRV-153

NODE NUMBER	525			510		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	-5959	3595	-4701	-6710	2225	-6561
THERMAL 1	2852	-4053	1999	2961	-3923	2271
THERMAL 2	3932	-3806	4366	3673	-3767	3725
SEISMIC OBE	±9951	±5546	±1702	±4646	±4981	±9759
SEISMIC DBE	±13438	±7551	±2527	±7165	±6806	±15305
BLOWDOWN PORV	±3998	±2113	±9683	±7039	±4021	±11669

VALVE NUMBER NMO-153

NODE NUMBER	505			490		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	-6204	562	-5309	-4760	-784	-2629
THERMAL 1	3094	-3766	2600	3202	-3636	2866
THERMAL 2	3358	-3723	2946	3105	-3682	2317
SEISMIC OBE	±4753	±5126	±10677	±8361	±7712	±9107
SEISMIC DBE	±7196	±7003	±16578	±9231	±6785	±17895
BLOWDOWN PORV	±8354	±6186	±12386	±4807	±6132	±13195

UNITS: INCH-POUNDS

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-1
Revision 0

6-124

VALVE END MOMENTS

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: AMB DATE: 5-25-83
CHECKED BY: DMD DATE: 5/27/83

VALVE NUMBER NRV-152

NODE NUMBER	385			400		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	-347	595	-4480	1429	-1879	-5198
THERMAL 1	-400	1634	89	-704	-37	212
THERMAL 2	-1418	-1618	78	-1374	-3349	60
SEISMIC OBE	±4646	±2854	±1240	±9380	±4125	±12514
SEISMIC DBE	±6450	±4457	±1972	±14835	±6030	±18821
BLOWDOWN PORV	±4233	±1847	±3336	±11543	±3164	±12310

VALVE NUMBER NMO-152

NODE NUMBER	405			420		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	76	-4888	-4650	-2685	-7312	-3174
THERMAL 1	-1073	-2072	361	-1371	-3709	481
THERMAL 2	-1319	-5455	38	-1275	-7152	20
SEISMIC OBE	±10544	±4509	±13030	±14271	±6013	±16190
SEISMIC DBE	±16123	±6182	±19393	±21126	±8564	±23806
BLOWDOWN PORV	±10442	±5391	±11858	±10039	±4745	±9527

UNITS: INCH-POUNDS

TELEDYNE ENGINEERING SERVICES

Technical Report
TR-5364-1
Revision 0

6-125

VALVE END MOMENTS

DONALD C. COOK
UNIT #1
PROJECT 5364

BY: DMB DATE: 5-25-83
CHECKED BY: SmD DATE: 5/27/83

VALVE NUMBER NRV-151

NODE NUMBER	625			635		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	5091	-575	670	7219	42	5939
THERMAL 1	7775	1660	4472	5328	-3428	-1588
THERMAL 2	5387	-3196	2717	4882	-5146	1466
SEISMIC OBE	±5763	±4843	±2129	±9577	±4397	±4585
SEISMIC DBE	±8659	±7323	±3281	±14592	±6809	±7333
BLOWDOWN PORV	±3207	±2431	±8262	±8007	±4980	±17493

VALVE NUMBER NMO-151

NODE NUMBER	645			657		
	MX	MY	MZ	MX	MY	MZ
DEADWEIGHT	8389	790	8832	8022	1396	9243
THERMAL 1	2349	-9618	-8955	-47	-14606	-14900
THERMAL 2	4267	-7517	-55	3772	-9431	-1283
SEISMIC OBE	±9728	±2722	±3576	±11289	±3684	±3669
SEISMIC DBE	±14704	±3880	±5836	±17293	±5411	±5967
BLOWDOWN PORV	±9321	±8307	±15478	±7523	±7192	±8935

UNITS: INCH-POUNDS

6.6 Miscellaneous Calculations

6.6.1 Thermal Boundary Displacements

[illegible]

[illegible]

TELEDYNE ENGINEERING SERVICES

BY DMD DATE 4/13/83 CHKD. BY [illegible] DATE 7-15-83

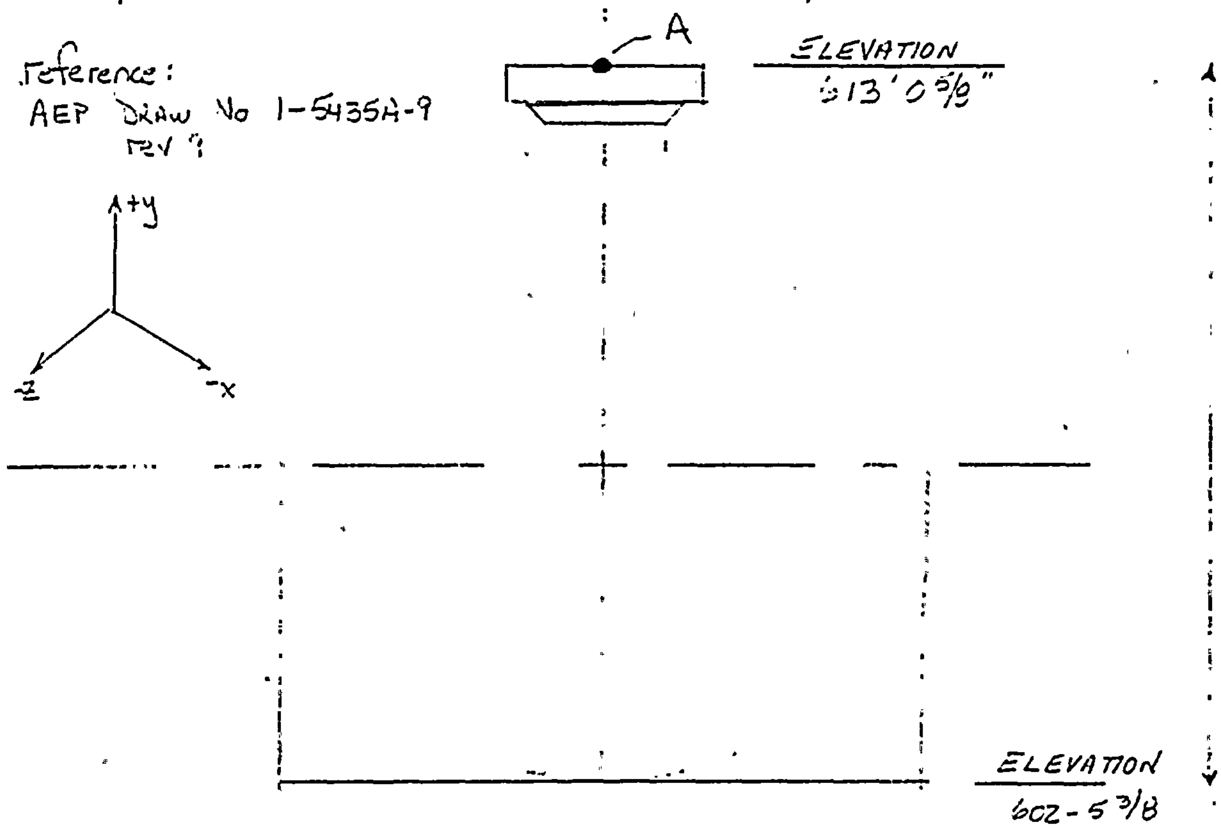
THERMAL BOUNDARY DISPLACEMENT
NORMAL THERMAL CONDITION

SHEET NO. 1 OF ___
PROJ. NO. 5364

UNITS 1 & 2

Temperature @ Quench Tank = 85°F (per AEP letter dated 11/29/82)

reference:
AEP Draw No 1-5435A-9
rev 9



Want displacements at point A

y = 613'-0 5/8"
 − 602-5 3/8"
 ―――――――――
 10'-7 1/4 = 10.604'

x movement = z movement = 0 since nozzle is at ℄ of Q-tank

y movement = $\alpha \Delta t \, l$

$\alpha = 6.135 \times 10^{-6}$ in/in/°F (for ferritic carbon steel)

$\Delta t = 15°F$ (85-70)

$l = 10.604' = 127.248"$

$\Delta y = 6.135 \times 10^{-6} \times 15 \times 127.248 = .0117"$

Summary $\Delta x = 0$ $\Delta y = +.0117"$ $\Delta z = 0$

[illegible]

[illegible]

TELEDYNE ENGINEERING SERVICES

BY DMD DATE 4/12/83
CHKD. BY [illegible] DATE [illegible]

α, ΔT Values UNITS 1 & 2

SHEET NO. 1 OF
PROJ. NO. 5364

temperature ⇒ 653°F

$\Delta T = 653 - 70 = 583$

for austentic stainless steel $\alpha_{650} = 9.37 \times 10^{-6}$

$\alpha_{700} = 9.93 \times 10^{-6}$

$\alpha_{700} - \alpha_{650} = 9.93 - 9.37 = .06$

$\frac{.06}{50°} = \frac{x}{3°}$ $x = .0036$

$\alpha_{653} = 9.37 + .0036 = 9.8736 \times 10^{-6}$

temperature = 85°

$\Delta T = 85 - 70 = 15°$

for austentic stainless steel $\alpha_{70} = 9.11 \times 10^{-6}$

$\alpha_{100} = 9.16 \times 10^{-6}$

$\alpha_{100} - \alpha_{70} = 9.16 - 9.11 = .05$

$\frac{.05}{30} = \frac{x}{15}$ ⇒ $x = .025$

$\alpha_{85} = 9.11 + .025 = 9.135 \times 10^{-6}$

TELEDYNE ENGINEERING SERVICES

BY DMD DATE 4/12/83 | Thermal Boundary Displacements Normal Thermal Condition | SHEET NO. 2 OF ____
CHKD. BY ___ DATE ___ | | PROJ. NO. 5364

Temperature of Pressurizer = 653°F (per AEP letter dated 11/29/82)

references ① AEP DRAW No 1-5435-8 rev 8
② (W) DRAW No 1097 J56 sheet 1 of 2
③ AEP DRAW No 1-5436-?

per reference ② dimension from base of pressurizer to SRV & PORV nozzles is:

$$535.5 - (52.00 - 35.06) = 618.56''$$

Δy will be same for all four nozzles since the elevations are the same.

$\alpha_{583°} = 7.3366 \times 10^{-6}$ in/in/°F for carbon steel @ 653°

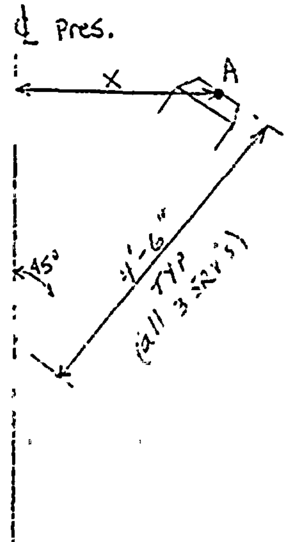
$l = 618.56''$

$\Delta t = 653 - 70 = 583$

$$\Delta y = + \alpha \Delta t l = 7.3366 \times 10^{-6} \times 618.56'' \times 583°F = 2.6457''$$

radial growth

per section "6-7" of ref 3



$$\frac{\sin 30}{4.5} = \frac{\sin 45}{x}$$

$x = 3.182' = 38.1838''$

note: this page of calculations is the same for both units since the pressurizer & nozzle dimensions are essentially identical

TELEDYNE ENGINEERING SERVICES

BY DMD DATE 4/12/83
CHKD. BY. DATE

Thermal Boundary Displacements
NORMAL Thermal Condition

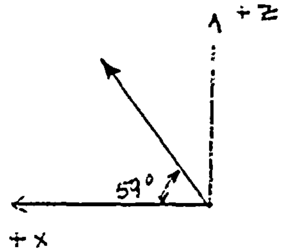
SHEET NO. 3 OF
PROJ. NO. 5364

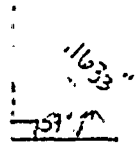
UNIT 1

radial Δ = $7.3366 \times 10^{-6} \times 583 \times 38.1839 = .1633''$

determine x & z components for radial Δ for each SRV valve

Valve SV-45A

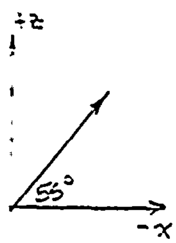


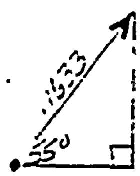


$$\frac{\sin 90}{.1633''} = \frac{\sin 59}{+\Delta z} = \frac{\cos 59}{+\Delta x}$$

$\Delta x = +.0841''$
$\Delta z = +.1400''$

Valve SV-45B

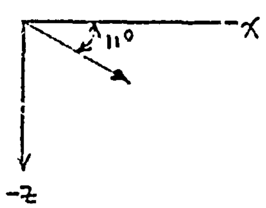


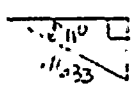


$$\frac{\sin 90}{.1633} = \frac{\sin 55}{-z} = \frac{\cos 55}{-x}$$

$\Delta X = -.0937$
$\Delta z = -.1338$

Valve SV-45C





$$\frac{\sin 90}{.1633} = \frac{\sin 11}{-z} = \frac{\cos 11}{-x}$$

$\Delta X = -.1603$
$\Delta z = -.0312$

TELEDYNE ENGINEERING SERVICES

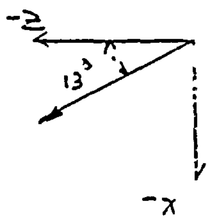
BY DMD. DATE 4/12/83
CHKD. BY [illegible] DATE 4-12-83

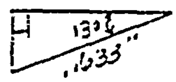
**Thermal Boundary Displacements
Normal Thermal Condition**

SHEET NO. 4 OF ____
PROJ. NO. 5364

UNIT 1

porv relief line





$$\frac{\sin 90}{.1633} = \frac{\sin 13°}{-\Delta X} = \frac{\cos 13°}{-\Delta Z}$$

$\Delta X = -.0367''$
$\Delta Z = -.1591''$

Summary, for the 4 pressurizer nozzles the following displacements will be inserted

node 138 (SV-45C)
$\Delta x = -.1603''$
$\Delta y = +2.6457''$
$\Delta z = -.0312''$

node 185 (SV-45B)
$\Delta x = -.0937''$
$\Delta y = +2.6457''$
$\Delta z = +.1338''$

node 244 (SV-45A)
$\Delta x = +.0841''$
$\Delta y = +2.6457''$
$\Delta z = +.1400''$

node 750 (PORV relief)
$\Delta x = -.0367''$
$\Delta y = +2.6457''$
$\Delta z = -.1591''$

6.6.2 OBE Spectra

[illegible]

[illegible]

TELEDYNE ENGINEERING SERVICES

BY DMD DATE 4/8/83
CHKD. BY [illegible] DATE 4/8/83

Response Spectra

SHEET NO. 1 OF
PROJ. NO. 5364

OBE Analysis

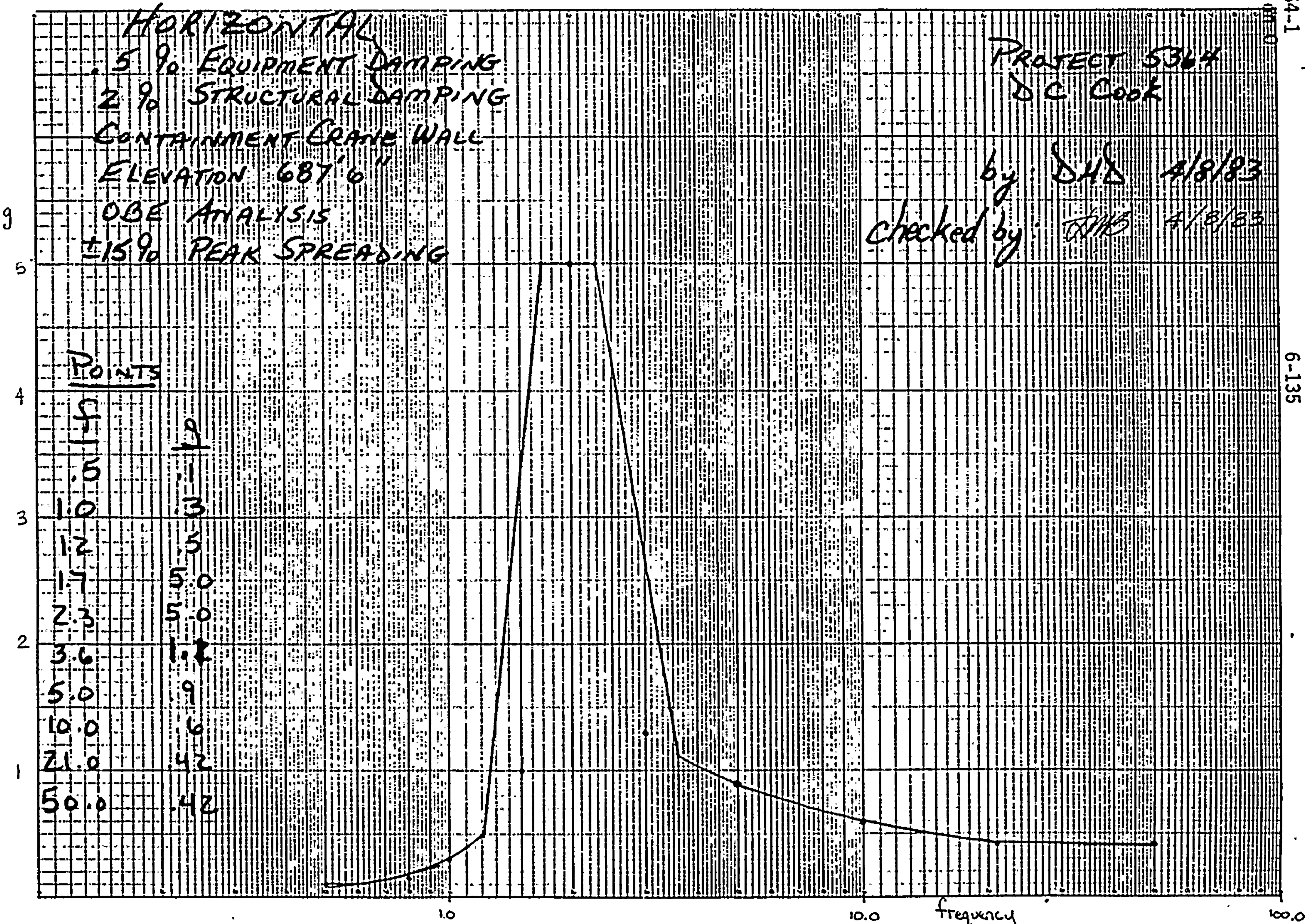
for both Units 1 & 2 the attached spectra curves indicate that Containment CRANE WALL elevation 687'-6" governs for all frequencies. Therefore the horizontal (X & Z) response spectra for OBE analysis is

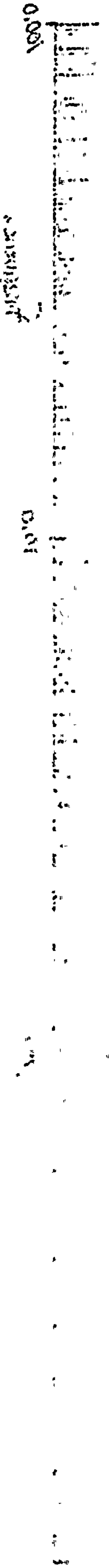
f	g
.5	.10
1.0	.30
1.2	.50
1.7	5.0
2.3	5.0
3.6	1.10
5.0	.10
10.0	.60
21.0	.42
50.0	.42

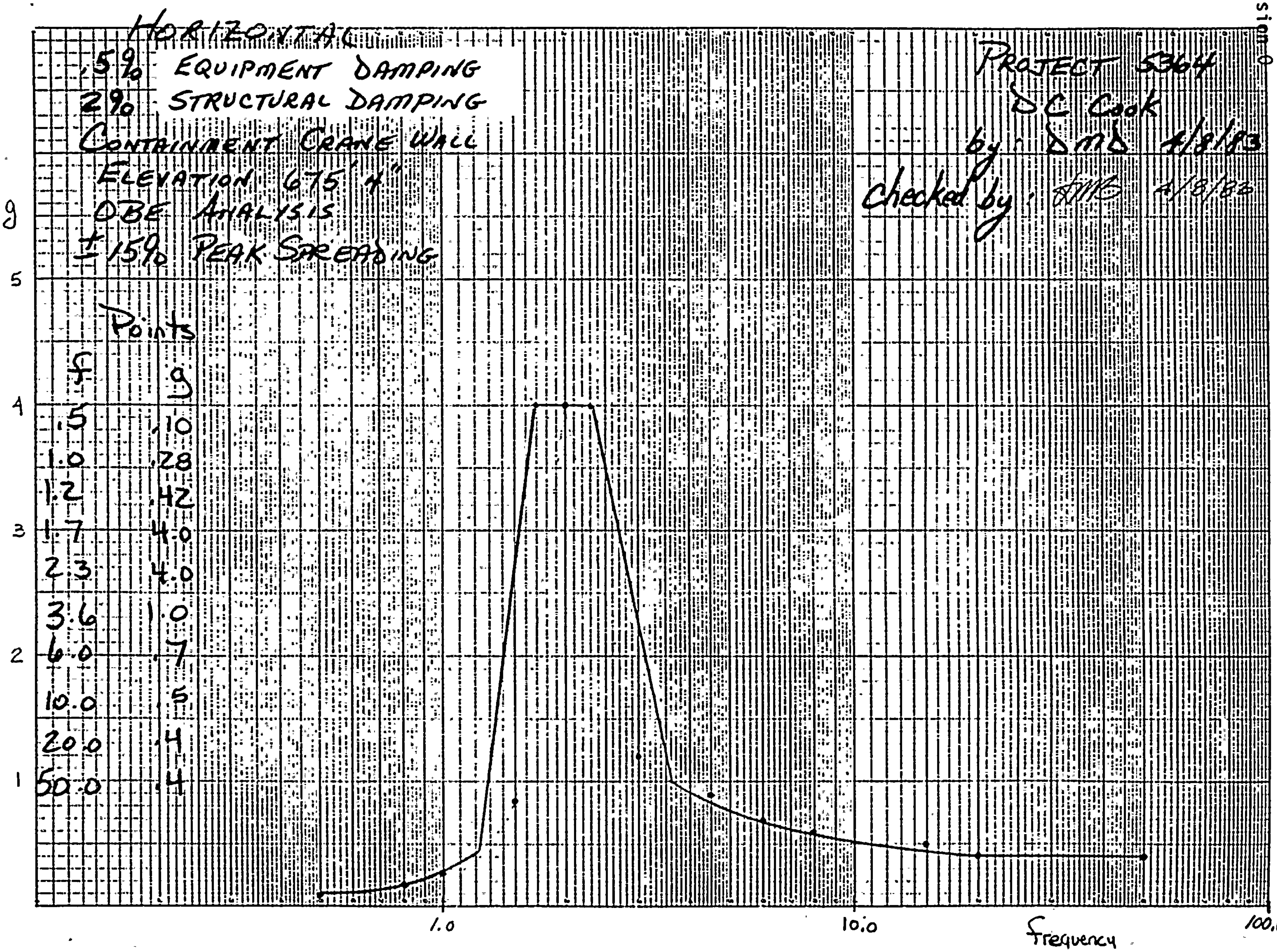
VERTICAL

The vertical OBE response, per the attached spectra, is:

f	g
.5	.04
1.0	.13
1.22	.20
1.70	1.33
2.30	1.33
3.10	.62
5.00	.62
10.0	.23
22.0	.12
50.0	.12

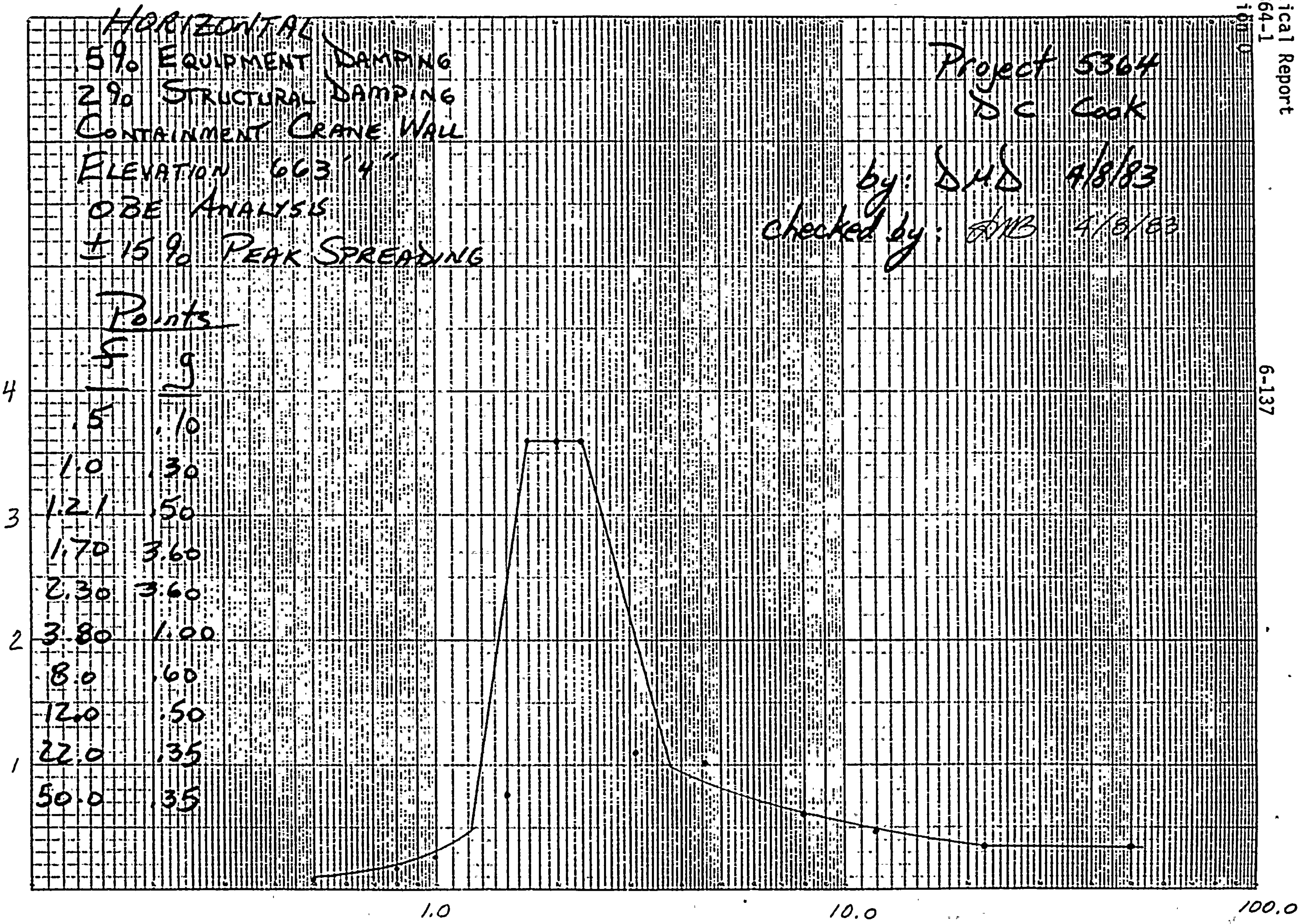

HORIZONTAL
.5 % EQUIPMENT DAMPING
2 % STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 687'6"
OBE ANALYSIS
±15% PEAK SPREADING
PROJECT 5364
DC Cook
by DHD 4/8/83
checked by
POINTS
f g
.5 .1
1.0 .3
1.2 .5
1.7 5.0
2.3 5.0
3.6 1.1
5.0 .9
10.0 .6
21.0 .42
50.0 .42
g
5
4
3
2
1
1.0
10.0
100.0
frequency

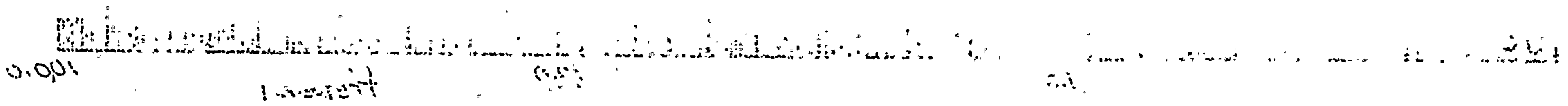


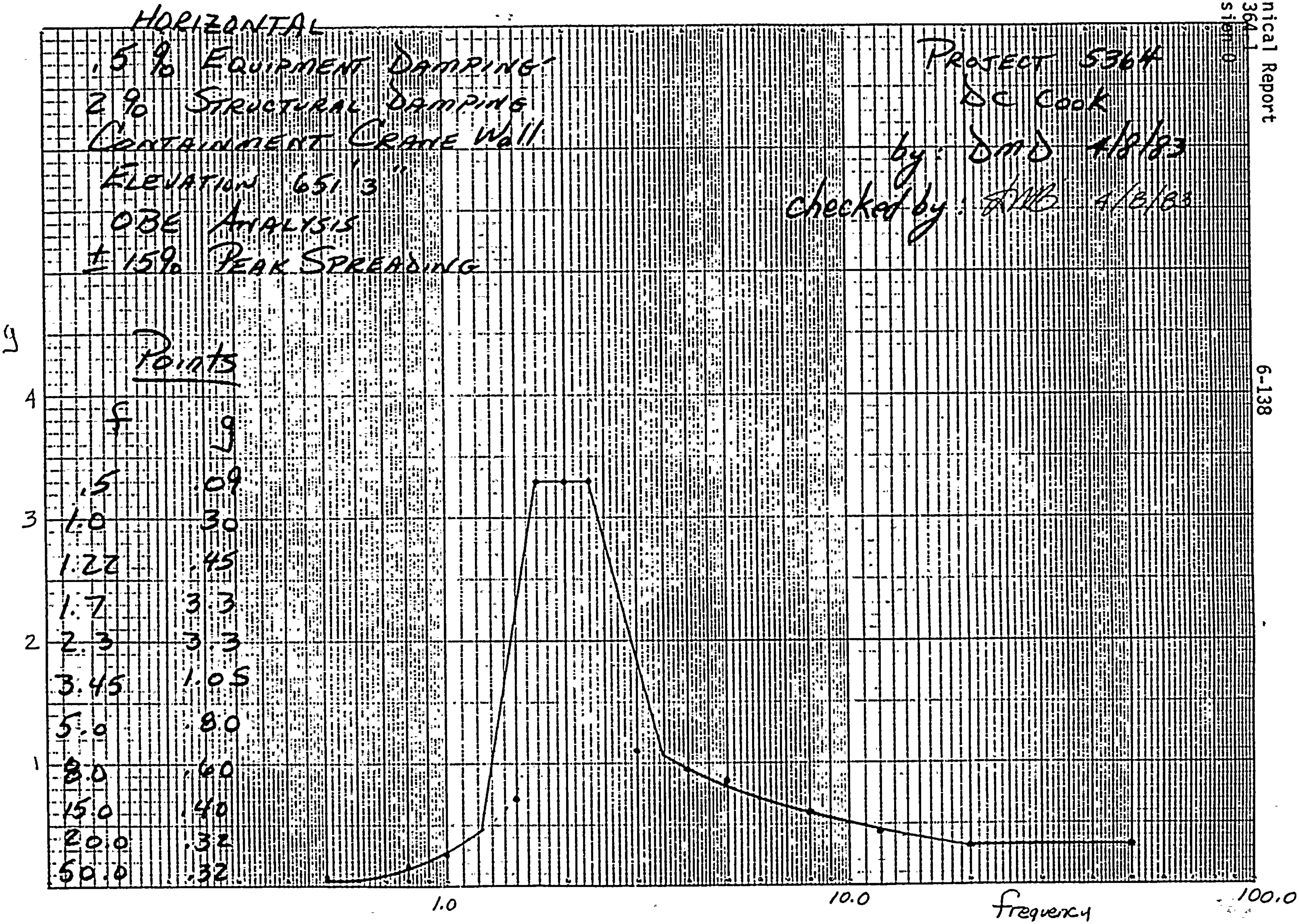

HORIZONTAL
.5% EQUIPMENT DAMPING
2% STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 675'4"
DBE ANALYSIS
±15% PEAK SPREADING
PROJECT 5364
DC Cook
by: DMD 4/8/83
Checked by: AMB 4/8/83
g
5
4
3
2
1
Points
f g
.5 .10
1.0 .28
1.2 .42
1.7 4.0
2.3 4.0
3.6 1.0
6.0 .7
10.0 .5
20.0 .4
50.0 .4
1.0
10.0
100.0
Frequency

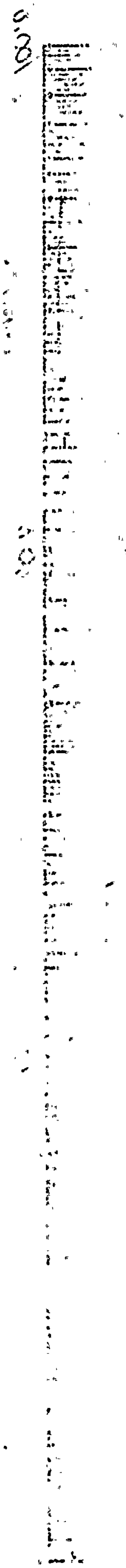
[illegible]

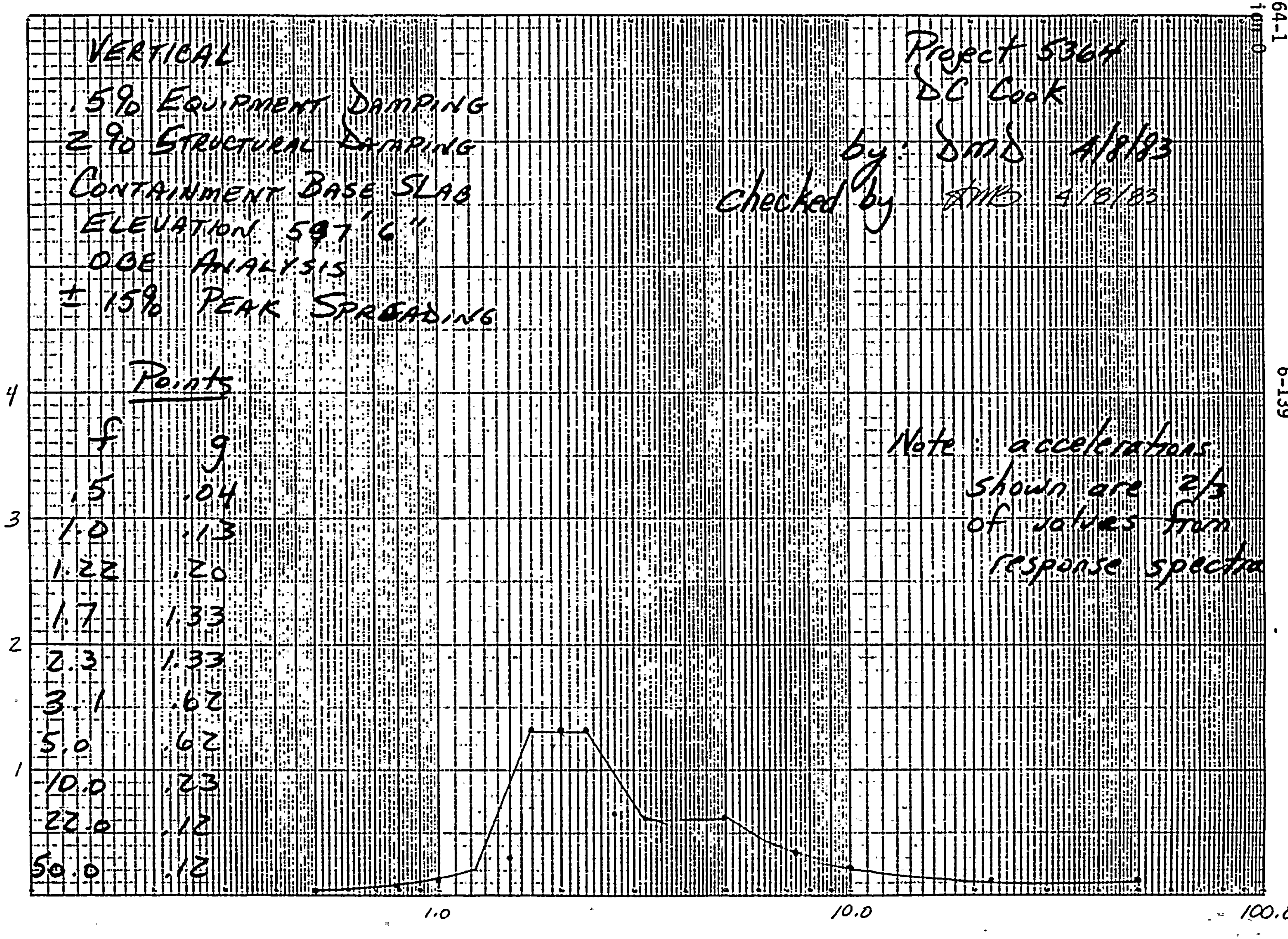
0.601


HORIZONTAL
5% EQUIPMENT DAMPING
2% STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 663'4"
OBE ANALYSIS
±15% PEAK SPREADING
Project 5364
D C Cook
by: DMD 4/8/83
checked by: HMB 4/8/83
Points
f g
.5 .10
1.0 .30
1.21 .50
1.70 3.60
2.30 3.60
3.80 1.00
8.0 .60
12.0 .50
22.0 .35
50.0 .35
4
3
2
1
1.0
10.0
100.0


0.001


HORIZONTAL
.5 % EQUIPMENT DAMPING
2 % STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 651' 3"
OBE ANALYSIS
± 15% PEAK SPREADING
PROJECT 5364
DC COOK
by: DMD 4/8/83
checked by: AMB 4/8/83
Points
f g
.5 .09
1.0 .30
1.22 .45
1.7 3.3
2.3 3.3
3.45 1.05
5.0 .80
8.0 .60
15.0 .40
20.0 .32
50.0 .32
g
4
3
2
1
1.0
10.0
100.0
frequency




VERTICAL
.5% EQUIPMENT DAMPING
2% STRUCTURAL DAMPING
CONTAINMENT BASE SLAB
ELEVATION 597'6"
OBE ANALYSIS
± 15% PEAK SPREADING
Project 5364
DC Cook
by: DMD 4/8/83
Checked by RMB 4/8/83
Points
f g
.5 .04
1.0 .13
1.22 .20
1.7 1.33
2.3 1.33
3.1 .62
5.0 .62
10.0 .23
22.0 .12
50.0 .12
Note: accelerations shown are 2/3 of values from response spectra
4
3
2
1
1.0
10.0
100.0

6.6.3 DBE Spectra

[illegible]

[illegible]

TELEDYNE ENGINEERING SERVICES

BY DMD DATE 4/11/83 | SHEET NO. 1 OF
CHKD. BY [illegible] DATE 4/13/83 | PROJ. NO. 5364

RESPONSE SPECTRA

DBE Analysis

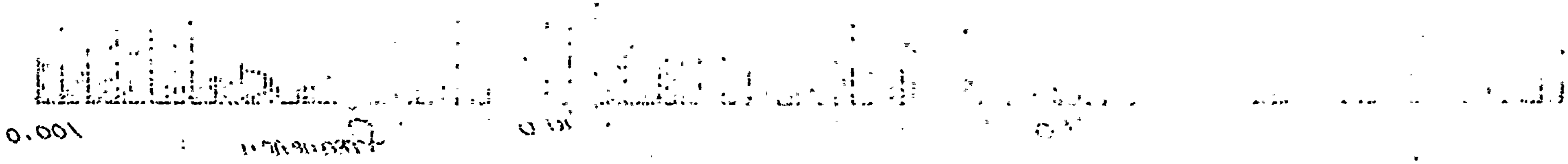
per the attached figures, enveloping CONTAINMENT CRANE WALL ELEVATIONS 651.3, 663.3, 675.3 & 687.5 results in the following DBE horizontal spectra for both Units 1 & 2

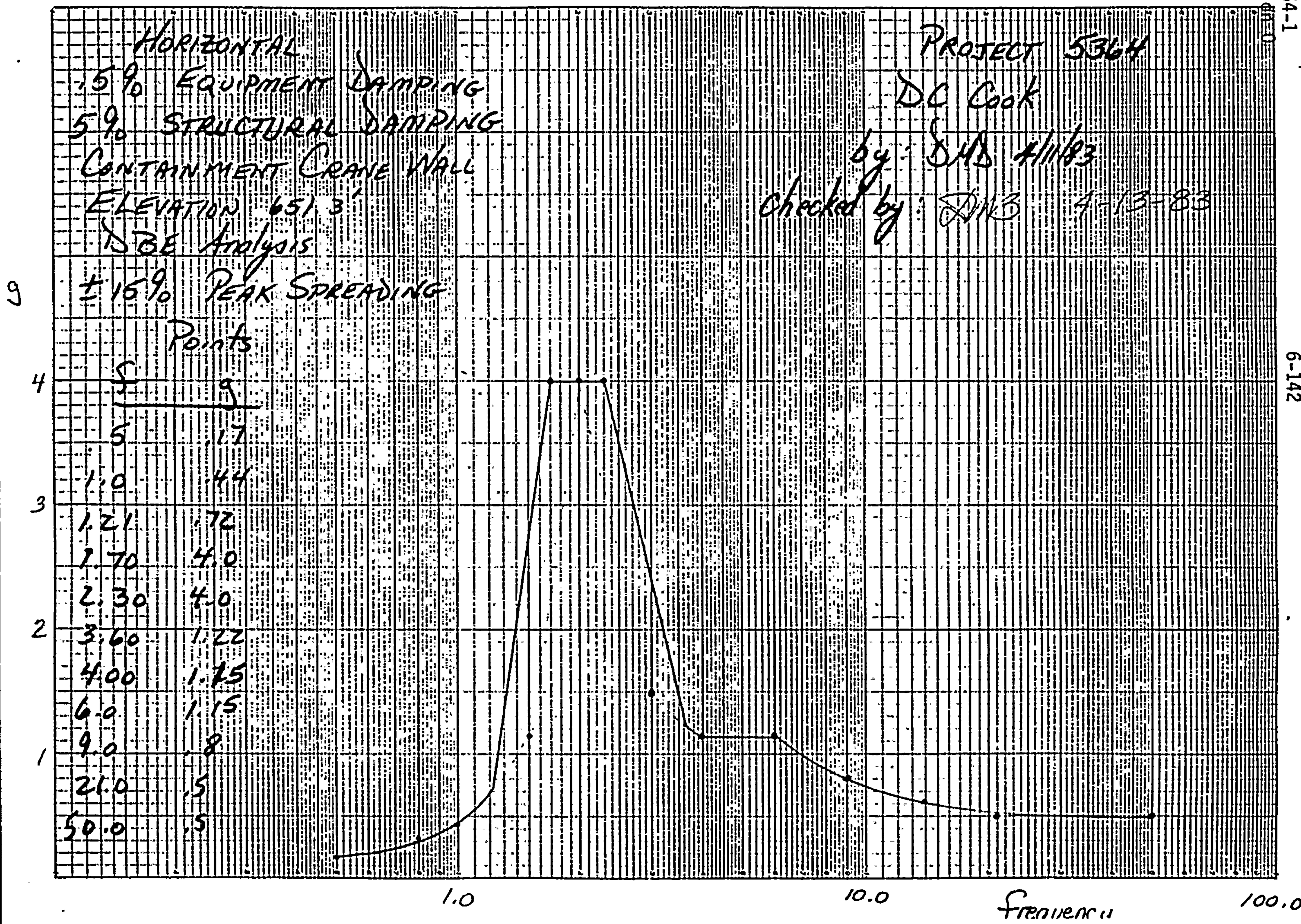
freq	a
.5	.19
1.0	.50
1.18	.70
1.7	5.2
2.3	5.2
3.15	2.6
3.65	1.46
6.0	1.40
7.0	1.15
10.0	1.0
17.0	.72
50.0	.72

VERTICAL

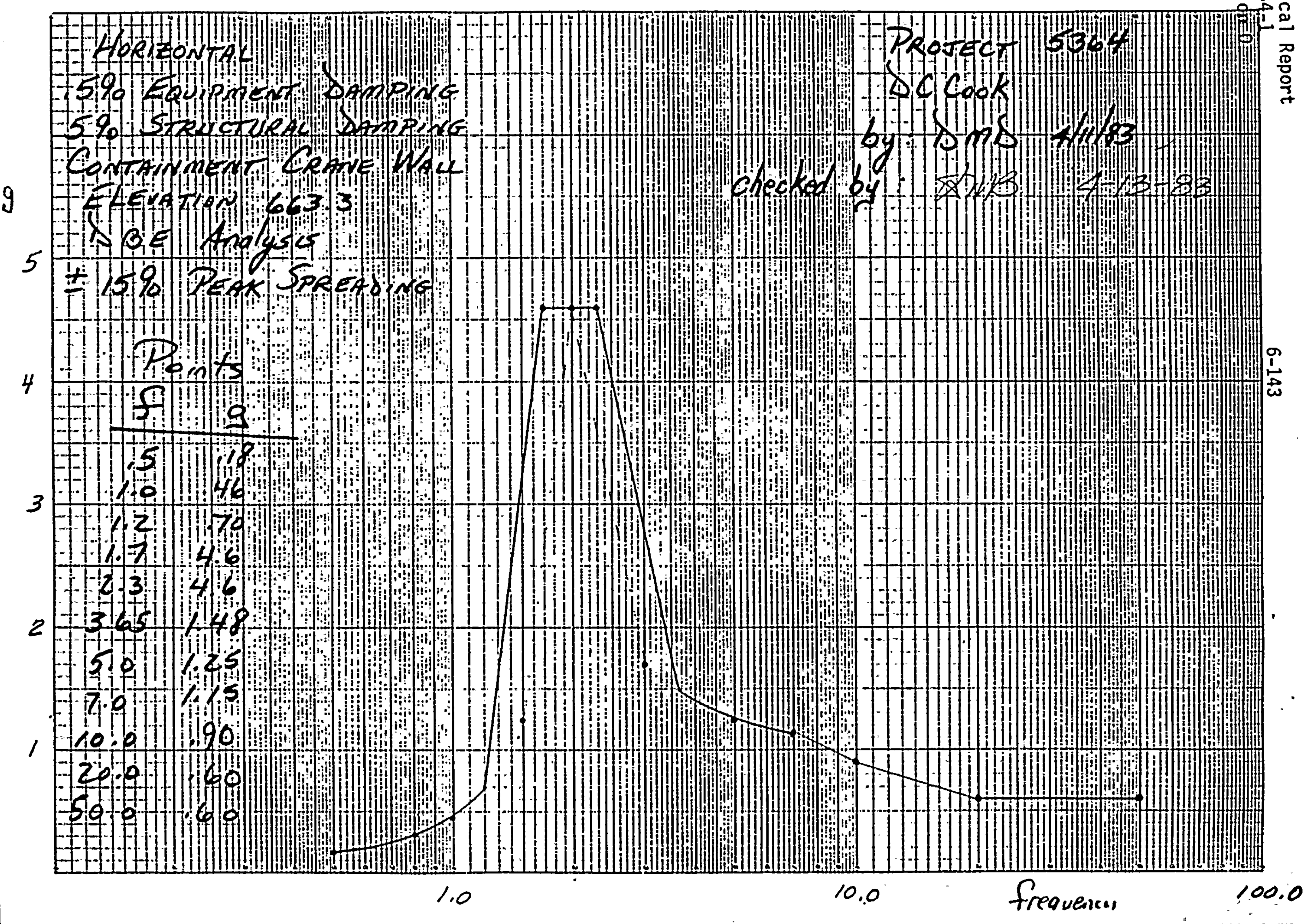
The vertical DBE response for Units 1 & 2, per the attached spectra, is.

f	g
.5	.11
1.0	.25
1.18	.33
1.70	1.40
2.30	1.40
3.42	.80
6.00	.80
10.0	.43
15.0	.28
25.0	.20
50.0	.20

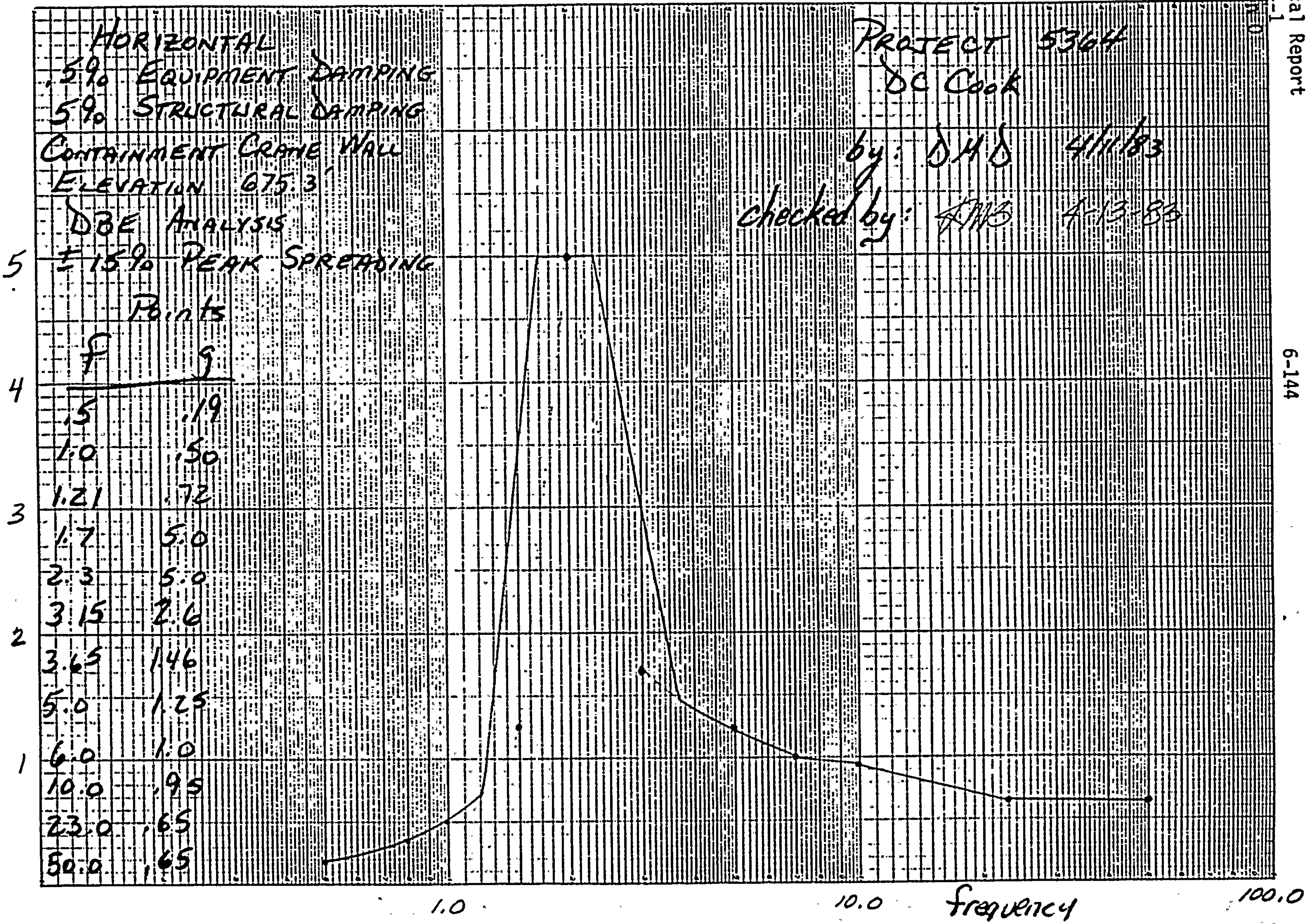

0.001

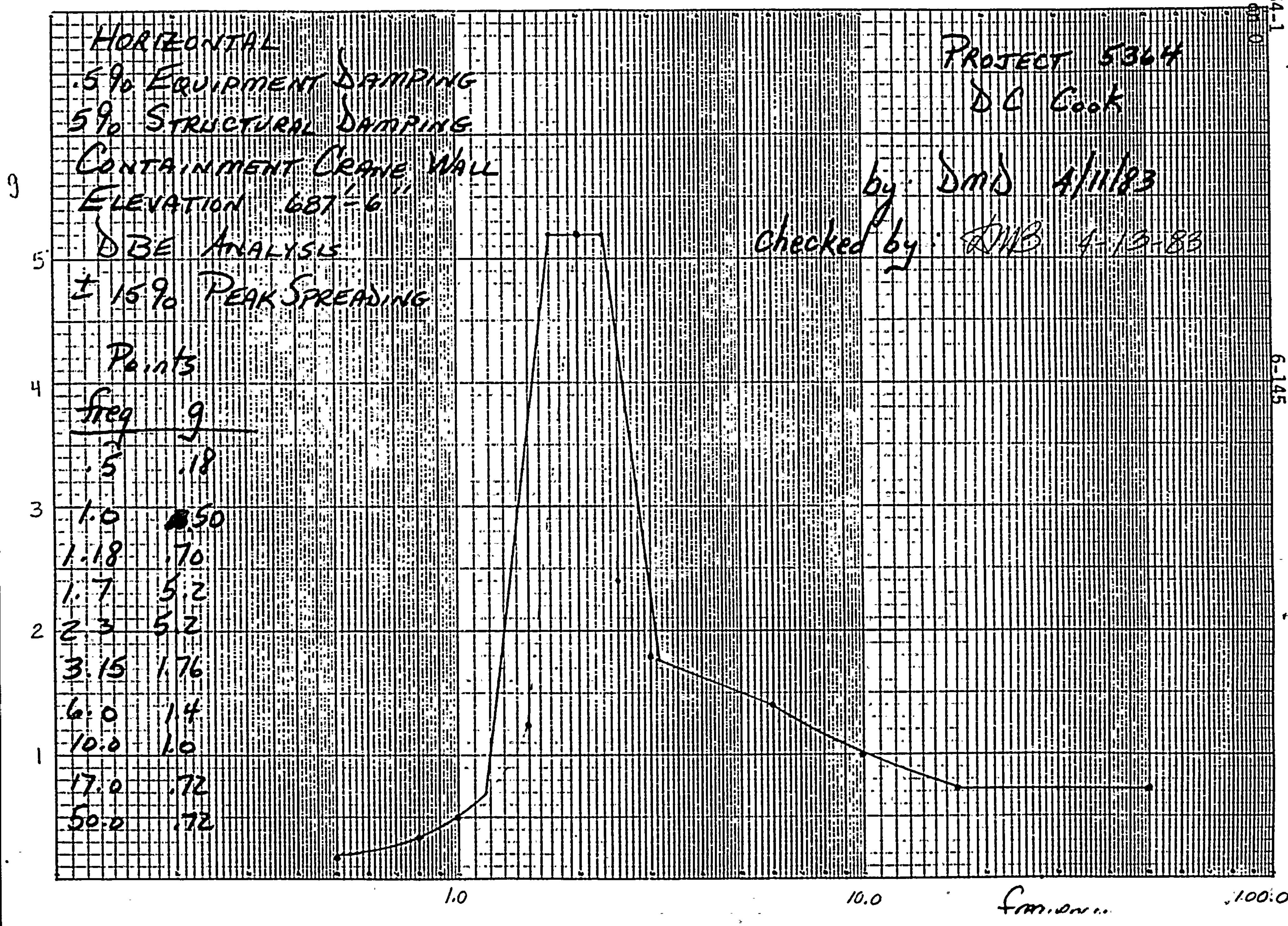

HORIZONTAL
.5% EQUIPMENT DAMPING
5% STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 651 3'
DBE Analysis
±15% PEAK SPREADING
PROJECT 5364
DC Cook
by: DMB 4/11/83
Checked by: DMB 4-13-83
Points
f g
.5 .17
1.0 .44
1.21 .72
1.70 4.0
2.30 4.0
3.60 1.22
4.00 1.15
6.0 1.15
9.0 .8
21.0 .5
50.0 .5
g
4
3
2
1
1.0
10.0
100.0
Frequency

[illegible]


HORIZONTAL
5% EQUIPMENT DAMPING
5% STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 663.3
DBE Analysis
± 15% PEAK SPREADING
PROJECT 5364
DC Cook
by: DMD 4/11/83
Checked by 4-13-83
Points
f g
.5 .18
1.0 .46
1.2 .70
1.7 4.6
2.3 4.6
3.65 1.48
5.0 1.25
7.0 1.15
10.0 .90
20.0 .60
50.0 .60
g
5
4
3
2
1
1.0
10.0
100.0
frequency

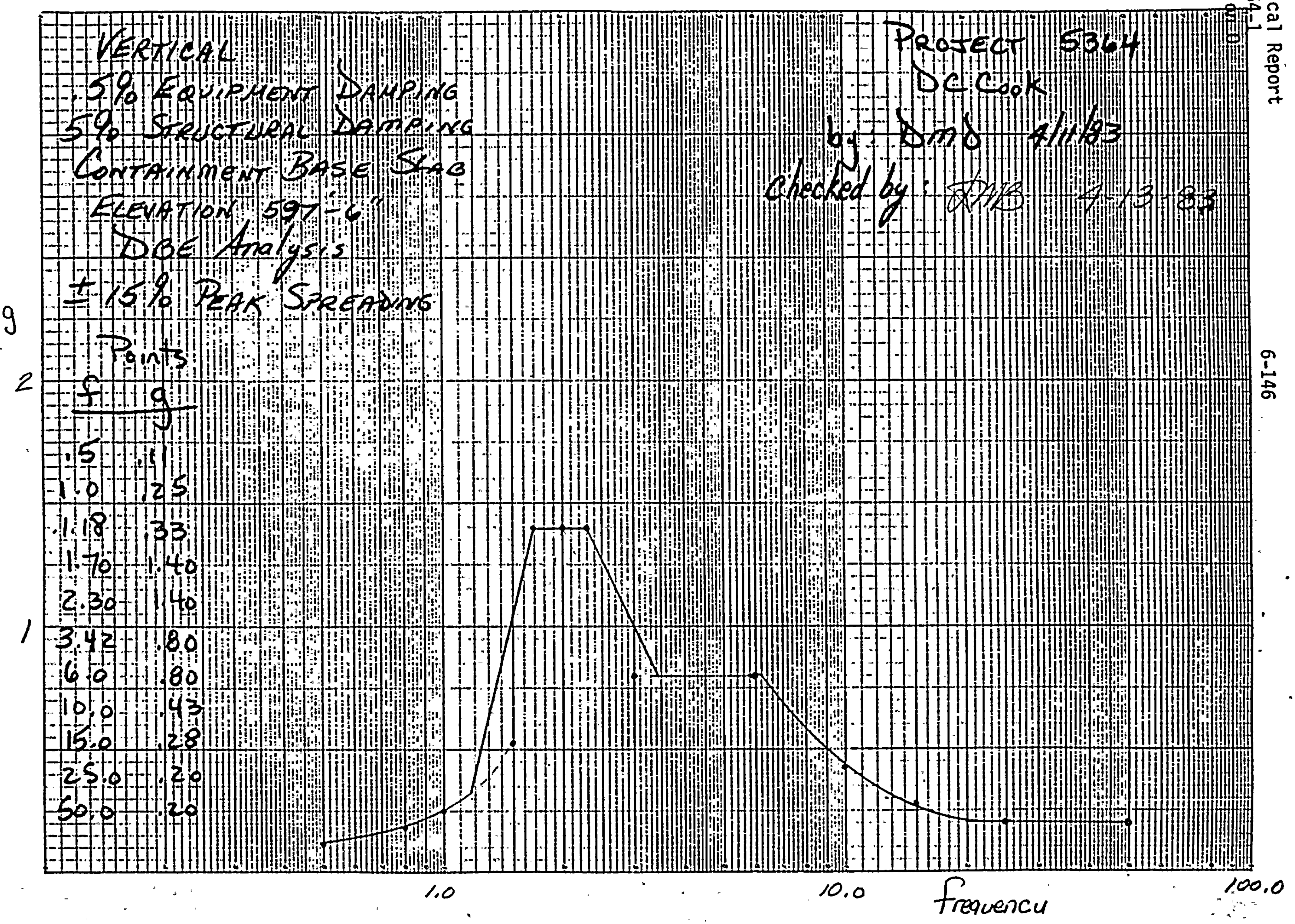
[illegible]


HORIZONTAL
.5% EQUIPMENT DAMPING
5% STRUCTURAL DAMPING
CONTAINMENT CRANE WALL
ELEVATION 675.3'
DBE ANALYSIS
± 15% PEAK SPREADING
Points
f g
.5 .19
1.0 .50
1.21 .72
1.7 5.0
2.3 5.0
3.15 2.6
3.65 1.46
5.0 1.25
6.0 1.0
10.0 .95
23.0 .65
50.0 .65
PROJECT 5364
DC Cook
by: DHD 4/11/83
checked by: AMB 4-13-83
g
5
4
3
2
1
1.0
10.0
100.0
frequency



Points

freq	g
.5	.18
1.0	.50
1.18	.70
1.7	5.2
2.3	5.2
3.15	1.76
6.0	1.4
10.0	1.0
17.0	.72
50.0	.72


VERTICAL
5% EQUIPMENT DAMPING
5% STRUCTURAL DAMPING
CONTAINMENT BASE SLAB
ELEVATION 597'-6"
DBE Analysis
± 15% PEAK SPREADING
PROJECT 5364
DC Cook
by DMD 4/11/83
Checked by: 4-13-83
Points
f g
.5 .1
1.0 .25
1.18 .33
1.70 1.40
2.30 1.40
3.42 .80
6.0 .80
10.0 .43
15.0 .28
25.0 .20
50.0 .20
g
2
1
1.0
10.0
100.0
Frequency

7.0 DRAWINGS

8.0 REFERENCES

1. Teledyne Engineering Services Technical Proposal PR-5653, dated May 14, 1981.

2. Letter from Mr. S. Ulan of AEP to Mr. L.B. Semprucci of TES, dated November 29, 1983.

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4. RELAP5 MOD1 - Version 2.11 - A five equation Thermal-Hydrodynamic Analysis computer program including non-condensibles.

5. TMRPIPE - A system of Computer Programs for the Complete Analysis of Nuclear Piping.

6. TES Technical Report TR-5364-2, Donald C. Cook Nuclear Generating Station, "Analysis of Pressurizer Safety Valves/Relief Valves Discharge Piping Systems per NUREG 0737, II.D.1, Unit 2.

7. Letter from Mr. S. Ulan of AEP to Mr. P. D. Harrison of TES, dated May 26, 1983.

8. TES letter 5364-21, dated February 2, 1983 from Mr. P. D. Harrison of TES to Mr. Sam Ulan of AEP.

9. TES letter 5364-25, dated February 14, 1983 from Mr. P. D. Harrison of TES to Mr. Sam Ulan of AEP.

10. TES letter 5364-33, dated April 8, 1983 from Mr. P. D. Harrison of TES to Mr. Sam Ulan of AEP.

8.0 REFERENCES (Continued)

11. 1967 Edition of USAS B31.1 Power Piping Code.

12. Letter from Mr. J. L. Williams of AEP to Mr. L. B. Semprucci of TES dated September 16, 1982.

13. Crosby Valve Drawing and Gage Company Drawing No. H-51688, Revision A.

14. Masoneilan International, Inc. Control Valve Model No. 38-20721, Drawing No. CP1-18-55, Revision H.

15. Westinghouse Electric Company, Drawing No. 110E272.

16. EPRI Safety and Relief Valve Test Report, Research Project V102 Interim Report, April 1982.

17. ASME Code NB7000, Section III.

18. ITI Report, "Evaluation of RELAP5/MOD1 for Calculation of Safety and Relief Valve Discharge Piping Hydrodynamic Loads," February 1982. Prepared by Intermountain Technologies.