DUKE POWER COMPANY

DESIGN ENGINEERING DEPARTMENT

SQRT AUDIT RESOLUTIONS

CATAWBA UNIT 1

FOR

SQRT AUDIT CONDUCTED

MARCH 13-16, 1984

RESOLUTION SUBMITTAL DATE

APRIL 17, 1984

SQRT AUDIT RESOLUTION SUBMITTAL

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CATAWBA NUCLEAR STATION

SEISMIC QUALIFICATION OF SAFETY-RELATED ELECTRICAL EQUIPMENT

RESOLUTION OF SQRT AUDIT ITEMS

On March 13-16, 1984, the NRC conducted a Seismic Qualification Review Team (SQRT) audit at Catawba. The purpose of this submittal is to provide resolutions to the items identified by the NRC during the audit. The format of this submittal provides resolutions to the generic items followed by the resolutions to the equipment specific items. It should be noted that the SQRT audit forms (revised as necessary) are included in the equipment specific resolutions.

GENERIC ITEM

GENERIC ITEM #1

Duke is to provide a written description of the surveillance and maintenance program for equipment in a mild environment.

RESOLUTION SUMMARY: The Catawba surveillance and preventative maintenance program that includes qualification mandated equipment and component replacement requirements for safety-related electrical equipment conforms to the guidance contained in ANS 3.2/ANSI-N18.7-1976, "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants". The program is based on Technical Specification requirements, manufacturer's information, qualification program results, and Duke operating experience and is developed by station personnel. Implementation of this program is through station procedures. Various activities are included in this program such as channel calibration, channel checks, equipment performance tests, valve lineup tests, ESF actuation tests, equipment lubrication and maintenance, and equipment mechanical vibration studies. This program also facilitates ongoing reviews of equipment performance, and as such, the surveillance and preventative maintenance procedures can be continually updated based on experience.

In addition to the station specific program described above, Duke has implemented an Operating Experience Evaluation Program that monitors safety significant issues including equipment performance. This program consideres not only the operating experience from seven Duke nuclear units, but also overall nuclear industry experience via information mechanisms such as NRC IE Bulletins and Information Notices and INPO SERs and SOERs.

GENERIC ITEM

GENERIC ITEM #2

Provide confirmation for acceleration g levels used in valve qualification in relation to as-built piping analysis.

RESOLUTION SUMMARY: Duke Power Company Quality Assurance procedures require as-built piping analysis to assure that as-built piping accelerations are within the specified limits of all Catawba safety-related valves.

GENERIC ITEM

GENERIC ITEM #3

Complete qualifiction documentation packages by including purchase and design specifications. Traceability of change of seismic specification, and its potential impact to both old and new equipment items.

RESOLUTION SUMMARY: For the Catawba Nuclear Station, determination of seismic response spectra is organizationally the responsibility of the Civil/Environmental Division. The plant specific response spectra are generated and controlled under the Duke Quality Assurance Program with the individual response spectra identified by title and revision number. Changes to the spectra are evaluated for potential impact on existing equipment via a closed loop method such that the reviews and action items, if any, are documented. For equipment purchased following a change in the Catawba response spectra, the pertinent purchase document/ method would reflect the revised response spectra.

In summary, design mechanisms are provided to assure that changes in floor response spectra are properly evaluated for existing equipment implemented in the purchase of new equipment.

GENERIC ITEM

GENERIC ITEM #4

Some deficiencies in equipment mountings have been identified in the Control Room.

RESOLUTION SUMMARY: See resolutions to specific items number(s) 3, 6, and 17-4.

GENERIC ITEM #5

SQRT forms need to be revised, especially for BOP Scope Equipment.

RESOLUTION SUMMARY: SQRT forms have been revised and attached as part of the specific item resolutions.

GENERIC ITEM #6

In various cases, the qualification reports were found to need revision.

RESOLUTION SUMMARY: In cases where deficiencies in qualification reports were found, these will be revised.

SPECIFIC ITEM #1 UHI ISOLATION VALVE

PART 1: SQRT form to be revised in two places.

STATUS: This item is resolved.

RESOLUTION SUMMARY: The revised SQRT form follows this page.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba Unit 1 — Type:

1. Utility: Duke Power Company — PWR 4-loop
2. NSSS: Westinghouse — BWR ____
3. A/E: Duke Power Company — Other ____

II. Component Name: ASME Class 2 Hydraulic Operated GAte Valve Locations 9902A, B & 9903A, B

1. Scope: [x] NSSS [ ] BOP [ ] Other
2. Model Number: 12C1500 Quantity: 4
3. Size or Range: 12GX78SJW
4. Vendor: Anchor Darling
5. If the component is a cabinet or panel, name and model number of the devices included: N/A
6. Physical Description:
   a. Appearance: Hydraulic/Motor Operated Gate Valve
   b. Dimensions: 44.62" End to End; 169.25" high
   c. Weight: 6400 lb.
7. Location: Building: Outside Containment - Auxiliary Bldg.
   Elevation: 552' 3-1/8"
8. Field Mounting Conditions: [ ] Bolt (No. ____, Size ____)
   [ ] Weld (Length ____)
   [X] Butt Welded into Pipeline
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   Butt welded into pipeline with stem in vertical orientation
10. a. System in which located: Upper head injection system
   b. Functional Description: UHI Isolation Valve
   c. Is the equipment required for [ ] Hot Standby, [ ] Cold Shutdown
   [ ] Both [ ] Neither [X] Other Upper Head Injection

UHI VALVE QUALIFICATION

The qualification of the UHI valve can best be described by discussing the qualification of each component of the valve configuration.

A. The Anchor Darling Co. (valve vendor) first qualified the valve by analytical stress analysis and also performed a static deflection test to demonstrate operability. (MED-PVE-218)(EPS-82 Rev. B)

B. Westinghouse performed a supplemental stress analysis to demonstrate the ability of valve to withstand higher loads. In addition, Westinghouse also performed a natural frequency calculation to determine resonances. (E-5750 Rev. D) (WCAP-9369)

C. Solenoid qualification was gotten by test on the two different types of solenoids used on the valves. (EL:346)(EL:2226)

D. Limit switch qualification was gotten by test on the type of limit switches used on the valve. (F-C3879)

VALVE QUALIFICATION SUMMARY

A. Component: - Upper Head Injection Isolation Valve 9002A, B and 9003A, B

B. Qualification Approach:

The upper head injection isolation valves are designed in accordance with the ASME Boiler and Pressure Vessel Code, Section III, NC-3500. Structural integrity is demonstrated by designing the valve body in such a manner that the valve is not the limiting factor in the fluid system design. The section modulus and area of the body crotch is at least 110% of those for the connecting pipe after being corrected for the allowable stresses for the valve body versus the pipe. A seismic analysis of the valve assembly is performed to show that stresses incurred are at a level within the elastic range of the material.

In addition to the seismic analysis on the valve assembly, testing has been performed on the limit switches and active solenoids.

C. Summary of Load Conformance:

The actual accelerations are determined by the piping analysis. Following are the accelerations:

		Accelerations					
		OBE			SSE		
Valve Loc.	Node*	G_x	G_y	G_z	G_x	G_y	G_z
9902A (245A)	E	0.610	0.102	0.978	1.144	0.191	1.834
	F	0.970	0.102	1.406	1.819	0.191	2.636
	G	1.274	0.102	1.786	2.389	0.191	3.349
9902B (244B)	E	0.824	0.102	1.490	1.545	0.191	2.794
	F	1.321	0.102	2.147	2.477	0.191	4.026
	G	1.740	0.102	2.743	3.252	0.191	5.143
9903A (243A)	E	0.627	0.103	0.822	1.176	0.193	1.541
	F	0.993	0.103	1.163	1.862	0.193	2.181
	G	1.309	0.103	1.471	2.454	0.193	2.758
9903B (242B)	E	1.015	0.106	1.259	1.903	0.199	2.361
	F	1.628	0.106	1.802	3.052	0.199	3.379
	G	2.151	0.106	2.296	4.033	0.199	4.305

*See Figure 1 for node location

The seismic analysis was performed using a horizontal SSE acceleration of 6.1g's, $(G_x{}^2 + G_z{}^2)^{\frac{1}{2}}$ and a vertical acceleration of 2.0g's which is greater than the horizontal acceleration of 6.09g's on all cross-sections on valve 9902B (worst case accelerations) except those listed below. The below sections were analyzed using accelerations which are greater than those at the node points near the center of gravity of the section analyzed.

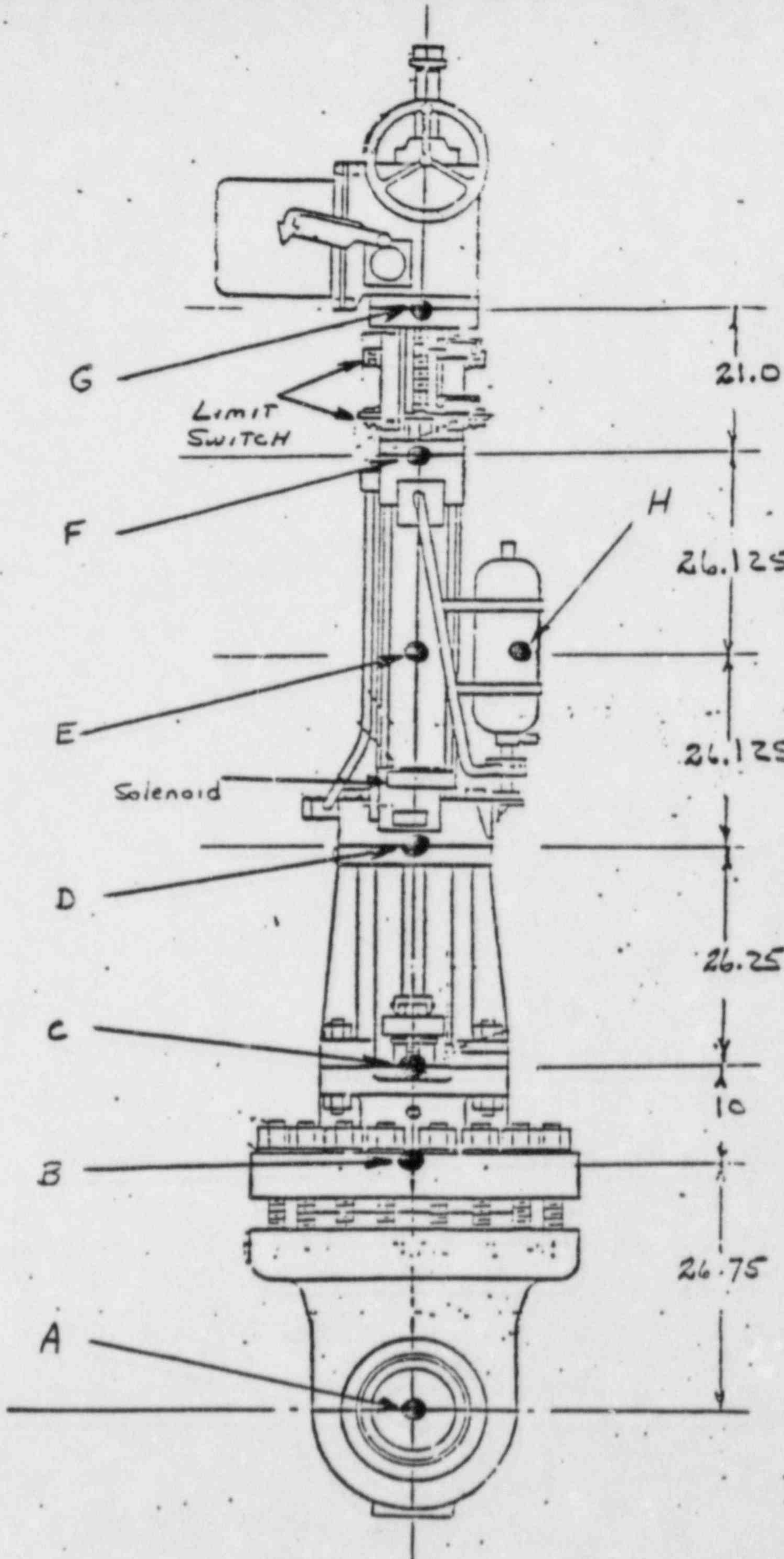
		Analyzed Acceleration			Actual Acceleration*		
Section Analyzed	Node	G_x	G_y	G_z	G_x	G_y	G_z
Lower Yoke-Bottom Section A-A	E	4.7	2.0	5.2	1.545	0.199	2 "94
Lower Yoke-Top Section B-B	F	4.1	2.1	4.1	2.477	0.199	4.026

*For valve location 9002B
OBE qualification levels are 8/15 SSE levels

Qualification of the Teledyne Republic Solenoid Model 21110-0303-5200 and Kepsel check valve Model 1337 was performed at combined horizontal SSE acceleration of 3.0 g's. The horizontal accelerations on valves 9902A and 9903A are 2.16g's and 1.938g's (Node E) respectively which is less than the qualification level.

Qualification of the Teledyne Republic Solenoid Model 21110-7303-5200 and Kepsel Check Valve Model 1337 was performed at 4.24/4.24/4.24 g's. The accelerations on valve 9002E and 9003B are 1.545/.191/2.794 and 1.903/ .199/2.361 g's respectively (Node E) which is less than the qualification level.

Statis deflections test was performed at a combined horizontal acceleration of 4.54 g's at the valve actuator assembly center of gravity which is greater than 3.193 g's (Node E) for valve.



VALVE NODES

FIGURE 1

STRESS ANALYSIS AND STATIC DEFLECTION

II. Pertinent Reference Design Specifications for Qualification Requirements:

General Specification 952304 Rev. 1

a. Seismic Input
See Item V.5

b. Hydrodynamic Load Input
Limited by Nozzle Loads (Note 1)

c. Fatigue Considerations
See Item V.6

d. Service Conditions
Per Design Specification

e. Qualified Life
40 years

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [ ] Analysis [x] Combination of Test and Analysis

Qualification Report:*	MED-PVE-2318 3/2/84	EPS-82 Rev. B
(No., Title and Date):	Seismic Qualification of UHI Isolation Valve	Static Seismic Testing
Company that Prepared Report:	Westinghouse	Anchor/Darling
Company that Reviewed Report:	Westinghouse	Westinghouse
Where Report is filed or available:	Westinghouse	Anchor/Darling or Westinghouse

Applicable Codes and/or Standards: Specification 952304 Rev.1 and ASME Code Section III, 1971 Edition Winter 72 Addenda

V. Vibration Input:

1. Loads considered:
   a. [x] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [X] Not applicable - as specified by piping analysis (other, specify)

3. Required Response Spectra** (attach the graphs): Not applicable - controlled by analysis of piping syste

Note:

*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

Note 1: LOCA loads are transmitted to the valves through the piping. Allowable nozzle loads on the valve are specified to limit loads transmitted through the piping to the valve.

4. Damping Corresponding to RRS: OBE N/A SSE N/A

5. Required Acceleration in Each Direction:

[ ] ZPA [X] Other As determined by piping analysis (specify)

OBE S/S = * F/B = * V = *

SSE S/S = * F/B = * V = *

6. Were fatigue effects considered?

[XX] Yes [ ] No

If yes, describe how they were treated in overall qualification program:

Per ASME Code Section III, NB-3550

VI. <u>If Qualification by Test, then complete</u>: Static Deflection Test

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [X] Static Deflection

2. [ ] Single Axis [ ] Independent Axis [ ] Multi-Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE N/A SSE 1 Other ____ (specify)

4. Frequency Range: N/A

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = See Item VII.2 F/B = ____ V = ____

6. Method of Determining Natural Frequencies:

[ ] Lab Test [ ] In-Situ Test [X] Analysis See Section VII

7. TRS enveloping RRS using Multi-Frequency Test N/A

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

* - See Attachment I for accelerations of each valve.

8. Maximum Input g-level Test:

OBE S/S = N/A F/B = N/A V = N/A

SSE S/S = 3.21**/2.794 F/B = 3.21**/1.545 V = 2.0/0.191

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length ____) [x] Bolted/Welded

B. Orientation and Fixturing: Stem vertical

10. Functional operability verified:

[x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: None

12. Other tests performed (such as aging or fragility test, including results):

13. Failure Modes (if appropriate N/A)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

Margin on accelerations —

VII. <u>If Qualification by Analysis, then complete:</u>

1. Method of Analysis:

[x] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ______ F/B = ______ V = ______ See Item VII.

3. Model Type: [xx] 3D [ ] 2D [ ] 1D

[ ] Finite Element [x] Beam

[ ] Closed Form Solution [ ] Other ______

**Combined effect is 4.54 g's

4. [X] Computer Codes: WECAN (frequency)
(WCAP 8929 currently under NRC review)
Frequency Range and No. of modes considered: 1 to 1,266 Hz, 12 Mode

[X] Hand Calculations Seismic Analysis

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[X] Absolute Sum [ ] SRSS [ ] Other: ______ (specify)

6. Damping

OBE N/A SSE N/A Basis for damping used: ______

7. Support Considerations in the model: Welded into pipe

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Lower Yoke		Seismic & Operating		26278	31500
Lower Yoke Stud		" "		37245	50000

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
See operability test		

9. Failure Modes: ______

10. Margins Available: [ ] Input Spectrum [x] Stress or Deflection

As identified in Item 8.A above, margins between actual and allowable stresses are available. Additionally, Table I provides a comparison of generic qualification and specific plant g values. As noted, there is margin in these values.

II. Pertinent Reference Design Specifications for Qualification Requirements:

____

a. Seismic Input

b. Hydrodynamic Load Input

c. Fatigue Considerations

d. Service Conditions

e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [x] Analysis [ ] Combination of Test and Analysis

Qualification Report:*	E-5750 Rev. D 4/2/75	
(No., Title and Date):	12"-1500# Hydraulic Operated Gate Valve Design Calculation	
Company that Prepared Report:	Anchor/Darling	
Company that Reviewed Report:	Westinghouse	
Where Report is filed or available:	Anchor/Darling or Westinghouse	

Applicable Codes and/or Standards: Specification 952304 Rev.1 and ASME Code Section III, 1971 Edition Winter 72 Addenda

V. Vibration Input:

1. Loads considered:
   a. [ ] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [ ] ______________ (other, specify)

3. Required Response Spectra** (attach the graphs): ______________

Note:

*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

NATURAL FREQUENCY CALCULATION

II. Pertinent Reference Design Specifications for Qualification Requirements:

____

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report:* WCAP-9369 (Natural Frequency)

(No., Title and Date): Experimental and Analytical Study of UHI Valve

Company that Prepared Report: Westinghouse

Company that Reviewed Report: Westinghouse

Where Report is filed or available: Westinghouse

Applicable Codes and/or Standards: Specification 952304 Rev. 1

V. Vibration Input: (Not applicable)

1. Loads considered: a. [ ] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [ ] ____________ (other, specify)

3. Required Response Spectra** (attach the graphs): ____________

Note:

*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE ____________ SSE ____________

5. Required Acceleration in Each Direction:

[ ] ZPA [ ] Other ______________________ (specify)

OBE S/S = ______________ F/B = ______________ V = ______________

SSE S/S = ______________ F/B = ______________ V = ______________

6. Were fatigue effects considered?

[ ] Yes [ ] No

If yes, describe how they were treated in overall qualification program:

____

____

VI. <u>If Qualification by Test, then complete:</u> N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] ______________

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ______________ SSE ______________ Other ______________ (specify)

4. Frequency Range: ____

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ______________ F/B = ______________ V = ______________

6. Method of Determining Natural Frequencies:

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = ______________ F/B = ______________ V = ______________

SSE S/S = ______________ F/B = ______________ V = ______________

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length ____) [ ] ______________

B. Orientation and Fixturing: ______________________________

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ______________________________

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (if appropriate ______________________________)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. <u>If Qualification by Analysis, then complete:</u>

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[XX] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 9.55 F/B = 8.5 V = >33

3. Model Type: [x] 3D [ ] 2D [ ] 1D

[ ] Finite Element [x] Beam

[ ] Closed Form Solution [ ] Other ______________

SOLENOID QUALIFICATION

(TEST)

II. Pertinent Reference Design Specifications for Qualification Requirements:

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial limit ailability

IV. Equipment Qualification Method: Solenoid Valve 21110-0303-5200 Kepsel check valve Model-1337

[x] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report:* EL:346 - April 1974

(No., Title and Data): Seismic Test of Two Control Valves

Company that Prepared Report: Westinghouse Electric Corp.

Company that Reviewed Report: Westinghouse Electric Corp.

Where Report is filed or available: Westinghouse Electric Corp.

Applicable Codes and/or Standards: IEEE 344-1971 and Spec. G-952304, Rev. 1

V. Vibration Input:

1. Loads considered: a. [x] Seismic only
b. [ ] Hydrodynamic only
c. [ ] Vibration from normal operation
d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[ ] Absolute Sum [ ] SRSS [x] Not applicable-test done to generic levels (other, specify)

3. Required Response Spectra** (attach the graphs): Not applicable-controlled by analysis of piping syst

Note:

*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE N/A SSE N/A

5. Required Acceleration in Each Direction:

[ ] ZPA [x] Other As determined by piping analysis (specify)

OBE S/S = - F/B = - V = -

SSE S/S = *3.0/See Att. 1 F/B = *3.0/See Att. 1 V = -

6. Were fatigue effects considered?

[ ] Yes [x] No

If yes, describe how they were treated in overall qualification program:

VI. If Qualification by Test, then complete:

1. [x] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ______

2. [x] Single Axis [ ] Independent Axis [ ] Multi-Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 0 SSE 1 Other ______ (specify)

4. Frequency Range: 1-50 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = > 50 Hz F/B = > 50 Hz V = > 50

6. Method of Determining Natural Frequencies:

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test N/A

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

*Test was conducted in each direction independently, therefore, SSE acceleration cannot exceed 3.0 g by SRSS in the horizontal direction

8. Maximum Input g-level Test:

OBE S/S = — F/B = — V = —

SSE S/S = 3.0 F/B = 3.0 V = —

9. Laboratory Mounting:

A. [X] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ___

B. Orientation and Fixturing: As installed

10. Functional operability verified:

[x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Functioned successfully with no evidence of degradation

12. Other tests performed (such as aging or fragility test, including results):

N/A

13. Failure Modes (if appropriate ___)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

Margins as provided by comparison of generic qualification and specific plant g values.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ___ F/B = ___ V = ___

3. Modal Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ___

II. Pertinent Reference Design Specifications for Qualification Requirements:

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method: Solenoid valve 21110-7303-5200
Kepsel check valve Model-1337

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report:* EL:2226 DRAFT

(No., Title and Date): Seismic Test of Two Hydraulic Control Valves

Company that Prepared Report: Westinghouse Electric Corp.

Company that Reviewed Report: Westinghouse Electric Corp.

Where Report is filed or available: Westinghouse Electric Corp.

Applicable Codes and/or Standards: IEEE 344-1971 and Spec. G-952304, Rev. 1

V. Vibration Input:

1. Loads considered: a. [X] Seismic only
b. [ ] Hydrodynamic only
c. [ ] Vibration from normal operation
d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[ ] Absolute Sum [ ] SRSS [x] Not applicable test done to generic levels
(other, specify)

3. Required Response Spectra** (attach the graphs): Not applicable-Controlled by analysis of piping system

Note:

*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE N/A SSE N/A

5. Required Acceleration in Each Direction:

[ ] ZPA [x] Other As determined by the piping analysis (specify)

OBE S/S = 3.4/ SEE ATTACH 1 F/B = 3.4/ SEE ATTACH 1 V = 3.4/ SEE ATTACH 1

SSE S/S = 4.24/ SEE ATTACH 1 F/B = 4.24/ SEE ATTACH 1 V = 4.24/ SEE ATTACH 1

6. Were fatigue effects considered?

[x] Yes [ ] No

If yes, describe how they were treated in overall qualification program:

Vibration aging.

VI. If Qualification by Test, then complete:

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ______

2. [ ] Single Axis [ ] Independent Axis [x] Multi-Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 5 SSE 17 Other ______ (specify)

4. Frequency Range: 1 to 33 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = >33 F/B = > 33 V = > 33

6. Method of Determining Natural Frequencies:

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test N/A

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = 3.4 F/B = 3.4 V = 3.4

SSE S/S = 4.24 F/B = 4.24 V = 4.24

9. Laboratory Mounting:

A. [X] Bolt (No. ____, Size ____)

[ ] Weld (Length ____) [ ] ______________

B. Orientation and Fixturing: As mounted on the actuator

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Functioned successfully with no evidence of degradation

12. Other tests performed (such as aging or fragility test, including results): Vibration aging.

13. Failure Modes (if appropriate ______________)

14. Margins Available: [X] Input Spectrum [ ] Fragility

VII. <u>If Qualification by Analysis, then complete:</u>

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ______ F/B = ______ V = ______

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ______

LIMIT SWITCH QUALIFICATION

(TEST)

II. Pertinent Reference Design Specifications for Qualification Requirements:

____

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method: Limit Switch - EA-170

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report:* F-C3879 - 9/74

(No., Title and Date): Seismic Qualification Test of Limit Control Switches

Company that Prepared Report: The Franklin Institute REsearch Lab.

Company that Reviewed Report: NAMCO

Where Report is filed or available: Westinghouse

Applicable Codes and/or Standards: IEEE-344-71

V. Vibration Input:

1. Loads considered: a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [X] Not applicable-test done to generic levels (other, specify)

3. Required Response Spectra** (attach the graphs): Not applicable-controlled by analysis of piping system

Note:

*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE N/A SSE N/A

5. Required Acceleration in Each Direction:

[ ] ZPA [X] Other As determined by piping analysis (specify)

OBE S/S = - F/B = - V = -

SSE S/S = 5.2* F/B = 5.2* V = 5.2*

6. Were fatigue effects considered?

[X] Yes [ ] No

If yes, describe how they were treated in overall qualification program:

Vibration Testing

VI. If Qualification by Test, then complete:

1. [x] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] ______

2. [ ] Single Axis [x] Multi-Axis
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 0 SSE 4 Other ______ (specify)

4. Frequency Range: 1-35 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = > 33 F/B = > 33 V = >33

6. Method of Determining Natural Frequencies:

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test N/A

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

* Combined horizontal acceleration

8. Maximum Input g-level Test: See attached curve

OBE S/S = - F/B = - V = -

SSE S/S = ______ F/B = ______ V = ______

9. Laboratory Mounting:

A. [ ] Bolt (No. 4, Size ¼)

[ ] Weld (Length ___) [ ] ______

B. Orientation and Fixturing: Vertical Switches Mounted

10. Functional operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: None

12. Other tests performed (such as aging or fragility test, including results):

N/A

13. Failure Modes (if appropriate None)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

See Attachment 1

II. <u>If Qualification by Analysis, then complete</u>:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

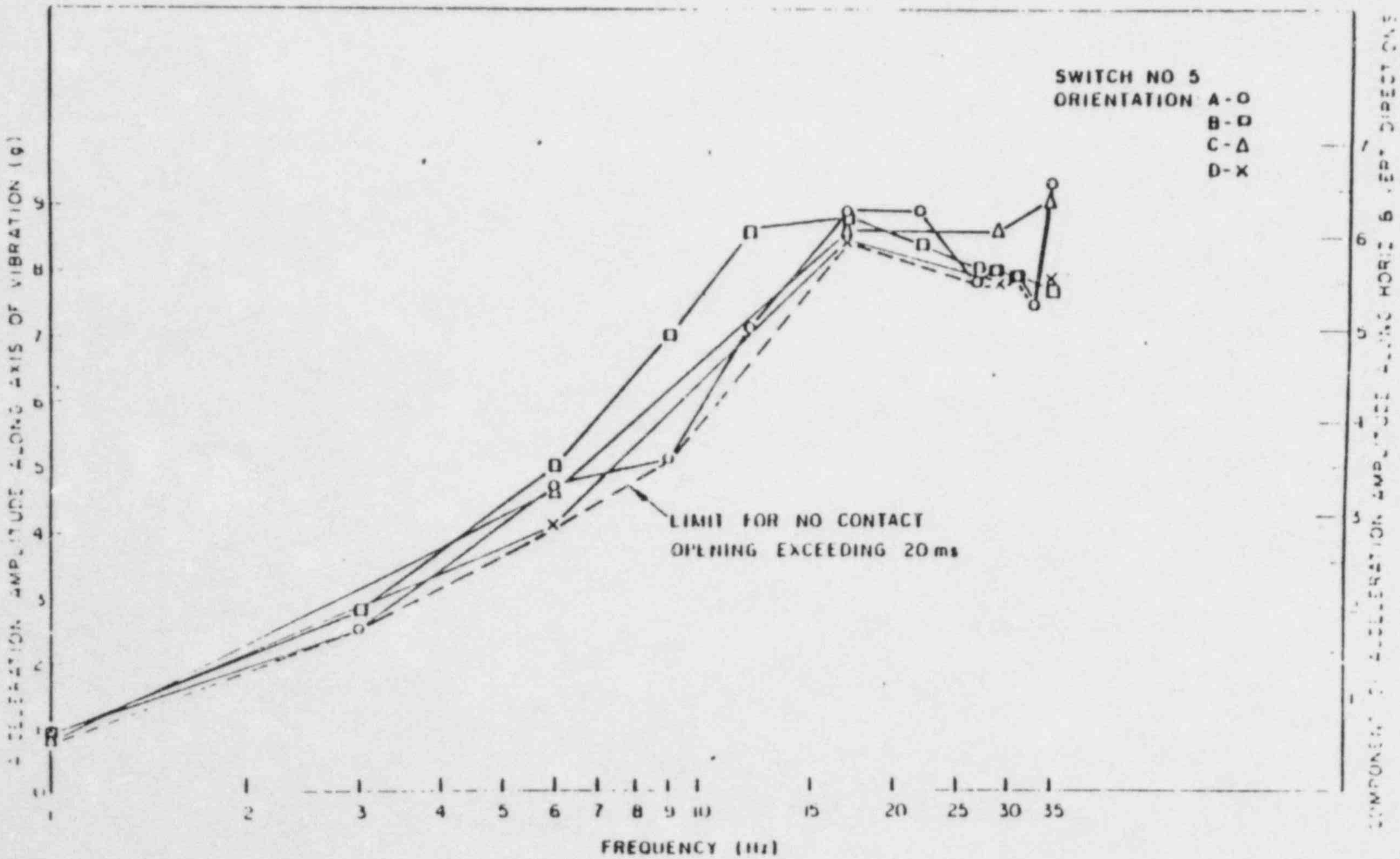
2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ______ F/B = ______ V = ______

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ______



Plot of Continuous Sine Dwell Data for Switch No. 5

SSE ACCELERATIONS

	ANALYZED				ACTUAL	Valve-9902A		
	Gx	Gy	Gz	Gc	Gx	Gy	Gz	Gc
VALVE ASSEMBLY								
a. Body-Bonnet Studs	*	2.0	*	6.1	1.144	.191	1.834	2.16
b. Upper Cylinder Studs	*	2.0	*	6.1	2.389	.191	3.349	4.11
c. Lower Cylinder Studs	*	2.0	*	6.1	1.819	.191	2.636	3.20
d. Lower Yoke Stud	*	2.0	*	6.1	1.819	.191	2.636	3.20
e. Lower Yoke (Sec.A-A)	4.7	2.0	5.2	---	1.144	.191	1.834	2.16
f. Lower Yoke (Sec.B-B)	4.1	2.0	4.1	---	1.819	.191	2.636	3.20
g. Upper Yoke	*	2.0	*	6.1	2.389	.191	3.349	4.11
h. Bonnet	*	2.0	*	6.1	1.144	.191	1.834	2.1[illegible]
. SOLENOIDS								
a. 21110-0303-5200	*	2.0	*	3.0	1.144	.191	1.834	2.16
b. 21110-7303-5200								
I. LIMIT SWITCHES **								
a. EA170-31302	*	5.2	*	7.3	2.389	.191	3.349	4.11
b. EA170-32302	*	5.2	*	7.3	2.389	.191	3.349	4.11

$$*G_c = (G_x^2 + G_z^2)^{\frac{1}{2}}$$

$$**G_c = (G_x^2 + G_y^2 + G_z^2)^{\frac{1}{2}}$$

SSE

ACCELERATIONS

	ANALYZED				ACTUAL Valve-9902B			
	Gx	Gy	Gz	Gc	Gx	Gy	Gz	Gc
. VALVE ASSEMBLY								
a. Body-Bonnet Studs	*	2.0	*	6.1	1.545	.191	2.794	3.1
b. Upper Cylinder Studs	*	2.0	*	6.1	3.262	.191	5.143	6.0
c. Lower Cylinder Studs	*	2.0	*	6.1	2.477	.191	4.026	4.7
d. Lower Yoke Stud	*	2.0	*	6.1	2.477	.191	4.026	4.7
e. Lower Yoke (Sec.A-A)	4.7	2.0	5.2	---	1.545	.191	2.794	3.1
f. Lower Yoke (Sec.B-B)	4.1	2.0	4.1	---	2.477	.191	4.026	4.7
g. Upper Yoke	*	2.0	*	6.1	3.263	.191	5.143	6.0
h. Bonnet	*	2.0	*	6.1	1.545	.191	2.794	3.1
I. SOLENOIDS								
a. 21110-0303-5200				--				
b. 21110-V303-5200	4.24	4.24	4.24		1.545	.191	2.794	3.1
II. LIMIT SWITCHES **								
a. EA170-31302	*	5.2	*	7.3	3.263	.191	5.143	6.0
b. EA170-32302	*	5.2	*	7.3	3.263	.191	5.143	6.0

$*G_c = (G_x^2 + G_z^2)^{\frac{1}{2}}$

$**G_c = (G_x^2 + G_y^2 + G_z^2)^{\frac{1}{2}}$

SSE

ACCELERATIONS

	ANALYZED				ACTUAL Valve-9903A			
	Gx	Gy	Gz	Gc	Gx	Gy	Gz	Gc
VALVE ASSEMBLY								
a. Body-Bonnet Studs	*	2.0	*	6.1	1.176	.193	1.541	1.9
b. Upper Cylinder Studs	*	2.0	*	6.1	2.454	.193	2.758	3.69
c. Lower Cylinder Studs	*	2.0	*	6.1	1.862	.193	2.181	2.8
d. Lower Yoke Stud	*	2.0	*	6.1	1.862	.193	2.181	2.8
e. Lower Yoke (Sec.A-A)	4.7	2.0	5.2	---	1.176	.193	1.541	1.9
f. Lower Yoke (Sec.B-B)	4.1	2.0	4.1	---	1.862	.193	2.181	2.8
g. Upper Yoke	*	2.0	*	6.1	2.454	.193	2.758	3.6
h. Bonnet	*	2.0	*	6.1	1.176	.193	1.541	1.9
. SOLENOIDS								
a. 21110-0303-5200	*	2.0	*	3.0	1.176	.193	1.541	1.9
b. 21110-7303-5200								
I. LIMIT SWITCHES **								
a. EA170-31302	*	5.2	*	7.3	2.454	.193	2.758	3.6
b. EA170-32302	*	5.2	*	7.3	2.454	.193	2.758	3.6

$$*G_c = (G_x^2 + G_z^2)^{\frac{1}{2}}$$

$$**G_c = (G_x^2 + G_y^2 + G_z^2)^{\frac{1}{2}}$$

SSE

ACCELERATIONS

	ANALYZED				ACTUAL	Valve-9903B		
	Gx	Gy	Gz	Gc	Gx	Gy	Gz	Gc
. VALVE ASSEMBLY								
a. Body-Bonnet Studs	*	2.0	*	6.1	1.903	.199	2.361	3.0
b. Upper Cylinder Studs	*	2.0	*	6.1	4.033	.199	4.305	5.9
c. Lower Cylinder Studs	*	2.0	*	6.1	3.052	.199	3.379	4.5
d. Lower Yoke Stud	*	2.0	*	6.1	3.052	.199	3.379	4.5
e. Lower Yoke (Sec.A-A)	4.7	2.0	5.2	---	1.903	.199	2.361	3.0
f. Lower Yoke (Sec.B-B)	4.1	2.0	4.1	---	3.052	.199	3.379	4.5
g. Upper Yoke	*	2.0	*	6.1	4.033	.199	4.305	5.9
h. Bonnet	*	2.0	*	6.1	1.903	.199	2.361	3.0
I. SOLENOIDS								
a. 21110-0303-5200								
b. 21110-7303-5200	4.24	4.24	4.24	--	1.903	.199	2.3[illegible]	
II. LIMIT SWITCHES **								
a. EA170-31302	*	5.2	*	7.3	4.033	.199	4.305	5.9
b. EA170-32302	*	5.2	*	7.3	4.033	.199	4.305	5.9

$$*G_c = (G_x^2 + G_z^2)^{\frac{1}{2}}$$

$$**G_c = (G_x^2 + G_y^2 + G_z^2)^{\frac{1}{2}}$$

OBE
ACCELERATIONS

	ANALYZED				ACTUAL	Valve-9902A		
	Gx	Gy	Gz	Gc	Gx	Gy	Gz	Gc
. VALVE ASSEMBLY								
a. Body-Bonnet Studs	*	2.0	*	6.1	0.610	.102	0.978	1.15
b. Upper Cylinder Studs	*	2.0	*	6.1	1.274	.102	1.786	2.19
c. Lower Cylinder Studs	*	2.0	*	6.1	0.970	.102	1.406	1.7
d. Lower Yoke Stud	*	2.0	*	6.1	0.970	.102	1.406	1.7
e. Lower Yoke (Sec.A-A)	2.51	1.07	2.77	---	0.610	.102	0.978	1.15
f. Lower Yoke (Sec.B-B)	2.19	1.07	2.19	---	0.970	.102	1.406	1.7
g. Upper Yoke	*	2.0	*	6.1	1.274	.102	1.786	2.1
h. Bonnet	*	2.0	*	6.1	0.610	.102	0.978	1.1
I. SOLENOIDS								
a. 21110-0303-5200	*	2.0	*	3.0	0.610	.102	0.978	1.1
b. 21110-7303-5200								
II. LIMIT SWITCHES **								
a. EA170-31302	*	5.2	*	7.3	1.274	.102	1.786	2.1
b. EA170-32302	*	5.2	*	7.3	1.274	.102	1.786	2.1

$*G_c = (G_x^2 + G_z^2)^{\frac{1}{2}}$

$**G_c = (G_x^2 + G_y^2 + G_z^2)^{\frac{1}{2}}$

OBE
ACCELERATIONS

	ANALYZED				ACTUAL	Valve-9902B		
	Gx	Gy	Gz	Gc	Gx	Gy	Gz	Gc
. VALVE ASSEMBLY								
a. Body-Bonnet Studs	*	2.0	*	6.1	0.824	.102	1.490	1.7
b. Upper Cylinder Studs	*	2.0	*	6.1	1.740	.102	2.743	3.2
c. Lower Cylinder Studs	*	2.0	*	6.1	1.321	.102	2.147	2.5
d. Lower Yoke Stud	*	2.0	*	6.1	1.321	.102	2.147	2.5
e. Lower Yoke (Sec.A-A)	2.51	1.07	2.77	——	0.824	.102	1.490	1.7
f. Lower Yoke (Sec.B-B)	2.19	1.07	2.15	——	1.321	.102	2.147	2.5
g. Upper Yoke	*	2.0	*	6.1	1.740	.102	2.743	3.2
h. Bonnet	*	2.0	*	6.1	0.824	.102	1.490	1.7
I. SOLENOIDS								
a. 21110-0303-5200								
b. 21110-7303-5200	3.4	3.4	3.4	--	0.824	.102	1.490	1.7
II. LIMIT SWITCHES **								
a. EA170-31302	*	5.2	*	7.3	1.740	.102	2.743	3.2
b. EA170-32302	*	5.2	*	7.3	1.740	.102	2.743	3.2

$*Gc = (Gx^2 + Gz^2)^{\frac{1}{2}}$

$**G_c = (G_x^2 + G_y^2 + G_z^2)^{\frac{1}{2}}$

OBE

ACCELERATIONS

	ANALYZED				ACTUAL	Valve-9903A		
	Gx	Gy	Gz	Gc	Gx	Gy	Gz	Gc
VALVE ASSEMBLY								
a. Body-Bonnet Studs	*	2.0	*	6.1	0.627	.103	0.822	1.03
b. Upper Cylinder Studs	*	2.0	*	6.1	1.309	.103	1.471	1.96
c. Lower Cylinder Studs	*	2.0	*	6.1	0.993	.103	1.163	1.5
d. Lower Yoke Stud	*	2.0	*	6.1	0.933	.103	1.163	1.5
e. Lower Yoke (Sec.A-A)	2.51	1.07	2.77	---	0.627	.103	0.822	1.0
f. Lower Yoke (Sec.B-B)	2.19	1.07	2.19	---	0.993	.103	1.163	1.5
g. Upper Yoke	*	2.0	*	6.1	1.309	.103	1.471	1.9
h. Bonnet	*	2.0	*	6.1	0.627	.103	0.822	1.0
I. SOLENOIDS								
a. 21110-0303-5200	*	2.0	*	3.0	0.627	.103	0.822	1.0
b. 21110-7303-5200								
II. LIMIT SWITCHES **								
a. EA170-31302	*	5.2	*	7.3	1.309	.103	1.471	1.9
b. EA170-32302	*	5.2	*	7.3	1.309	.103	1.471	1.9

$*Gc = (Gx^2 + Gz^2)^{\frac{1}{2}}$

$**G_c = (G_x^2 + G_y^2 + G_z^2)^{\frac{1}{2}}$

OBE
ACCELERATIONS

	ANALYZED				ACTUAL	Valve-9903B		
	Gx	Gy	Gz	Gc	Gx	Gy	Gz	Gc
. VALVE ASSEMBLY								
a. Body-Bonnet Studs	*	2.0	*	6.1	1.015	.106	1.259	1.91
b. Upper Cylinder Studs	*	2.0	*	6.1	2.151	.106	2.296	3.15
c. Lower Cylinder Studs	*	2.0	*	6.1	1.628	.106	1.802	2.43
d. Lower Yoke Stud	*	2.0	*	6.1	1.628	.106	1.802	2.43
e. Lower Yoke (Sec.A-A)	2.51	1.07	2.77	---	1.015	.106	1.259	1.91
f. Lower Yoke (Sec.B-B)	2.19	1.07	2.19	---	1.628	.106	1.802	2.43
g. Upper Yoke	*	2.0	*	6.1	2.151	.106	2.296	3.15
h. Bonnet	*	2.0	*	6.1	1.015	.106	1.259	1.9
I. SOLENOIDS								
a. 21110-0303-5200								
b. 21110-7303-5200	3.4	3.4	3.4	--	1.015	.106	1.259	1.9
II. LIMIT SWITCHES **								
a. EA170-31302	*	5.2	*	7.3	2.151	.106	2.296	3.1
b. EA170-32302	*	5.2	*	7.3	2.151	.106	2.296	3.1

$*Gc = (Gx^2 + Gz^2)^{\frac{1}{2}}$

$**G_c = (G_x^2 + G_y^2 + G_z^2)^{\frac{1}{2}}$

SPECIFIC ITEM #2 BORIC ACID TRANSFER PUMP

PART 1: Direction of deflection assumed in the analysis for frequency is incorrect. Westinghouse is to supplement the report and provide a summary of stresses.

STATUS: This item is resolved.

RESOLUTION SUMMARY: A summary of stresses has been included as an addendum to the seismic stress analysis, MED-PVE-2340. The method for determining deflections used in the Rayleigh frequency analysis has been corrected. The new shaft/rotor/impeller frequency has been calculated at 290 Hz. This is a decrease from the previously determined 801 Hz, but is still significantly greater than 33 Hz and also the running speed. The seismic shock analysis, report A-16799, which includes deflections and frequency determinations, has been revised to revision 3 to include the corrections. This report is filed and maintained by Westinghouse in the engineering files for the Catawba plant.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba Unit 1 — Type:

1. Utility: Duke Power Co. — PWR 4 Loop
2. NSSS: Westinghouse — BWR ______
3. A/E: Duke Power Co. — Other ______

II. Component Name: Boric Acid Transfer Pump

1. Scope: [x] NSSS [ ] BOP [ ] Other
2. Model Number: GVH-10K Quantity: 2 per plant
3. Size or Range: 75 gpm
4. Vendor: Chempump
5. If the component is a cabinet or panel, name and model number of the devices included: N/A

6. Physical Description:
   a. Appearance: Canned pump with integral motor
   b. Dimensions: Length = 27", width = 13.75", height = 20.0625"
   c. Weight: 295#
7. Location: Building: Auxiliary Building
   Elevation: 560 feet
8. Field Mounting Conditions: [x] Bolt (No. 4 , Size 1/2")
   [ ] Weld (Length ____)
   [ ] ______
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   Base plate mounted on floor
10. a. System in which located: Boric acid system
    b. Functional Description: Fill boric acid tanks
    c. Is the equipment required for [ ] Hot Standby, [ ] Cold Shutdown
       [x] Both [ ] Neither [ ] Other ______

SEISMIC QUALIFICATION SUMMARY

A. Component: Boric Acid Transfer Pump

The Catawba Boric Acid Transfer Pumps were designed based upon the criteria of the ASME Boiler and Pressure Vessel Code, Section III for Class 3 pumps. The assembly consists of a single stage centrifugal pump and an integral 10 horsepower motor.

B. Qualification Approach:

The program developed to assure seismic qualification of pump assemblies within the Westinghouse NSSS scope of supply is discussed in Sections 3.7 and 3.9.3.2 of the Catawba FSAR. These pumps are designed for the worst case loading combinations resulting from internal pressure, operating, deadweight, seismic and nozzle loads. The qualification program consists of:

1. ASME code design
2. Natural frequency and deflection analysis
3. Static seismic analysis.

Qualification is performed using plant specific nozzle loads and SSE accelerations of .26/.26/.173g. Margin exists between actual results and the allowables.

II. Pertinent Reference Design Specifications for Qualification Requirements:

E-Spec 678910 Rev. 1, E-Spec. 952343 Rev. 0

a. Seismic Input
See Item V.5

b. Hydrodynamic Load Input
See Note 1

c. Fatigue Considerations
See Item V.6

d. Service Conditions
See design specification

e. Qualified Life
40 years

III. Is Equipment Available for Inspection in the Plant:

[x] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method: Natural Frequency and Deflection Analysis

[ ] Test [x] Analysis [ ] Combination of Test and Analysis

Qualification Report:* A-16799 Addendum II - Natural Frequency

(No., Title and Date): Analysis 1/6/75

Company that Prepared Report: Chempump

Company that Reviewed Report: Westinghouse

Where Report is filed or available: Chempump/Westinghouse

Applicable Codes and/or Standards: E-Specs per Item II.11

V. Vibration Input:

1. Loads considered:
   a. [x] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [x] SRSS [ ] ____________ (other, specify)

3. Required Response Spectra** (attach the graphs): See attached

Note:

*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

Note 1: The Boric Acid Transfer Pump is located outside containment and is not subject to hydrodynamic loads such as LOCA.

4. Damping Corresponding to RRS: OBE N/A SSE N/A

5. Required Acceleration in Each Direction: N/A (For natural frequency analysis: see stress results)

[ ] ZPA [ ] Other ______ (specify)

OBE S/S = ______ F/B = ______ V = ______

SSE S/S = ______ F/B = ______ V = ______

6. Were fatigue effects considered?

[ ] Yes [x] No Not required by the ASME code.

If yes, describe how they were treated in overall qualification program:

______

______

VI. <u>If Qualification by Test, then complete</u>: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] ______

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ______ SSE ______ Other ______ (specify)

4. Frequency Range: ______

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ______ F/B = ______ V = ______

6. Method of Determining Natural Frequencies:

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = ______ F/B = ______ V = ______

SSE S/S = ______ F/B = ______ V = ______

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ______

B. Orientation and Fixturing: ______

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ______

12. Other tests performed (such as aging or fragility test, including results):

______

13. Failure Modes (if appropriate ______)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. <u>If Qualification by Analysis, then complete</u>:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[x] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = > 35 Hz F/B = > 35 Hz V = > 35 Hz

3. Model Type: [x] 3D [ ] 2D [ ] 1D

[ ] Finite Element [x] Beam

[ ] Closed Form Solution [ ] Other ______

4. [ ] Computer Codes: N/A

Frequency Range and No. of modes considered: N/A

[x] Hand Calculations to determine frequency

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: N/A (specify)

6. Damping N/A

OBE ______ SSE ______ Basis for damping used: ____________

7. Support Considerations in the model: Rigidly attached to floor - same as actual installation.

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Natural Frequency				53 Hz >	33 Hz

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
.0159"	Impeller	.0195" operability will not be impaired.

9. Failure Modes: None

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

Fn > 33 Hz

Note margin between actual deflection and allowable.

11. Pertinent Reference Design Specifications for Qualification Requirements:

____

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes   [ ] No   [ ] Partial or limited availability

IV. Equipment Qualification Method: Structural and Seismic Analysis

[ ] Test   [x] Analysis   [ ] Combination of Test and Analysis

Qualification Report:* MED-PVE-2340

(No., Title and Date): Seismic Analysis 3/9/84

Company that Prepared Report: Westinghouse

Company that Reviewed Report: Westinghouse

Where Report is filed or available: Westinghouse

Applicable Codes and/or Standards: E-Specs per Item II-11; ASME Code Section III

V. Vibration Input:

1. Loads considered:
   a. [x] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum   [x] SRSS   [ ] ____________ (other, specify)

3. Required Response Spectra** (attach the graphs): See attached

Note:

*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 2% SSE 2%

5. Required Acceleration in Each Direction:

[x] ZPA [ ] Other ______________ (specify)

Note 2 OBE S/S = N/A F/B = N/A V = N/A

SSE S/S = .26g F/B = .26g V = .173g

Qualified to actual plant accelerations

6. Were fatigue effects considered?

[ ] Yes [x] No Not required by the ASME code

If yes, describe how they were treated in overall qualification program:

____

____

VI. If Qualification by Test, then complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] ______________

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ______ [illegible] SSE ______________ Other ______________ (specify)

4. Frequency [illegible] ______________________________

5. Natural F[illegible] Each Direction (Side/Side, Front/Back, Vertical):

S/S = _ [illegible] = ______________ V = ______________

6. Method of D[illegible]rminin[illegible] atural Frequencies:

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

Note 2: Faulted condition results are shown to meet normal allowables, therefore, addressing the OBE condition is not necessary.

8. Maximum Input g-level Test:

OBE S/S = ____________ F/B = ____________ V = ____________

SSE S/S = ____________ F/B = ____________ V = ____________

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ____________

B. Orientation and Fixturing: ____________

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ____________

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (if appropriate ____________)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. <u>If Qualification by Analysis, then complete</u>:

1. Method of Analysis:

[x] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = > 35 Hz F/B = > 35 Hz V = > 35 Hz

3. Model Type: [x] 3D [ ] 2D [ ] 1D

[ ] Finite Element [x] Beam

[ ] Closed Form Solution [ ] Other ____________

4. [ ] Computer Codes: N/A

Frequency Range and No. of modes considered: N/A

[x] Hand Calculations for stress determination

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[x] Absolute Sum [ ] SRSS [ ] Other: ______ (specify)

6. Damping N/A

OBE ____ SSE ____ Basis for damping used: ______

7. Support Considerations in the model: Rigidly attached to floor - same as actual installation.

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Front Cradle Leg		SSE + DW + operating		6135 psi	21,750 psi
Cradle to Base Bolts		SSE + DW + operating		9398 psi	60,000 psi

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

Previously reported under frequency/deflection results

9. Failure Modes: None

10. Margins Available: [ ] Input Spectrum [x] Stress or Deflection

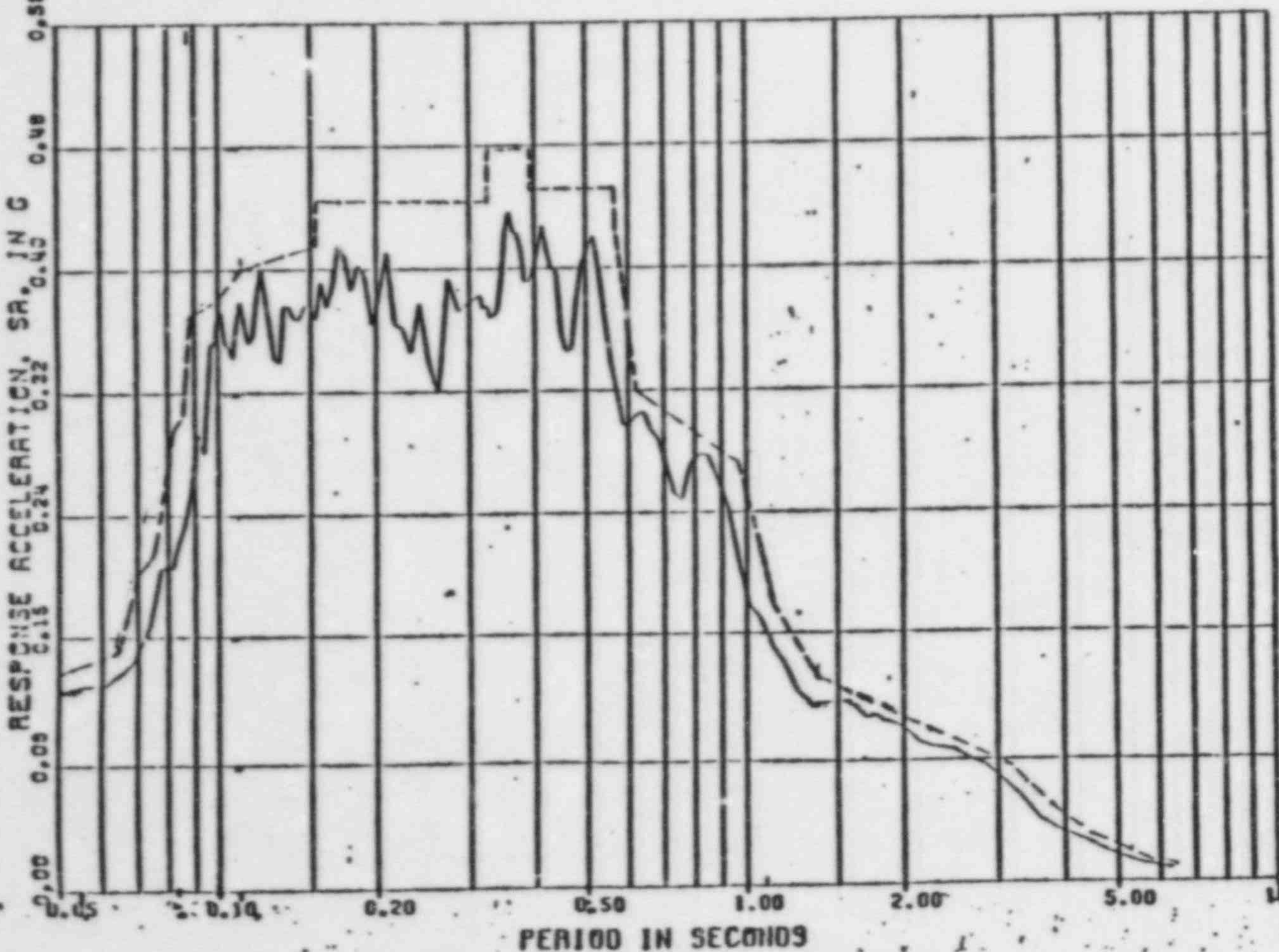
See Item VII.8 above

TRANSMITTED TO (W) BY CN-77A-6

CATAWBA AUX BLDG EAS-WES (Y) EARTHQUAKE

RESPONSE ACCELERATION SPECTRA. DAMPING= 0.020

ELEVATION 560+00 LINE X= -166.0



THESE CURVES ARE OBE.
MULTIPLY BY 1 5/8 FOR SSE.
VERTICAL = 2/3 HORIZONTAL

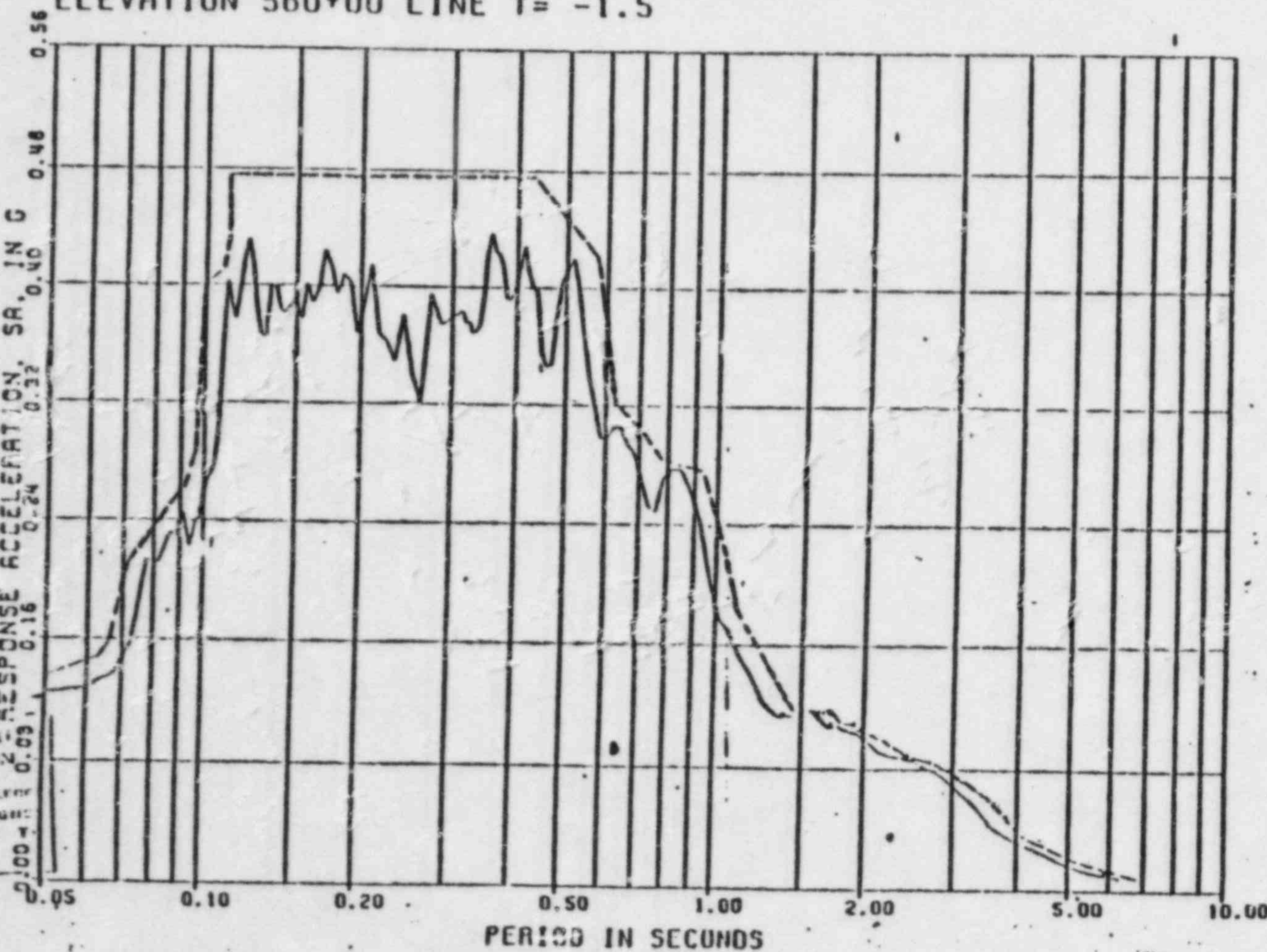
NUCLEAR SAFETY RELATED
DESIGN INFORMATION

TRANSMITTED TO (illegible) BY CN-77M-6

CATAWBA AUX BLDG NOR-SOU (X) EARTHQUAKE

RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020

ELEVATION 560+00 LINE Y= -1.5



THESE CURVES ARE OBE.

MULTIPLY BY 1 5/8 FOR SSE.

VERTICAL = 2/3 HORIZONTAL.

NUCLEAR SAFETY RELATED DESIGN INFORMATION

Boric Acid Transfer Pump

Item 1 The direction of deflection assumed in the analysis for frequency is incorrect. Westinghouse is to supplement the report and provide a summary of stresses.

Response: A summary of stresses has been included as an addendum to the seismic stress analysis, MED-PVE-2340. The method for determining deflections used in the Rayleigh frequency analysis has been corrected. The new shaft/rotor/impeller frequency has been calculated at 290 Hz. This is a decrease from the previously determined 801 Hz, but is still significantly greater than 33 Hz and also the running speed. The seismic shock analysis, report A-16799, which includes deflections and frequency determinations, has been revised to revision 3 to include the corrections. This report is filed and maintained by Westinghouse in the engineering files for the Catawba plant.

SPECIFIC ITEM #3 ENGINEERING SAFEGUARDS TEST CABINET

PART 1: Shim is required at bottom of cabinet to provide continuous contact.

STATUS: Field was notified.

RESOLUTION SUMMARY: The Unit 1 Engineering Safeguards Test Cabinet will be inspected and, if necessary, shims will be installed to provide continuous contact prior to fuel load.

Seismic and Dynamic Qualification Summary of Equipment

Plant Name: Catawba Unit 1 (DCP) Type:

1. Utility: Duke Power Co. PWR x
2. NSSS: Westinghouse BWR
3. A/E: Duke Power Co. Other

II. Component Name: Safeguards Test Cabinet Tag No.: 1ESFA, 1ESFB

1. Scope: [x] NSSS [ ] BOP [ ] Other
2. Model Number: 1060E22 Quantity: 2 units (Train A & B)
3. Size or Range: -
4. Vendor: Westinghouse (WID)
5. If the component is a cabinet or panel, name and model number of the devices included: Reference drawing 1060E22 Rev. A, 6065D41 Rev. D
6. Physical Description:
   a. Appearance: Single - Bay Vertical Cabinet
   b. Dimensions: 30" wide x 30" deep x 91.31" high
   c. Weight: Approximately 1500 lbs.
7. Location: Building: Auxiliary Building
   Elevation: 594 ft.
8. Field Mounting Conditions: [x] Bolt (No. 4, Size 5/8") A325
   [x] Weld (Length 16") 1/4" Fillet Weld
   [ ] ________
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   Floor Mounted
10. a. System in which located: Reactor Protection System
    b. Functional Description: Provide test capability (@ power)
    c. Is the equipment required for [ ] Hot Standby, [ ] Cold Shutdown
    [x] Both [ ] Neither [ ] Other

II. Pertinent Reference Design Specifications for Qualification Requirements:

P.O. # 209036 E-Spec. 952512 Rev. 1

a. Seismic Input
See Section VI.1

b. Hydrodynamic Load Input
N/A

c. Fatigue Considerations
N/A

d. Service Conditions
Controlled Environment

e. Qualified Life
5 years

III. Is Equipment Available for Inspection in the Plant:

[x] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[x] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report:* WCAP 7817 "Seismic Testing of Electrical & Control Equipment", Rev. 0, December, 1971.

(No., Title and Date): WCAP 7817, Supplement 7 "Seismic Testing of Electrical & Control Equipment for Low Seismic Plants", Rev. 0, September 19

Company that Prepared Report: Westinghouse NTD

Company that Reviewed Report: Westinghouse NTD

Where Report is filed or available: Westinghouse NTD/NRC/DP

Applicable Codes and/or Standards: IEEE 344-1971

V. Vibration Input:

1. Loads considered:
   a. [x] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [x] SRSS [ ] ____ (other, specify)

3. Required Response Spectra** (attach the graphs): See attached Figures 1, 2, and

Note:

*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE N/A SSE 5%

5. Required Acceleration in Each Direction: Not Applicable (N/A)

[ ] ZPA [ ] Other ______ (specify)

OBE S/S = N/A F/B = N/A V = N/A

SSE S/S = N/A F/B = N/A V = N/A

6. Were fatigue effects considered?

[ ] Yes [x] No

If yes, describe how they were treated in overall qualification program:

______

______

VI. If Qualification by Test, then complete:

1. [x] Single Frequency [ ] Multi-Frequency: [ ] random [x] sine beat [ ] 5 beats (10 cpb) @ each test frequency

2. [x] Single Axis [ ] Independent Axis [ ] Multi-Axis [ ] In-phase motions

3. Number of Qualifications Tests: Front-to-Back Side-to-Side Vertical

OBE ______ SSE 3 Other ______ (specify)

4. Frequency Range: 1 Hz to 35 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 9.5 - 13 Hz F/B = 19 - 20 Hz V = > 33 Hz

6. Method of Determining Natural Frequencies:

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[x] No TRS envelopes RRS using single frequency sine beat testing (Figures 4 and 5)

8. Maximum Input g-level Test: See attached Figures 4 and 5

OBE S/S = ______________ F/B = ______________ V = ______________

SSE S/S = ______________ F/B = ______________ V = ______________

9. Laboratory Mounting:

A. [x] Bolt (No. 4, Size 3/4") A307

[ ] Weld (Length ____) [ ] ______________

B. Orientation and Fixturing: Test unit was mounted in-line with the test input.

10. Functional operability verified:

[x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Test results were acceptable. No modifications were made to the equipment.

12. Other tests performed (such as aging or fragility test, including results):

None

13. Failure Modes (if appropriate None)

14. Margins Available: [x] Input Spectrum [ ] Fragility
See attached Figures 4 and 5

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ______________ F/B = ______________ V = ______________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ______________

4. [ ] Computer Codes: N/A

Frequency Range and No. of modes considered: ______

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: ______ (specify)

6. Damping

OBE ______ SSE ______ Basis for damping used: ______

7. Support Considerations in the model: ______

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

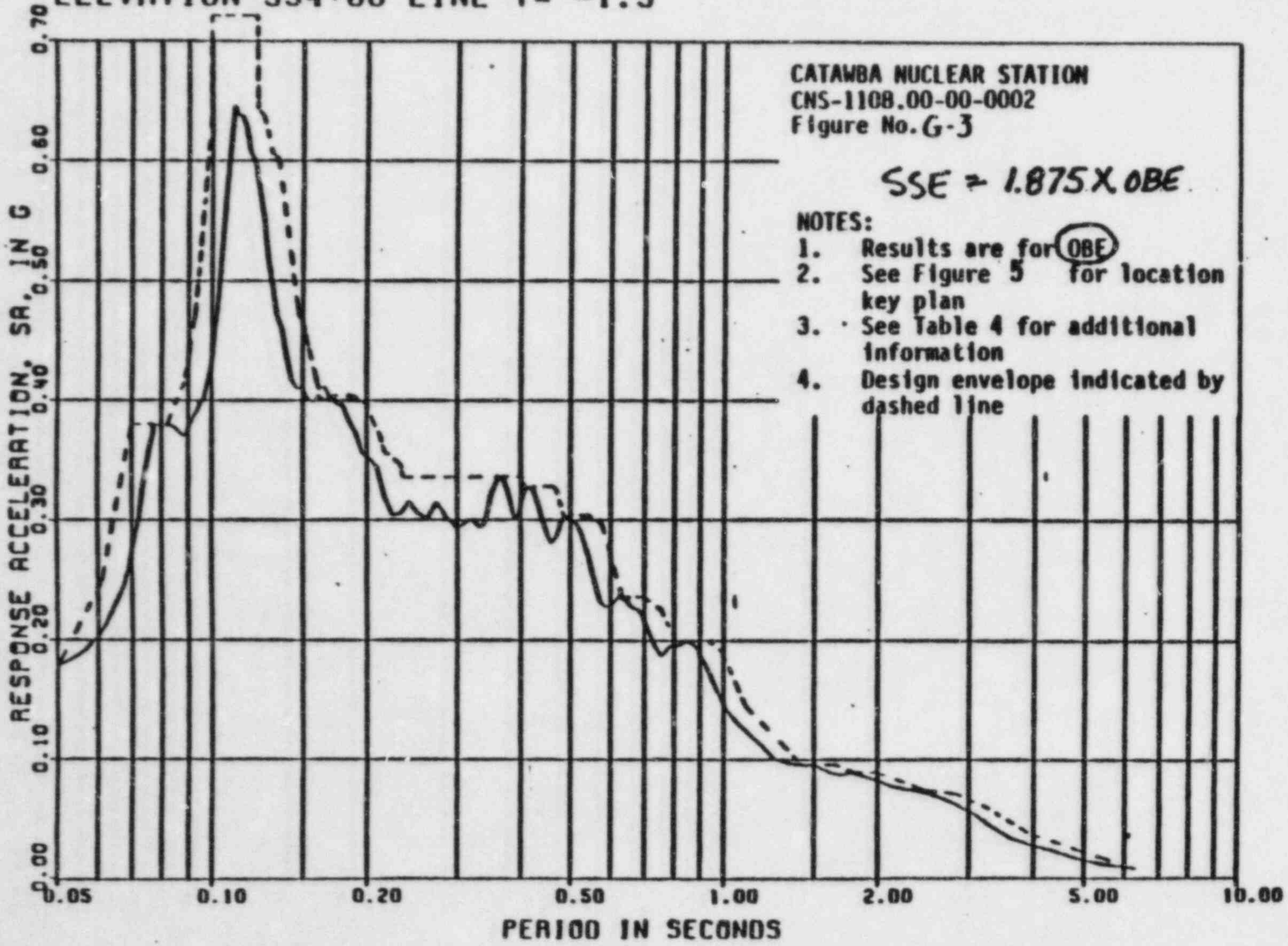
B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: ______

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

CATAWBA AUX BLDG NOR-SOU (X) EARTHQUAKE
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.050
ELEVATION 594+00 LINE Y= -1.5



HORIZONTAL SIDE TO SIDE

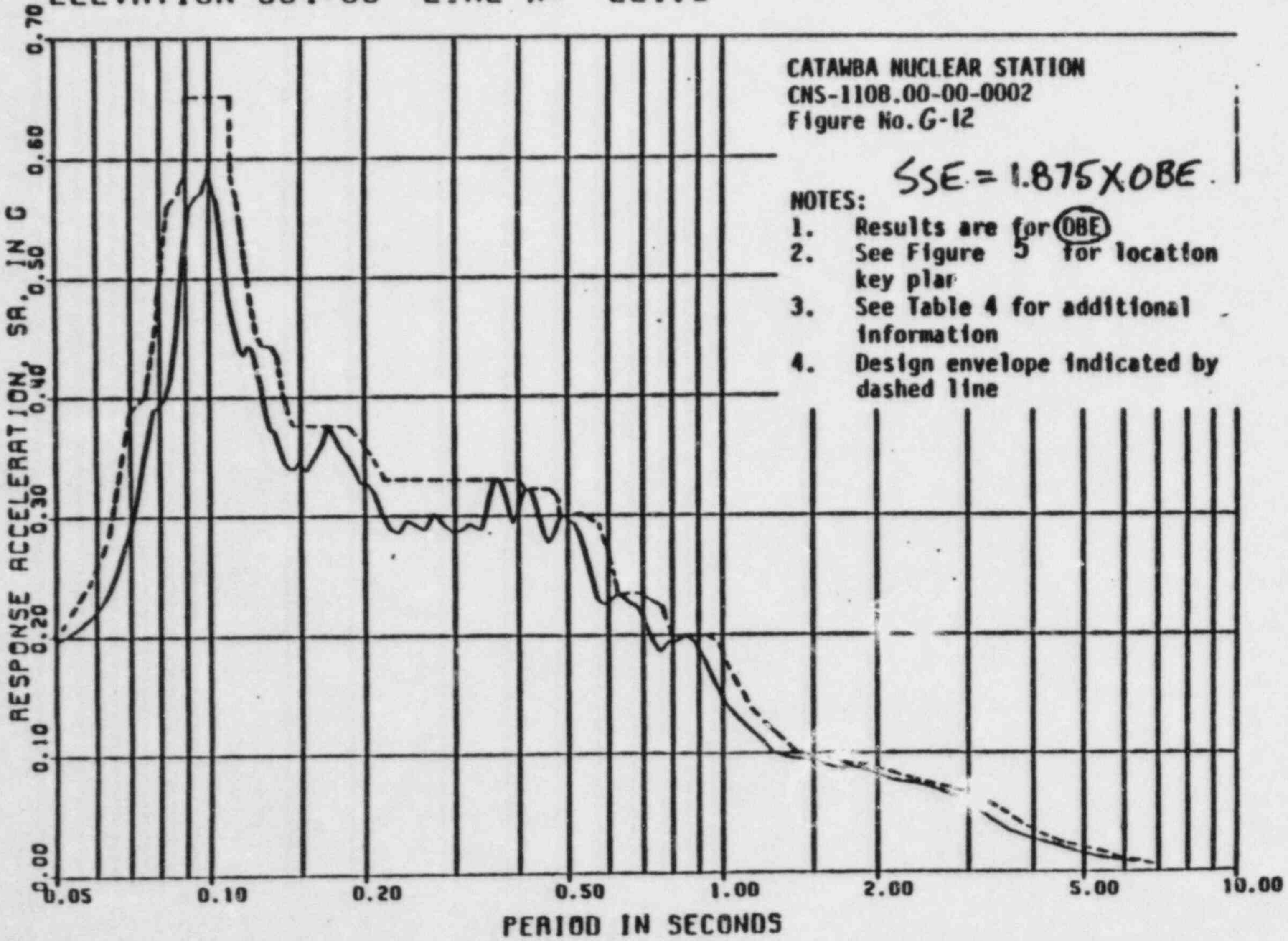
Figure 1

Revision 3: July 1, 1982
Date: December 5, 1980

CATAWBA AUX BLDG EAS-WES (Y) EARTHQUAKE

RESPONSE ACCELERATION SPECTRA, DAMPING= 0.050

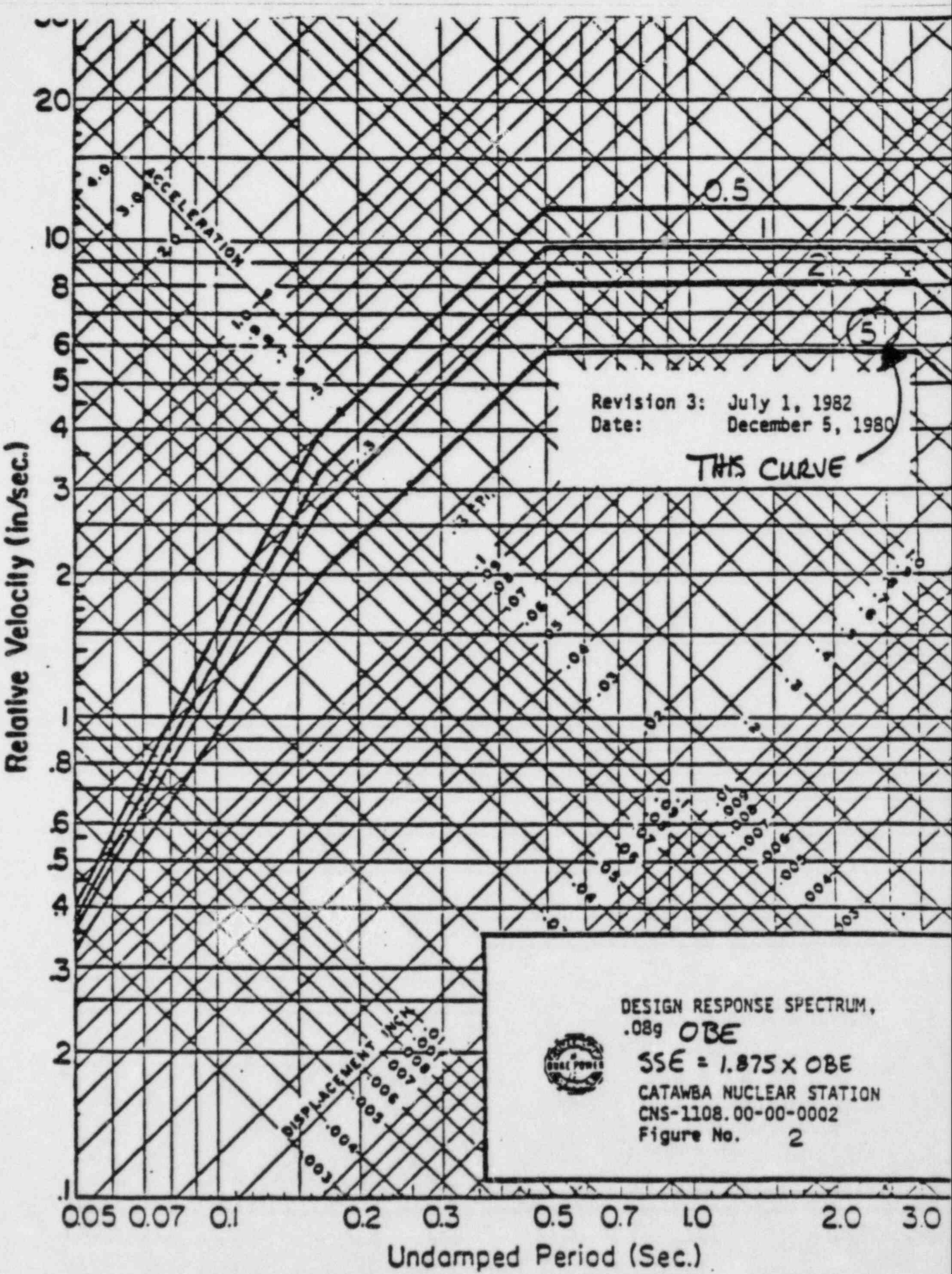
ELEVATION 594+00 LINE X= -221.5



HORIZONTAL FRONT TO BACK

Figure 2

Revision 3: July 1, 1982
Date: December 5, 1980

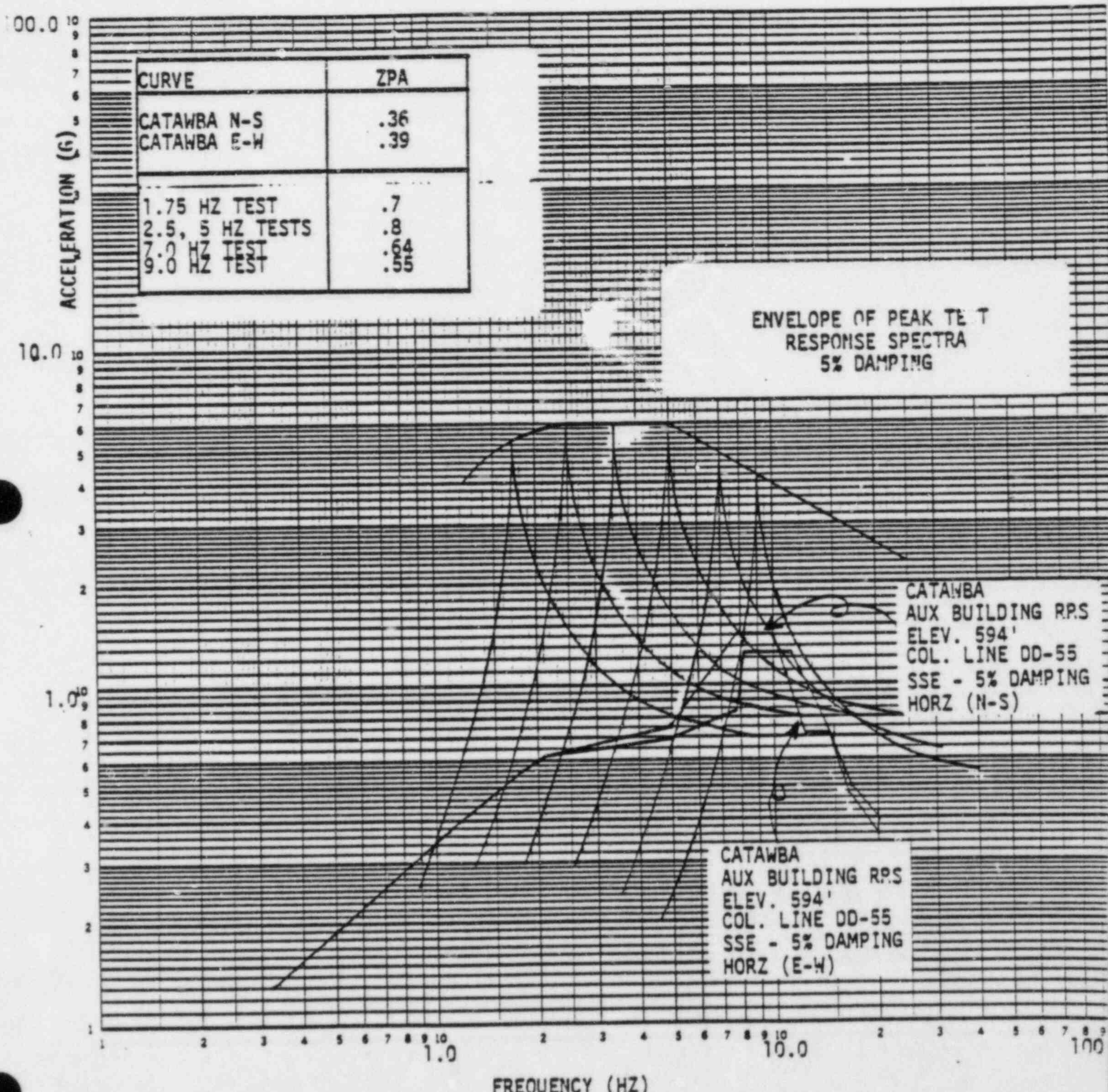


VERTICAL

Figure 3

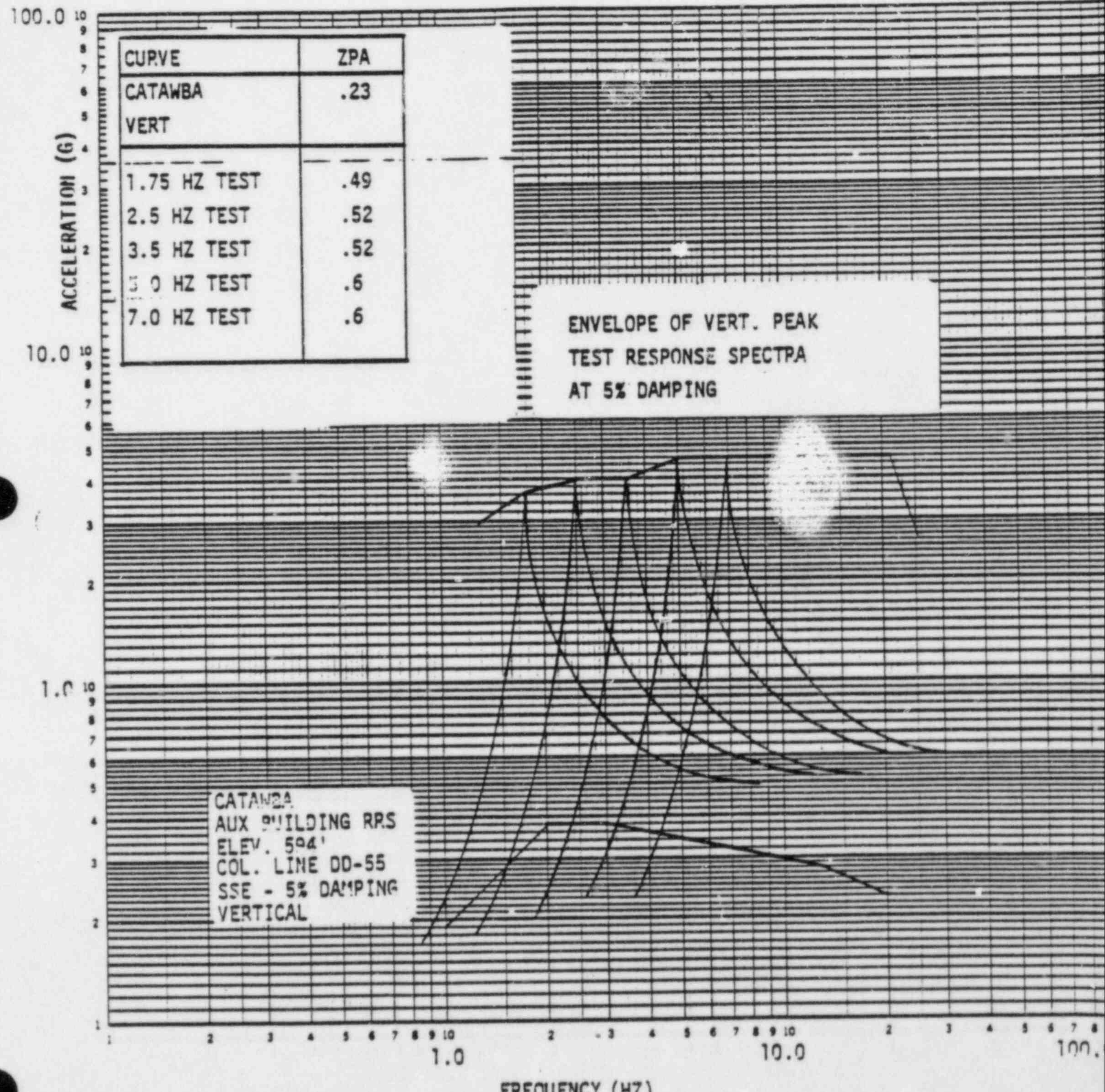
SSPS LOCATION: ELEVATION 594' COLUMN LINE DD-55

FIGURE 4



SAFEGUARDS TEST CABINET (STC) TRS FOR SINGLE FREQUENCY SINGLE AXIS HORIZONTAL TESTS COMPARED TO DCP HORIZONTAL RESPONSE SPECTRA FOR AUXILIARY BUILDING, ELEVATION 594' (COL LINE DD-55).

FIGURE 5



SAFEGUARDS TEST CABINET (STC) TRS FOR SINGLE FREQUENCY SINGLE AXIS VERTICAL TESTS COMPARED TO DCP VERTICAL RESPONSE SPECTRA FOR AUXILIARY BUILDING, ELEVATION 594' (COL LINE DD-55).

SPECIFIC ITEM #4 THERMAL REGENERATIVE DEMINERALIZER TANK

PART 1: At the upper level of the demineralizer tank, the tank surface is in contact with the flex conduit terminator of an adjacent limit switch. Does this limit switch have a safety-related function?

STATUS: This item has been resolved.

RESOLUTION SUMMARY: The limit switch in question is on a non-safety 3" Tufline plug valve. The plug valve is a Class E valve which only serves as a pressure boundary. For this case, the limit switch has no safety-related function. Therefore, failure of the switch poses no safety concern.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba Units 1 and 2 (DCP/DDP) Type:

1. Utility: Duke Power Company PWR X
2. NSSS: Westinghouse BWR
3. A/E: Duke Power Company Other

II. Component Name: BTRS Demineralizer

1. Scope: [x] NSSS [ ] BOP [ ] Other
2. Model Number: n/a Quantity: five/plant
3. Size or Range: See Item 6
4. Vendor: Lamco Industries Inc.
5. If the component is a cabinet or panel, name and model number of the devices included: n/a
6. Physical Description:
   a. Appearance: vertical unit on four leg supports
   b. Dimensions: height = 123.88"; shell OD = 48"
   c. Weight: 3825# (empty); 9400# (flooded)
7. Location: Building: auxiliary

   Elevation: 560'
8. Field Mounting Conditions: [X] Bolt (No. 16*, Size 1-1/8") *from design report
   [ ] Weld (Length ____)
   [ ] ____
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

   floor mounted

10. a. System in which located: CVCS/boron thermal regen subsystem
    b. Functional Description: Remove boron from the process fluid and store it in the resin contained therein
    c. Is the equipment required for [ ] Hot Standby, [ ] Cold Shutdown

       [ ] Both [X] Neither [ ] Other ____

Seismic Qualification Summary

A. Component: Boron Thermal Regenerative System Demineralizers

The demineralizers used in the Boron Thermal Regenerative System at Catawba were designed and built to the ASME Boiler and Pressure Vessel Code, Section III. The assembly consists of a tank with an internal resin bed and is supported by four legs.

B. Qualification Approach:

The program developed to assure seismic qualification of the tanks and demineralizers within the Westinghouse NSSS scope of supply is discussed in Sections 3.7 and 3.9.3 of the Catawba FSAR. These demineralizers are designed for the worst case loading combinations resulting from internal pressure, deadweight seismic and nozzle loads. The qualification program consists of the following:

1. ASME code design calculations
2. Dynamic frequency analysis
3. Static seismic and structural analysis

Generic qualification is performed to SSE acceleration levels of 1.06g/1.06g/1.0g. Actual plant SSE accelerations are .26g/.26g/.17g. Thus significant margin exists.

11. Pertinent Reference Design Specifications for Qualification Requirements:

E-Spec 679066, Rev. 2; EDS-DM-001, Rev. 3

a. Seismic Input
See Item V.5

b. Hydrodynamic Load Input
See Note 1

c. Fatigue Considerations
See Item V.6

d. Service Conditions
See E-Spec and referenced spec.

e. Qualified Life
40 years

III. Is Equipment Available for Inspection in the Plant:

[x] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [x] Analysis [ ] Combination of Test and Analysis

Qualification Report:* (No., Title and Date):	Design Report CS4813, Rev. B Stress Calcs (6/26/75)	Dynamic Analysis Summary Sheet Nos. 49-11-0 & 49-11-6
Company that Prepared Report:	Lamco	Westinghouse
Company that Reviewed Report:	Westinghouse	Westinghouse
Where Report is filed or available:	Lamco/W NTD	W NTD
Applicable Codes and/or Standards:	ASME B&PV Code 1971 Ed & Addendum through Summer	

V. Vibration Input:

1. Loads considered:
   a. [x] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [x] SRSS [ ] ____________ (other, specify)

3. Required Response Spectra** (attach the graphs): Duke ltr CN-77M-6 (1/27/77)

Note:

*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.
Note 1: The BTRS Deminieralizer is located on a Class 3 System in the Auxiliary Building and is not subjected to any hydrodynamic loads such as LOCA.

4. Damping Corresponding to RRS: OBE 1.0% SSE 2.0%

5. Required Acceleration in Each Direction:

[ ] ZPA [x] Other floor response spectra (specify)

Note 5 * OBE S/S = 0.53 g/0.14g F/B = .53g/.14g V = 0.5g/0.09g

* SSE S/S = 1.06g/0.26g F/B = 1.06g/.26g V = 1.0g/0.17g

*Generic/Plant Specific

6. Were fatigue effects considered?

[ ] Yes [x] No Not required per ASME Code for Class 3 components.

If yes, describe how they were treated in overall qualification program:

VI. If Qualification by Test, then complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ______

2. [ ] Single Axis [ ] Independent Axis [ ] Multi-Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ______ SSE ______ Other ______ (specify)

4. Frequency Range: ______

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ______ F/B = ______ V = ______

6. Method of Determining Natural Frequencies:

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE S/S = ____________ F/B = ____________ V = ____________

SSE S/S = ____________ F/B = ____________ V = ____________

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ____________

B. Orientation and Fixturing: ____________

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ____________

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (if appropriate ____________)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [x] Equivalent Static Analysis

Note 3. [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 23 Hz F/B = 23 Hz V = 33 Hz

3. Model Type: [ ] 3D [x] 2D Note 2 [ ] 1D

[x] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ____________

Note 2: The BTRS demineralizer was qualified to SSE accelerations of 1.5gH/1.0gV and OBE accelerations of .75gH/.50gV. Per WCAP 8230, these accelerations are equivalent to 1.06gH/1.06gH/1.0gV for SSE and .53gH/.53gH/.50gV for OBE for 3D comparisons.

Note 3: Westinghouse does perform a dynamic analysis only to obtain natural frequencies. These natural frequencies are used to find plant specific acceleration levels which are then compared to generic levels.

4. [X] Computer Codes: WESTDYN (for natural frequency only)

Frequency Range and No. of modes considered: 1.0 - 40.0 Hz/15 modes

[X] Hand Calculations
(for stresses)

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[X] Absolute Sum [ ] SRSS [ ] Other: ______ (specify)

6. Damping

OBE 1.0 SSE 2.0 Basis for damping used: Regulatory Guide 1.61

7. Support Considerations in the model: legs fixed to foundation per as installed configuration

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Note 5 Stress Allowable
Supports		faulted		0.49 (ratio)	1.0 (ratio) Note 4
Baseplate		faulted		18.88 ksi	31.6 ksi
Anchor Bolts		faulted		17.19 ksi	28.26 ksi

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
n/a		Demineralizer is a passive piece of equipment. Therefore, operability is not applicable.

9. Failure Modes: None

10. Margins Available: [ ] Input Spectrum [x] Stress or Deflection

See Item VII.8(A)

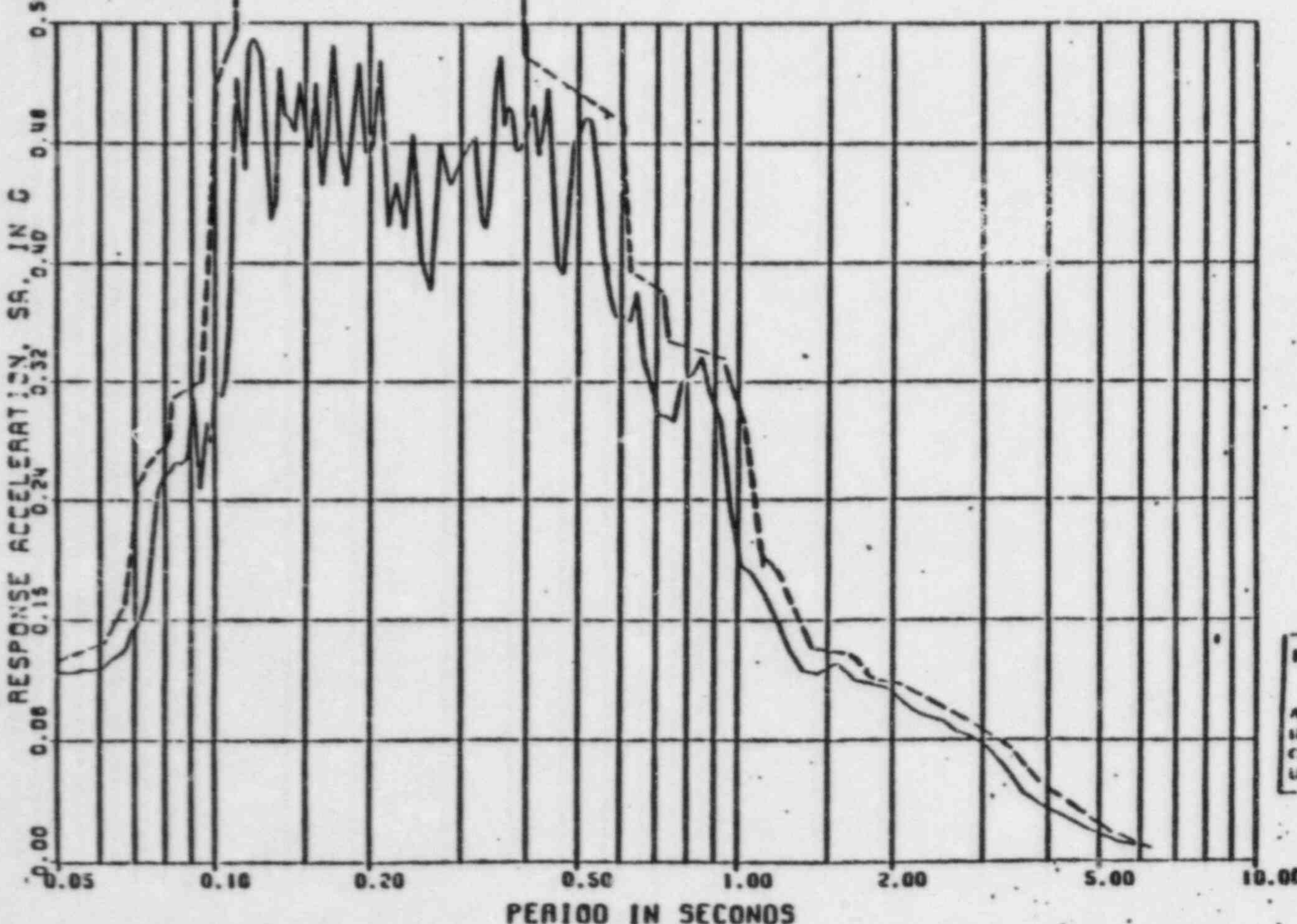
Note 4: This is a combined bearing and compression ratio allowable. The individual stresses and their respective allowables are:

Bending - fb = 9357 psi < Fb = 31,600 psi

Compression - fa = 6463 psi < Fa = 27,142 psi

Note 5: As noted in V.5, there is margin between plant specific and generic qualification levels. Additionally, as noted in VII.8, there is considerable margin between the actual stresses which are based on generic loads and allowable stresses.

CATAWBA AUX BLDG NOR-SOU (X) EARTHQUAKE
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.010
ELEVATION 560+00 LINE Y= -1.5

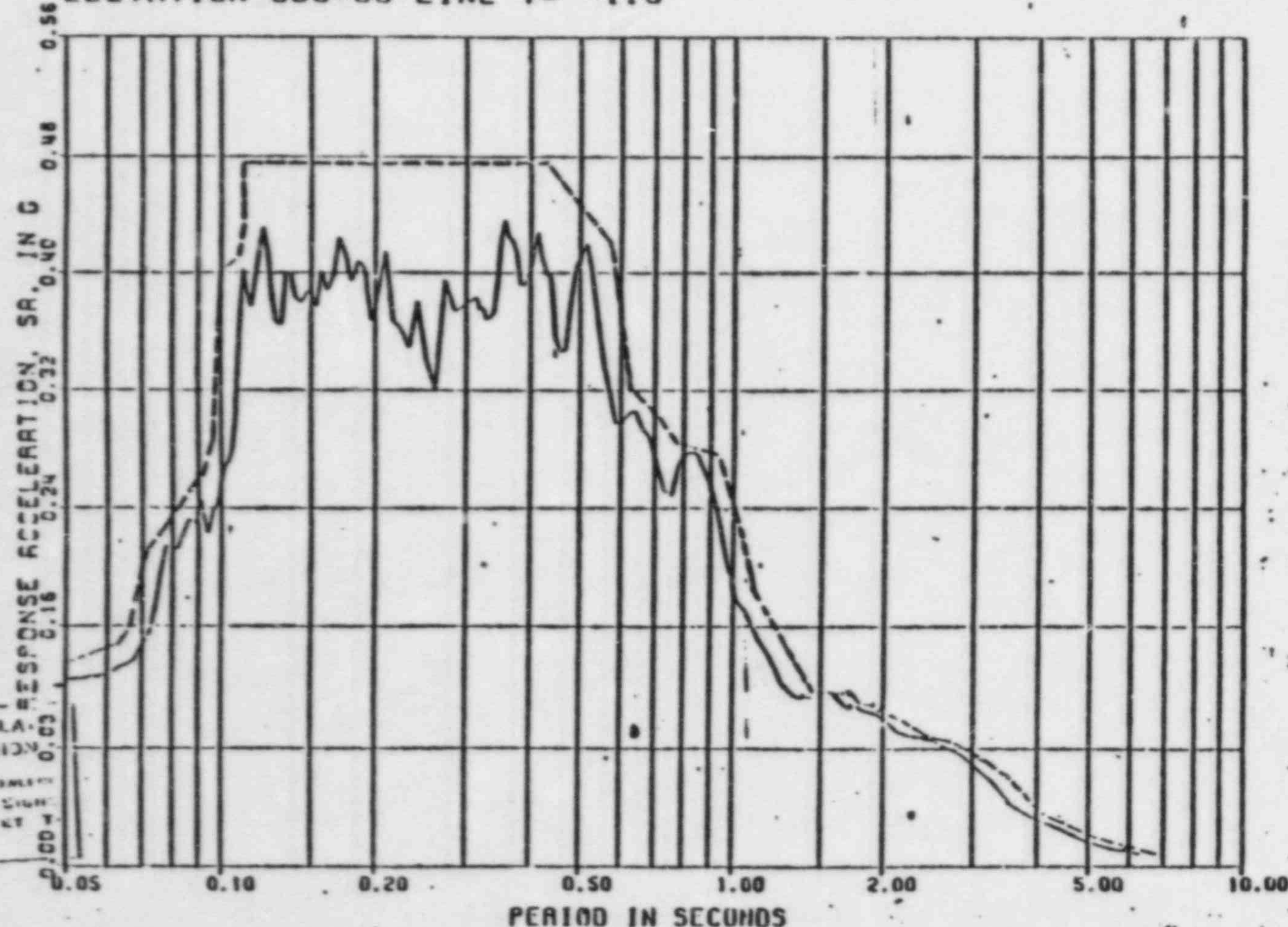


NUCLEAR SAFETY RELATED
DESIGN INFORMATION

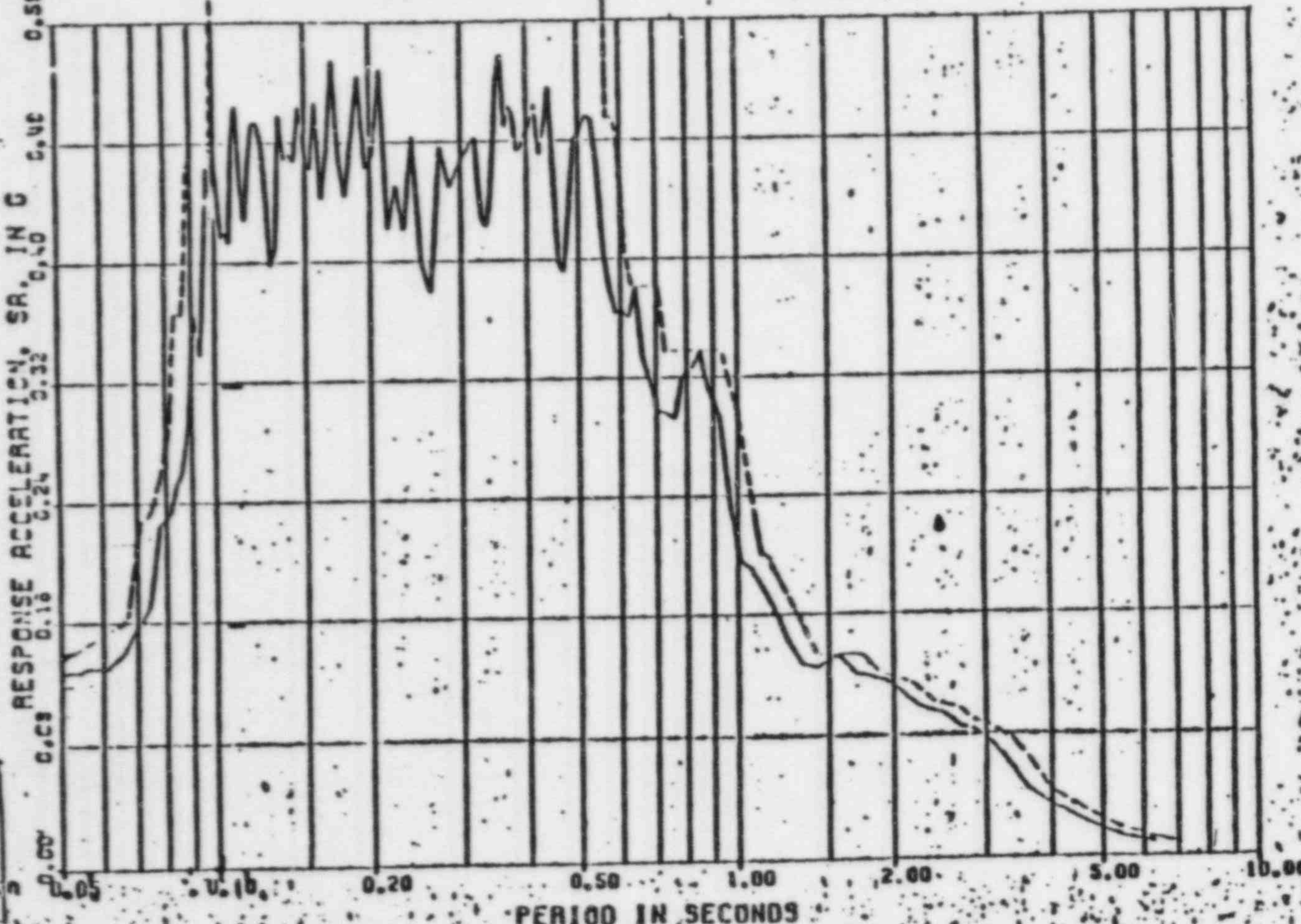
ADDRESSEES PLEASE ACKNOWLEDGE RECEIPT BY RETURNING SIGNED COPY OF THIS SHEET TO UNDERSIGNED

TRANSMITTED TO (W) BY CN-77M-6

CATAWBA AUX BLDG NOR-SOU (X) EARTHQUAKE
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 560+00 LINE Y= -1.5



CATAWBA AUX BLDG EAS-WES (Y) EARTHQUAKE
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.010
ELEVATION-560+00-LINE-X=--166.0



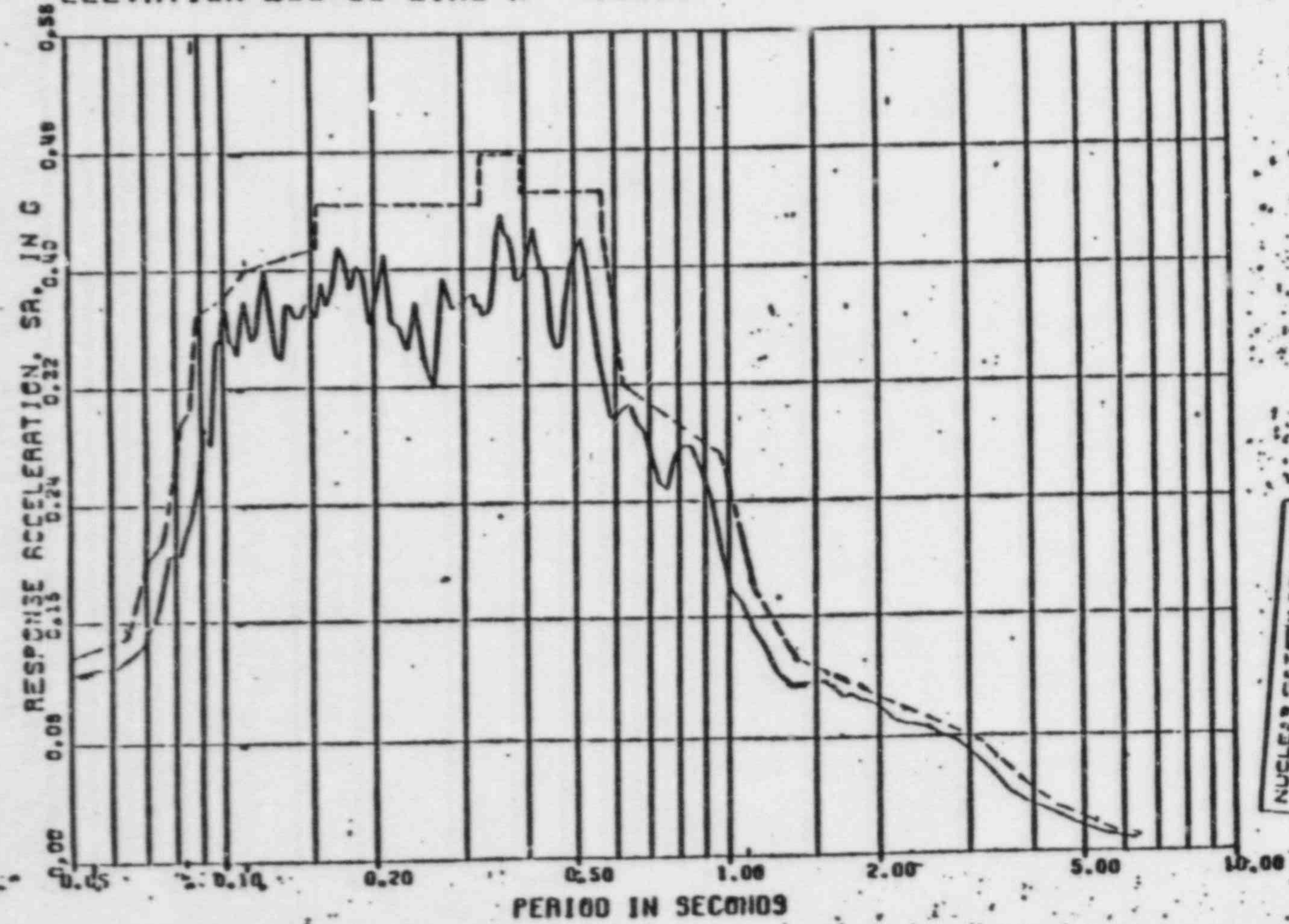
NON SAFETY RELATED
DESIGN INFORMATION

Transmitted to (W) by CN-779-6

CATAWBA AUX BLDG EAS-WES (Y) EARTHQUAKE

RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020

ELEVATION 560+00 LINE X= -166.0



NUCLEAR SAFETY RELATED DESIGN INFORMATION

SPECIFIC ITEM #5 CHARGING SAFETY INJECTION PUMP

PART 1: Bearing pressure calculations are for the static case for the pump only. Bearing pressures for the operating mode (with seismic) are to be calculated and justification for stresses are to be provided for the pump, motor, and reduction gear.

STATUS: This item has been resolved.

RESOLUTION SUMMARY: An analysis (CALC #MED-PVE-2388, Dated 3/30/84) has been completed which indicates that the Charging/SI Pump, motor and reduction gear bearing stresses due to hydrodynamic operational and seismic loads are well within the allowable limits as shown in Attachment C-1 which is the summary sheet of the analysis. The analysis is retained in the Westinghouse engineering file.

PART 2: Calculations of the natural critical circular frequency of the turning gear and pump shaft are to be provided, and the concern regarding potential resonance at the critical speed and operational speed must be addressed.

STATUS: This item has been resolved.

RESOLUTION SUMMARY: Review of the Westinghouse engineering files revealed that these calculations are available in a 1971 report. This report (Ref. Number B46617) was prepared by Pacific Pump Division. It clearly shows, through critical speed calculations that the critical speeds of the pump and motor shafts do not coincide with their running speeds of 4849 and 1800 rpm. The Pacific Pump report will be retained in the Westinghouse engineering files.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba Unit 1 — Type:

1. Utility: Duke Power Co. — PWR 4 Loop
2. NSSS: Westinghouse — BWR
3. A/E: Duke Power Co. — Other

II. Component Name: Charging/Safety Injection Pump A

1. Scope: [x] NSSS [BOP [ ] Other
2. Model Number: Pump: 2 1/2 .IJ, 11 Stage Motor: 6808-S — Quantity: 2 per plant
3. Size or Range: 150 gpm (design)
4. Vendor: Pacific Pump
5. If the component is a cabinet or panel, name and model number of the devices included: N/A
6. Physical Description:
   a. Appearance: Horizontal pump/gear/motor assembly
   b. Dimensions: Overall length = 226", width = 52.75", height = 80.94"
   c. Weight: Total Weight = 20,210 lbs.
7. Location: Building: Auxiliary
   Elevation: 543 feet
8. Field Mounting Conditions: [X X] Bolt (No. 16, Size 1/8")
   [ ] Weld (Length ___)
   [ ] ___
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   Base plate mounted to floor
10. a. System in which located: Chemical Volume and Control; Safety Injection
    b. Functional Description: Charging and Safety Injection Flow
    c. Is the equipment required for [ ] Hot Standby, [ ] Cold Shutdown
       [x] Both [ ] Neither [ ] Other ___

SEISMIC QUALIFICATION SUMMARY

A. Component: Charging/Safety Injection Pump A

The Catawba Charging/Safety Injection Pumps were designed based upon the criteria of the ASME Boiler and Pressure Vessel Code, Section III for Class 2 pumps. The assembly consists of a multistage centrifugal pump, a speed increaser (gear) and a motor.

B. Qualification Approach:

The program developed to assure seismic qualification of pump assemblies within the Westinghouse NSSS scope of supply is discussed in Sections 3.7 and 3.9.3.2 of the Catawba FSAR. These pumps are designed for the worst case loading combinations resulting from internal pressure, operating, deadweight, seismic and nozzle loads. The qualification program consists of the following:

1. Resonance search testing performed on the entire assembly.

2. ASME Code design calculations.

3. Independent static seismic analyses of the pump, gear and motor. Although components are analyzed separately, interfacing loads are considered.

Generic qualification is performed to SSE acceleration levels of 2.1/2.1/2.1 g. Actual plant SSE accelerations are .13/.13/.13 g. Thus, significant seismic margin exists.

II. Pertinent Reference Design Specifications for Qualification Requirements:

See page 2a

a. Seismic Input
See Item V.5

b. Hydrodynamic Load Input
See Note 1

c. Fatigue Considerations
See Item V.6

d. Service Conditions
See Design Specifications

e. Qualified Life
Pump - 40 years
Motor - 5 years
Continuous operation 1 year post accident

III. Is Equipment Available for Inspection in the Plant:

[XX] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method: Pump

[ ] Test [ ] Analysis [XX] Combination of Test and Analysis

Qualification Report:* Nuclear Service Pump Design Calculations

(No., Title and Date): K-318-1 Rev. 5 9/25/78

Company that Prepared Report: Pacific Pumps

Company that Reviewed Report: Westinghouse

Where Report is filed or available: Pacific Pumps/Westinghouse

Applicable Codes and/or Standards: ASME Section III and E-Specs on Page 2a

V. Vibration Input:

1. Loads considered:
   a. [XX] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [X] SRSS [ ] ________ (other, specify)

3. Required Response Spectra** (attach the graphs): See attached

Note:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

Note 1: The charging/SI pump is located in a Class 2 system in the Auxiliary Building and is not subject to any hydrodynamic loads such as LOCA.

11. Pertinent Reference Design Specifications for Qualification Requirements

Pump

E-Spec 678815 Rev. 2 - General Class 2 Pumps

E-Spec 952494 Rev. 0 - DCP/DDP Addendum to 678815 Rev. 2

Motor

E-Spec 677474 Rev. 0 - Auxiliary Pump Motors

E-Spec 952456 Rev. 0 - DCP/DDP Addendum to 677470 Rev. 0

II. Pertinent Reference Design Specifications for Qualification Requirements:

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[x] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report:* Natural Frequency Test

(No., Title and Date): Pacific Pumps Natural Frequency Test, 12/10/76

Company that Prepared Report: Pacific Pumps

Company that Reviewed Report: Westinghouse NTD

Where Report is filed or available: Westinghouse NTD/Pacific Pumps

Applicable Codes and/or Standards: E-Specs pg. 2a

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a) (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [ ] NA (other, specify)

3. Required Response Spectra** (attach the graphs): NA

Note:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE NA SSE 1%

5. Required Acceleration in Each Direction:

[XX] ZPA [ ] Other ________ (specify)

Note 2 OBE S/S = N/A F/B = N/A V = N/A

Note 3 SSE* S/S = 2.1g/.13g F/B = 2.1g/.13g V = 2.1g/.13g

*Generic/Plant Specific

6. Were fatigue effects considered?

[ ] Yes [xx] No Not required by ASME Code for Class 2 components.

If yes, describe how they were treated in overall qualification program:

____

____

VI. If Qualification by Test, then complete: Testing was only performed to determine assembly natural frequency.

1. [x] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ________

2. [X] Single Axis [ ] Independent Axis [ ] Multi-Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE NA SSE NA Other NA (specify)

4. Frequency Range: 1-35 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ≥35Hz F/B = ≥35Hz V = ≥35Hz

6. Method of Determining Natural Frequencies:

[XX] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test Not applicable

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

Note 2: The SSE case was analyzed with results being compared to normal allowables. Therefore, OBE analysis was not required.

Note 3: The floor response spectra used are at 1% damping rather than the 4% commonly associated with SSE. Since OBE analysis was not performed damping is not applicable.

8. Maximum Input g-level Test:

OBE S/S = NA F/B = NA V = NA

SSE S/S = NA F/B = NA V = NA

9. Laboratory Mounting:

A. [XX] Bolt (No. 16, Size 1 1/8") Same as in-plant mounting configuration.

[ ] Weld (Length ____) [ ] ____________

B. Orientation and Fixturing: Field mounting simulated

10. Functional operability verified:

[ ] Yes [ ] No [X] Not Applicable

11. Test Results including modifications made: All frequencies are greater than or equal to 35 Hz. The motor conduit box required bracing.

12. Other tests performed (such as aging or fragility test, including results):

N/A

13. Failure Modes (if appropriate None)

14. Margins Available: [ ] Input Spectrum [ ] Fragility
Not applicable

VII. <u>If Qualification by Analysis, then complete</u>: The information provided below is applicable to the pump.

1. Method of Analysis:

[XX] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = $\geq$35 Hz F/B = $\geq$35 Hz V = $\geq$35 Hz

3. Model Type: [ ] 3D [X] 2D Note 4 [ ] 1D

[ ] Finite Element [X] Beam

[ ] Closed Form Solution [ ] Other ____________

Note 4: The pumps were qualified to 3g horizontal and 2g vertical. Per WCAP-8230, these accelerations are equivalent to 2.1g/2.1g/2.1g.

4. [ ] Computer Codes: NA

Frequency Range and No. of modes considered: NA

[XX] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[XX] Absolute Sum [ ] SRSS [ ] Other: ______ (specify)

6. Damping N/A

OBE N/A SSE N/A Basis for damping used: ______

7. Support Considerations in the model: Rigidly mounted to building per as-installed condition.

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Suction Hozzle Stress		Oper. + SSE		15,935 psi	16,600 psi
Flange Bolting Stress		Oper.		27,140 psi	31,400 psi
Foundation Bolts		Oper. + SSE		22,457 psi	36,000 psi

(actuals based on generic rather than plant specific b

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

See motor results for shaft deflection.

9. Failure Modes: None

10. Margins Available: [ ] Input Spectrum [x] Stress or Deflection
See Note 5

Note 5: As identified in Item 8.A above, margins between actual and allowable stresses are available. Additionally, Item V.5 provides a comparison between generic and specific plant values. As noted, there is considerable margin in these values.

II. Pertinent Reference Design Specifications for Qualification Requirements:

____

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method: Motor

[ ] Test [ ] Analysis [xxx] Combination of Test and Analysis

Qualification Report:* Seismic Analysis Report for the DCP/DDP Charging/

(No., Title and Date): Safety Injection Pump Motors - M030501 9/12/83

Company that Prepared Report: Westinghouse NTD

Company that Reviewed Report: Westinghouse NTD

Where Report is filed or available: Westinghouse NTD

Applicable Codes and/or Standards: IEEE 344-1975 and E-Specs on page 2a.

V. Vibration Input:

1. Loads considered:
   a. [xx] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [XX] SRSS [ ] ____________ (other, specify)

3. Required Response Spectra** (attach the graphs): See attached.

Note:

*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE ___NA___ SSE ___1%___

5. Required Acceleration in Each Direction:

[xx] ZPA [ ] Other ______________ (specify)

Note 2 OBE S/S = ___N/A___ F/B = ___N/A___ V = ___N/A___

Note 3 SSE* S/S = ___2.1g/.13g___ F/B = ___2.1g/.13g___ V = ___2.1g/.13g___

*Generic/Plant Specific

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program:

____

____

VI. If Qualification by Test, then complete: Testing was only performed to determine assembly natural frequency. Information provided in "Pump" section.

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ______________

2. [ ] Single Axis [ ] Independent Axis [ ] Multi-Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ______________ SSE ______________ Other ______________ (specify)

4. Frequency Range: ______________________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ______________ F/B = ______________ V = ______________

6. Method of Determining Natural Frequencies:

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Maximum Input g-level Test:

OBE. S/S = ______________ F/B = ______________ V = ______________

SSE S/S = ______________ F/B = ______________ V = ______________

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length ____) [ ] ______________

B. Orientation and Fixturing: ______________

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ______________

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (if appropriate ______________)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. <u>If Qualification by Analysis, then complete</u>: The information provided below is applicable to the motor.

1. Method of Analysis:

[xx] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = $\geq$35 Hz F/B = $\geq$35 Hz V = $\geq$35 Hz

3. Model Type: [X] 3D [ ] 2D [ ] 1D

[X] Finite Element [X] Beam

[ ] Closed Form Solution [X] Other Combination

4. [X] Computer Codes: WECAN (motor shaft and rotor)

Frequency Range and No. of modes considered: N/A

[X] Hand Calculations Some stress calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[X] Absolute Sum [ ] SRSS [ ] Other: ______ (specify)

6. Damping N/A

OBE N/A SSE N/A Basis for damping used: ______

7. Support Considerations in the model: Assumed rigidly bolted to pump assembly per installed condition.

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Shaft shear stress				10,037 psi	14,400 psi
Anchor bolt shear stress				8,353 pis	21,700 psi

(Actuals based on generic rather than plant specific loads)

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
.00285"	Rotor/Shaft	.0255" - No adverse effect on operability

9. Failure Modes: None

10. Margins Available: [ ] Input Spectrum [XX] Stress or Deflection
See Note 6.

Note 6: As identified in Item 8.A above, margins between actual and allowable stresses are available. Additionally, Item V.5 provides a comparions between generic and specific plant values. As noted, there is considerable margin in these values.

II. Pertinent Reference Design Specifications for Qualification Requirements:

____

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[ ] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method: Gear

[ ] Test [ ] Analysis [x] Combination of Test and Analysis

Qualification Report:* Gear Seismic Analysis for Model SU1023-8X5

(No., Title and Date): 3/17/76

Company that Prepared Report: Westinghouse MM&G

Company that Reviewed Report: Westinghouse NTD

Where Report is filed or available: Westinghouse NTD

Applicable Codes and/or Standards: E-Specs on Page 2a.

V. Vibration Input:

1. Loads considered:
   a. [x] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [x] SRSS [ ] ______ (other, specify)

3. Required Response Spectra** (attach the graphs): See attached

Note:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 1% SSE 1%

5. Required Acceleration in Each Direction:

[X] ZPA [ ] Other ______ (specify)

OBE* S/S = 1.05g/.13g F/B = 1.05g/.13g V = 1.05g/.13g

Note 7 SSE* S/S = 2.1g/.13g F/B = 2.1g/.13g V = 2.1g/.13g

*Generic/Plant Specific

6. Were fatigue effects considered?

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program:

______

______

VI. If Qualification by Test, then complete: Testing was only performed to determine assembly natural frequency. Information provided in "Pump" section.

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ______

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ______ SSE ______ Other ______ (specify)

4. Frequency Range: ______

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ______ F/B = ______ V = ______

6. Method of Determining Natural Frequencies:

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

Note 7: The floor response spectra used are at 1% damping rather than 4% commonly associated with SSE. Note that generic OBE qualification levels are compared to SSE response spectra accelerations.

8. Maximum Input g-level Test:

OBE S/S = ______________ F/B = ______________ V = ______________

SSE S/S = ______________ F/B = ______________ V = ______________

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length ____) [ ] ______________

B. Orientation and Fixturing: ______________

10. Functional operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ______________

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (if appropriate ______________)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete: The information provided below is applicable to the gear.

1. Method of Analysis:

[X] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = $\geq$35 Hz F/B = $\geq$35 Hz V = $\geq$35 Hz

3. Model Type: [ ] 3D [X] 2D See Note 4 [ ] 1D

[ ] Finite Element [X] Beam

[ ] Closed Form Solution [ ] Other ______________

d

4. [ ] Computer Codes: NA

Frequency Range and No. of modes considered: ______

[X] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[X] Absolute Sum [ ] SRSS [ ] Other: ______ (specify)

6. Damping N/A

OBE N/A SSE N/A Basis for damping used: ______

7. Support Considerations in the model: Assumed rigidly mounted to pump per as-installed configuration.

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Bearing Stress		Oper. + SSE		233 psi	300 psi
LS Shaft Stress		Oper. + SSE		20,821 psi	53,500 psi

(Actuals based on generic loa[d] rather than plant specific l[oad])

B.

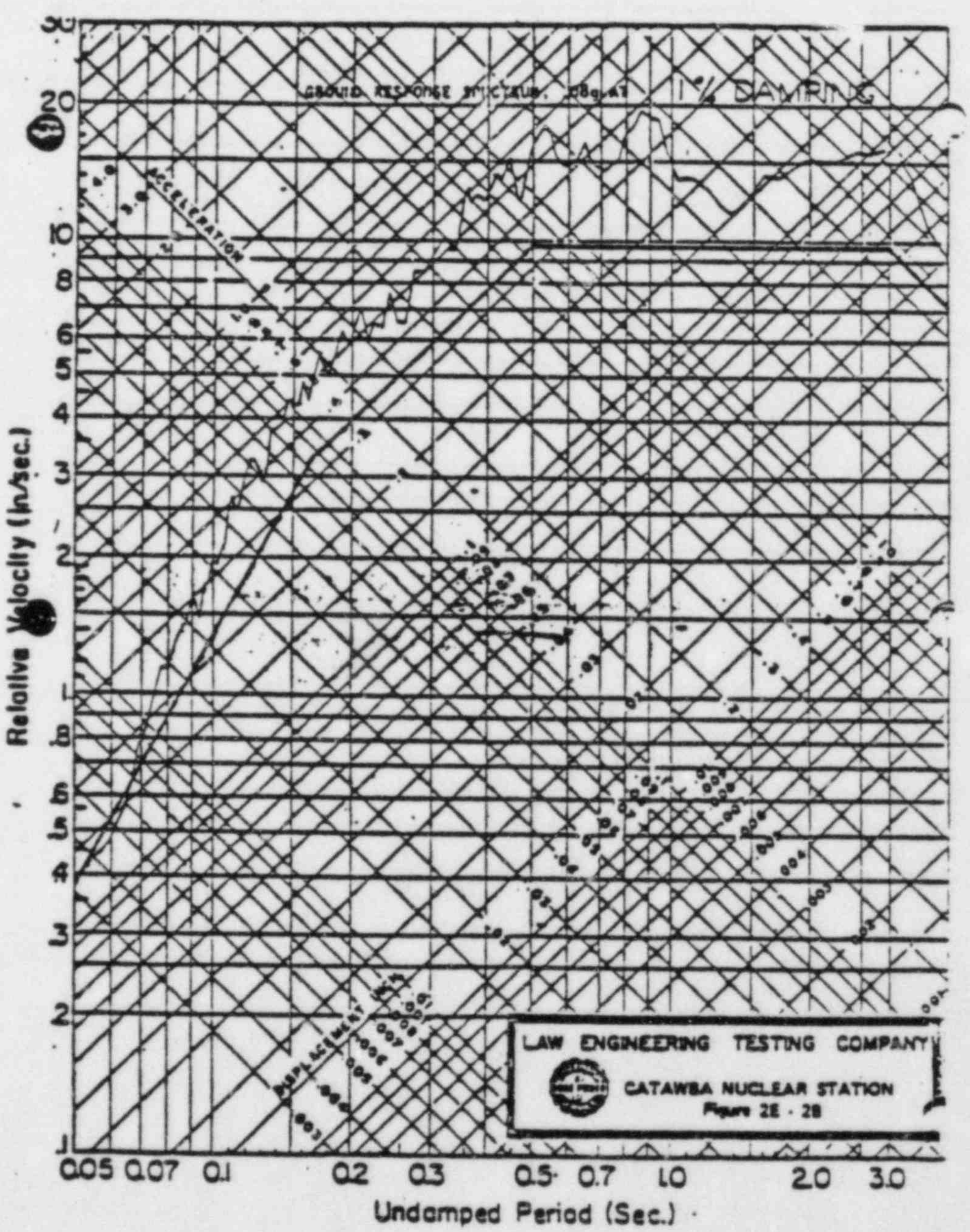
Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: None

10. Margins Available: [ ] Input Spectrum [X] Stress or Deflection
See Note 8

Note 8: As identified in Item 8.A above, margins between actual and allowable stresses are available. Additionally, Item V.5 provides a comparison between generic and specific plant values. As noted, there is considerable margin in these values.

TITLE			PAGE
CH/SI PUMP MOTOR ANALYSIS			11 OF 82
PROJECT	AUTHOR / DATE	CHK'D. BY / DATE	CHK'D. BY / DATE
DCP/DDP	MARK KAMENIC 4/22/93	[illegible] 5/19/93	PB 6/12/93
S.O.	CALC. NO.	FILE NO.	GROUP
206	MD3031		EQT



REV. NO.	REV. DATE	AUTHOR	DATE	CHK'D. BY	DATE	CHK'D. BY	DATE

Charging Pump A

Item 1 Bearing pressure calculations are for the static case for the pump only. Bearing pressures for the operating mode (with seismic) are to be calculated and justification for streses are to be provided for the pump, motor, and reduction gear.

Response: An analysis (CALC #MED-PVE-2388, Dated 3/30/84) has been completed which indicates that the Charging/SI Pump, motor and reduction gear bearing stresses due to hydrodynamic operational and seismic loads are well within the allowable limits as shown in Attachment C-1 which is the summary sheet of the analysis. This analysis is retained in the Westinghouse engineering file.

Item 2 Calculations of the natural critical circular frequency of the turning gear and pump shaft are to be provided, and the concern regarding potential resonance at the critical speed and operational speed must be addressed.

Response: Review of the Westinghouse engineering files revealed that these calculations are available in a 1971 report. This report (Ref. Number B46617) was prepared by Pacific Pump Division. It clearly shows, through critical speed calculations that the critical speeds of the pump and motor shafts do not coincide with their running speeds of 4849 and 1800 rpm. The Pacific Pump report will be retained in the Westinghouse engineering files.

TITLE			PAGE
CH/SI PUMP MOTOR, AND GEAR BEARING ANALYSIS			4 of 12
PROJECT: DCP/DDP	AUTHOR: MJ Dunny DATE: 3/30/84	CHK'D. BY: TJ Matty DATE: 3/30/84	CHK'D. BY DATE
S.O.: 205	CALC. NO.: MED-PVE-2388	FILE NO.: 205/197097/5	GROUP: PVE

SUMMARY OF STRESSES

	CALCULATED VALUE	ALLOWABLE	
		VALUE	BASIS/REFERENCE
1. PUMP BEARING MAXIMUM PRESSURE	238 psi	270 psi	STATIC ALLOWABLE PER REF. 1
2. MOTOR BEARING MAXIMUM PRESSURE	295 psi	800 psi	ALLOWABLE PER REF. 2
3. REDUCTION GEAR MAXIMUM PRESSURES	–		MINIMUM FILM THICKNESS OF 0.00075 in
a. LOW SPEED	624 psi	669 psi	
b. HIGH SPEED	459 psi	550 psi	

REV. NO.	REV. DATE	AUTHOR DATE	CHK'D. BY DATE	CHK'D. BY DATE

TITLE			PAGE
CH/SI PUMP, MOTOR, AND GEAR BEARING ANALYSIS			12 OF 12
PROJECT DCP/DDP	AUTHOR / DATE M L Drury 3/30/84	CHK'D. BY / DATE T J Matty 3/30/84	CHK'D BY / DATE
S.O. 205	CALC. NO. MED-PVE-2388	FILE NO. 205/197097/5	GROUP PVE

6.0 REFERENCES

1. PACIFIC PUMP REPORT K-318-1 REV. 5, 9/25/78
2. WESTINGHOUSE MOTOR SEISMIC REPORT MD30501, 9/12/83
3. GEAR SEISMIC ANALYSIS FOR MODEL SU1023-8X5, 3/17/76
4. "MECHANICAL ENGINEERING DESIGN", SHIGLEY
5. "DESIGN OF MACHINE ELEMENTS", FAIRES

REV. NO.	REV. DATE	AUTHOR / DATE	CHK'D. BY / DATE	CHK'D. BY / DATE

SPECIFIC ITEM #6 SOLID STATE PROTECTION SYSTEM (SSPS) CABINET

PART 1: There was no indication that this equipment was tested beyond 25 Hz. Westinghouse is to confirm that it was tested beyond 25 Hz or provide justification for this position.

STATUS: This item is resolved.

RESOLUTION SUMMARY: At the time the seismic tests were performed and the WCAP 7817 written, 25 Hz was considered the upper frequency limit for testing (as noted in WCAP 7817 "Basis of Criteria," Page B-4). However, as a precaution against having to perform additional tests at higher frequencies at a later date, seismic tests were performed to an upper frequency limit of 35 Hz. During these added tests from 25 Hz to 35 Hz, no resonance frequencies were found and the sine beat acceleration was held constant at 0.2g. No mechanical changes in any equipment was observed and all electrical functions were normal during these additional tests. A record of the 35 Hz testing is in the Westinghouse detailed test data file.

SPECIFIC ITEM #6 SOLID STATE PROTECTION SYSTEM CABINET

PART 2: Westinghouse is requested to identify the mounting in the test configuration.

STATUS: This item is resolved.

RESOLUTION SUMMARY: As noted on the SQRT form, twelve (12) three-quarter inch (3/4") bolts (A307) represent the mounting configuration for the SSPS testing documented in WCAP-7817. Although this mounting configuration is not specifically identified in the WCAP, its acceptability has been demonstrated in other testing of SSPS units by Westinghouse. As noted during the audit, Duke Power demonstrated the acceptability of the specific plant mounting configuration.

SPECIFIC ITEM #6 SOLID STATE PROTECTION SYSTEM CABINET

PART 3: Provide an auditable link for qualification documents (i.e., qualified vs. installed).

STATUS: This item is resolved.

RESOLUTION SUMMARY: A review of the SSPS furnished by Westinghouse was made with the view of selecting a standard SSPS for testing to establish criteria as stated in Section 1 of WCAP 7817. As a result, the SSPS tested was chosen as being representative of the SSPS supplied to Duke Power Company for the Catawba plant. Therefore, since this identified equipment was subjected to type tests under simulated seismic accelerations which envelope the Catawba specific seismic requirements, the Catawba equipment is qualified based on WCAP 7817 and the test data cited in Part 1 of this response. This response confirms the applicability of the testing in WCAP 7817 to the specific SSPS for Catawba, consistent with the requirements of IEEE-34-1971.

SPECIFIC ITEM #6 SSPS CABINET MOUNTING (ELECTRICAL ISOLATION)

PART 4: Provide justification for using insulating washers in field while solid contact was made in test.

STATUS: Analysis has been performed and is in calculation file CNC-1381.05-00-0060

RESOLUTION SUMMARY: The bolting configuration for the SSPS cabinet has been investigated for adverse effects due to the inclusion of the electrical isolating materials. An examination of the bolt assembly indicated that the connection, which uses high-strength bolts with pretension, is a friction-type connection with no slippage between the various materials. This is based on the maximum possible seismic inertial forces (static equivalent) in conjunction with the minimum coefficients of friction. A friction-type bolted connection allows no slippage giving rigid, solid contact between the base channel and the SSPS cabinet enclosure.

SPECIFIC ITEM #6 SOLID STATE PROTECTION SYSTEM

PART 5: In field mounting the glastic filler plate is not secured.

STATUS: Field was notified.

RESOLUTION SUMMARY: Because Unit 1 SSPS cabinet was energized and under test, the NRC auditors were shown the Unit 2 SSPS cabinet. The Unit 2 cabinet had not been turned over from construction and system work was not completed. Therefore, the glastic filler plate was not secured on the Unit 2 cabinet.

The Unit 1 SSPS cabinet will be inspected and, if necessary, the glastic filler plate will be secured prior to fuel load.

Additionally, the field has been notified and Unit 2 SSPS cabinet glastic filler plate will be secured prior to turnover.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba Unit 1 (DCP) — Type:

1. Utility: Duke Power Co. — PWR x
2. NSSS: Westinghouse — BWR
3. A/E: Duke Power Co. — Other

II. Component Name: Solid State Protection System — Tag No: 1SSPSA, 1SSPSB

1. Scope: [x] NSSS [ ] BOP [ ] Other
2. Model Number: 1059E44 — Quantity: 2 units (Train A&B)
3. Size or Range: -
4. Vendor: Westinghouse (WID)
5. If the component is a cabinet or panel, name and model number of the devices included: Reference drawing 1059E44 Rev. E and 5656D86 Rev. 8
6. Physical Description:
   a. Appearance: Three-Bay Vertical Cabinet
   b. Dimensions: 90" wide x 30" deep x 91.31" high
   c. Weight: Approximately 2300 lbs.
7. Location: Building: Auxiliary Building
   Elevation: 594 ft.
8. Field Mounting Conditions: [x] Bolt (No. 12 , Size 1/2") A325
   [x] Weld (Length 16) 1/4" fillet welds
   [ ] ______
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   Floor mounted
10. a. System in which located: Reactor Protection System
    b. Functional Description: Provides reactor trip function and safeguards actuation
    c. Is the equipment required for [ ] Hot Standby, [ ] Cold Shutdown
       [x] Both [ ] Neither [ ] Other ______

II. Pertinent Reference Design Specifications for Qualification Requirements:
P.O. # 209036
E-Spec. 952512 Rev. 1, EQDP-ESE-16

a. Seismic Input
See Section VI.1
b. Hydrodynamic Load Input
N/A
c. Fatigue Considerations
N/A
d. Service Conditions
Controlled Environment
e. Qualified Life
5 years

III. Is Equipment Available for Inspection in the Plant:

[x] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[x] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report:* WCAP-7817 "Seismic Testing of Electrical and Control Equipment," Rev. 0, December 1971

(No., Title and Date): WCAP-7817, Supplement 2, "Seismic Testing of Electrical and Control Equipment (Low Seismic Plants)," Rev. 0, December 1971

Company that Prepared Report: Westinghouse NTD

Company that Reviewed Report: Westinghouse NTD

Where Report is filed or available: Westinghouse NTD/NRC/DP

Applicable Codes and/or Standards: IEEE 344-1971

V. Vibration Input:

1. Loads considered:
   a. [x] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [x] SRSS [ ] ______ (other, specify)

3. Required Response Spectra** (attach the graphs): See attached Figures 1, 2 and

Note:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE N/A SSE 5%

5. Required Acceleration in Each Direction: Not Applicable (N/A)

[ ] ZPA [ ] Other ________ (specify)

OBE S/S = N/A F/B = N/A V = N/A

SSE S/S = N/A F/B = N/A V = N/A

6. Were fatigue effects considered?

[ ] Yes [x] No

If yes, describe how they were treated in overall qualification program:

VI. If Qualification by Test, then complete:

1. [x] Single Frequency [ ] Multi-Frequency: [ ] random [x] sine beat [ ] 5 beats (10 cpb) @ each test frequency

2. [x] Single Axis [ ] Multi-Axis
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests: Front-to-Back Side-to-Side Vertical

OBE ________ SSE 3 Other ________ (specify)

4. Frequency Range: 1 - 5 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 8.0 - 9.5 F/B = 8.5 - 10.5 V = > 33 Hz

6. Method of Determining Natural Frequencies:

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[x] No TRS envelopes RRS using single-frequency sine beat testing (Figures 4 and 5)

II. Pertinent Reference Design Specifications for Qualification Requirements:
P.O. #209036
E-spec 952512 Rev. 1, EQDP-ESE-16

a. Seismic Input
See Section VI. 1
b. Hydrodynamic Load Input
N/A
c. Fatigue Considerations
N/A
d. Service Conditions
Controlled Environment
e. Qualified Life
5 years

III. Is Equipment Available for Inspection in the Plant:

[x] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[x] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report:* WCAP-7817 "Seismic Testing of Electrical and Control Equipment," Rev. 0, December 1971

(No., Title and Date): WCAP-7817, Supplemental 3, "Seismic Testing of Electrical and Control Equipment (WSSPS) Low Seismic Plants," Rev. 0, December, 1

Company that Prepared Report: Westinghouse NTD

Company that Reviewed Report: Westinghouse NTD

Where Report is filed or available: Westinghouse NTD/NRC/DP

Applicable Codes and/or Standards: IEEE 344-1971

V. Vibration Input:

1. Loads considered: a. [x] Seismic only

b. [ ] Hydrodynamic only

c. [ ] Vibration from normal operation

d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[ ] Absolute Sum [x] SRSS [ ] ________ (other, specify)

3. Required Response Spectra** (attach the graphs): See attached Figures 1, 2, an

Note:

*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE N/A SSE 5%

5. Required Acceleration in Each Direction: Not applicable (N/A)

[ ] ZPA [ ] Other ______ (specify)

OBE S/S = N/A F/B = N/A V = N/A

SSE S/S = N/A F/B = N/A V = N/A

6. Were fatigue effects considered?

[ ] Yes [x] No

If yes, describe how they were treated in overall qualification program:

______

______

VI. If Qualification by Test, then complete:

1. [x] Single Frequency [ ] Multi-Frequency: [ ] random [x] sine beat [ ] 5 beats (10 cpb) @ each test frequency

2. [x] Single Axis [ ] Independent Axis [ ] Multi-Axis [ ] In-phase motions

3. Number of Qualifications Tests: Front-to-Back Side-to-Side Vertical

OBE ______ SSE 3 Other ______ (specify)

4. Frequency Range: 5-25 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 8.0 - 9.5 F/B = 8.5 - 10.5 V = > 33 Hz

6. Method of Determining Natural Frequencies:

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)
[x] No TRS envelopes RRS using single-frequency sine beat testing (Figures 4 and 5)

8. Maximum Input g-level Test: See attached Figures 4 and 5

OBE S/S = ______________ F/B = ______________ V = ______________

SSE S/S = ______________ F/B = ______________ V = ______________

9. Laboratory Mounting:

A. [x] Bolt (No. 12, Size 3/4") A307

[ ] Weld (Length ____) [ ] ______________

B. Orientation and Fixturing: Test unit was mounted in-line with the test input

10. Functional operability verified:

[x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Test results were acceptable. Number of bolts used to fasten the three-rack structure to the rack base was increased from 12 to 24.

12. Other tests performed (such as aging or fragility test, including results):

None

13. Failure Modes (if appropriate None)

14. Margins Available: [x] Input Spectrum [ ] Fragility

See attached Figures 4 and 5

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ______________ F/B = ______________ V = ______________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ______________

N/A

4. [ ] Computer Codes: ______________________

Frequency Range and No. of modes considered: ______________

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: ______________ (specify)

6. Damping

OBE _____ SSE _____ Basis for damping used: __________

7. Support Considerations in the model: ______________________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

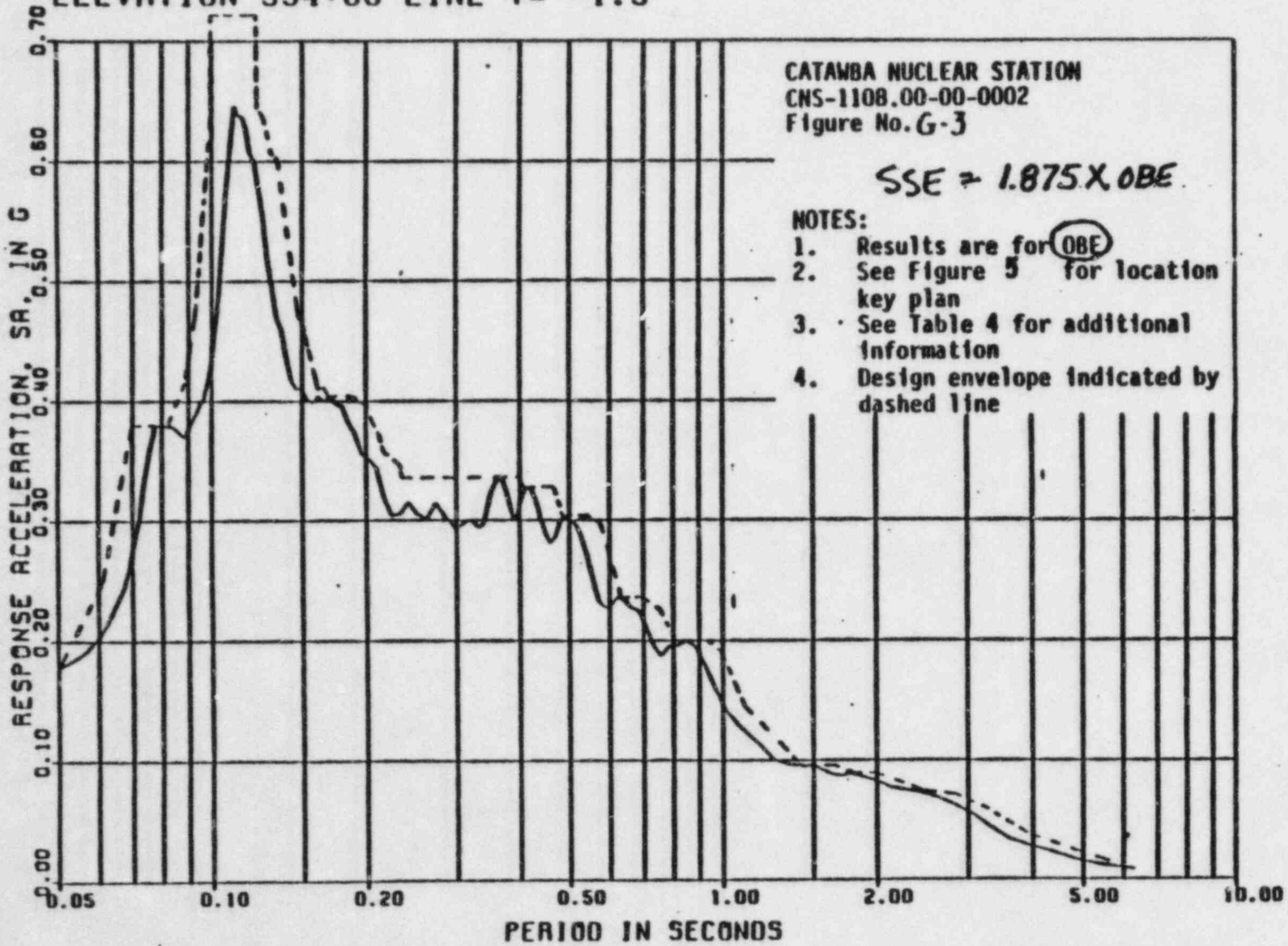
B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: ______________________

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

CATAWBA AUX BLDG NOR-SOU (X) EARTHQUAKE
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.050
ELEVATION 594+00 LINE Y= -1.5



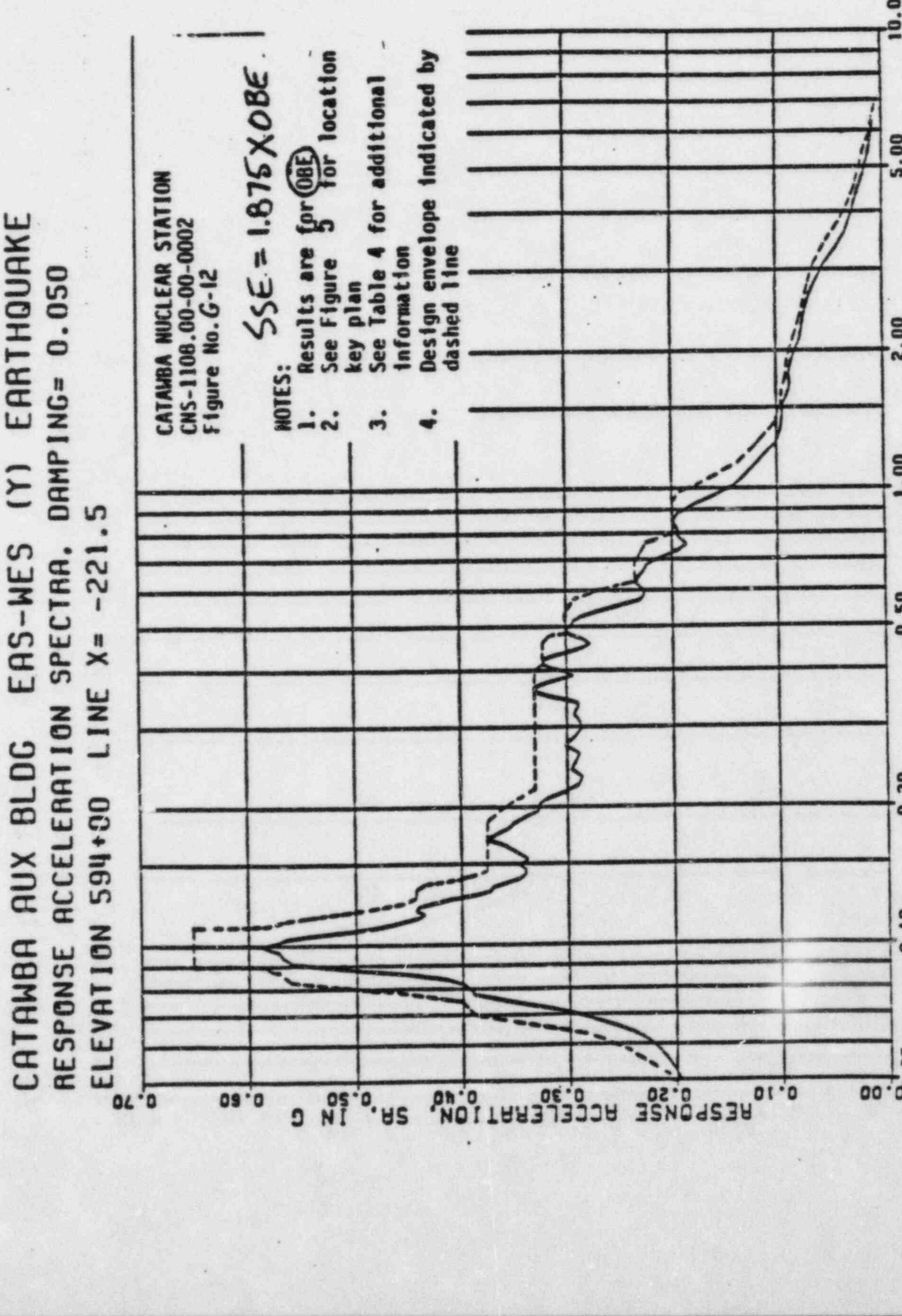
HORIZONTAL SIDE TO SIDE

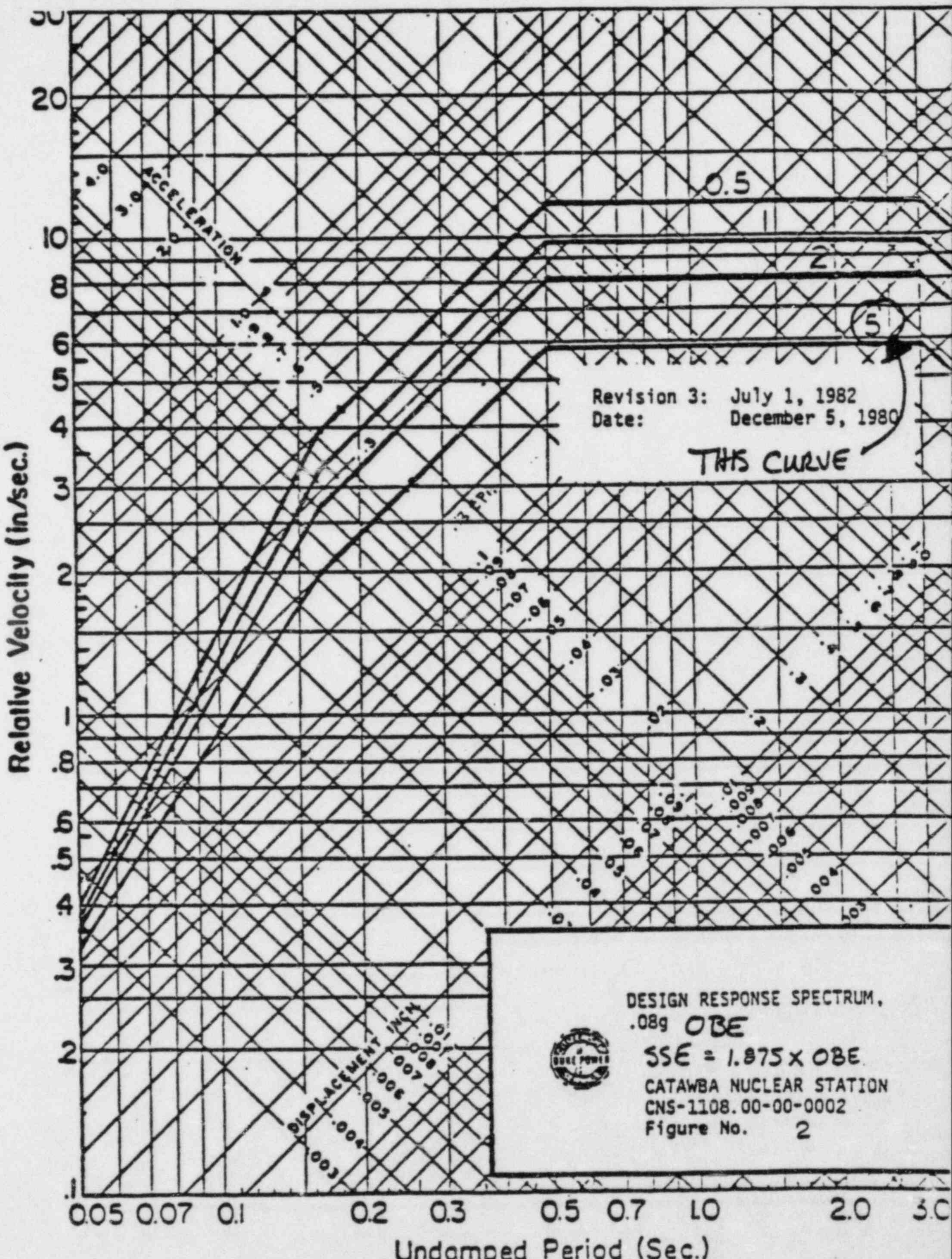
Figure 1

Revision 3: July 1, 1982
Date: December 5, 1980

Figure 2

Revision 3: July 1, 1982
Date: December 5, 1980



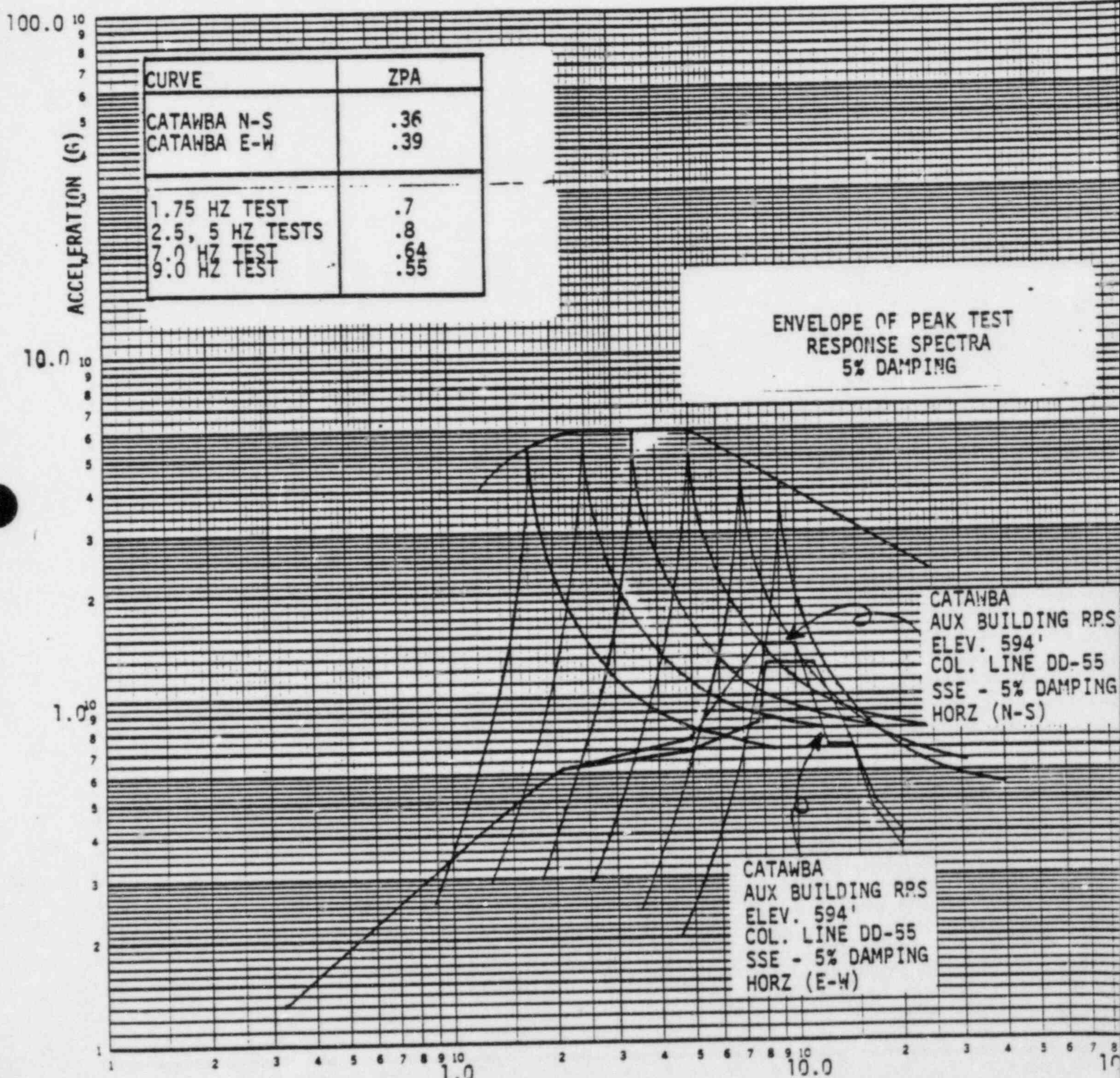


VERTICAL

Figure 3

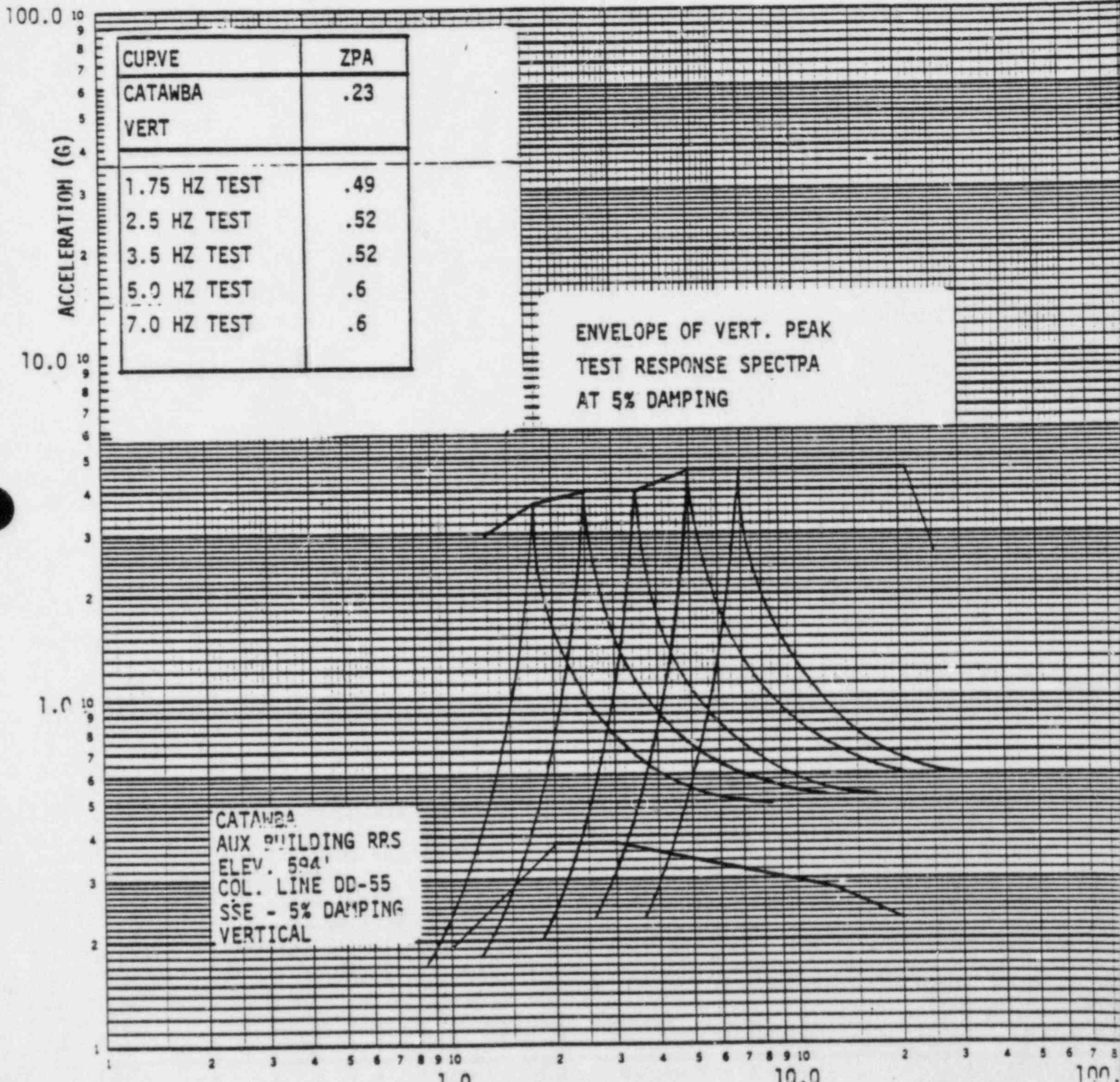
SSPS LOCATION: ELEVATION 594' COLUMN LINE DD-55

FIGURE 4



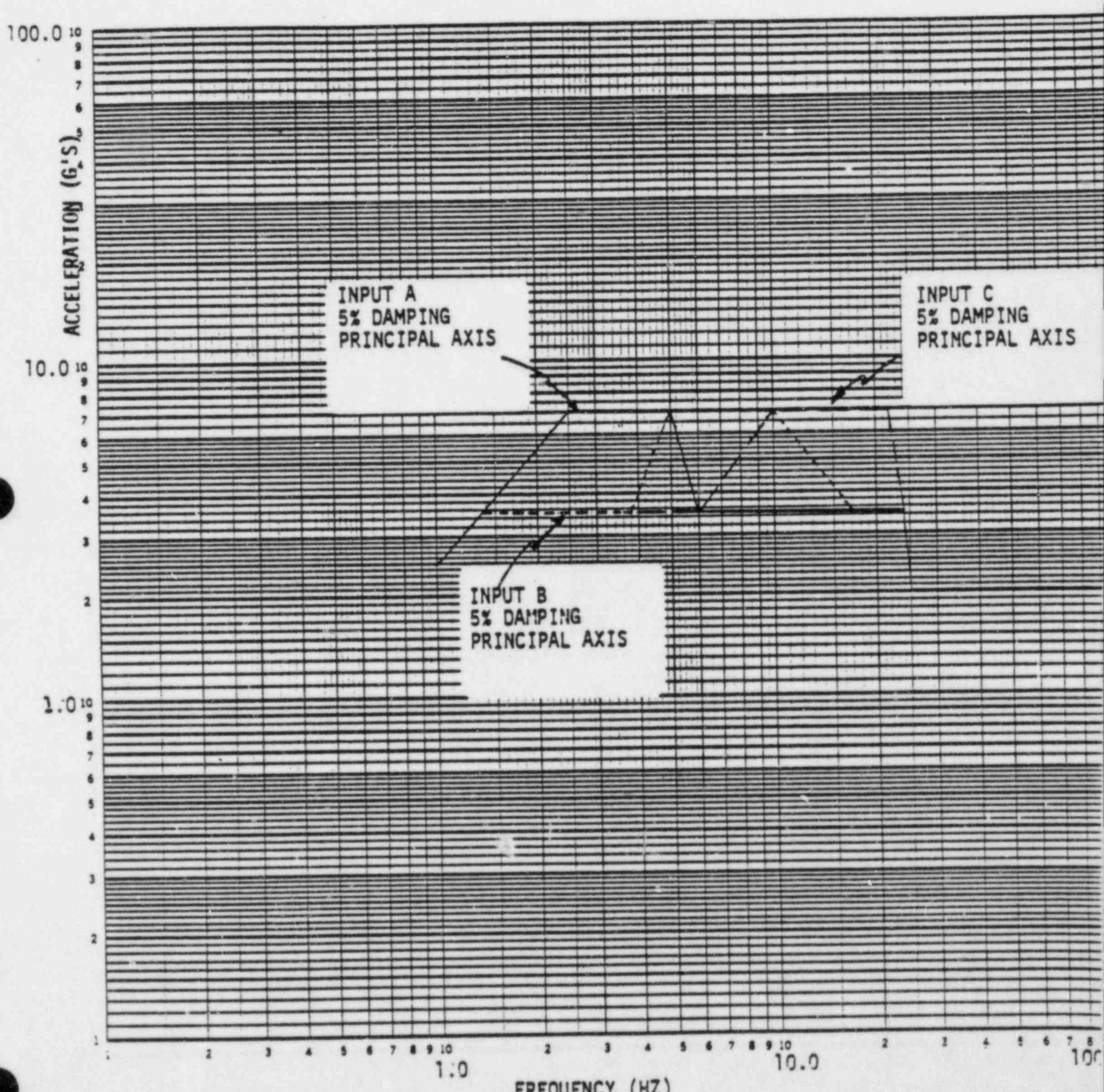
SOLID STATE PROTECTION SYSTEM (SSPS) TRS FOR SINGLE FREQUENCY SINGLE AXIS HORIZONTAL TESTS COMPARED TO DCP HORIZONTAL RESPONSE SPECTRA FOR AUXILIARY BUILDING, ELEVATION 594' (COL LINE DD-55).

FIGURE 5



SOLID STATE PROTECTION SYSTEM (SSPS) TRS FOR SINGLE FREQUENCY SINGLE AXIS VERTICAL TESTS COMPARED TO DCP VERTICAL RESPONSE SPECTRA FOR AUXILIARY BUILDING, ELEVATION 594' (COL LINE DD-55).

FIGURE 1



VERITRAK PRESSURE TRANSMITTERS
TEST REQUIRED RESPONSE SPECTRA

Solid State Protection System

Item 1 There was no indication that this equipment was tested beyond 25 Hz. Westinghouse is to confirm that it was tested beyond 25 Hz or provide justification for this position. Westinghouse is also requested to identify the mounting in the test configuration and provide an auditable link for qualification documents (i.e., qualified vs. installed).

Response: At the time the seismic tests were performed and the WCAP 7817 written, 25 Hz was considered the upper frequency limit for testing (as noted in WCAP 7817 "Basis of Criteria," Page B-4). However, as a precaution against having to perform additional tests at higher frequencies at a later date, seismic tests were performed to an upper frequency limit of 35 Hz. During these added tests from 25 Hz to 35 Hz, no resonance frequencies were found and the sine beat acceleration was held constant at 0.2g. No mechanical changes in any equipment was observed and all electrical functions were normal during these additional tests. A record of the 35 Hz testing is in the Westinghouse detailed test data file.

As noted on the SQRT form, twelve (12) three-quarter inch (3/4") bolts (A307) represent the mounting configuration for the SSPS testing documented in WCAP-7817. Although this mounting configuration is not specifically identified in the WCAP, its acceptability has been demonstrated in other testing of SSPS units by Westinghouse. As noted during the audit, Duke Power demonstrated the acceptability of the specific plant mounting configuration.

A review of the SSPS furnished by Westinghouse was made with the view of selecting a standard SSPS for testing to established criteria as stated in Section 1 of WCAP 7817. As a result, the

SSPS tested was chosen as being representative of the SSPS supplied to Duke Power Company for the Catawba plant. Therefore, since this identified equipment was subjected to type tests under simulated seismic accelerations which envelope the Catawba specific seismic requirements, the Catawba equipment is qualified based on WCAP-7817 and the test data cited in the first paragraph of this response. This response confirms the applicability of the testing in WCAP 7817 to the specific SSPS for Catawba, consistent with the requirements of IEEE-34-1971.

SPECIFIC ITEM #7 RHR PUMP/MOTOR

PART 1: A summary of the stress calculations at the nozzle to casing interfaces (for both suction and discharge nozzles) is required.

STATUS: This item has been resolved.

RESOLUTION SUMMARY: Combined stress intensities for the pump casing in the regions of nozzle attachments have been clearly identified on pages 14 and 15 of the pump seismic report, ME-174. The combined stress intensities have been determined using a Bijlaard analysis and the guidelines of Welding Research Council Bulletin 107. A comparison between the results and the allowables have been added to the Summary of Results table, page 3 of ME-174. As shown, the allowable stresses are greater than the actual stresses.

PART 2: Improved stress calculations in elements 90 and 92 are required as well as a comparison with allowable stresses.

STATUS: This item has been resolved.

RESOLUTION SUMMARY: The finite element model generated for determining pump casing and cover stresses due to operating pressure and gasket seating loads is judged to be adequate as indicated in "RHR Pump Cover Evaluation". All stresses in the regions of concern are acceptable. This evaluation will be placed in the Westinghouse equipment qualification file which will be maintained for the life of the plant.

PART 3: A calculation of the critical circular frequency and a check against operational speed is required. The concern of resonance should be addressed.

STATUS: This item has been resolved.

RESOLUTION SUMMARY: A critical speed determination has been performed for the shaft/rotor/impeller assembly. The critical speed was found to be 2760 rpm. This is 55% higher than the running speed of 1777 rpm. Thus, no response problems will occur. This analysis has been included in revision 1 of the motor seismic report, M010201. This report will be kept in the Westinghouse engineering files.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba Unit 1 — Type:

1. Utility: Duke Power Co. — PWR 4 Loop
2. NSSS: Westinghouse — BWR ______
3. A/E: Duke Power Co. — Other ______

II. Component Name: Residual Heat Removal Pump A

1. Scope: [X] NSSS   [ ] BOP   [ ] Other
2. Model Number: 8x20 WDF   Quantity: 2 per plant
3. Size or Range: 3000 gpm (design)
4. Vendor: Ingersoll-Rand
5. If the component is a cabinet or panel, name and model number of the devices included: N/A
6. Physical Description:
   a. Appearance: Vertical Pump/Motor Assembly
   b. Dimensions: Overall Length = 44", Width = 51.6", Height = 97.65"
   c. Weight: Total Assembly = 9542 lbs.
7. Location: Building: Auxiliary Building
   Elevation: 522 feet
8. Field Mounting Conditions: [x] Bolt (No. 3, Size 1 7/8")
   [ ] Weld (Length ____)
   [ ] ______
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   Mounted on rigid structure on floor in vertical position
10. a. System in which located: Residual Heat Removal; Safety Injection
    b. Functional Description: Residual Heat Removal: Low Head Safety Injection
    c. Is the equipment required for [ ] Hot Standby, [ ] Cold Shutdown
    [X] Both   [ ] Neither   [ ] Other ______

SEISMIC QUALIFICATION SUMMARY

A. Component: Residual Heat Removal Pump

The Catawba Residual Heat Removal Pumps were designed based upon the criteria of the ASME Boiler and Pressure Vessel Code, Section III for Class 2 pumps. The assembly consists of a single stage centrifugal pump and a 400 horsepower motor.

B. Qualification Approach:

The program developed to assure seismic qualification of pump assemblies within the Westinghouse NSSS scope of supply is discussed in Sections 3.7 and 3.9.3.2 of the Catawba FSAR. These pumps are designed for the worst case loading combinations resulting from internal pressure, operating, deadweight, seismic and nozzle loads. The qualification program consists of:

1. ASME Code design calculations

2. Resonance search testing performed on the motor

3. Independent static seismic analyses on the pump and motor. Although components are analyzed separately, interfacing loads are considered.

Generic qualification is performed to SSE accelerations of 2.1/2.1/2.1 g. Actual plant SSE accelerations are .26/.26/.173 g. Thus, significant seismic margin exists.

II. Pertinent Reference Design Specifications for Qualification Requirements:

See page 2a

a. Seismic Input
See Item V.5

b. Hydrodynamic Load Input
See Note 1

c. Fatigue Considerations
See Item V.6

d. Service Conditions
See Design Specification

e. Qualified Life
Pump - 40 years
Motor - 5 years
Continuous operation 1 year post accident

III. Is Equipment Available for Inspection in the Plant:

[x] Yes [—] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [x] Analysis [ ] Combination of Test and Analysis

	Pump Seismic	Motor Seismic
Qualification Report:* (No., Title and Date):	Structural Integrity & Operability Analysis ME-174	Seismic Analysis Report M010201
Company that Prepared Report:	McDonald Eng. Analysis Co.	WNTD
Company that Reviewed Report:	Ingersoll Rand/ Westinghouse NTD	WNTD
Where Report is filed or available:	W NTD	WNTD
Applicable Codes and/or Standards:	ASME Sec. III and E-Specs on pg. 2a	IEEE 344-1975 and E-Specs on pg. 2a

V. Vibration Input:

1. Loads considered:
   a. [x] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [x] SRSS [ ] ________ (other, specify)

3. Required Response Spectra** (attach the graphs): See attached

Note:

*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

Note 1: The RHR pump is located in a Class 2 system in the auxiliary building and, therefore, is not subject to any hydrodynamic loads such as LOCA.

11. Pertinent Reference Design Specifications for Qualification Requirements

Pump

E-Spec 678815 Rev. 2	-	General Class 2 Pumps
E-Spec 952494 Rev. 1	-	DCP/DDP Addendum to 678815 Rev. 2
E-Spec 952495 Rev. 0	-	DCP/DDP RHR Pumps

Motor

E-Spec 677474 Rev. 0	-	Auxiliary Pump Motors
E-Spec 952456 Rev. 0	-	DCP/DDP Addendum to 677470 Rev. 0

4. Damping Corresponding to RRS: OBE 2% SSE 2%

5. Required Acceleration in Each Direction:

[x] ZPA [ ] Other ________ (specify)

Note 2 OBE *S/S = 1.05g/.14g F/B = 1.05g/.14g V = 1.05g/.093g

SSE *S/S = 2.1g/.26g F/B = 2.1g/.26g V = 2.1g/.173g

*Generic/Plant Specific

6. Were fatigue effects considered?

[ ] Yes [x] No Not required per ASME Code for Class 2 components.

If yes, describe how they were treated in overall qualification program:

____

____

VI. If Qualification by Test, then complete: Not Applicable

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] ________

2. [ ] Single Axis [ ] Multi-Axis
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ________ SSE ________ Other ________ (specify)

4. Frequency Range: ________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ________ F/B = ________ V = ________

6. Method of Determining Natural Frequencies:

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test Not Applicable

[ ] Yes (Attach TRS & RRS graphs)
[ ] No

Note 2: Floor response spectra were not generated for Elevation 522' of the Auxiliary Building. The spectra at Elevation 560' are used. Also, since curves at 4% damping are not available, 2% damping is used for SSE.

8. Maximum Input g-level Test:

OBE S/S = NA F/B = NA V = NA

SSE S/S = NA F/B = NA V = NA

9. Laboratory Mounting:

A. [ ] Bolt (No. ____, Size ____)

[ ] Weld (Length ____) [ ] ______________

B. Orientation and Fixturing: Same as field mounting

10. Functional operability verified:

[ ] Yes [ ] No [x] Not Applicable

11. Test Results including modifications made: ______________

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (if appropriate ______________)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. <u>If Qualification by Analysis, then complete</u>:

1. Method of Analysis:

[x] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = >35 Hz F/B = >35 Hz V = >35 Hz

See Note 3

3. Model Type: [ ] 3D [x] 2D [ ] 1D

Note 4

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ______

Note 3: The natural frequency of the motor was verified by test to have a natural frequency >37 Hz in all directions.

Note 4: The pumps were qualified to 3g horizontal and 2g vertical. Per WCAP 8230, these accelerations are equivalent to 2.1g/2.1g/2.1g for 3D comparisons.

4. [x] Computer Codes: WECAN (motor shaft and rotor)
ICES-STRUDL (frequency)
NASTRAN (finite element of pump casing)

Frequency Range and No. of modes considered: 21 degrees of freedom over appropriate frequency range

[x] Hand Calculations - Some stress calculations

5. Method of Combining Dynamic Responses from Seismic and other Dynamic Loads:

[x] Absolute Sum [ ] SRSS [ ] Other: ______ (specify)

6. Damping N/A

OBE N/A SSE N/A Basis for damping used: ______

7. Support Considerations in the model: Assumed rigid attachment to foundation per as-installed configuration

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Shaft stress		Oper. & SSE		13,059 psi	14,400 psi
				(based on generic rather than plant specific loads)	

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
.00226"	rotor/shaft	.022 " - No adverse effect on operability

9. Failure Modes: None

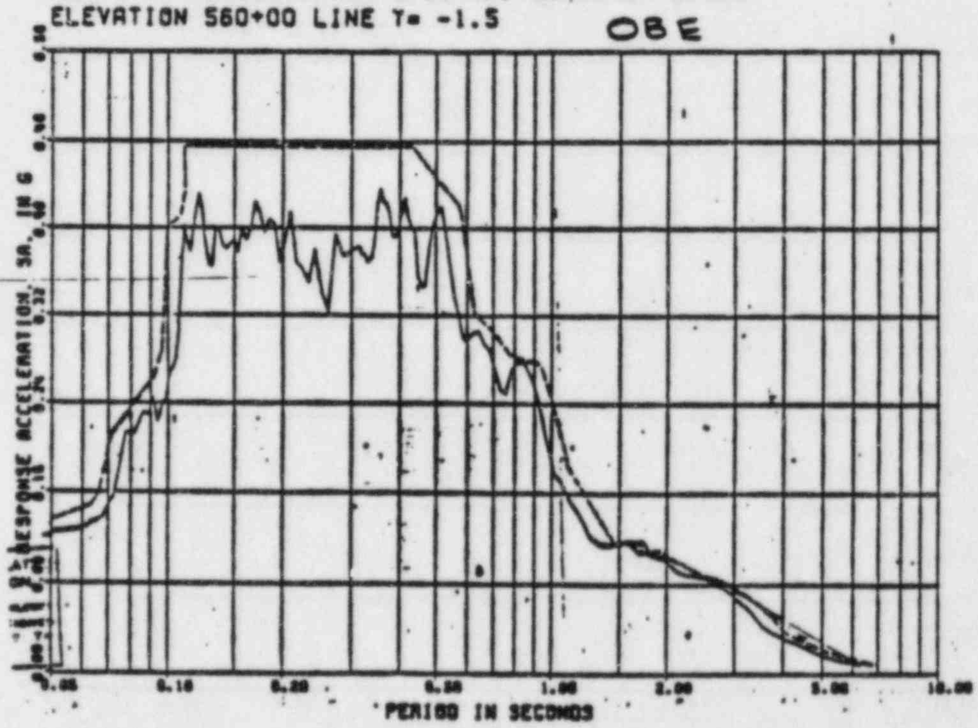
10. Margins Available: [ ] Input Spectrum [x] Stress or Deflection
See Note 5

Note 5: As identified in Item 8.a above, margins between actual and allowable stresses are available. Additionally, Item V.5 provides a comparison between generic and specific plant values. As noted, there is considerable margin in these values.

TITLE			PAGE
RHR PUMP MOTOR ANALYSIS			15 OF 88
PROJECT	AUTHOR / DATE	CHK'D. BY / DATE	CHK'D. BY / DATE
GAE/GBE - DCP/DDP	MARK KAMENIC 12/29/82	P.F. 8/31/87	
S.O.	CALC. NO.	FILE NO.	GROUP
206	M010201		MEQ

TRANSMITTED TO Ⓦ BY CN-77M-6

CATAWBA AUX BLDG NOR-SOU (X) EARTHQUAKE
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 560+00 LINE Y= -1.5 OBE



$SSE = \frac{15}{8} \times OBE$

ZPA FOR SSE:

$\frac{15}{8} \times .14 = .26\ g$

VERTICAL = 2/3 HORIZONTAL
= 2/3 × .26
= .173 g

REV. NO.	REV. DATE	AUTHOR / DATE	CHK'D. BY / DATE	CHK'D. BY / DATE

WESTINGHOUSE NUCLEAR TECHNOLOGY DIVISION

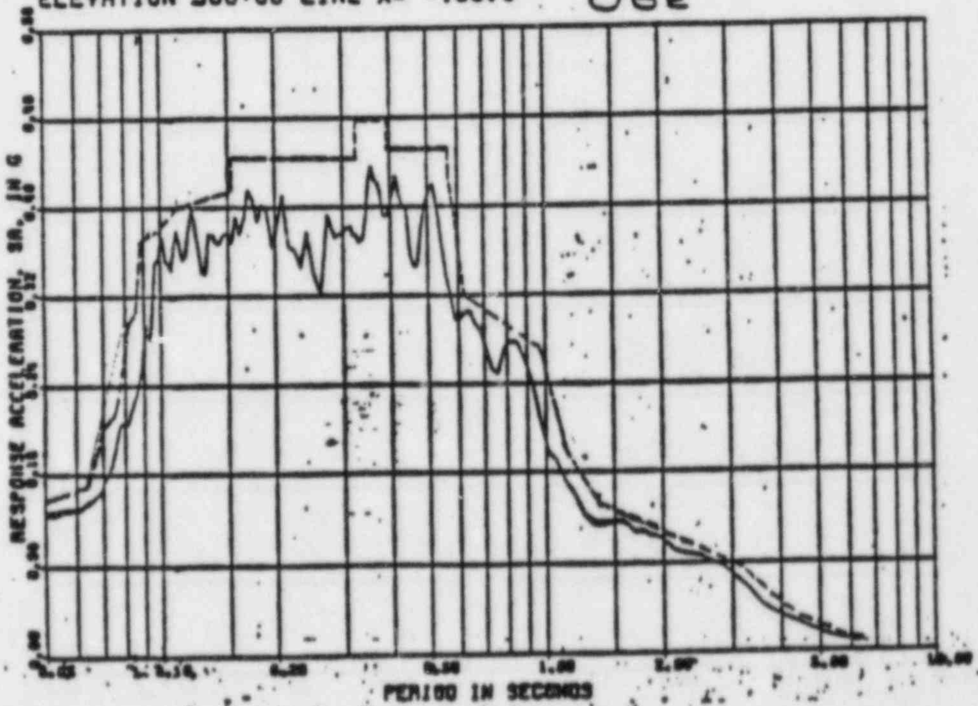
TITLE			PAGE
RHR PUMP MOTOR ANALYSIS			16 OF 88
PROJECT: GAE/GZE - DCP/DDP	AUTHOR: MARK KAMENIC DATE: 12/20/82	CHK'D. BY: [illegible] DATE: 8/31/82	CHK'D. BY / DATE
S.O.: 206	CALC. NO.: M010201	FILE NO.	GROUP: MEQ

TRANSMITTED TO [illegible] BY [illegible]

CATAWBA AUX BLDG EAS-WES (Y) EARTHQUAKE

RESPONSE ACCELERATION SPECTRA. DAMPING= 0.020

ELEVATION 560+00 LINE X= -166.0 OBE



SSE = $\frac{15}{8}$ x OBE

ZPA FOR SSE:

$\frac{15}{8}$ x .14 = .26g

VERTICAL = 2/3 HORIZONTAL

= 2/3 x .26

= .173 g

REV. NO.	REV. DATE	AUTHOR DATE	CHK'D. BY DATE	CHK'D. BY DATE

WESTINGHOUSE FORM 882130

RHR Pump A

Item 1 A summary of the stress calculations at the nozzle to casing interfaces (for both suction and discharge nozzles) is required.

Response: Combined stress intensities for the pump casing in the regions of nozzle attachments have been clearly identified on pages 14 and 15 of the pump seismic report, ME-174. The combined stress intensities have been determined using a Bijlaard analysis and the guidelines of Welding Research Council Bulletin 107. A comparison between the results and the allowables have been added to the Summary of Results table, page 3 of ME-174 (Attachment A-1). As shown, the allowable stresses are greater than the actual stresses.

Item 2 Improved stress calculations in elements 90 and 92 are required as well as a comparison with allowable stresses.

Response: The finite element model generated for determining pump casing and cover stresses due to operating pressure and gasket seating loads is judged to be adequate as indicated in Attachment A-2, "RHR Pump Cover Evaluation." All stresses in the regions of concern are acceptable. Attachment A-2 will be placed in the Westinghouse equipment qualification file which will be maintained for the life of the plant.

Item 3 A calculation of the critical circular frequency and a check against operational speed is required. The concern of resonance should be addressed.

Response: A critical speed determination has been performed for the shaft/rotor/impeller assembly. The critical speed was found to be 2760 rpm. This is 55% higher than the running speed of 1777 rpm. Thus, no response problems will occur. This analysis has been

included in revision 1 of the motor seismic report, M010201. A copy of the report cover sheet is enclosed as Attachment A-3. This report will be kept in the Westinghouse engineering files.

2. SUMMARY OF RESULTS

A summary of the results of the detailed calculations is presented for both the OBE and SSE loads.

2.1 Normal + SSE + Maximum Nozzle Loads

	ACTUAL	ALLOWABLE
Pump Hold Down Bolts (tensile)	22,671 psi	38,940 psi
(shear)	10,969 psi	17,556 psi
Support Bracket Stress	26,343 psi	29.160
Support Weld Stress	20,651 psi	28,800
Casing Stress at Support	24,059 psi	48,600
Cooler Bracket Stress	9,875	24,960
Cooler Bracket Bolt (tensile)	3,043	24,000
Supporting Head Channels	6,164	24,960
Motor Hold Down Bolts (tensile)	16,816	22,838
(shear)	5,605	12,000
Pump Flange Bolts (tensile)	21,518	24,360
Pump Casing Stress	20,067	29,160
Rotor-Stator Clearance	.008 in.	.051 in.
Motor Bearing (upper)	1850 lbs.	9000 lbs.
(lower)	3265	13900
Impeller Contact Stress	818 psi	19,440 psi
Shaft Stress	10,534 psi	18,000
DISCHARGE NOZZLE STRESS INTENSITY	1,675 psi	48,600 psi
SUCTION NOZZLE STRESS INTENSITY	5,775 psi	48,600 psi

MEK 3/26/84

WESTINGHOUSE NUCLEAR TECHNOLOGY DIVISION

TITLE			PAGE
RHR PUMP COVER EVALUATION			1 OF 9
PROJECT DCP/DDP	AUTHOR MARK KAMENIC DATE 3/28/84	CHK'D BY [signature] DATE 3/28/84	CHK'D. BY — DATE
S.O. 206	CALC. NO. EQ+T-EQT-789	FILE NO.	GROUP EQT

DURING THE COURSE OF THE SEISMIC QUALIFICATION REVIEW TEAM (SQRT) AUDIT FOR THE CATAWBA SITE, SOME CONCERNS WERE RAISED REGARDING THE ADEQUACY OF A FINITE ELEMENT MODEL DEVELOPED FOR DETERMINING STRESSES DUE TO INTERNAL PRESSURE AND GASKET SEATING LOADS FOR THE RHR PUMPS, THE MODEL OF THE PUMP COVER IN THE AREA OF THE STUFFING BOX WAS CLAIMED TO BE OF TOO COARSE A MESH TO ACCURATELY DESCRIBE THE EFFECTS OF THE GEOMETRIC DISCONTINUITY. THE RESULTS FOR ELEMENTS 90 AND 92 ARE IN QUESTION.

THE MODEL IS AXISYMMETRIC, CONSTRUCTED WITH NASTRAN ISOPARAMETRIC ELEMENTS. RADIAL, CIRCUMFERENTIAL, AXIAL AND SHEAR STRESSES ARE DETERMINED AT FIVE POINTS IN EACH ELEMENT, AT EACH OF THE FOUR CORNERS AND AT THE ELEMENT CENTER. IT IS ACKNOWLEDGED THAT STRESSES AT CERTAIN NODES ARE GOING TO BE INFLUENCED BY GEOMETRIC DISCONTINUITIES. AT THESE DISCONTINUITIES, THE STRESS FIELDS WILL NOT BE HOMOGENEOUS. THIS IS AN INHERENT FEATURE OF FINITE ELEMENT ANALYSIS AND WILL EXIST NO MATTER HOW FINE A MESH IS USED.

HOWEVER, STRESSES AT A NODE THAT IS COMMON TO SEVERAL ELEMENTS CAN BE REASONABLY PREDICTED BY AVERAGING THE RESULTS OF THAT NODE FROM EACH ELEMENT. FOR EXAMPLE, THE STRESS AT NODE 125, WHICH IS COMMON TO ELEMENTS 92, 93 AND 95 AND EXISTS AT A DISCONTINUITY, CAN BE DETERMINED AS FOLLOWS:

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S.O.: 206	CALC. NO.: EQ+T-EQT-789	FILE NO.	GROUP: EQT

FROM PAGE C-17 OF SEISMIC REPORT ME-174 COME THE RESULTS FOR NODE 125

ELEMENT 92

RADIAL = 32,838 psi

CIRCUMFERENTIAL = 20,919 PSI

AXIAL = 14,659 PSI

SHEAR = - 7983 PSI

ELEMENT 93

RADIAL = 15,046 PSI

CIRCUMFERENTIAL = 13,297 PSI

AXIAL = 7033 PSI

SHEAR = 5698 PSI

ELEMENT 95

RADIAL = 17,204 PSI

CIRCUMFERENTIAL = 15,451 PSI

AXIAL = 12,070 PSI

SHEAR = -8712 PSI

AVERAGING THE RESULTS YIELDS:

RADIAL = 21,693 PSI

CIRCUMFERENTIAL = 16,556 PSI

AXIAL = 11,254 PSI

SHEAR = -3666 PSI

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RHR PUMP COVER EVALUATION			3 OF 9
PROJECT: DCP/DDP	AUTHOR: MARK KAMENIC DATE: 3/23/84	CHK'D. BY: [signature] DATE: 3/28/84	CHK'D. BY: — DATE:
S.O.: 206	CALC. NO.: EQ-T-EQT-789	FILE NO.:	GROUP: EQT

THE MAXIMUM PRINCIPAL STRESS EQUATION IS:

$$\sigma_1 = \frac{\sigma_x + \sigma_y}{2} + \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau^2}$$

$$= \frac{21,693 + 11,254}{2} + \sqrt{\left(\frac{21,693 - 11,254}{2}\right)^2 + (3666)^2}$$

σ_1 = 22,852 PSI

BECAUSE OF THE DISCONTINUITY, A PORTION OF THIS STRESS IS A PEAK OR SECONDARY STRESS. THE PERCENTAGE IS UNKNOWN. HOWEVER, EVEN THIS VALUE IS LESS THAN THE PRIMARY MEMBRANE PLUS PRIMARY BENDING ALLOWABLE OF 1.5 S = (1.5)(16,200) = 24,300 PSI. FOR SECONDARY STRESS, THE ALLOWABLE IS 3.0 S = 48,600 PSI.

EVEN THOUGH THE VALUE OF σ_1 = 22,852 PSI IS A REASONABLE PREDICTION, IT IS CERTAIN THAT RESULTS OBTAINED FROM A MORE DENSELY MESHED MODEL WOULD NOT EXCEED THE 3.0S ALLOWABLE.

THE STRESS AT NODE 120, WHICH IS COMMON TO ELEMENTS 91, 90 AND 92, WILL ALSO BE EVALUATED SINCE IT EXISTS AT A DISCONTINUITY.

ELEMENT 91

RADIAL = 1072 PSI

CIRCUMFERENTIAL = 400 PSI

AXIAL = 2062 PSI

SHEAR = 568 PSI

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S.O. 206	CALC. NO. EQ-T-EQT-789		FILE NO.	GROUP EQT

ELEMENT 90

RADIAL = -3178 PSi

CIRCUMFERENTIAL = -3850 PSi

AXIAL = -7856 PSi

SHEAR = -5198 PSi

ELEMENT 92

RADIAL = -17,450 PSi

CIRCUMFERENTIAL = -9966 PSi

AXIAL = -13,971 PSi

SHEAR = 4618 PSi

AVERAGING THE RESULTS YIELDS:

RADIAL = -6519 PSi

CIRCUMFERENTIAL = -4472 PSi

AXIAL = -6588 PSi

SHEAR = -4 PSi

$$\sigma_1 = \frac{-6519 - 6588}{2} - \sqrt{\left(\frac{-6519 + 6588}{2}\right)^2 + (-4)^2}$$

$$\sigma_1 = -6588 \text{ psi}$$

AGAIN THIS VALUE IS FAR LESS THAN THE PRIMARY MEMBRANE PLUS PRIMARY BENDING ALLOWABLE OF 1.5S = 24,300 PSi.

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S.O.: 206	CALC. NO.: EQ+T-EQT-789	FILE NO.:	GROUP: EQT

AGAIN ONE SHOULD KEEP IN MIND THE APPLICABLE LOADING CONDITION. THE PUMP COVER IS SUBJECT TO ONLY INTERNAL PRESSURE AND GASKET SEATING LOADS, THESE LOADS ARE STATIC IN NATURE, THUS NOT OF A HIGH CYCLIC NATURE. THE FOLLOWING IS TAKEN FROM THE 1971 ASME CODE, SECTION III, NB-3213.11,

> "PEAK STRESS IS THAT INCREMENT OF STRESS WHICH IS ADDITIVE TO THE PRIMARY-PLUS-SECONDARY STRESSES BY REASON OF LOCAL DISCONTINUITIES OR LOCAL THERMAL STRESS INCLUDING THE EFFECTS OF STRESS CONCENTRATIONS. THE BASIC CHARACTORISTIC OF A PEAK STRESS IS THAT IT DOES NOT CAUSE ANY NOTICEABLE DISTORTION AND IS OBJECTIONABLE ONLY AS A POSSIBLE SOURCE OF A FATIGUE CRACK OR BRITTLE FRACTURE."

THE LOADING CONDITION IS NOT CONDUCIVE TO FATIGUE OR BRITTLE FAILURE.

EACH PUMP IS SUBJECTED TO A HYDROSTATIC TEST AT 150% OF DESIGN PRESSURE. NEVER HAVE ANY FAILURES OF PUMP COVERS BEEN EXPERIENCED. MANY YEARS OF SUCCESSFUL OPERATION ARE ALSO SUPPORTIVE OF THE PUMP'S DESIGN BEING ADEQUATE.

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WESTINGHOUSE NUCLEAR TECHNOLOGY DIVISION

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RHR PUMP COVER EVALUATION			6 OF 9
PROJECT: DCP/DDP	AUTHOR: MARK KAMENIC DATE: 3/28/84	CHK'D BY: [signature] DATE: 3/28/84	CHK'D BY: — DATE:
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IN SUMMATION, THE FINITE ELEMENT MODEL GENERATED FOR DETERMINING PUMP CASING AND COVER STRESSES DUE TO OPERATING PRESSURE AND GASKET SEATING LOADS IS JUDGED TO BE ADEQUATE. PRIMARY MEMBRANE PLUS PRIMARY BENDING PLUS SECONDARY STRESSES DETERMINED AT LOCATIONS OF GEOMETRIC DISCONTINUITY ARE FOUND TO BE LESS THAN A 1.5S ALLOWABLE EVEN THOUGH A 3.0S ALLOWABLE IS JUSTIFIABLE. A MORE DENSE MESH WOULD ONLY BE WARRANTED FOR EVALUATING CYCLIC OR THERMAL LOADING CONDITIONS.

ALSO, THE PREOPERATING TESTING AND OPERATING EXPERIENCE SUPPORT THE DESIGN ADEQUACY OF THE PUMP COVER.

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S.O.: 206	CALC. NO.: EQ-T-EQT-789	FILE NO.	GROUP: EQT

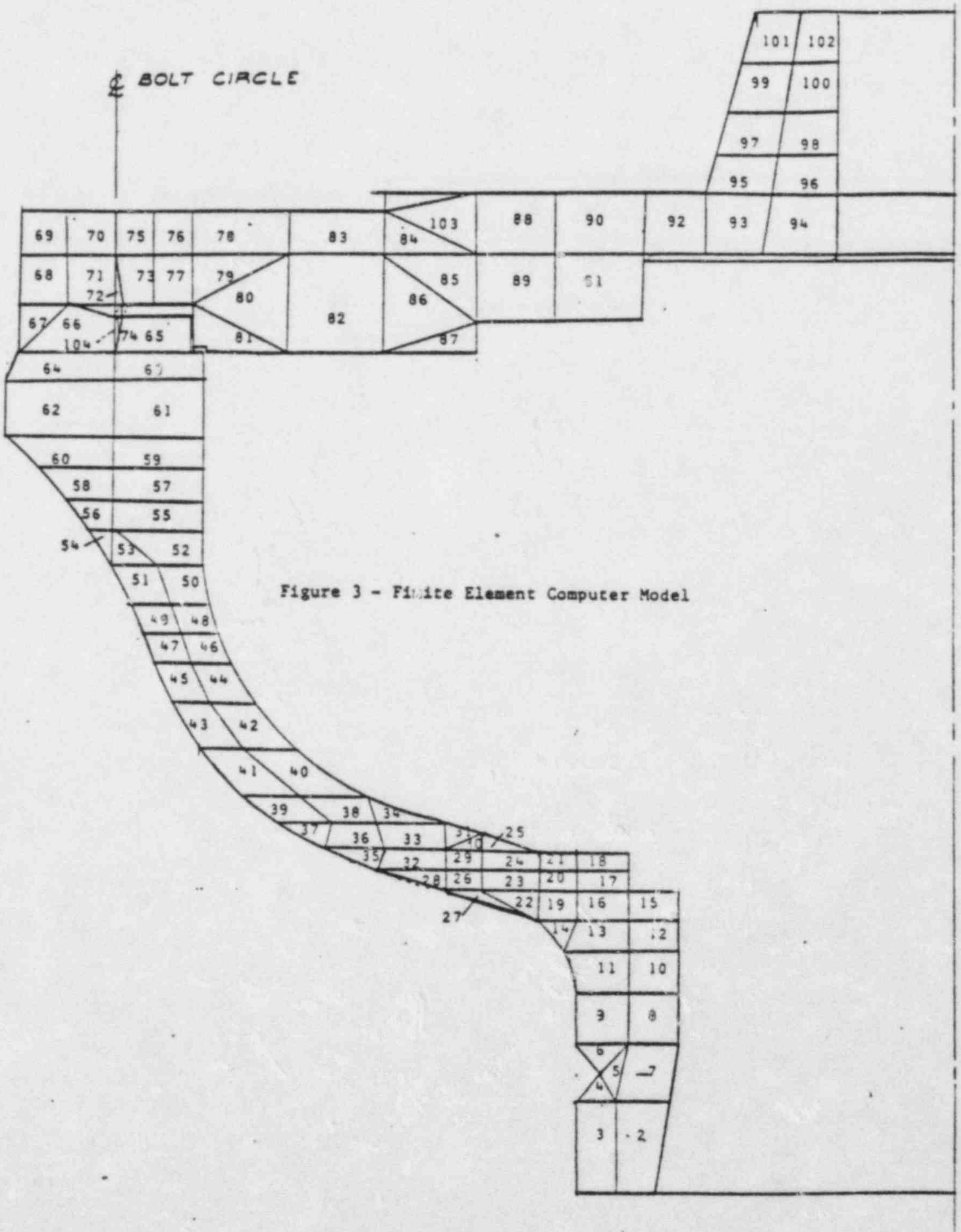

Figure 3 - Finite Element Computer Model

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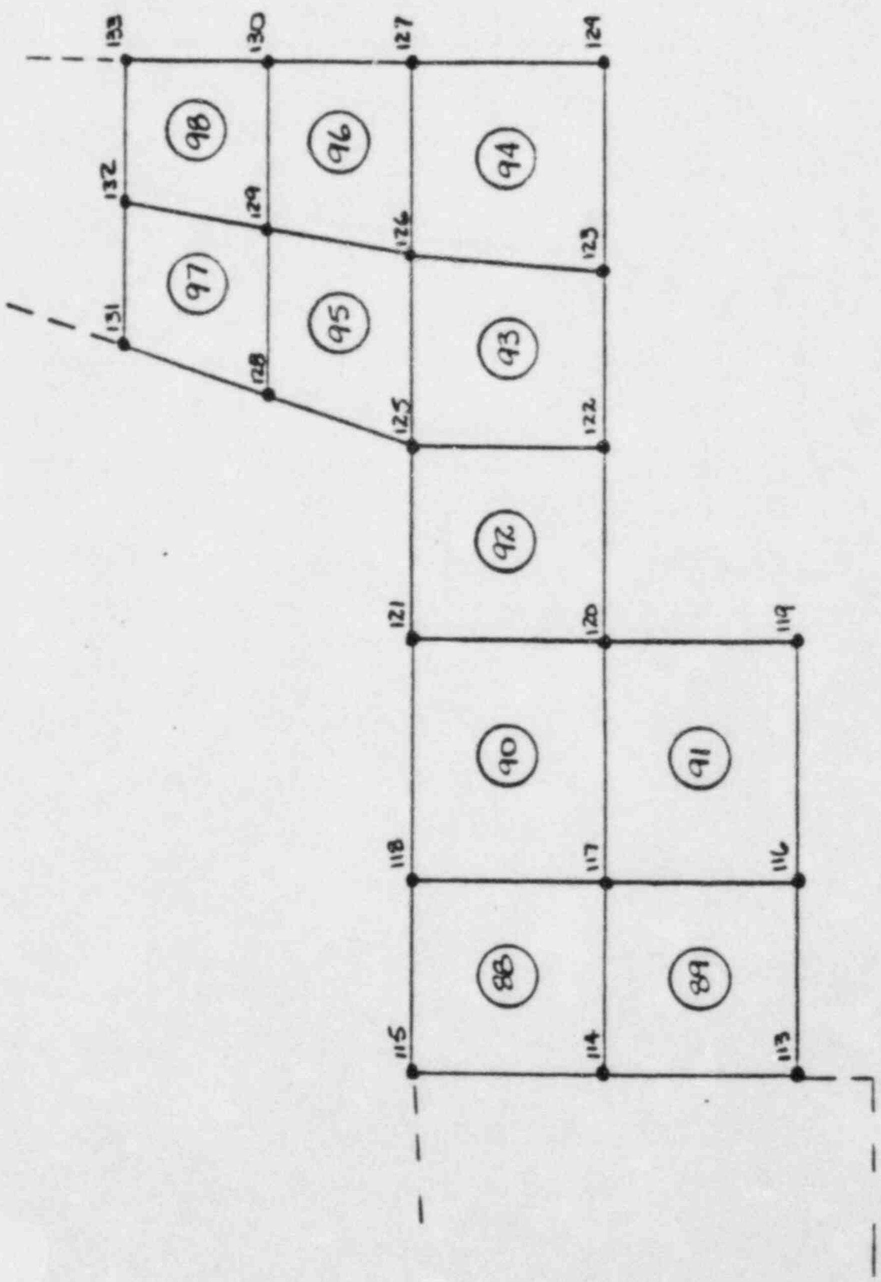

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DCP/DDP	MARK KAMENIC 3/22/84	[signature] 3/28/84	—

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C-17

STRESS ANALYSIS OF 8X20WDF PUMP FOR INGERSOLL RAND/WESTINGHOUSE AUGUST 20, 1974 NASTRAN 5/13/72 PAGE 20

SUBCASE 1

S T R E S S E S F O R T H E T R A P E Z O I D A L R I N G S (C T R A P R G)

EL ID	STRESS POINT	RADIAL (RX)	CIRCUMFERENTIAL (THETA)	AXIAL (ZX)	SHEAR (ZRX)
90	1	-3.178175E 03	-3.849750E 03	-7.855750E 03	-5.197535E 03
	2	-2.125307E 03	-2.657637E 03	-5.525445E 03	1.451954E 02
	3	2.005775E 04	1.853100E 04	7.446102E 03	6.903750E 02
	4	1.879213E 04	1.674238E 04	4.913000E 03	-4.652313E 03
	5	8.398313E 03	7.194935E 03	-2.456250E 02	-2.253625E 03
91	1	-6.160175E 03	-1.747294E 04	-5.475875E 03	2.888735E 02
	2	-3.946664E 03	-1.291441E 04	-2.589867E 03	1.218176E 02
	3	1.654908E 03	1.131948E 03	3.307494E 03	4.012500E 02
	4	1.071563E 03	4.094375E 02	2.061625E 03	5.682500E 02
	5	-1.794625E 03	-7.089438E 03	-6.708125E 02	3.450625E 02
92	1	-1.365500E 04	-5.402250E 03	-6.885313E 03	-6.060500E 03
	2	-1.744974E 04	-9.965992E 03	-1.397123E 04	4.617633E 03
	3	3.207413E 04	2.243445E 04	1.060789E 04	2.695063E 03
	4	3.283814E 04	2.091944E 04	1.465913E 04	-7.983125E 03
	5	8.462305E 03	7.270813E 03	1.112813E 03	-1.682813E 03
93	1	-7.909250E 03	1.081250E 02	-6.885563E 03	-1.046689E 03
	2	-7.741305E 03	-1.869250E 03	-4.351367E 03	4.476742E 03
	3	1.504586E 04	1.329367E 04	7.031379E 03	5.698250E 03
	4	1.257294E 04	1.010088E 04	1.982688E 03	-3.169375E 02
	5	2.976125E 03	5.370250E 03	-5.718750E 02	2.202934E 03
94	1	6.500625E 02	8.998090E 03	-1.908125E 03	2.835586E 02
	2	-1.731641E 03	2.900734E 03	-3.351750E 03	1.670502E 03
	3	3.934094E 03	6.232199E 03	-1.372919E 03	1.797435E 03
	4	4.447200E 03	1.001725E 04	-4.647500E 02	5.116875E 02
	5	1.286125E 03	6.308063E 03	-2.187500E 03	1.065875E 03
95	1	1.180356E 04	9.331563E 03	1.910000E 02	-2.342691E 03
	2	1.723425E 04	1.545138E 04	1.206950E 04	-8.712398E 03
	3	1.763477E 03	4.973640E 03	3.022973E 03	-5.876250E 03
	4	-1.607684E 03	2.671938E 03	-4.580000E 03	5.268750E 01
	5	7.189438E 03	7.966375E 03	2.114688E 03	-4.219688E 03
96	1	3.977509E 03	9.553563E 03	-1.547000E 03	-2.537109E 01
	2	1.975270E 03	5.074207E 03	-4.076813E 03	-2.716507E 02
	3	1.101359E 03	4.157832E 03	-4.534664E 03	-3.729375E 02
	4	2.964913E 03	8.113625E 03	-2.283000E 03	-1.441875E 02
	5	2.259875E 03	6.711750E 03	-3.331000E 01	-2.040000E 02
97	1	1.044009E 03	5.524563E 03	7.500000E 01	-2.153785E 03
	2	1.961063E 03	5.199750E 03	3.529938E 03	-2.125612E 03
	3	1.050777E 03	3.311770E 03	2.157332E 03	-1.338933E 03
	4	-4.737503E 01	3.061625E 01	-1.256000E 03	-1.364813E 03
	5	9.515625E 02	4.141313E 03	1.071000E 03	-1.745813E 03

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WESTINGHOUSE NUCLEAR TECHNOLOGY DIVISION

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GAE/GBE-DCP/DDP	MARK KAMENIC 12/9/82			
S.O.	CALC. NO.	FILE NO.	GROUP	
206	M010201		MEQ	

REPORT NO. M010201 REV. 1

SEISMIC ANALYSIS REPORT
FOR THE
GAE/GBE-DCP/DDP RHR PUMP MOTORS

WESTINGHOUSE ELECTRIC CORP.
P.O. BOX 355
PITTSBURGH, PA. 15230

PREPARED BY: Mark Kamenic 12/30/82
MARK KAMENIC

VERIFIED BY: Peter J. Biordo 3/31/83

REV. NO.	REV. DATE	AUTHOR / DATE	CHK'D. BY / DATE	CHK'D. BY / DATE
1	3/26/84	MARK KAMENIC 3/26/84	Peter J. Biordo 3/26/84	

WESTINGHOUSE FORM 55213D

SPECIFIC ITEM #8   CONTROL ROOM AH UNIT FAN/MOTOR

PART 1: SQRT form should be revised to show correct model number.

STATUS: This item is complete.

RESOLUTION SUMMARY: The correct model number is shown on the SQRT form which follows this page.

PART 2: SQRT form should be revised to show the correct bolt size.

STATUS: This item is complete.

RESOLUTION SUMMARY: The correct bolt size is shown on the SQRT form which follows this page.

PART 3: A letter is needed from Reliance Electric which clarifies the motor seismic test report with regard to the method of calculating critical speed and the units used in a data table.

STATUS: This item has been completed by Reliance Electric.

RESOLUTION SUMMARY: See attached letter from Thomas L. Gruber of Reliance Electric to Joseph Voglewede of Duke Power Company dated March 16, 1984.

RELIANCE ELECTRIC

General Offices
24701 Euclid Avenue
Cleveland, Ohio 44117
216-266-7000

March 16, 1984

Duke Power Company
P.O. Box 33189
Charlotte, North Carolina 28242

Attn: Mr. Joseph Voglewede

Subject: Reliance Seismic Analysis #81-b-A-26 and phone conversation of 3-15-84.

Dear Joe,

The following should answer the questions which the NRC auditor posed concerning the subject seismic analysis.

1. The critical speed calculation is based on the Mycklestad-Prohl method.

2. In this report loads are measured in pounds, critical speed in rpm, and linear dimensions are in inches.

3. The figures which represent the rotating element of the motor are generic. However, each individual seismic report has the stations (length, diameter and weight) identified with values appropriate to each specific motor design and application. Note: the computer assumes that the rotating assembly is of steel construction and includes this data automatically. Any additional masses such as motor rotor or interface sheave must be added as input values.

4. Belt effect shaft loads or other external loads applied to the motor are input parameters to the program. The program then calculates seismic stresses and adds them to any operating stresses which area result of the motor application to determine the final stress levels.

The subject seismic report is typical of all seismic reports for NEMA size motors. As a result, the above comments will apply generically to all similar reports.

Should you have any further questions please feel free to contact me.

Very truly yours,

Thomas L. Gruber
Product Manager, Utilities

CC: John Early - RGO
Buster Youngs - RCR

Seismic and Dynamic Qualification Summary of Equipment

MDSS

I. Plant Name: Catawba   TYPE:

1. Utility: Duke Power Co   PWR: √

2. NSSS: Westinghouse   BWR: ____

3. A/E: N/A   Other ____

II. Component Name: Control Room Air Handling Unit Fan

1. Scope: [ ] NSSS   [√] BOP   [ ] Other

2. Model Number: 39ED39   Quantity: 2

3. Size or Range: 26,000 CFM

4. Vendor: Carrier Corp

5. If the component is a cabinet or panel, name and model Number of the devices included: ASME III Code Case 1607-1, ASME III Subsection NF (No Date)

6. Physical Description:

   a. Appearance: Air Handling Unit

   b. Dimensions: 11'-9½" x 9'-11" x 5'-5½"

   c. Weight: Operating Weight - 7810 lbs

7. Location: Building: Aux Bldg.

   Elevation: Elev. 594'-0"

8. Field Mounting Conditions   [X] Bolt (No. 16 , Size 5/8")
   [ ] Weld (Length ____)
   [ ] ____

9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

   Floor Mounted

10. a. System is which located: VC

    b. Functional Description: Maintains Control Room Temperature

    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

    [ ] Both   [ ] Neither   [X] Other
    All Conditions

II. Pertinent Reference/Design Specifications for Qualification Requirements: CNS-1211.00-9

(a.) Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[√] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [√] Analysis [ ] Combination of Test and Analysis

Qualification Report*: CNM 1211.00-423

(No., Title and Date): Seismic Qualification Report of Control Room Area AHU's for CNS

Company that Prepared Report: Corporate Consulting & Development Co.

Company that Reviewed Report: Duke Power Company

Where Report is filed or available: Duke Power Co. Design Engineering

Applicable Codes And/Or Standards: N/A

V. Vibration Input:

1. Loads considered:
   a. [ ] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [√] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [√] SRSS [ ] ________ (other, specify)

3. Required Response Spectra** (attach the graphs): See Attachment

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 2% SSE 2%

5. Required Acceleration in Each Direct:

[√] ZPA [ ] Other ________ (specify)

OBE N/S = 0.33G E/W = 0.325G V = 0.13G

SSE S/S = 0.62G F/B = 0.62G V = 0.244G

6. Were fatigue effects considered:

[ ] Yes [√] No

If yes, describe how they were treated in overall qualification program: ________

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency [ ] random
[ ] sine beat
[ ] ________

2. [ ] Single Axis [ ] Multi-Frequency
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ________ SSE ________ Other ________ (specify)

4. Frequency Range: ________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ________ F/B = ________ V = ________

6. Method of Determining Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)

[ ] No

8. Maximum Input g Level Test:

OBE S/S = ______ F/B = ______ V = ______

SSE S/S = ______ F/B = ______ V = ______

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ______

B. Orientation and Fixturing: ______

10. Functional Operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ______

______

12. Other tests performed (such as aging or fragility test, including results):

______

______

13. Failure Modes (If appropriate ______)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[√] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical): Fundamental Mode has a natural frequency of 16 Hz.

S/S = ______ F/B = ______ V = ______

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[√] Finite Element [ ] Beam

[ ] Closed Form Solution [√] Other Modal Analysis

4. [√] Computer Codes: STARDYNE

Frequency Range and No. of modes 1 to 29 Hz, 4

[√] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[√] Absolute Sum [ ] SRSS [ ] Other: ________ (specify)

6. Damping:

OBE 2% SSE 2% Basis for the damping used: Spec

7. Support Considerations in the model: Unit Anchor Bolts

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Unit Anchor Bolts	Bottom of unit	Tensile	--	3,065 psi	20,000 psi
		Shear	--	5,863 psi	10,000 psi

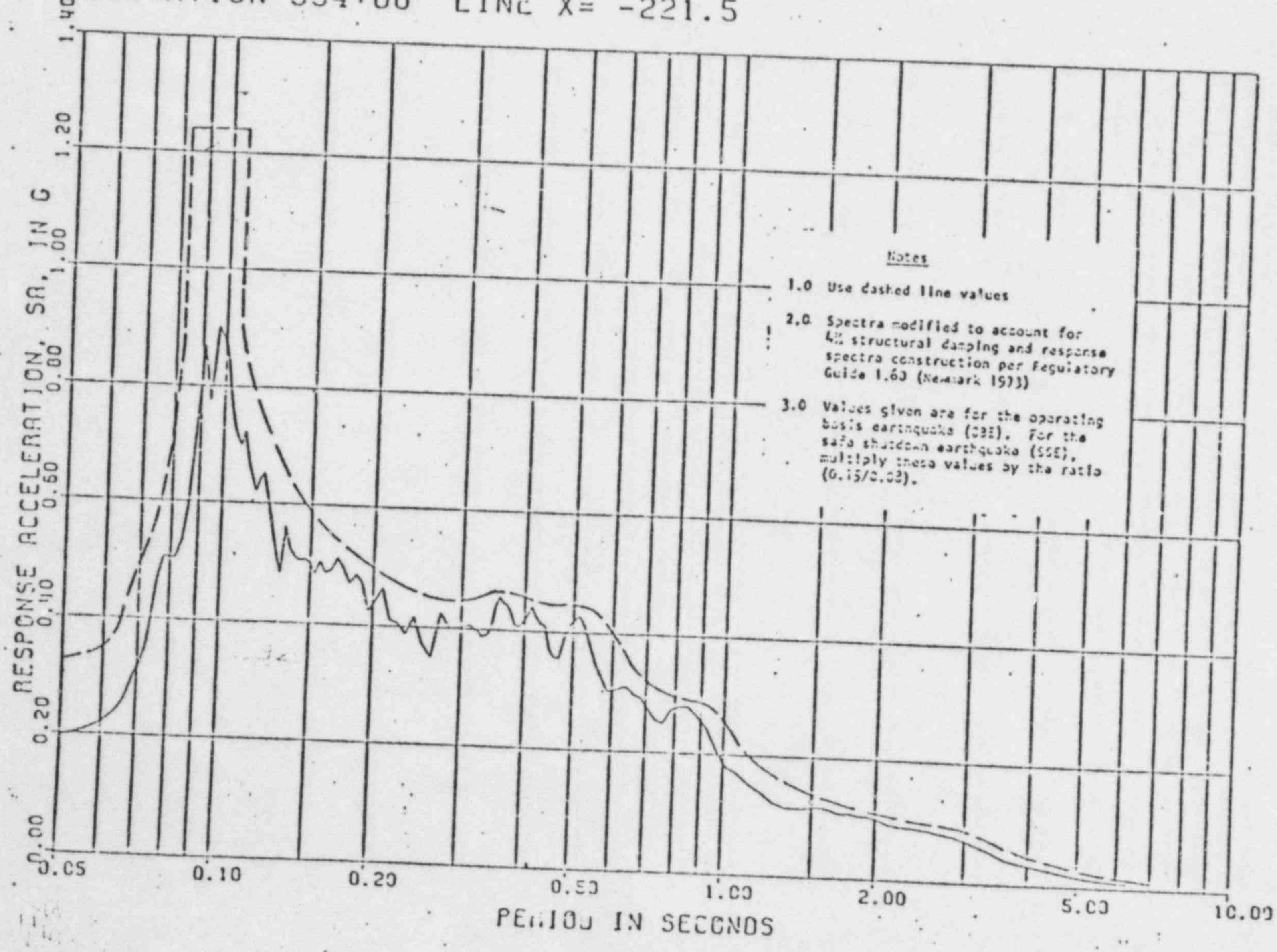
B.

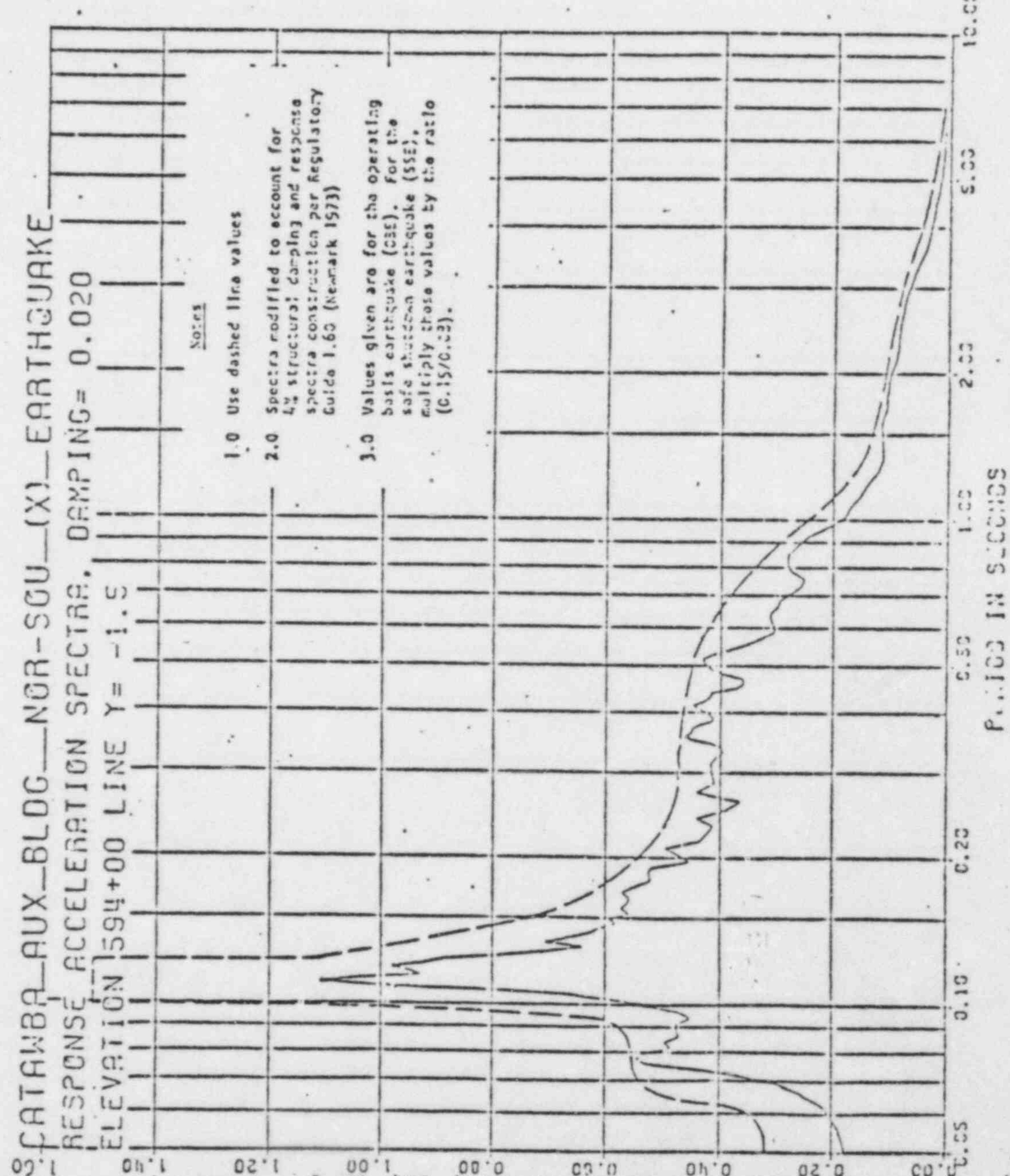
Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
N/A		N/A

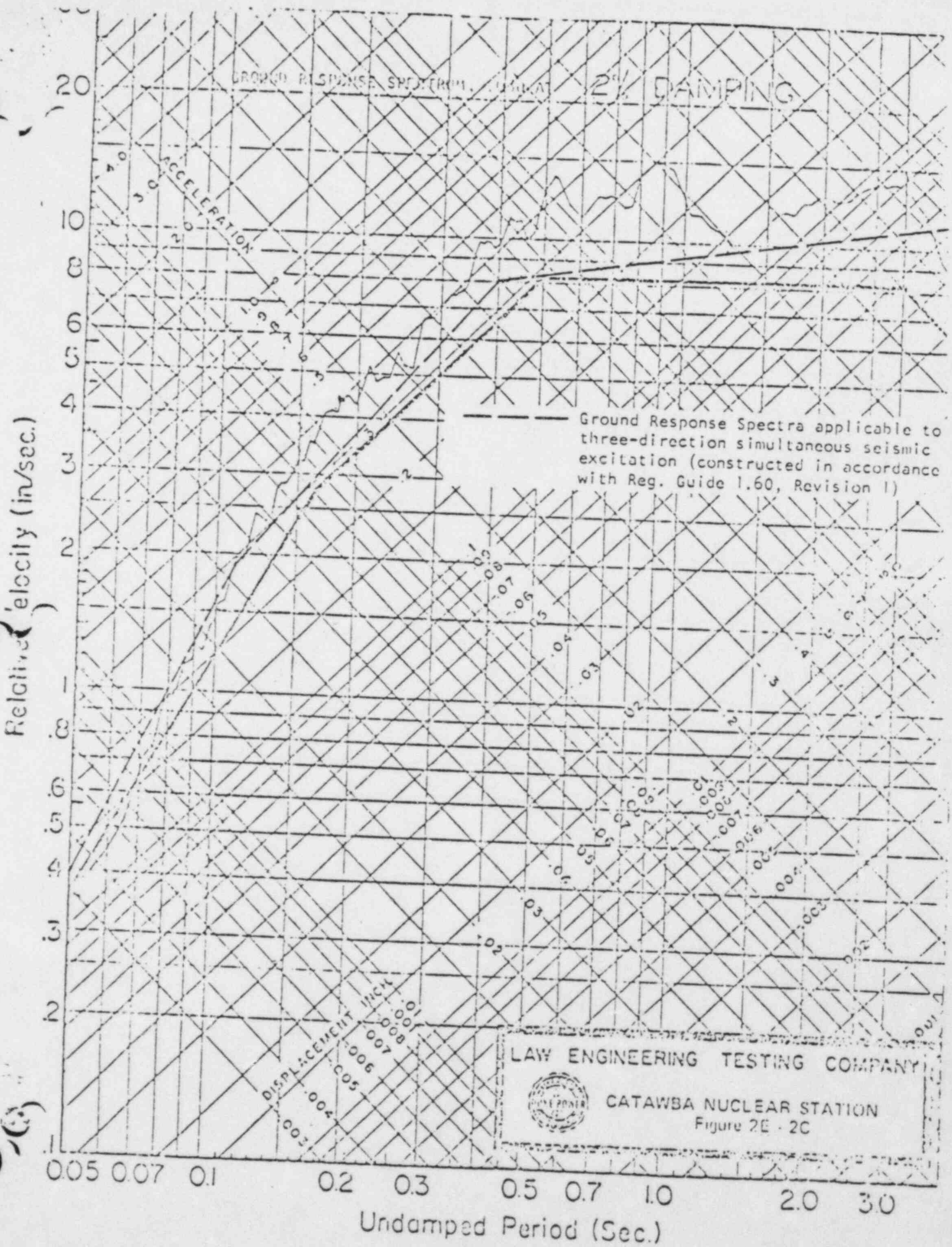
9. Failure Modes: N/A

10. Margins Available: [ ] Input Spectrum [√] Stress or Deflection

CATAWBA AUX BLDG EAS-WES (Y) EARTHQUAKE
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 594+00 LINE X= -221.5




CATAWBA AUX BLDG NOR-SGU (X) EARTHQUAKE
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 594+00 LINE Y= -1.5
Notes
1.0 Use dashed line values
2.0 Spectra modified to account for 4% structural damping and response spectra construction per Regulatory Guide 1.60 (Newmark 1973)
3.0 Values given are for the operating basis earthquake (OBE). For the safe shutdown earthquake (SSE), multiply those values by the ratio
RESPONSE ACCELERATION, SA, IN G
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
0.05
0.10
0.20
0.50
1.00
2.00
5.00
10.00
PERIOD IN SECONDS


2% DAMPING
ACCELERATION
DISPLACEMENT INCH
Ground Response Spectra applicable to three-direction simultaneous seismic excitation (constructed in accordance with Reg. Guide 1.60, Revision 1)
LAW ENGINEERING TESTING COMPANY
CATAWBA NUCLEAR STATION
Figure 2E - 2C
Relative Velocity (in/sec.)
Undamped Period (Sec.)
0.05 0.07 0.1 0.2 0.3 0.5 0.7 1.0 2.0 3.0
20 10 8 6 5 4 3 2 1 .8 .6 .5 .4 .3 .2 .1

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba — TYPE:

1. Utility: Duke Power — PWR: √
2. NSSS: Westinghouse — BWR: ______
3. A/E: Duke Power — Other ______

II. Component Name: Control Room Air Handling Unit Fan Motor

1. Scope: [ ] NSSS [√] BOP [ ] Other
2. Model Number: 326T — Quantity: 1 per unit
3. Size or Range: 50 HP
4. Vendor: Reliance
5. If the component is a cabinet or panel, name and model Number of the devices included: ______

   N/A
6. Physical Description:
   a. Appearance: Fan Motor - horizontally mounted
   b. Dimensions: 27.5" long X 15.5" wide X 16.25" high
   c. Weight: 500 lb
7. Location: Building: Auxiliary

   Elevation: 594
8. Field Mounting Conditions
   [√] Bolt (No. 4, Size .625)
   [ ] Weld (Length ____)
   [ ] ______
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

   Mounted on fan base
10. a. System is which located: Aux. Building Ventilation (VA)
    b. Functional Description: Emergency Exhaust of ESG Area
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

       [ ] Both [ ] Neither [√] Other LOCA

11. Pertinent Reference/Design Specifications for Qualification Requirements: CNS 1393.00-1, CNS1320.53-6

a. Seismic Input

b. Hydrodynamic Load Input

c. Fatigue Considerations

d. Service Conditions

e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[√] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [√] Analysis [ ] Combination of Test and Analysis

Qualification Report*: yes

(No., Title and Date): 8 lb-A-26 Summary Report Seisman Analysis of Horizontal, Foot Mounted Electric Motor 10/20/81

Company that Prepared Report: Reliance

Company that Reviewed Report: Duke Power

Where Report is filed or available: DE File # CNM1320.53-0042

Applicable Codes And/Or Standards: IEEE344-1975

V. Vibration Input:

1. Loads considered:
   a. [√] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [√] N/A (other, specify)

3. Required Response Spectra** (attach the graphs): See Attached

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 1% SSE 1%

5. Required Acceleration in Each Direct:

[√] ZPA [ ] Other ____________ (specify)

OBE S/S = .5 F/B = .5 V = .33

SSE S/S = .94 F/B = .94 V = .63

6. Were fatigue effects considered:

[ ] Yes [√] No

If yes, describe how they were treated in overall qualification program: ____________

____

____

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [ ] Multi-Frequency [ ] random
[ ] sine beat
[ ] ____________

2. [ ] Single Axis [ ] Multi-Frequency
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ____________ SSE ____________ Other ____________ (specify)

4. Frequency Range: ____________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ____________ F/B = ____________ V = ____________

6. Method of Determining Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)

[ ] No

8. Maximum Input g Level Test:

OBE S/S = ____________ F/B = ________________ V = ______________

SSE S/S = ____________ F/B = ________________ V = ______________

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ___________

B. Orientation and Fixturing: ___________________________________

10. Functional Operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _______________________

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (If appropriate ___________________________________)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[√] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical): No natural frequencies below 20 hz. (See report 816-A-26, page 2)

S/S = ____________ F/B = ________________ V = ______________

3. Model Type: [ ] 3D [ ] 2D [√] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ________

4. [√] Computer Codes: Reliance program #706

Frequency Range and No. of modes

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum [√] SRSS [ ] Other: ________ (specify)

6. Damping:

OBE 1% SSE 1% Basis for the damping used: specification

7. Support Considerations in the model: Hold-Down Bolts

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Hold-down Bolts	See attached Dwg. CNM132.53-41	Seismic, dead weight, Shear	--	6387PSI	13717PSI

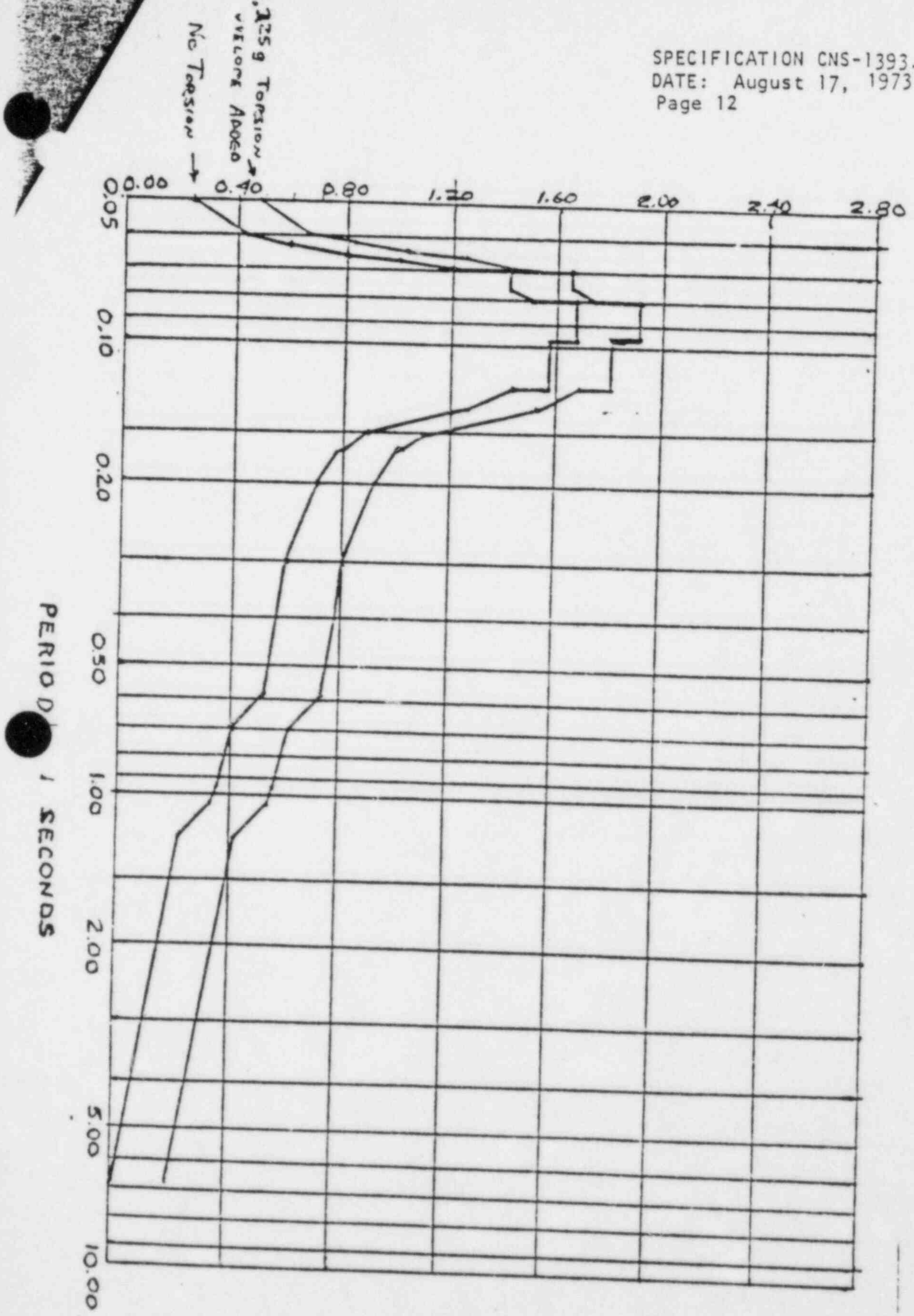
B.

Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
.0016 inch	Bearing Housing B.E.	.0070

9. Failure Modes: N/A

10. Margins Available: [ ] Input Spectrum [√] Stress or Deflection

MCGUIRE & CATAWBA OBE 1% Composite Response Spectra for all McGuire 767 (and below) and Catawba 594' (and below) elevations in both N-S and E-W directions in Auxiliary Building.



These curves are for the operating basis earthquake (OBE). For the design basis earthquake (DBE) multiply these values by the ratio of (.015/.008)

FIGURE 4

E. Installation

1. Power Knockout, Fan Motor - Panels on drive side of fan section are provided with fan motor power wiring knockouts. Refer to certified drawings for location and size of knockouts.

2. Fan Motor - Motors are supplied and installed by Duke Power. Use smallest slots in motor mounting base which will accomodate motor.*

3. Sheave alignment and Belt Tension - Refer to pages 25 and 26 of 39E-7SI for proper sheave alignment and belt tension.

4. Chilled Water Coils - Coils are shipped assembled in the units. For location and size of coil connections and vents/drains, refer to certified drawings.

Coils are shipped with a 10 psig of dry nitrogen. Before removing blank coil for connecting piping, release pressure from each coil thru valves under the protective caps.

The chilled water coils have removeable headers on both ends, and have air baffles installed on the air entering and leaving sides of the coils.

On the blind end of the coil, two rows of screws must be removed from the coil tube sheet prior to operation in order to allow for proper thermal expansion of the coil core. A

*Motor Bolting Information

Unit Item No.	Use	Dia (in.)	Min. Bolt Grade (S.A.E.)	Torque (ft-lbs)
1SGR-AHU-1	Motor hold-down bolts	0.5	5	31-92
1SGR-AHU-2	" " " "	0.5	5	31-92
1SGR-AHU-3	" " " "	0.5	5	31-92
1SGR-AHU-4	" " " "	0.5	5	31-92
2SGR-AHU-1	" " " "	0.5	5	31-92
2SGR-AHU-2	" " " "	0.5	5	31-92
2SGR-AHU-3	" " " "	0.5	5	31-92
2SGR-AHU-4	" " " "	0.5	5	31-92
1CR-AHU-1	" " " "	0.625	5	63-185
2CR-AHU-1	" " " "	0.625	5	63-185

QA CONDITION 1
NUCLEAR SAFETY RELATED

SPECIFIC ITEM #9   AUX. FEEDWATER PUMP TURBINE

PART 1: Spring valve latch failed in test. Verify that the specification is revised to call for a stiffer spring.

STATUS: This item has be^n resolved.

RESOLUTION SUMMARY: The correct latch spring was install per Duke requirements. Response from Terry Corporation has been inserted in turbine seismic report.

PART 2: Revision of SQRT form is necessary.

STATUS: The item has been resolved.

RESOLUTION SUMMARY: The revised SQRT form follows this page.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba TYPE:

1. Utility: Duke Power PWR: √
2. NSSS: Westinghouse BWR: ____
3. A/E: N/A Other ____

II. Component Name: Auxiliary Feedwater Pump Turbine

1. Scope: [ ] NSSS [ ] BOP [ ] Other
2. Model Number: GS-2N Quantity: 1
3. Size or Range: ____
4. Vendor: Terry Steam Turbine Company
5. If the component is a cabinet or panel, name and model Number of the devices included: ____
6. Physical Description:
   a. Appearance: See Duke drawing CNM-1201.05-143
   b. Dimensions: See Duke drawing CNM-1201.05-143
   c. Weight: 3400 lbs.
7. Location: Building: Auxiliary Building
   Elevation: 543'
8. Field Mounting Conditions
   [√] Bolt (No. 2, Size 1")
   [ ] Weld (Length ____)
   [√] Bolt (No. 4, Size 3/4")
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   on floor with baseplate & pedestals
10. a. System is which located: SA
    b. Functional Description: Auxiliary Feedwater Pump drive
    c. Is the equipment required for [√] Hot Standby [ ] Cold Shutdown
       [ ] Both [ ] Neither [ ] Other ____

11. Pertinent Reference/Design Specifications for Qualification Requirements: CNS-1201.05-00-0005

(a.) Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
(d.) Service Conditions
(e.) Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[√] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [ ] Analysis [√] Combination of Test and Analysis

Qualification Report*: CNM-1201.05-276

(No., Title and Date): GS-2N Qualification Report for Duke Power Company F-40096 A & B (11-7-77)

Company that Prepared Report: Terry Steam Turbine Company

Company that Reviewed Report: EDS Nuclear, Inc. (Impell)

Where Report is filed or available: Duke Power (General Services)

Applicable Codes And/Or Standards: See Duke Specification CNS-1201.05-00-0005 Paragraph 4.4

V. Vibration Input: Req'd.

1. Loads considered:
   a. [√] Seismic only
   b. [ ] Hydrodynamic only
   c. [√] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [√] SRSS [ ] ______ (other, specify)

3. Required Response Spectra** (attach the graphs): Attached

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 2% SSE 2%

5. Required Acceleration in Each Direct:

[ ] ZPA [√] Other SLF (specify)

Plant Specific Values	OBE S/S = 0.43	F/B = 0.43	V = 0.27
	SSE S/S = 0.8g	F/B = 0.8g	V = 0.5g

6. Were fatigue effects considered:

[ ] Yes [√] No

If yes, describe how they were treated in overall qualification program: ______

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [√] Multi-Frequency [√] random
[√] sine beat
[ ] ______

2. [ ] Single Axis [ ] Multi-Frequency
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 14 SSE 16 Other ______ (specify)

4. Frequency Range: 1 to 100 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 15, 21, & 27 Hz F/B = 15, 23, & 34 Hz V = 22 & 32 Hz See attached tables for accelerometer locations

6. Method of Determining Natural Frequencies

[√] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[√] Yes (Attach TRS & RRS graphs)

[ ] No

8. Maximum Input g Level Test:

OBE S/S = 11g F/B = 9g V = 20g

SSE S/S = 15g F/B = 13g V = 21g

9. Laboratory Mounting:

A. [√] Bolt (No. 6, Size 1")

[ ] Weld (Length ___) [ ] ___________

B. Orientation and Fixturing: ___________________________

10. Functional Operability verified:

[√] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ___________________

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (If appropriate ___________________________)

14. Margins Available: [√] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[√] Static Analysis [√] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ___________ F/B = ___________ V = ___________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ________

4. [ ] Computer Codes: ______________________

Frequency Range and No. of modes

[√] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: N/A (specify)

6. Damping: N/A

OBE ______ SSE ______ Basis for the damping used: ______

7. Support Considerations in the model: N/A

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Coupling End Hold Down Bolts		14,670 psi		94,500psi
Governor End Hold Down Bolts		3,982 psi		94,500psi
Taper Pins		48,121 psi		87,000psi
Guide Blocks		6,208 psi		22,400psi

B.

Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
0.004"	shaft	0.020"

9. Failure Modes: N/A

10. Margins Available: [√] Input Spectrum [√] Stress or Deflection
See Above and
Attachment

CUSTOMER TERRY CORP

Test Title: SINE BEATS ON SEISMIC RANDOM

Specimen GS-2 TURBINE

Part No. SEE REC INSP

Job No. 58038

S/N SEE REC INSP

Date 4-9-76

TABLE I

ACCELEROMETER MOUNTINGS AND AXES DEFINITIONS

ACCELEROMETER NUMBER	LOCATION	✱ DIRECTION X-Y	✱ DIRECTION Z-Y
1	HORIZONTAL CONTROL		
2	VERTICAL CONTROL		
3	LIMITORQUE OPERATOR	X	Z
4	TRIP SOLENOID	Y	Y
5	TRIP & THROTTLE VALVE BODY	Y	Y
6	GOVERNOR VALVE LEVER PIVOT SUPPORT	X	Z
7	ELECTRICAL JUNCTION BOX	X	Z
8	OIL FILTERS	X	Z
9	EGR ACTUATOR	X	Y
10	GOVERNOR END BEARING CAP	X	Y
11	EGM PANEL	X	Y
12	COUPLING END BEARING CAP	X	Y
13	OIL COOLER	Y	Z
14	CENTER OF BASE PLATE	Z	Z

✱ NOTE: DURING RESONANCE SEARCHES, ALL ACCELEROMETERS IN LINE WITH DIRECTION OF EXCITATION.

X AXIS: PARALLEL TO TURBINE SHAFT - HORIZONTAL

Z AXIS: PERPENDICULAR TO TURBINE SHAFT - HORIZONTAL

Y AXIS: VERTICAL

wf

SPECIFICATION: CNS-12[illegible].05-00-0005
Addendum No. 7
October 29, 1982

DUKE POWER COMPANY
Catawba Nuclear Station
Units 1 & 2

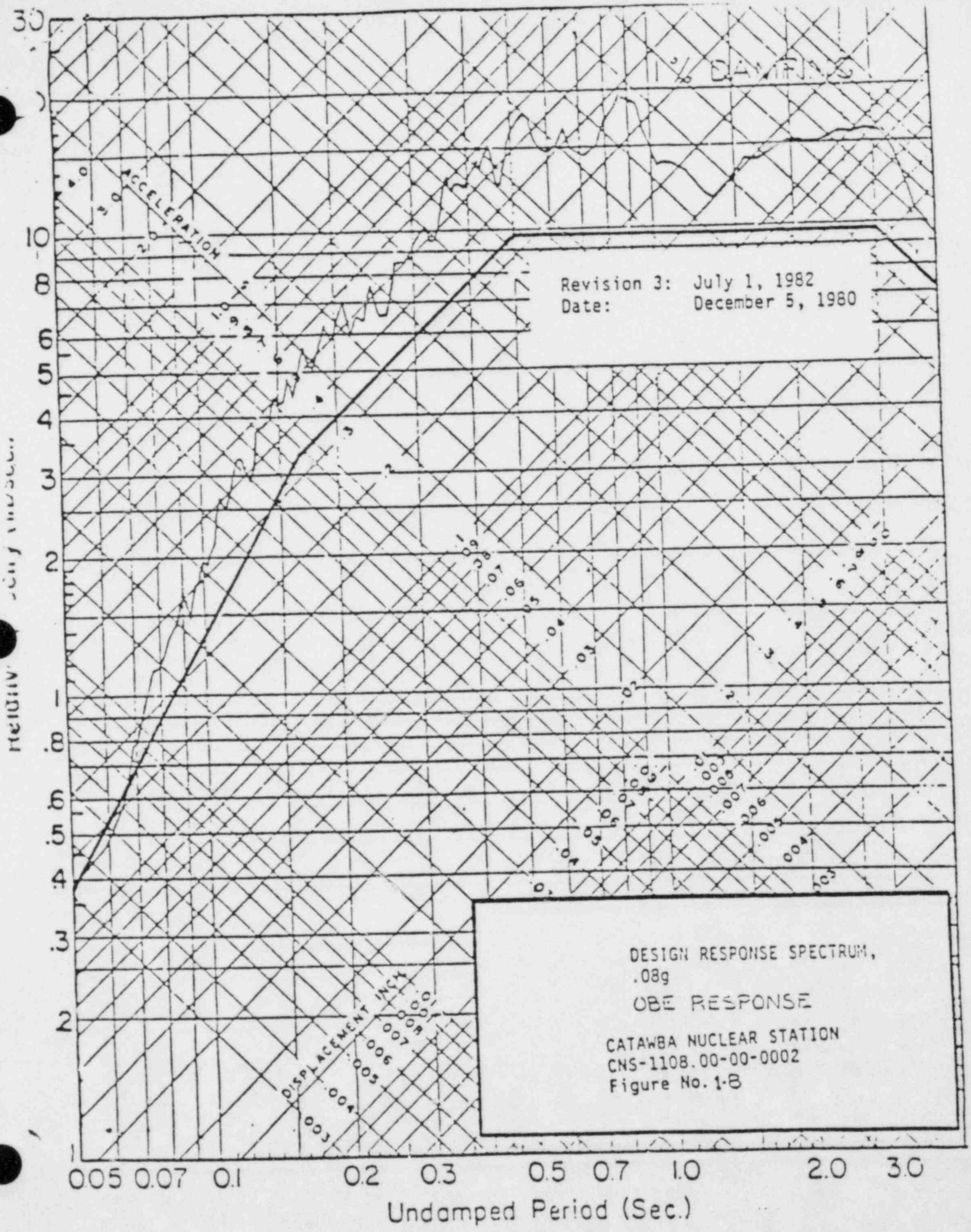
Auxiliary Feedwater Pump Turbines
Addendum #7

1. Turbine control panels shall be located in an area subject to the following environments:

   Normal ambient temperature: 120F
   Normal relative humidity: 20-90%
   Maximum ambient temperature (DBE): 145F @ 100% RH (single occurence, duration of 3½ days)
   Water spray: 1 occurence, duration of 30 minutes (sprinkler system), water at ambient temperature
   Radiation dosage: 400 rads (total integrated dosage over 40 years).

2. The manufacturer shall consider the above environments for purposes of IEEE 323 aging and operability qualifitation tests.

3. The attached response spectrum, Figure 1-B, shall be used for IEEE 344 seismic testing of the control panels and associated devices (panel-mounted). The solid line represents the required response for the OBE test in two orthogonal horizontal directions. Vertical accelerations shall be taken as 2/3 of the horizontal values. SSE response accelerations are to be obtained by multiplying the OBE values by 15/8.



ACCELERATION
Revision 3: July 1, 1982
Date: December 5, 1980
DISPLACEMENT INCH
DESIGN RESPONSE SPECTRUM,
.08g
OBE RESPONSE
CATAWBA NUCLEAR STATION
CNS-1108.00-00-0002
Figure No. 1-8
0.05 0.07 0.1 0.2 0.3 0.5 0.7 1.0 2.0 3.0
Undamped Period (Sec.)

DUKE POWER COMPANY
SEISMIC DESIGN REQUIREMENTS
CATAWBA 1 & 2
AUXILIARY FEEDWATER
PUMP TURBINE

1.0 Seismic Design Manual

The turbine and all auxiliary equipment supplied under this specification shall be qualified to meet the seismic design requirements of this specification in accordance with the procedures and guidelines of the Duke Power Company Seismic Design Manual. The Manual is intended to be utilized only as a reference to this section and not to be used alone. The sections of the Manual pertaining to particular portions of this specification are noted below. However, these sections should not be used directly without the background information provided in the remainder of the Manual.

2.0 Operating Conditions

2.1 Modes of Operation

Two modes of operation shall be considered (Manual Section 4.1.3). The upset mode includes the effects of the Operational Basis Earthquake (OBE), and the faulted mode includes the effects of the Safe Shutdown Earthquake (SSE). The seismic loads shall be considered in combination with all other concurrent loadings on the turbine (Manual Section 4.1.3). The criteria for these loads are specified below.

2.2 Seismic Input Criteria

For the SSE, a Seismic Load Factor (SLF) of 0.8g shall be applied in each of two orthogonal horizontal directions in combination with an SLF of 0.5g in the vertical direction, all acting simultaneously (Manual Section 4.1.1.1). The SLF values for the OBE shall be taken as 8/15 of the respective values for the SSE.

2.3 Concurrent Loading Conditions

Other concurrent loadings to be considered are described in Manuan Section 4.1.3. Any additional considerations are specified below.

2.3.1 Nozzle Loads

The following represent the maximum design loads due to the attached piping on the turbine. These shall be applied at each nozzle location acting simultaneously. The values given represent the component of the load to be applied in each of three orthogonal directions.

(moments)	$M = \pm 4000$ Dt (ft-lbs)	
(forces)	$F = \pm 1600$ Dt (lbs)	
where	D = nozzle pipe outside diameter (in) t = nozzle thickness (in)	

These values represent the nozzle loads for the OBE conditions. For the corresponding SSE levels, multiply these by 1.5.

3.0 Seismic Qualification

3.1 Procedure

One of the following procedures may be utilized for the seismic qualification:

3.1.1 Equivalent Static Analysis

An analysis shall be performed in accordance with Manual Section 4.2. The results shall be demonstrated to fulfill the acceptance criteria of Manual Section 6.0.

3.1.2 Testing

A testing program shall be performed in accordance with Manual Section 5.0. Test procedures 5.2.1 to 5.2.8 shall be performed. It is to be noted that a preliminary report shall be submitted prior to any test (Manual Section 5.0).

3.1.3 Combined Testing and Analysis

A testing program may be selected to satisfy only a portion of the seismic requirements. The remainder of the equipment shall be qualified by analysis. Complete documen-

tation shall be presented demonstrating the correlation between the analysis and the test results (Manual Section 5.0).

3.2 Orientation

The equipment shall be considered in the worst possible orientation (highest stress/deformation level in each pump component) with respect to the total combined loading condition.

3.3 Interaction and Support Conditions

The foundation loads due to the combined concurrent loading conditions shall be presented and shown to be acceptable. Complete design information, due to the effects of all components being supplied, is required for the attachment to a common foundation plate supporting both the pump and the turbine. Bolting loads, sizes and materials shall be provided by the turbine supplier for this purpose. If applicable, anchorage data shall also be provided for all other components forming the interface with Duke's facilities. Weights and centers of gravity of all components shall also be included. The shaft coupling to the pump shaft shall be analyzed and any interaction effects, such as coupling rotations and displacements, shall be presented and shown to be acceptable.

3.4 Nozzles

The adequacy of the pipe nozzle attachments themselves, as well as the remainder of the equipment, due to the nozzle loadings shall be demonstrated.

3.5 Rigidity

All components shall be designed such that there are no natural frequencies less than 33Hz. This shall be demonstrated either via testing (Manual Section 5.2.4, Exploratory Scanning Test) or by analysis (Manual Section 4.2.1.2).

3.6 Internal Components/Auxiliary Equipment

The effects of the combined loading conditions on all internal components shall be analyzed by the above methods. Each shall be shown to meet the applicable acceptance criteria, indicating, in particular, that no stress or deformation levels in any component, such as shaft bearings, valves, linkages, turbine wheels, will impair the overall functional capability of the turbine and thus the entire pump assembly.

Auxiliary electrical equipment essential to turbine operation shall be qualified independently to ensure there is no loss of contact. The correlation of these results with the remainder of the equipment qualifications shall be presented.

3.7 Shaft Deflections

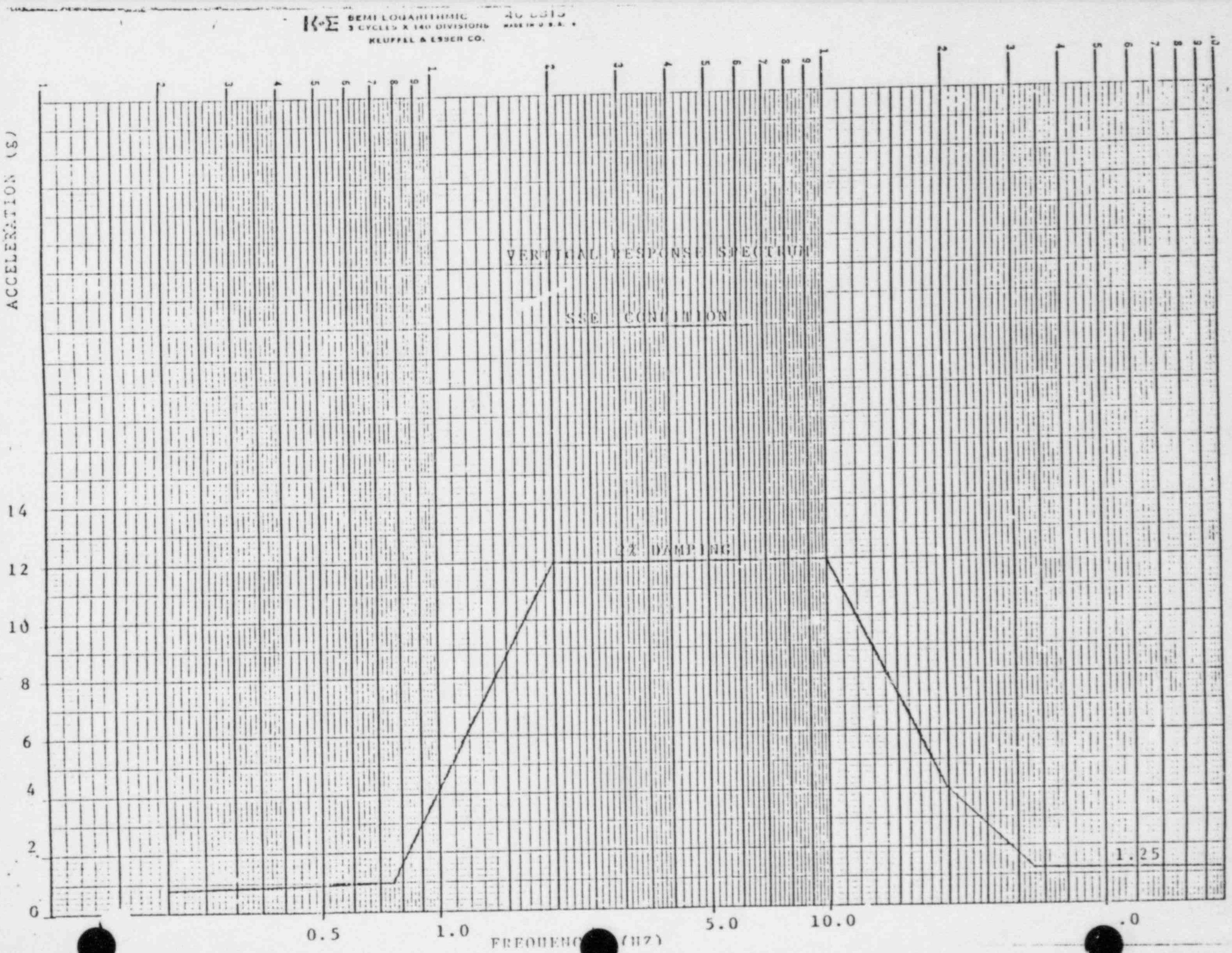
The turbine shaft shall be statically qualified to demonstrate that deflections under an SSE loading of 0.8 g horizontally and 0.5 g vertically, in addition to all other operating conditions, shall be less than available clearances. This can be done either by an equivalent static analysis (Manual Section 4.1) or by a static deflection test (Manual Section 5.2.9). It shall be demonstrated that no operational interference occurs during or after the seismic disturbance.

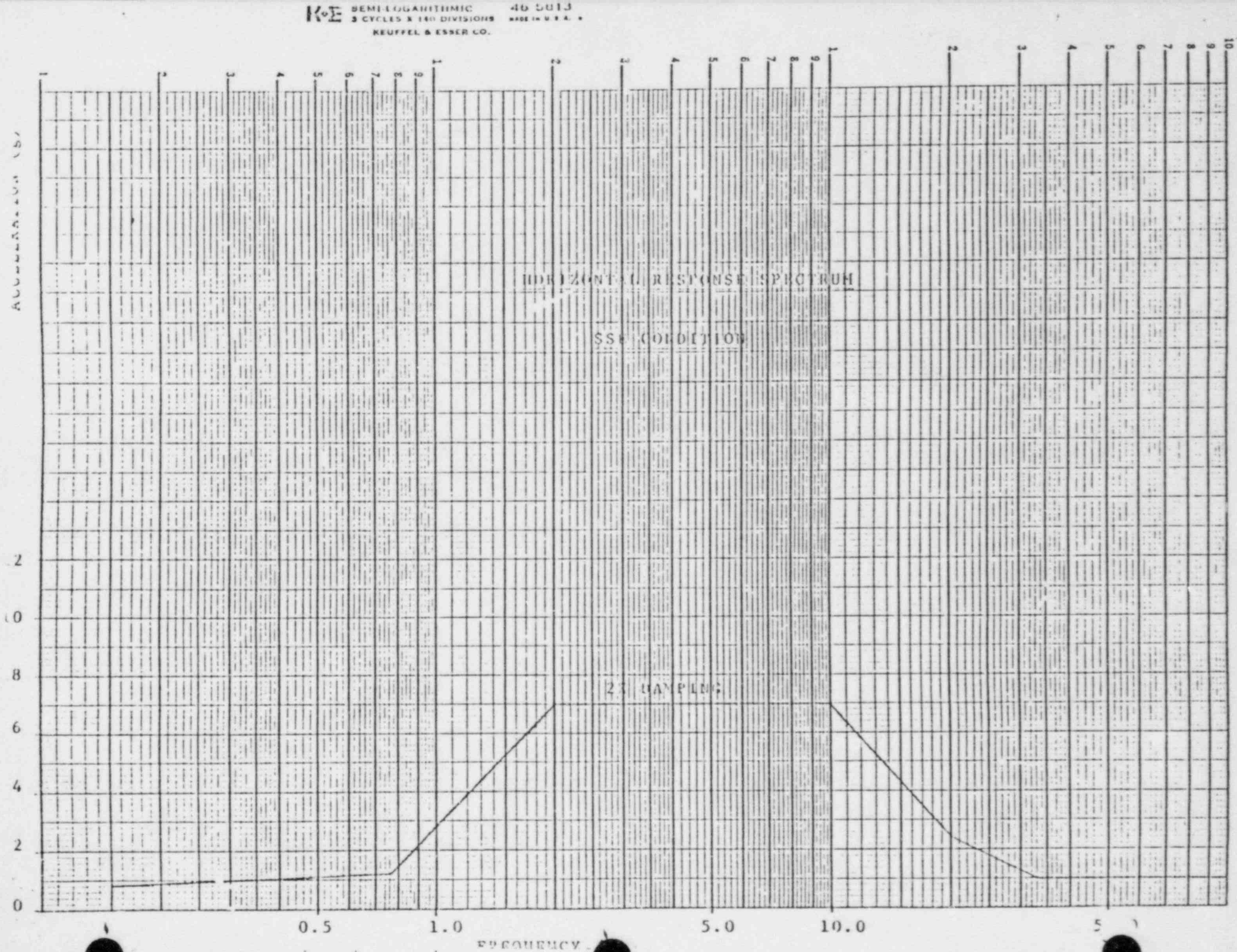
4.0 General Considerations

4.1 In addition to these seismic criteria, requirements equivalent to ASME III for Class 3 pumps shall be met for the turbine assembly.

5.0 Reporting Requirements

A fully documented report on the seismic qualification shall be submitted in accordance with Sections 7.0 and 8.0 of the Seismic Design Manual. This report must be approved by Duke Power Company prior to shipment of any items of equipment.


K·E SEMI-LOGARITHMIC 3 CYCLES X 140 DIVISIONS
KEUFFEL & ESSER CO.
46 5513
MADE IN U.S.A.
ACCELERATION (g)
VERTICAL RESPONSE SPECTRUM
SSE CONDITION
2% DAMPING
14
12
10
8
6
4
2
0
1.25
0.5
1.0
5.0
10.0
FREQUENCY (HZ)


K+E SEMI-LOGARITHMIC 46 5013
3 CYCLES X 140 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.
HORIZONTAL RESPONSE SPECTRUM
SSE CONDITION
2% DAMPING
0
2
4
6
8
10
12
0.5
1.0
5.0
10.0

SPECIFIC ITEM #10 4" STAINLESS STEEL GATE VALVE

PART 1: Confirm that hanger on operator will be permanent. If hangers are not permanent, confirm the acceptability of the acceleration levels of the operator.

STATUS: This item has been resolved.

RESOLUTION SUMMARY: The hangers are not permanent. The accelerations have been verified to be acceptable.

PART 2: Address the concern of the small amount of clearance between the operator and a nearby pipe.

STATUS: This item has been resolved.

RESOLUTION SUMMARY: The valve operator was rotated to eliminate potential interference.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba Nuclear Station   TYPE:

1. Utility: Duke Power Co.   PWR: √

2. NSSS: Westinghouse   BWR: ____

3. A/E: Duke Power Company   Other ____

II. Component Name: Centrifugal Charging Pump to Cold Leg discharge Isolation

1. Scope: [ ] NSSS   [√] BOP   [ ] Other

2. Model Number: 70460-1   Quantity: 9

3. Size or Range: 4" 1500 lb Stainless Steel Emo Gate Valve

4. Vendor: Borg-Warner Corporation

5. If the component is a cabinet or panel, name and model Number of the devices included: ____

6. Physical Description:

   a. Appearance: 4" SS Emo Gate Valve

   b. Dimensions: L = 16" H = 50" W = 37"

   c. Weight: 647 lbs

7. Location: Building: Auxiliary Building

   Elevation: 570 Col. JJ-KK 51-52

8. Field Mounting Conditions   [ ] Bolt (No. ____,) Size ____)
   [ ] Weld (Length ____)
   [√] Welded in pipe

9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

   Pipe mounted

10. a. System is which located: Safety Injection

    b. Functional Description: Isolates CCP from cold legs

    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

    [ ] Both   [ ] Neither   [√] Other Emergency Core Cooling

11. Pertinent Reference/Design Specifications for Qualification Requirements: CNS-1205.00-00-0005

(a.) Seismic Input

b. Hydrodynamic Load Input

c. Fatigue Considerations

(d.) Service Conditions

(e.) Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[√] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [√] Analysis [ ] Combination of Test and Analysis

*** Qualification Report*: NSR 70460-1 Design Report of 4"

(No., Title and Date): 1500 lb SS Gate Valve W/Emo 2/7/84

Company that Prepared Report: Borg-Warner Corp/Anamet Laboratories

Company that Reviewed Report: Duke Power Company

Where Report is filed or available: Manufacturer's Drawing File

Applicable Codes And/Or Standards: ASME Section III, 1971 Edition through Summer 1973 addenda

V. Vibration Input:

1. Loads considered:
   a. [√] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [√] SRSS [ ] ____________ (other, specify)

3. Required Response Spectra** (attach the graphs): See V-5

NOTE:
* If more than one report complete items IV thru VII for each report.
** If other than RRS is used, describe method.
*** Static deflection test is part of design report.

4. Damping Corresponding to RRS: OBE ________ SSE ______________

5. Required Acceleration in Each Direct:

[ ] ZPA [√] Other Seismic Load Factor
(specify)

Plant Specific Values	OBE S/S = .356 g	F/B = .24 g	V = .108 g
	SSE S/S = .668 G	F/B = .45 g	V = .203 g

6. Were fatigue effects considered:

[ ] Yes [√] No

If yes, describe how they were treated in overall qualification program: ______________________________

____

____

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [ ] Multi-Frequency [ ] random
[ ] sine beat
[ ] ____________

2. [ ] Single Axis [ ] Multi-Frequency
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ____________ SSE ____________ Other ______________________
(specify)

4. Frequency Range: ______________________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ___________ F/B = _________________ V = _____________

6. Method of Determining Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)

[ ] No

8. Maximum Input g Level Test:

OBE S/S = ____________ F/B = ________________ V = ______________

SSE S/S = ____________ F/B = ________________ V = ______________

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ___________

B. Orientation and Fixturing: ___________________________________

10. Functional Operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: _______________________

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (If appropriate ______________________________________)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [√] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ____________ F/B = ___________ V = Lowest f_n = 74 Hz (yoke)*

3. Model Type: [ ] 3D [ ] 2D [√] 1D

[ ] Finite Element [√] Beam

* See Frequency Report for natural frequency used in piping analysis.

[ ] Closed Form Solution [ ] Other ________

3a. Input g load used in analysis:

OBE S/S = $\frac{8}{15}$ (3)   F/B = $\frac{8}{15}$ (3)   V = $\frac{8}{15}$ (2)

SSE S/S = 3   F/B = 3   V = 2

4. [ ] Computer Codes: ______________________

Frequency Range and No. of modes

[√] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum   [√] SRSS   [ ] Other: __________ (specify)

6. Damping: N/A

OBE ______ SSE ______ Basis for the damping used: __________

7. Support Considerations in the model: Valve ends

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Valve Body	Combination	1.78	30.62	49.8 (ksi)
Yoke	of normal pipe		25.63	32.4
Yoke Clamp	and seismic		13.22	21.6
Body to Bonnet			11.83	24.9

B.

Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
Δ = .009 in Δ = .004 in	yoke	Assurance of operability done by test.

9. Failure Modes: ______________________

10. Margins Available: [√] Input Spectrum [ ] Stress or Deflection

See VIII - 3a.

IV. Equipment Qualification Method:

[ ] Test [√] Analysis [ ] Combination of Test and Analysis

Qualification Report*: Frequency Analysis for Item 9J-202

(No., Title and Date): EDJ Letter No 0930220-253 10/27/78

Company that Prepared Report: EDS Nuclear

Company that Reviewed Report: Duke Power Company

Where Report is filed or available: Duke drawing file: CNM-1205.00-574

Applicable Codes And/Or Standards: ASME Section III, 1971 Edition through Summer 1973 Addenda

V. Vibration Input:

1. Loads considered:
   a. [√] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [ ] ______ (other, specify)

3. Required Response Spectra** (attach the graphs): ______

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE ______ SSE ______

5. Required Acceleration in Each Direct:

   [ ] ZPA [ ] Other ______ (specify)

   OBE S/S = ______ F/B = ______ V = ______

   SSE S/S = ______ F/B = ______ V = ______

6. Were fatigue effects considered:

[ ] Yes [ ] No

If yes, describe how they were treated in overall qualification program: ______________________________

____

____

VI. <u>If Qualification by Test, then Complete</u>:

1. [ ] Single Frequency [ ] Multi-Frequency [ ] random
[ ] sine beat
[ ] ____________

2. [ ] Single Axis [ ] Multi-Frequency
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ____________ SSE ____________ Other ____________ (specify)

4. Frequency Range: ______________________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = __________ F/B = ______________ V = ____________

6. Method of Determining Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)

[ ] No

8. Maximum Input g Level Test:

OBE S/S = ____________ F/B = ______________ V = ____________

SSE S/S = ____________ F/B = ______________ V = ____________

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ____________

B. Orientation and Fixturing: ______________________

10. Functional Operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ______________________

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (If appropriate ______________________)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[√] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = See below* F/B = ____________ V = ____________

3. Model Type: [√] 3D [ ] 2D [ ] 1D

[√] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ________

* Combined natural frequency 32.2 Hz. This frequency is used for piping analysis.

4. [√] Computer Codes: ______________________

Frequency Range and No. of modes 1 to 75 Hz 3 modes

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: ____________ (specify)

6. Damping:

OBE _______ SSE ______ Basis for the damping used: ____________

7. Support Considerations in the model: ______________________________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: ______________________________________

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

SPECIFIC ITEM #11   FEEDWATER ISOLATION VALVE

The effects of dynamic loading due to sudden closure of isolation valves are to be addressed with relation to valve operability and structural integrity.

STATUS: This item has been resolved.

RESOLUTION SUMMARY: Dynamic loads on the valve due to water hammer during closure are not appreciable. Impell Corporation has verified that the valve is qualified for dynamic loading with considerable margin. Documentation has been inserted in the valve seismic report.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba Nuclear Station TYPE:

1. Utility: Duke Power Co. PWR: X

2. NSSS: Westinghouse Corp. BWR: ____

3. A/E: Duke Power/Design Engr Dept Other ____

II. Component Name: Feedwater Isolation Valves

1. Scope: [ ] NSSS [X] BOP [ ] Other

2. Model Number: 74040 Quantity: 4/Unit

3. Size or Range: 18"

4. Vendor: Borg-Warner

5. If the component is a cabinet or panel, name and model Number of the devices included: N/A

6. Physical Description:

a. Appearance: Gate Valve/Operator

b. Dimensions: 39 1/8" x 42" x 8.3'

c. Weight: 5441 lbs

7. Location: Building: Doghouse

Elevation: 577 + 00

8. Field Mounting Conditions [ ] Bolt (No. ____,) Size ___)
[X] Weld (Length ____)
[ ] ____________

9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

Suspended in pipeline

10. a. System is which located: Feedwater (CF)

b. Functional Description: Isolation Valve for Main Feedwater

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

[X] Both [ ] Neither [ ] Other ____

11. Pertinent Reference/Design Specifications for Qualification Requirements: Duke Design Specification CNS-1205.12-1 dated April 15, 1975 including Addendums 1 thru 4.

(a.) Seismic Input

b. Hydrodynamic Load Input

c. Fatigue Considerations

(d.) Service Conditions

(e.) Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [ ] Analysis [X] Combination of Test and Analysis

Qualification Report*: Seismic Report

(No., Title and Date): NSR 74040; Seismic Report for 18" FIV; 8/25/78

Company that Prepared Report: Borg-Warner NVD

Company that Reviewed Report: EDS Nuclear, Inc.

Where Report is filed or available: Duke Power Co. (Ref. CNM-1205.12-8)

Applicable Codes And/Or Standards: ASME Section III, Class 2, 1974 Ed.

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic
   b. [ ] Hydrodynamic only
   c. [X] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [X] SRSS [ ] ____________ (other, specify)

3. Required Response Spectra** (attach the graphs): See Attachment 1.

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 1%,3%,5% SSE 1%,3%,5%

5. Required Acceleration in Each Direct:

   [ ] ZPA [X] Other Seismic Load Factors (SLF)
   (specify)

   *OBE S/S = 1.6g/0.479 F/B = 1.6g/0.969 V = 1.06g/0.265
   (x) (z) (y)

   *SSE S/S = 3g/0.898 F/B = 3g/1.817 V = 2g/0.497
   (x) (z) (y)
   *Qualified Acceleration/Plant Specific Acceleration

6. Were fatigue effects considered:

   [ ] Yes [X] No

   If yes, describe how they were treated in overall qualification program: N/A

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [X] Multi-Frequency [X] random
   [ ] sine beat
   [ ] ______

2. [ ] Single Axis [X] Multi-Frequency
   [X] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

   OBE 5 SSE 5 Other ______
   (specify)

4. Frequency Range: 1-35 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 28 Hz F/B = 28 Hz V = 69 Hz

6. Method of Determining Natural Frequencies

   [X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

   [X] Yes (Attach TRS & RRS graphs) See Attachment 2 for OBE & SSE Runs

   [ ] No

8. Maximum Input g Level Test:

OBE S/S = 1.25g's F/B = 1.25g's V = 1.25g's

SSE S/S = 2.5g's F/B = 2.5g's V = 2.5g's

9. Laboratory Mounting:

A. [X] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ___________

B. Orientation and Fixturing: Valve operator axis vertical & upright

10. Functional Operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Operator performed as required before, during and after seismic event.

12. Other tests performed (such as aging or fragility test, including results):
Design Basis Accident (LOCA)-Operation performed its safety related function (close) during tests.

13. Failure Modes (If appropriate N/A)

14. Margins Available: [X] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [X] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 164.8 (torsional) F/B = ___________ V = 1744.9 (translational)

3. Model Type: [ ] 3D [ ] 2D [X] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ________

4. [X] Computer Codes: N/A

Frequency Range and No. of modes N/A

[X] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[X] Absolute Sum [ ] SRSS [ ] Other: ______________ (specify)

6. Damping: N/A

OBE _______ SSE _____ Basis for the damping used: ___________

7. Support Considerations in the model: Simple support at valve ends

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

(See Attachment 3)

B.

Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

(See Attachment 4)

9. Failure Modes: None

10. Margins Available: [ ] Input Spectrum [X] Stress or Deflection

" Attachment

Nuclear Valve Division

Borg-Warner Corporation
7500 Tyrone Ave., Van Nuys, California 91409

BORG WARNER Energy Equipment

REPORT NO. 1736

PAGE 29

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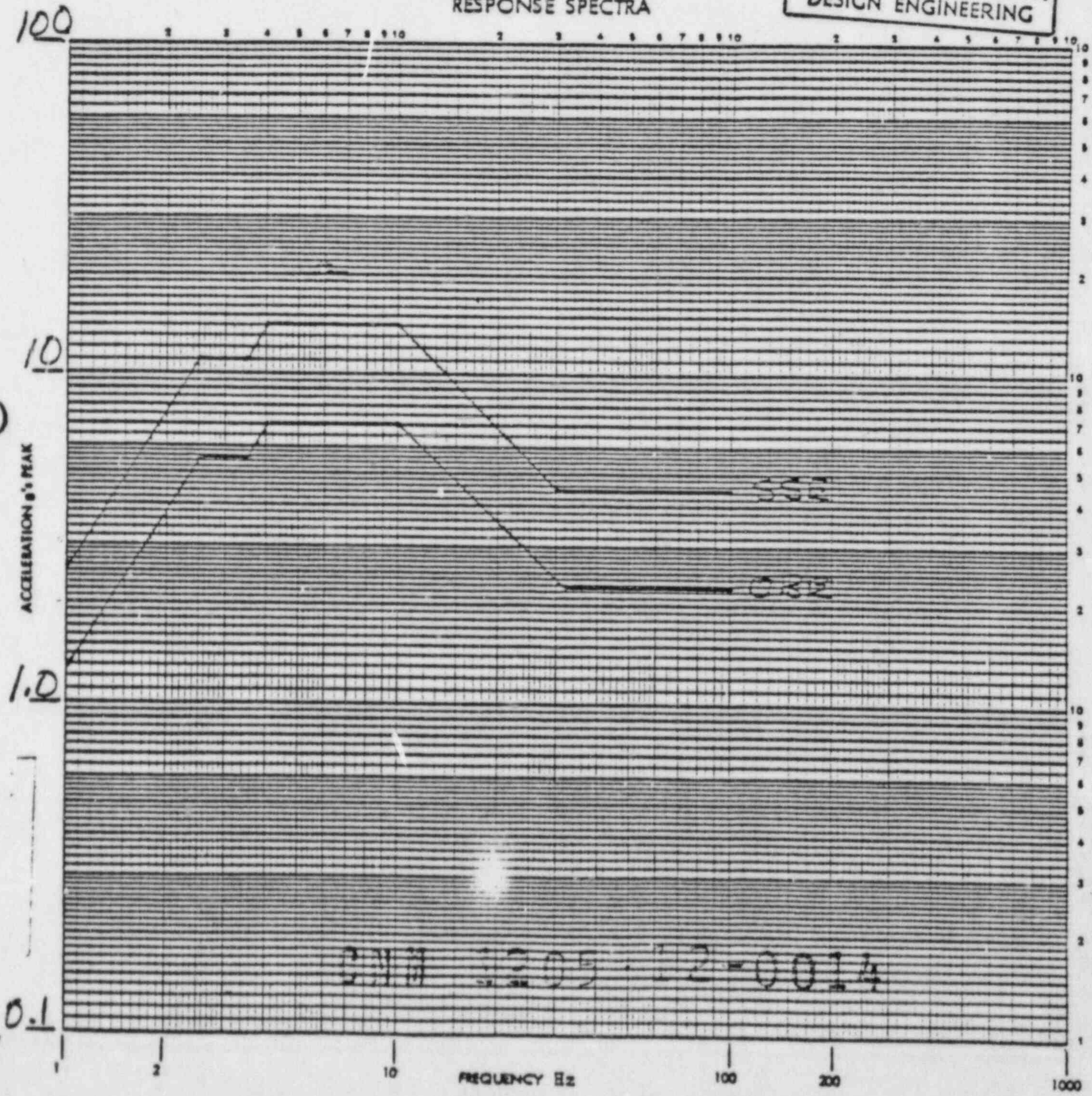
FIGURE 1

HORIZONTAL AND VERTICAL
RESPONSE SPECTRUM
5% Damping

RESPONSE SPECTRA



CNE 8105 12-0014

Attachment 2
1/24

WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 22

Full Scale 100 g Accel. No. ______ Control (✗) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

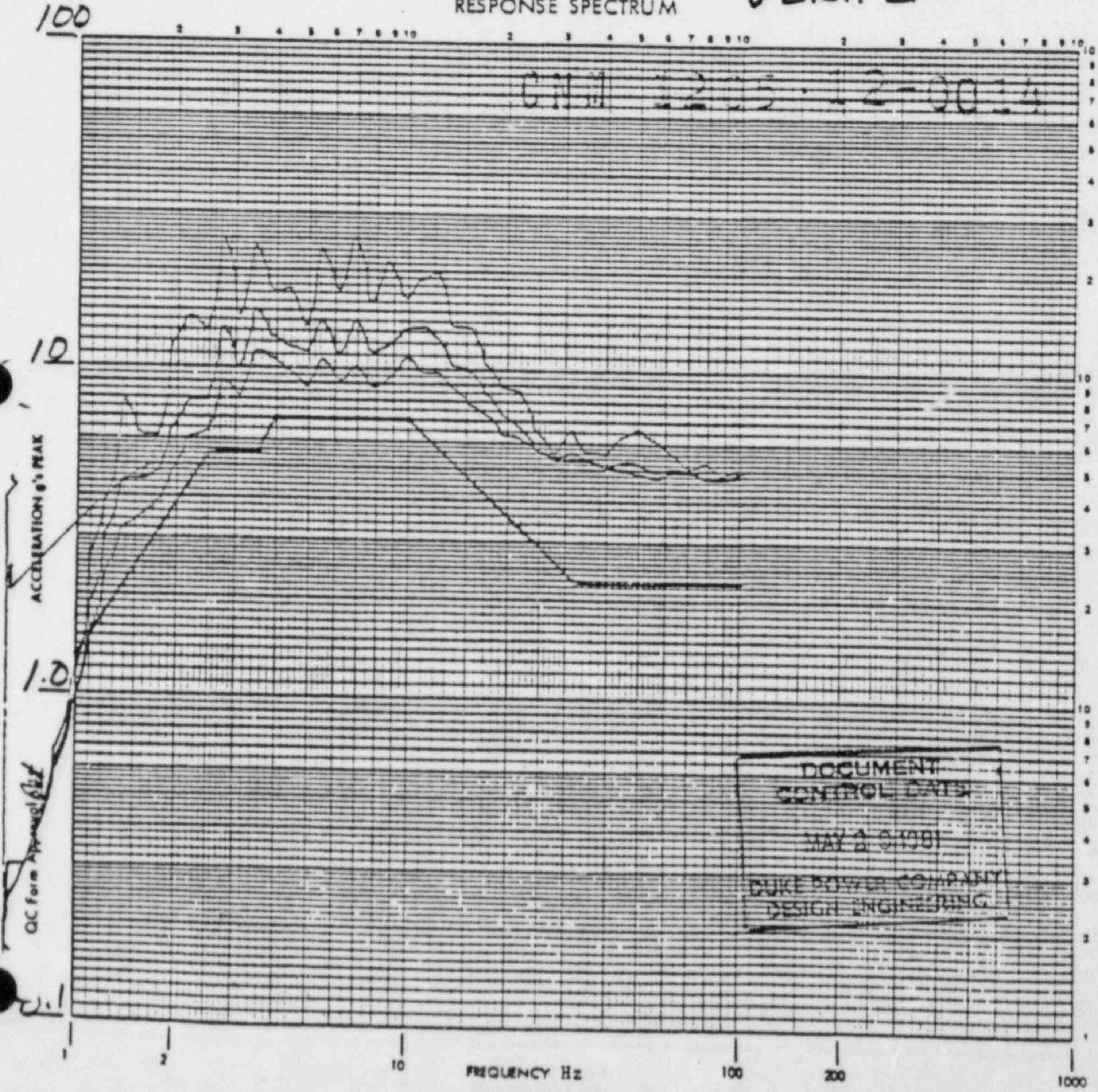
Date 2-1-78 Damping 5 % Axis of Test X:Y ☐ Z:Y ☒

1st OBE

Horiz. ☒

Vert. ☐

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 23

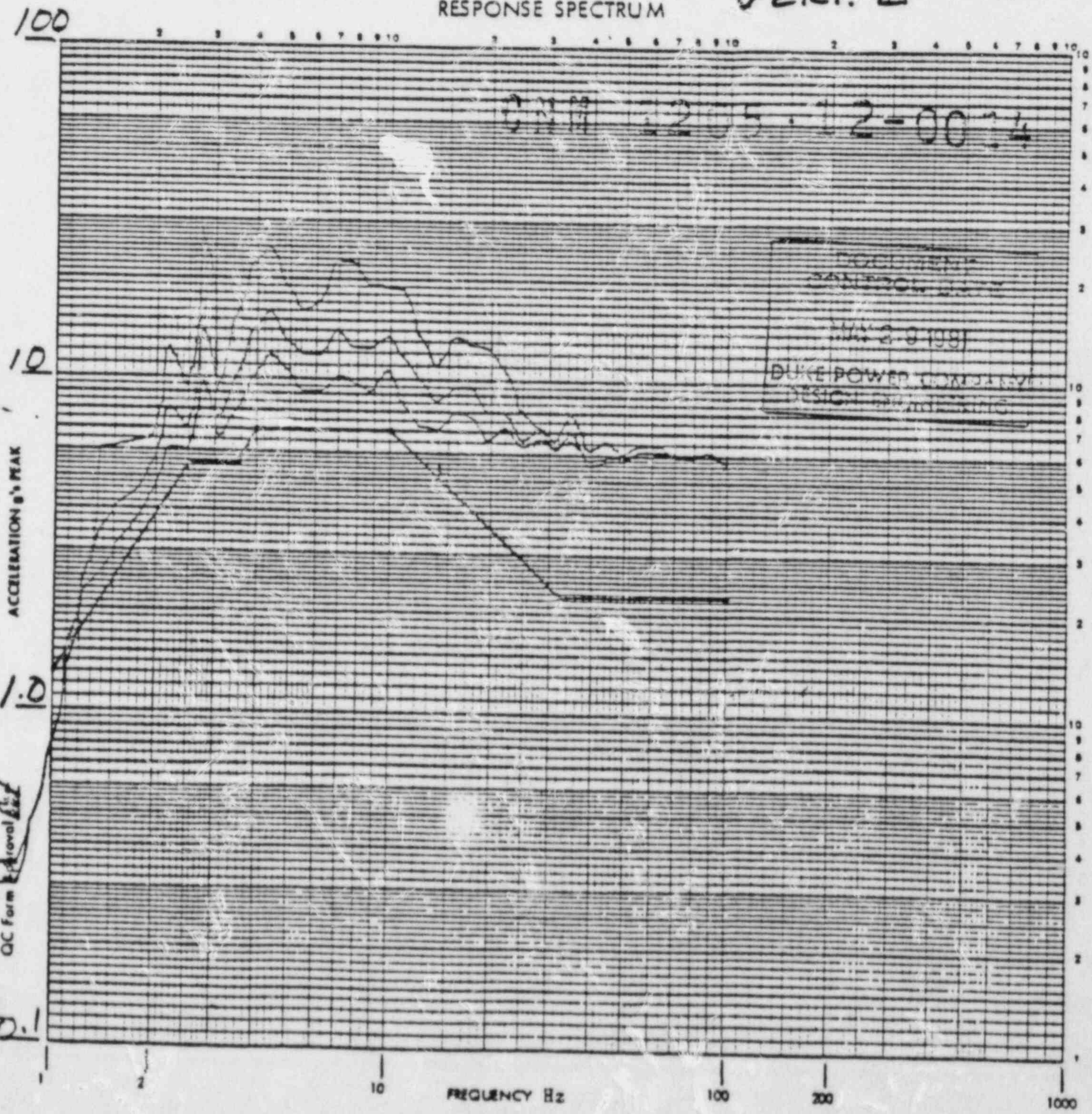
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-11-78 Damping 5 % Axis of Test X-Y ☐ Z-Y ☒

1st OBE HORIZ. ☐ VERT. ☒

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 24

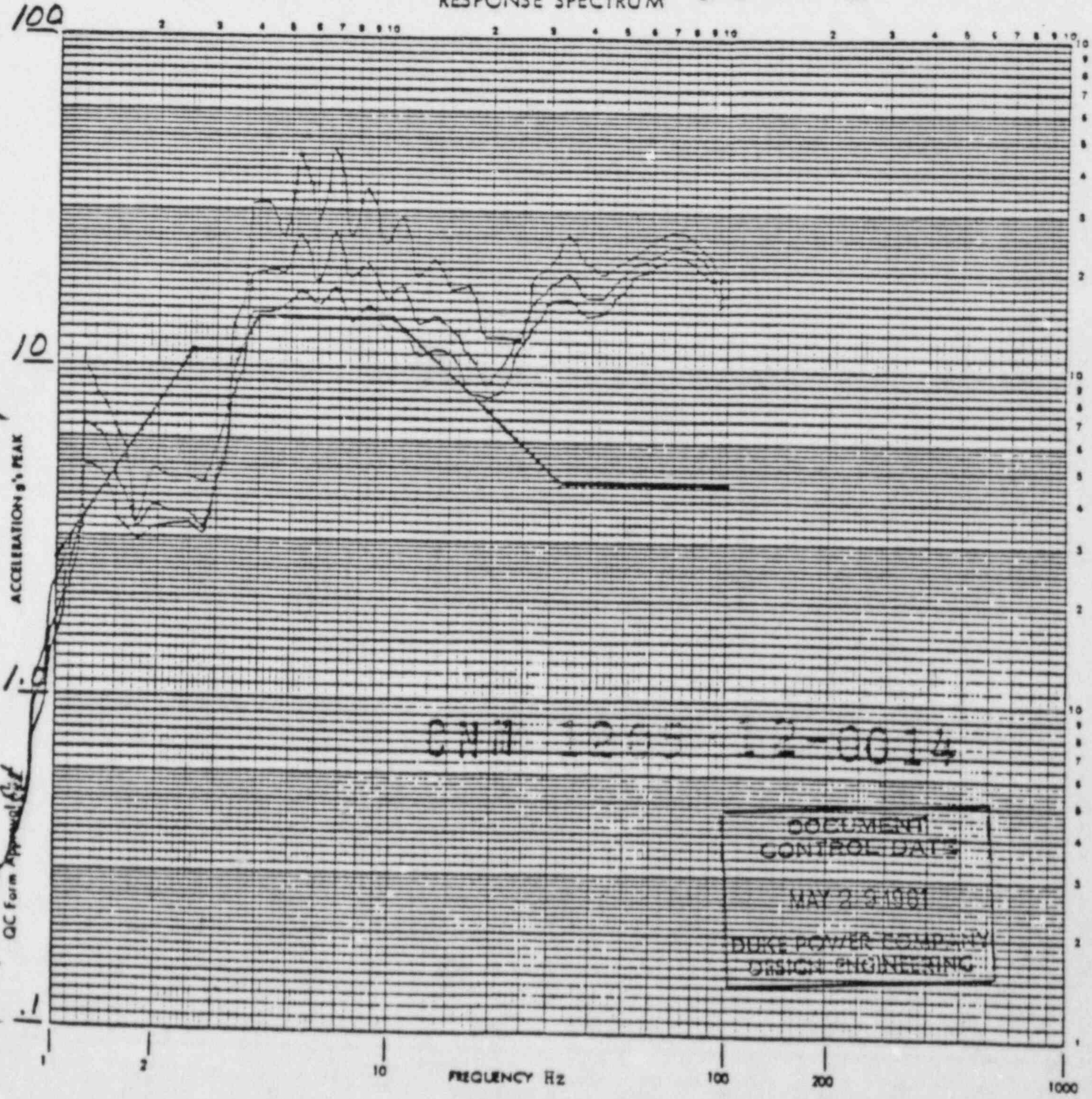
Full Scale 100 g Accel. No. ________ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-14-78 Damping 5 % Axis of Test X-Y ☐ Z-Y ☒

1 SSE 125% HORIZ. ☒ VERT. ☐

RESPONSE SPECTRUM



QC Form Approval

CNM 1205.12-0014

DOCUMENT CONTROL DATE

MAY 29 1981

DUKE POWER COMPANY DESIGN ENGINEERING

4/24

WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 25

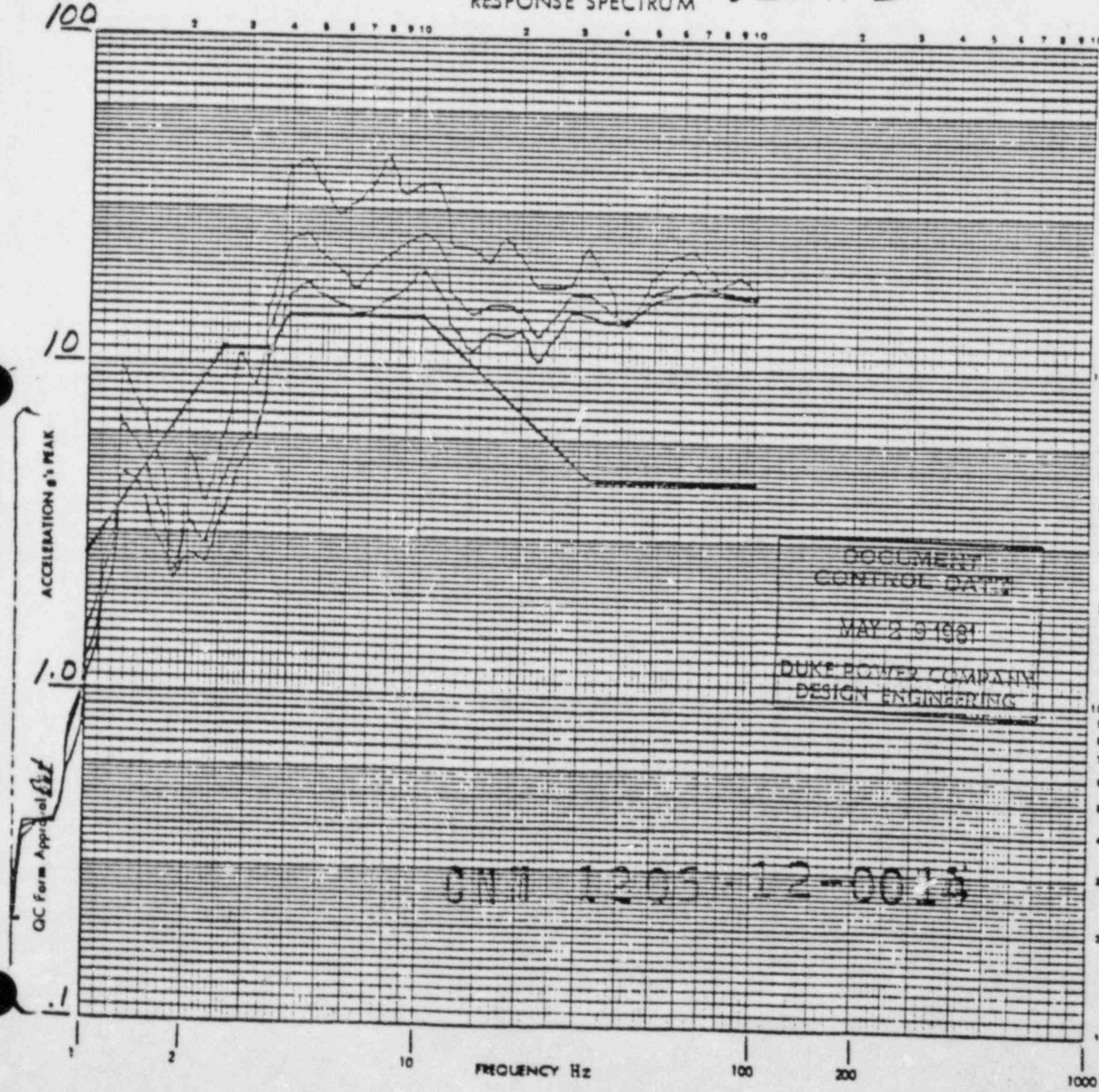
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-1-78 Damping 5 % Axis of Test X-Y ☐ Z-Y ☒

SSE HORIZ. ☐ VERT. ☒

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 26

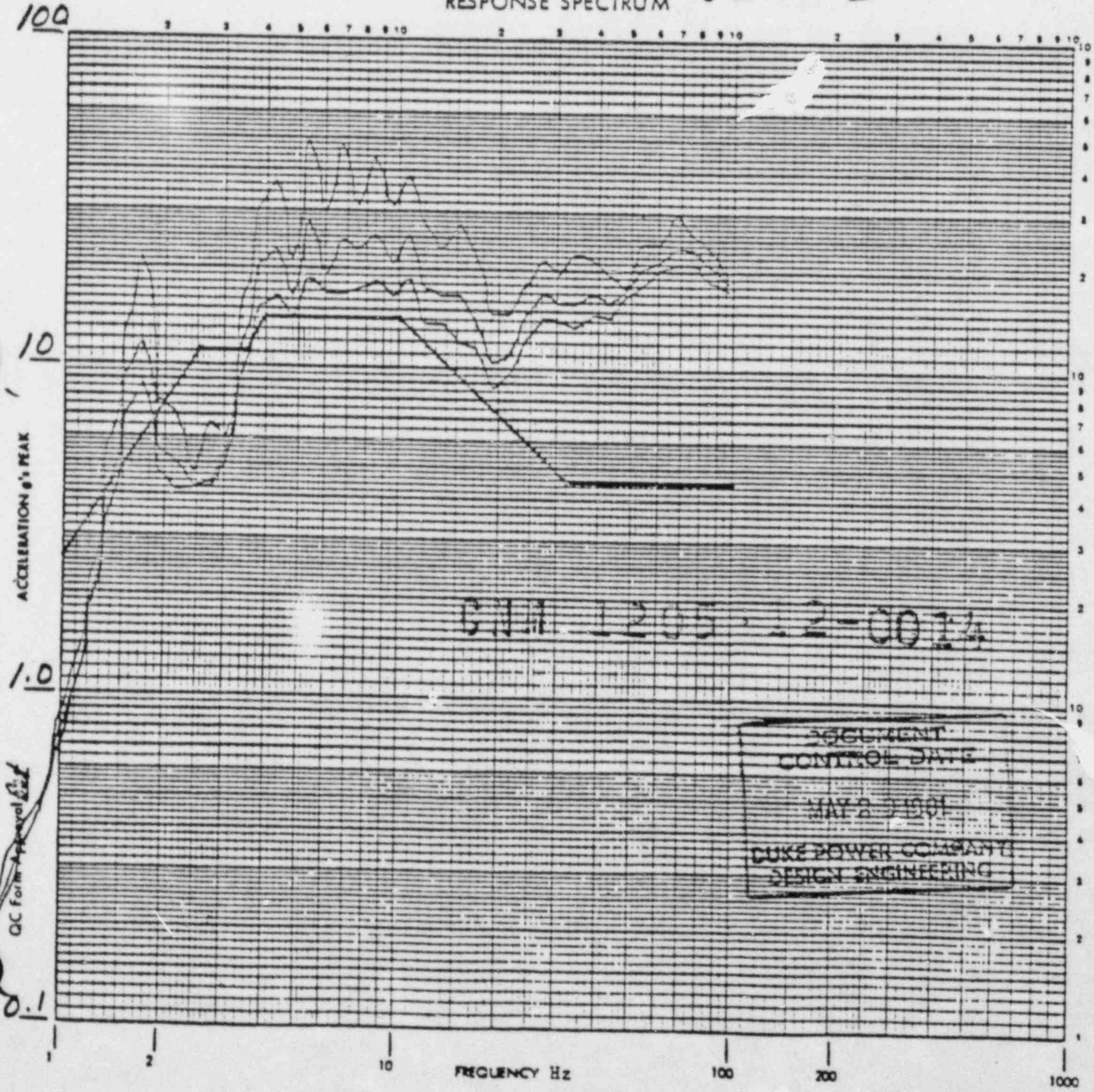
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-14-78 Damping 5 % Axis of Test X-Y ☐ Z-Y ☒

2nd SSE 1.6Hz HORIZ. ☒ VERT. ☐

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 27

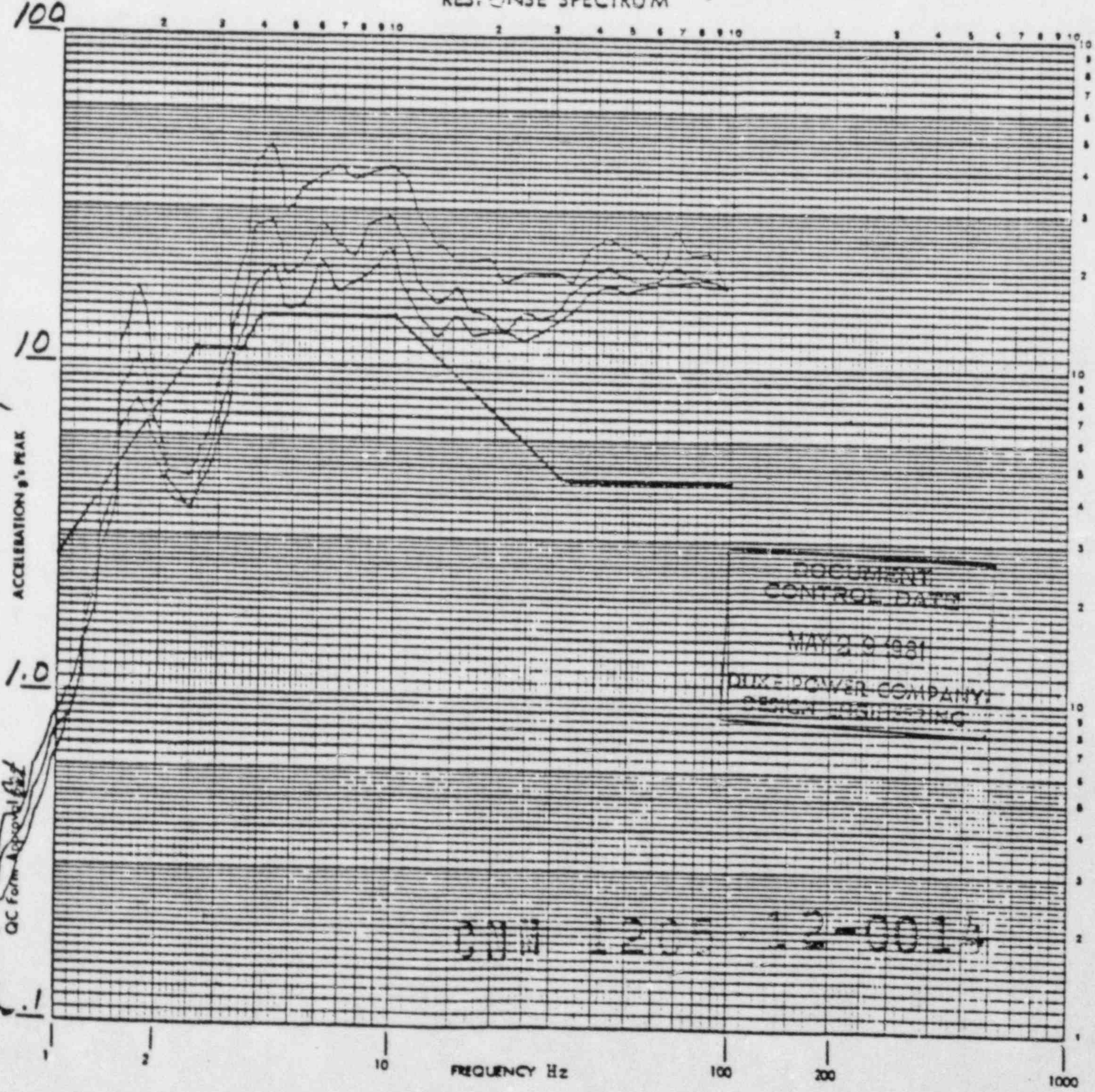
Full Scale 100 g Accel. No. ________ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-16-78 Damping 5 % Axis of Test X-Y ☐ Z-Y ☒

2nd SSE HORIZ. ☐ VERT. ☒

RESPONSE SPECTRUM



DOCUMENT CONTROL DATE MAY 29 1981 DUKE POWER COMPANY DESIGN ENGINEERING

CDM 1205 12-0015

7124

WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 28

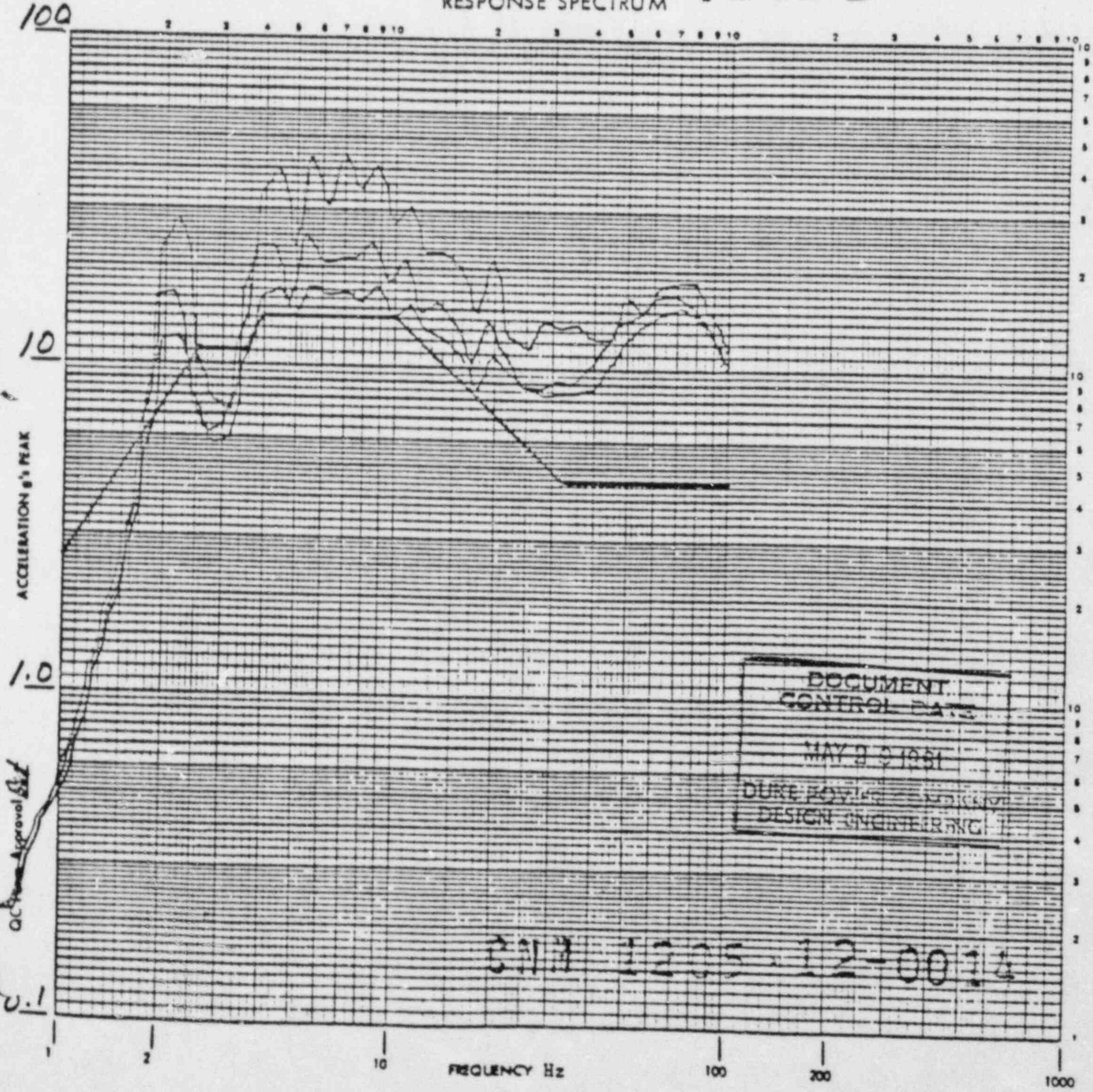
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-11-78 Damping 5 % Axis of Test X-Y ☐ Z-Y ☒

3a SSE 20 HORIZ. ☒ VERT. ☐

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 29

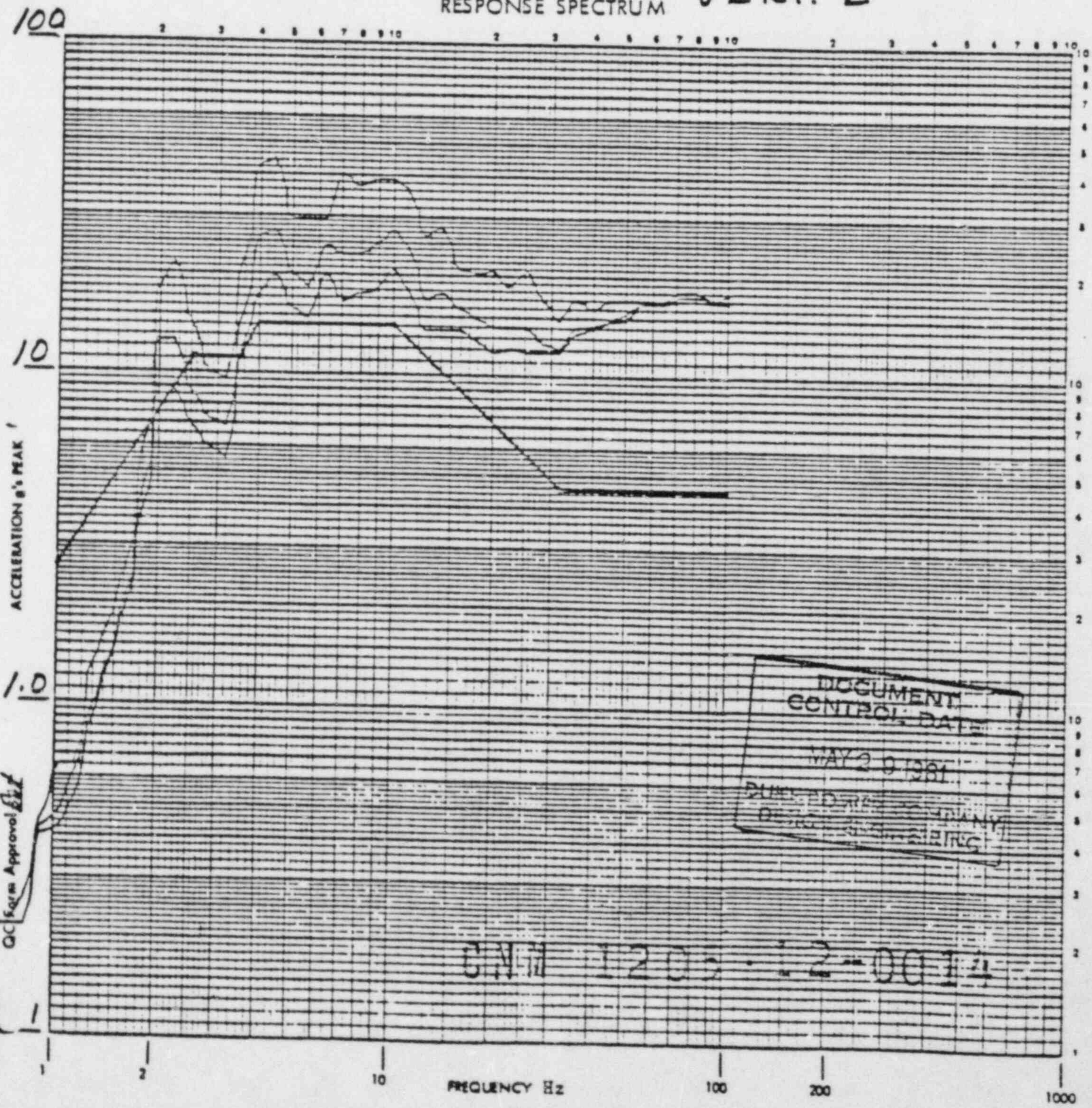
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-11-78 Damping 5 % Axis of Test X-Y ☐ Z-J ☒

3rd SSE 2.0 HORIZ. ☐ VERT. ☒

RESPONSE SPECTRUM



DOCUMENT CONTROL DATE MAY 2 9 1981 DUKE POWER COMPANY DESIGN ENGINEERING

CNM 1205.12-0014

9/24

WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 30

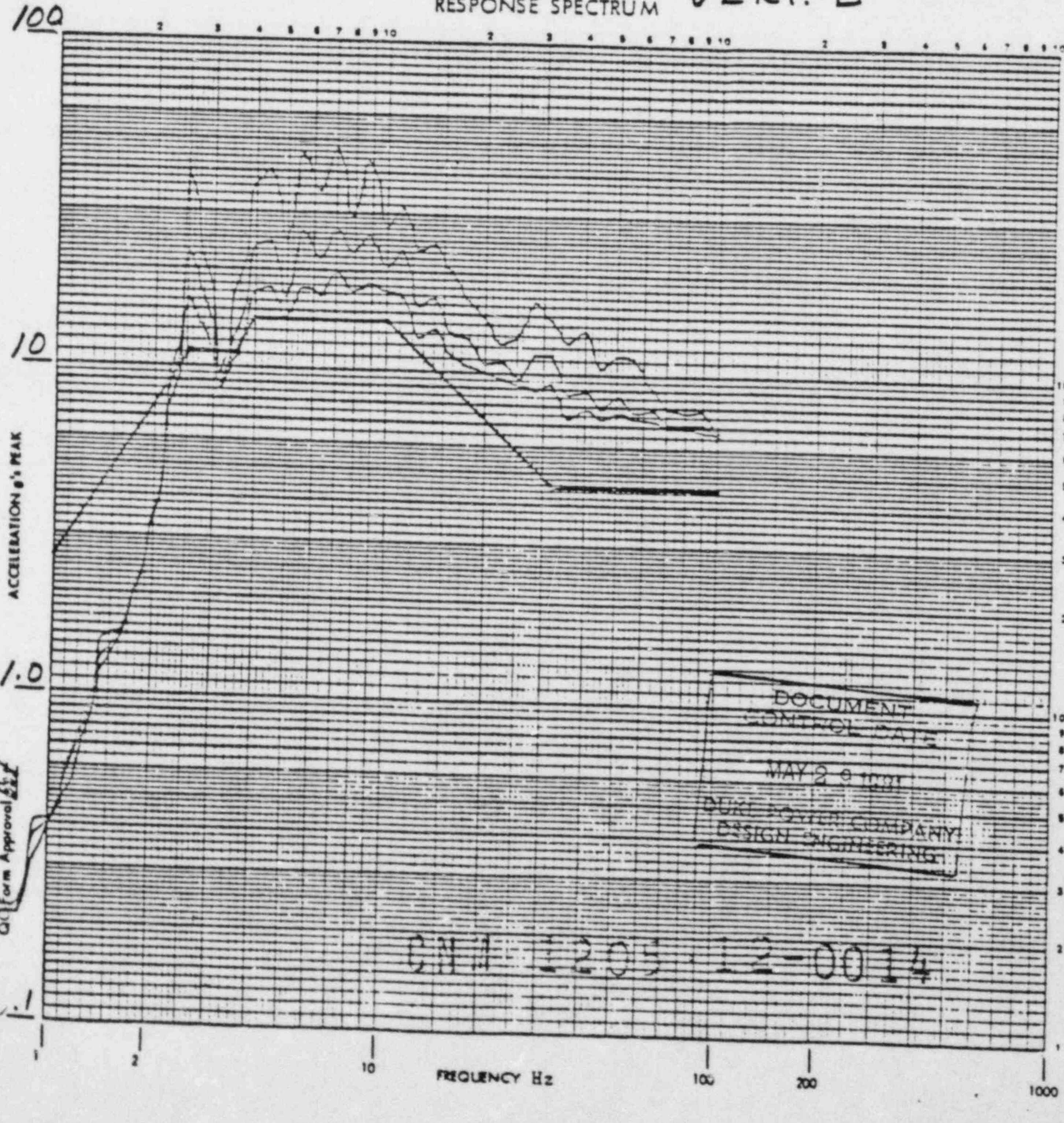
Full Scale 100 g Accel. No. ________ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-1-78 Damping 5 % Axis of Test X-Y ☐ Z-Y ☒

4th SSE 2.5Hz HORIZ. ☒ VERT. ☐

RESPONSE SPECTRUM



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DOCUMENT CONTROL DATE MAY 2 0 1981 DUKE POWER COMPANY DESIGN ENGINEERING

CN-1205.12-0014

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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 31

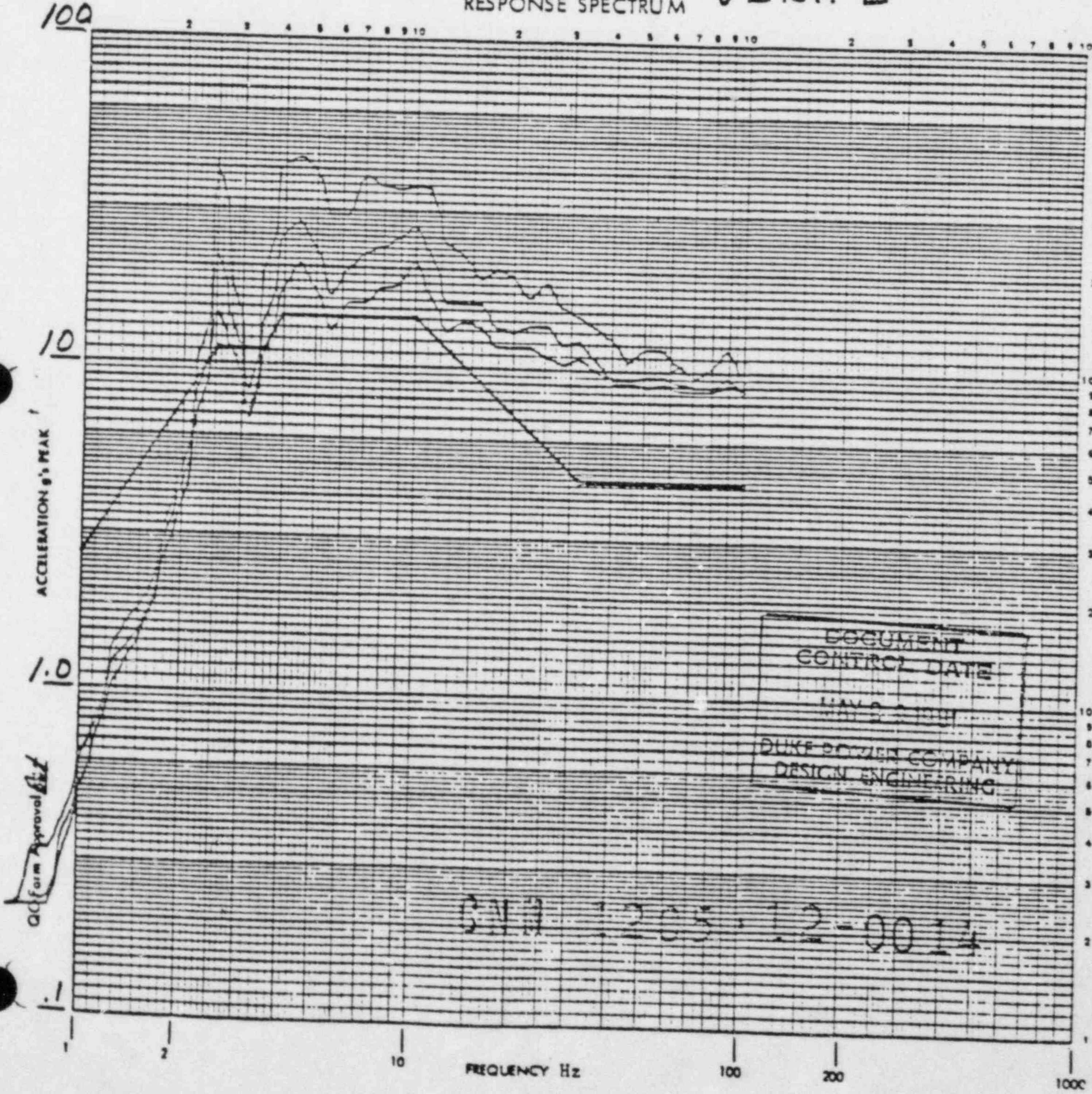
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-1-78 Damping 5 % Axis of Test X-Y ☐ Z-J ☒

4TH SSE 2.5Hz HORIZ. ☐ VERT. ☒

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 32

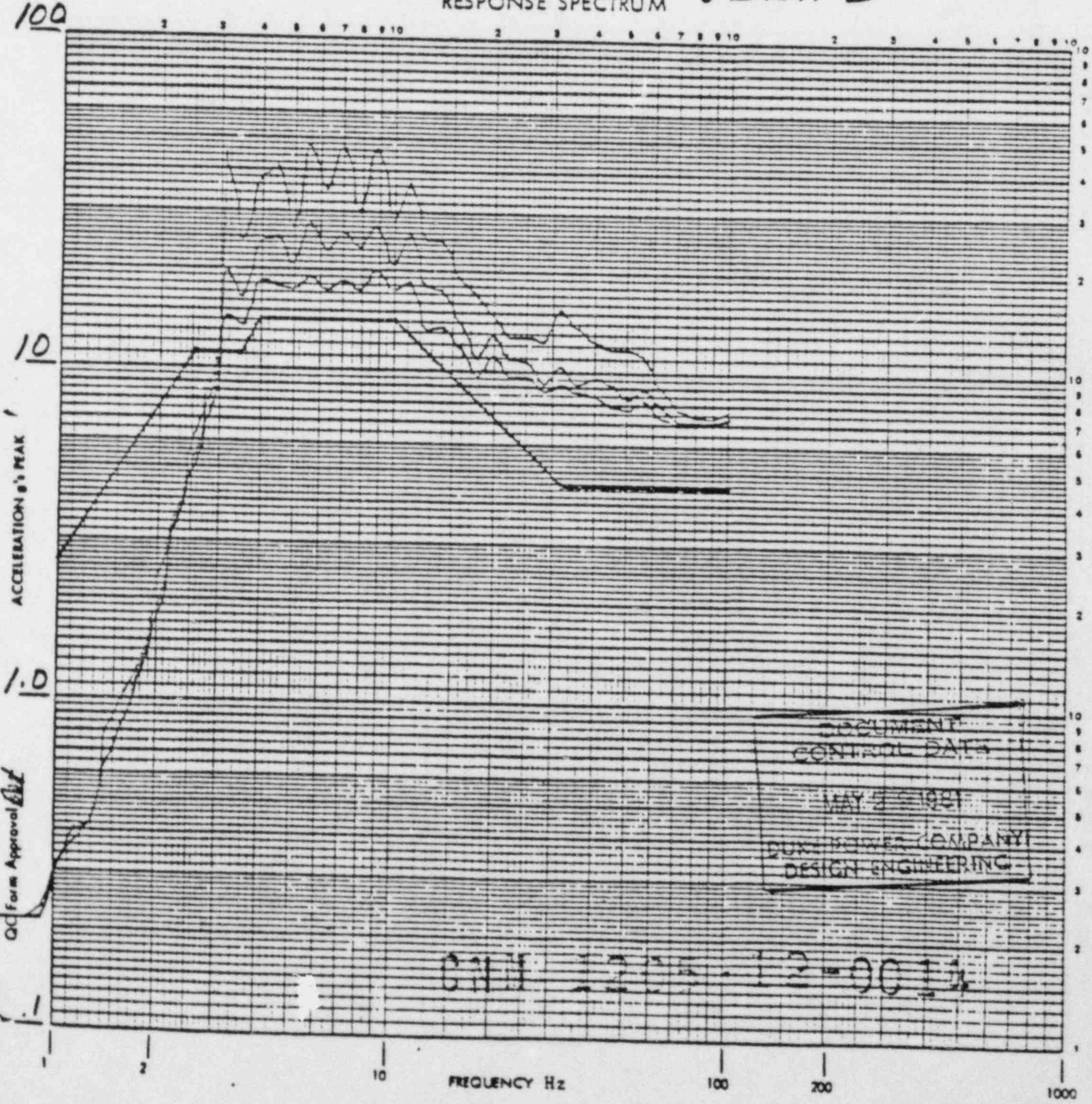
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-11-78 Damping 5 % Axis of Test X-Y ☐ Z-Y ☒

5th SSE 2.5th HORIZ. ☒ VERT. ☐

RESPONSE SPECTRUM



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DESIGN ENGINEERING

CNH 1205-12-0014

12/24

WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 33

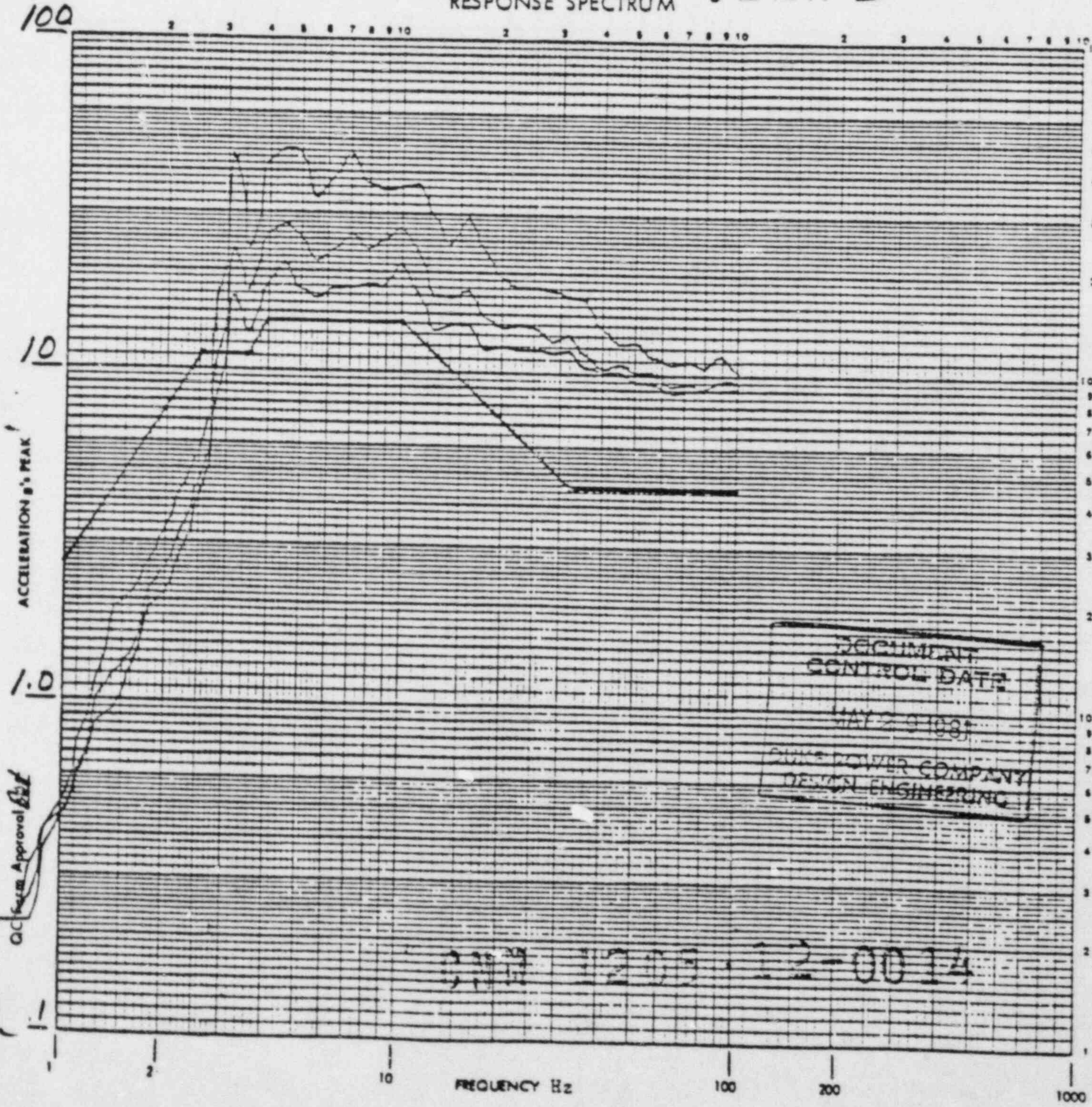
Full Scale 100 g Accel. No. ____ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-1-78 Damping 5 % Axis of Test X-Y ☐ Z-Y ☒

5TH SSE Z 15Hz HORIZ. ☐ VERT. ☒

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 34

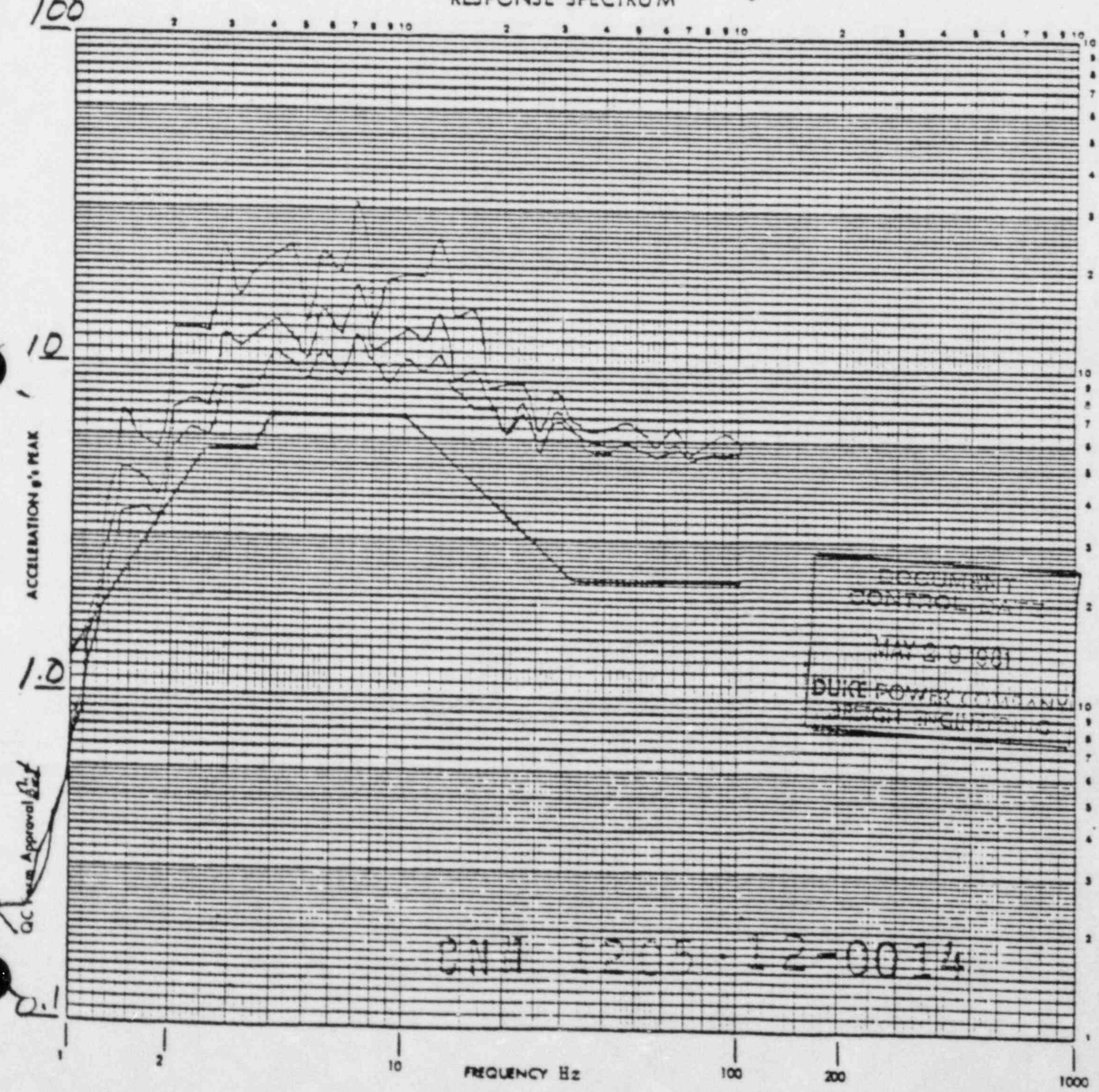
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-11-78 Damping 5 % Axis of Test X-Y ☒ ☐

1ST OBE HORIZ. ☒ VERT. ☐

RESPONSE SPECTRUM



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DUKE POWER COMPANY

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14/24

WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 35

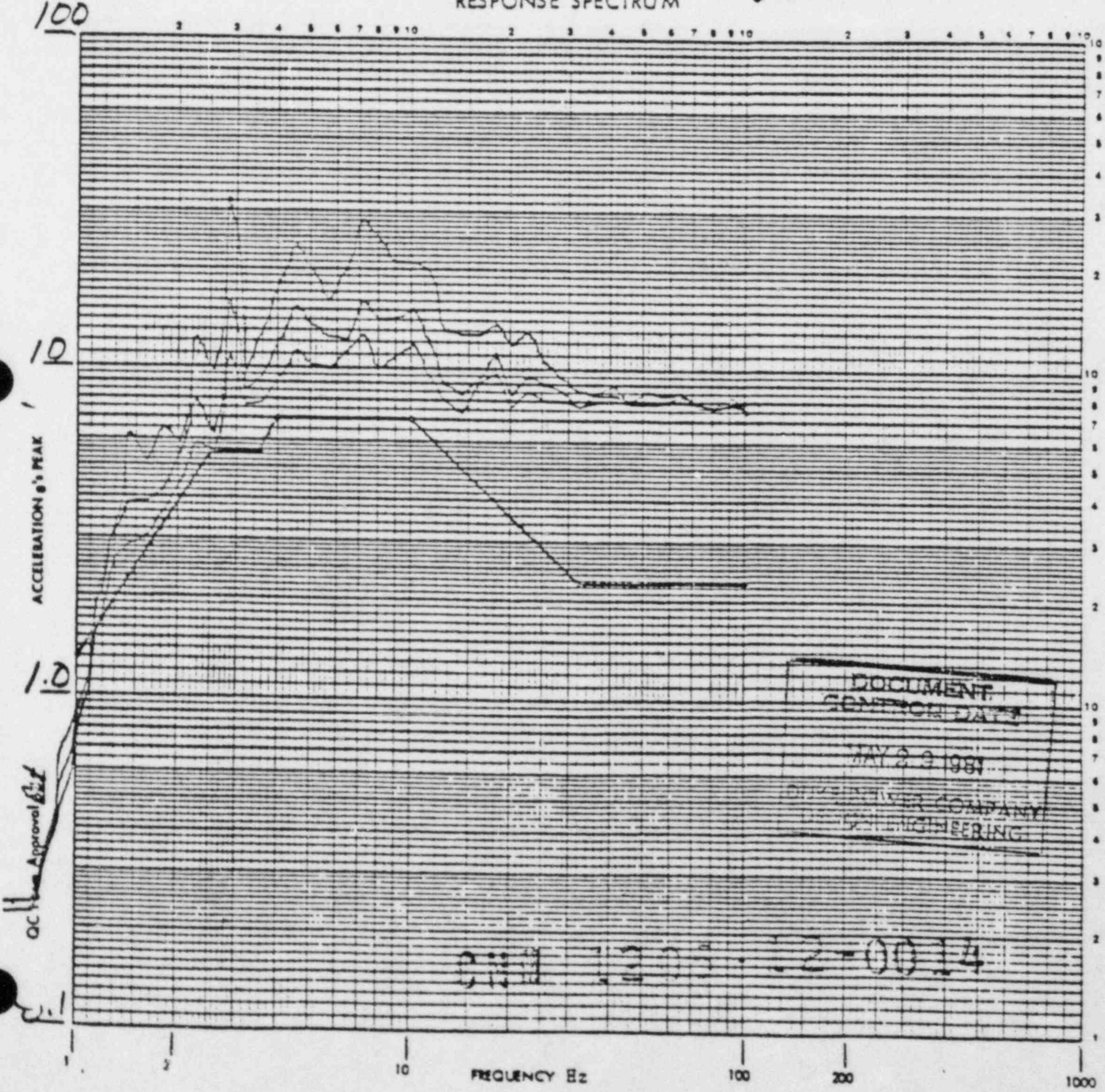
Full Scale 100 g Accel. No. ______ Control (*) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-1-78 Damping 5 % Axis of Test X-Y ☒ HORIZ. ☐ VERT. ☒

½ OBE

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 36

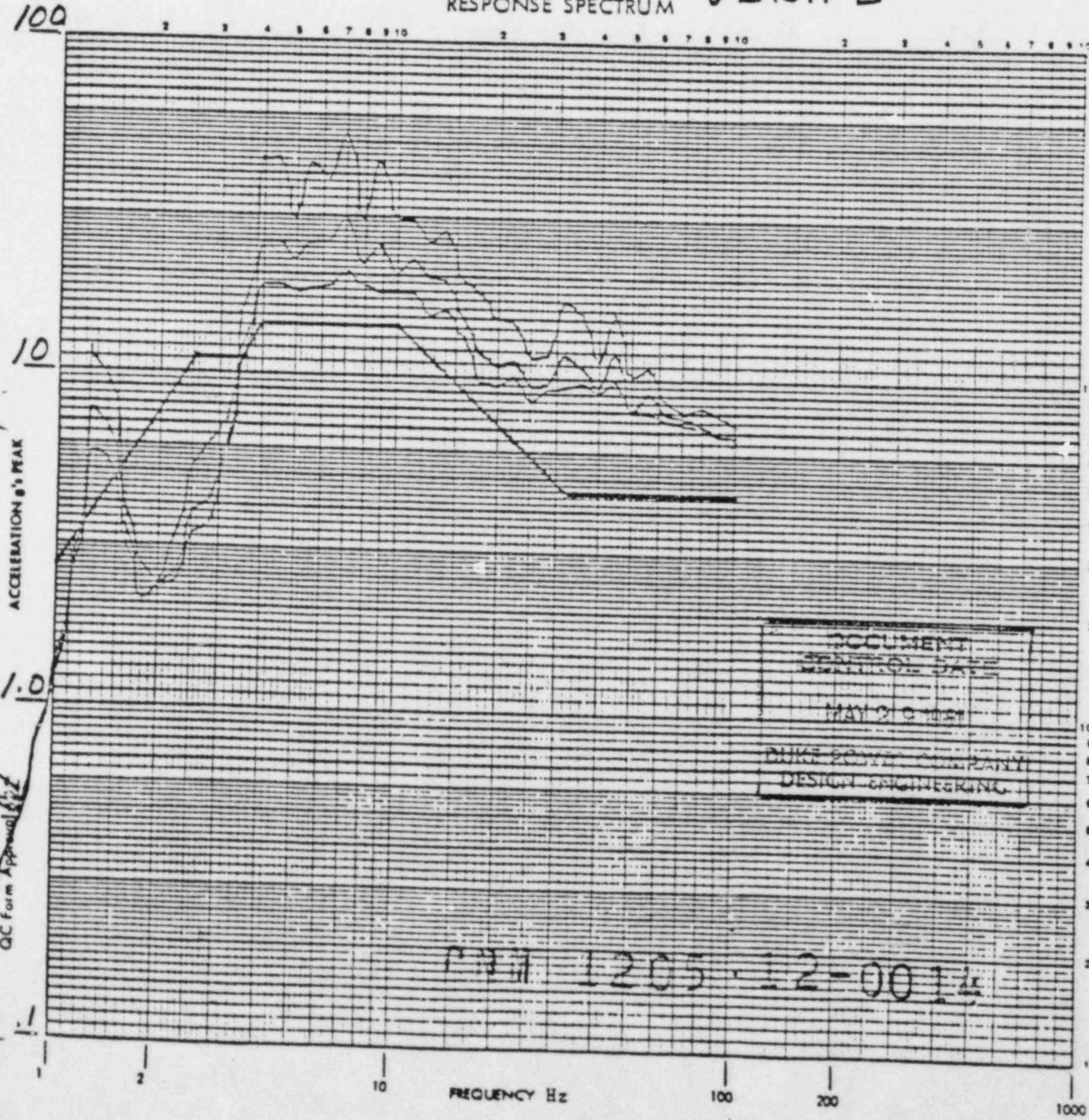
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-11-78 Damping 5 % Axis of Test X-Y ☒ Z-Y ☐

1st SSE 125Hz HORIZ. ☒ VERT. ☐

RESPONSE SPECTRUM



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DUKE POWER COMPANY DESIGN ENGINEERING

CNM 1205.12-0014

QC Form Approval [illegible]

16/24

WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 37

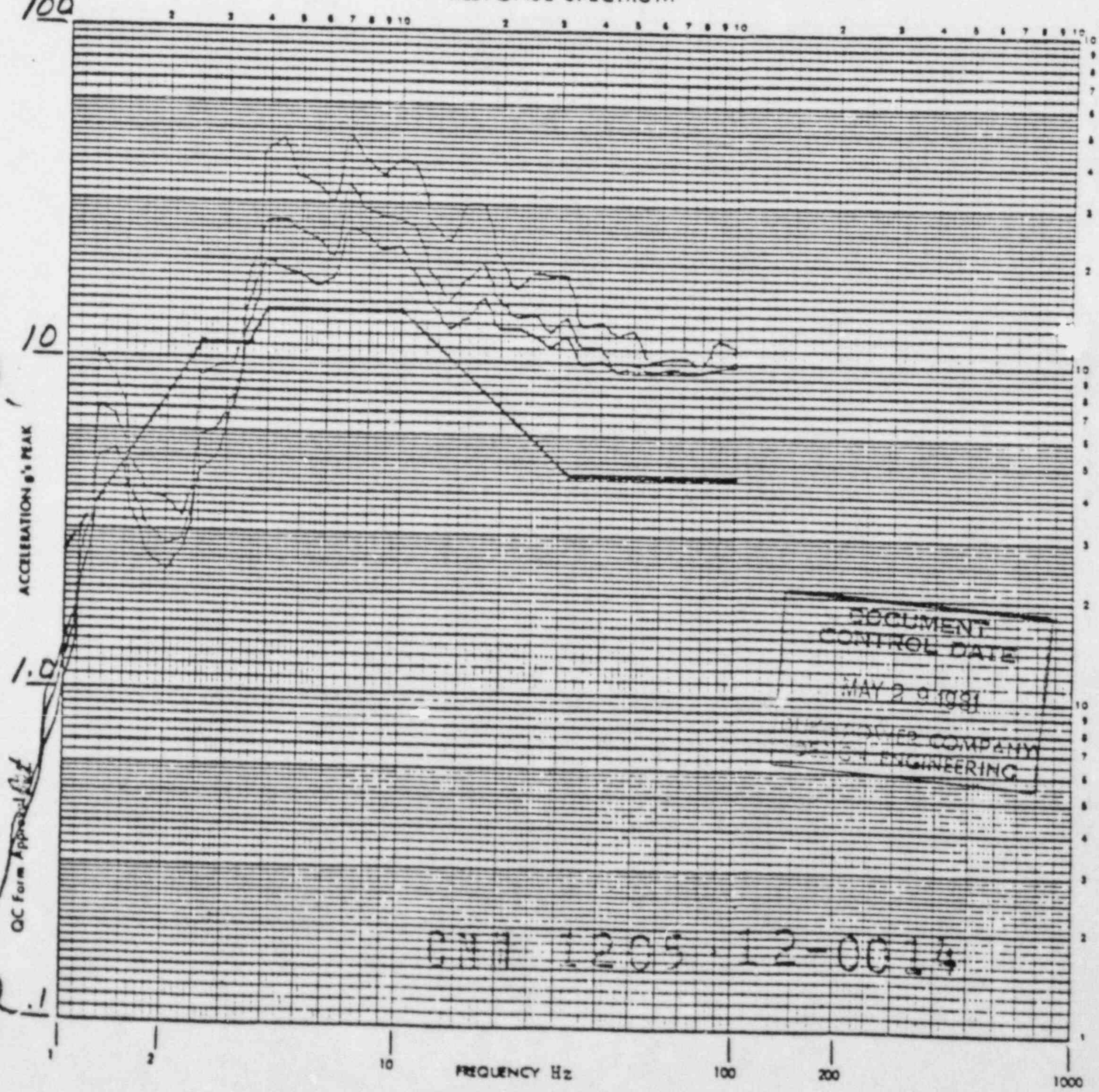
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2.11.78 Damping 5 % Axis of Test X-Y ☒ Z-Y ☐

1st SSE 1/2 SSE HORIZ. ☐ VERT. ☑

RESPONSE SPECTRUM



17/24

WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 38

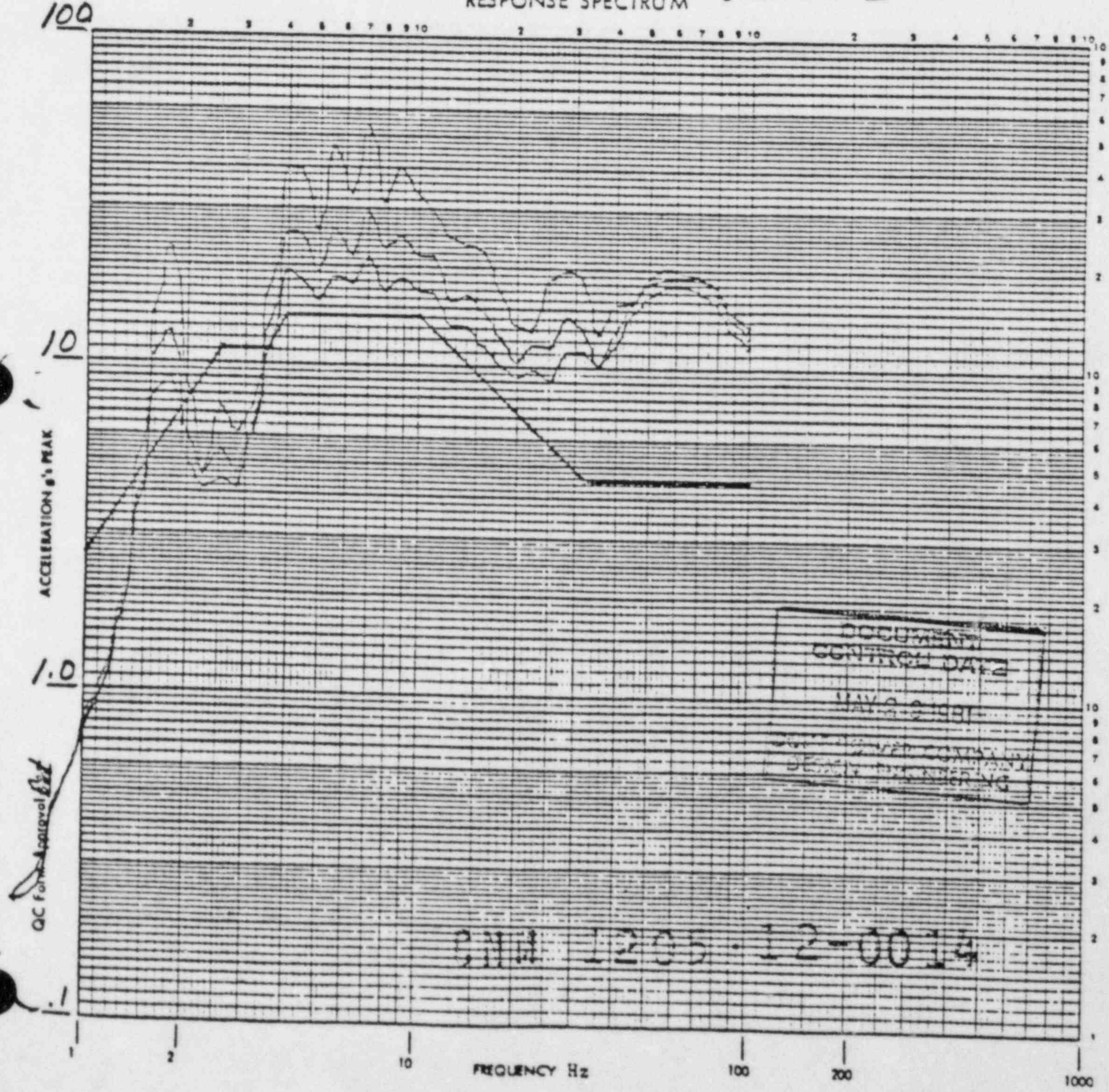
Full Scale 100 g Accel. No. ________ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-1-78 Damping 5 % Axis of Test X-Y [X] Z-Y [ ]

2ND SSE 16Hz HORIZ. [X] VERT. [ ]

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 39

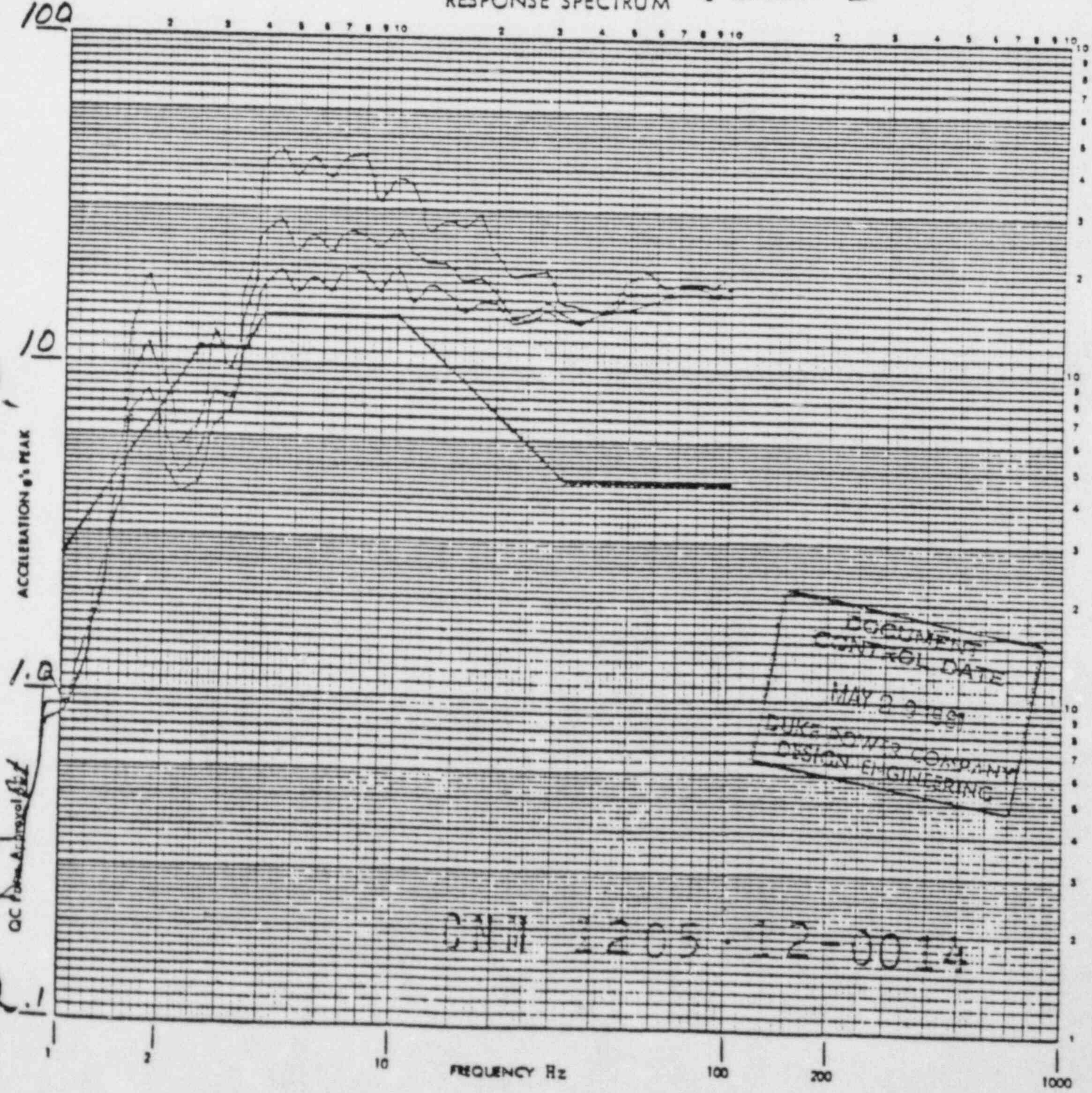
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-11-78 Damping 5 % Axis of Test X-Y ☒ Z-J ☐

2nd SSE 1.6" HORIZ. ☐ VERT. ☒

RESPONSE SPECTRUM



DOCUMENT CONTROL DATE MAY 2 9 1981 DUKE POWER COMPANY DESIGN ENGINEERING

CNM 1205.12-0014

WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 40

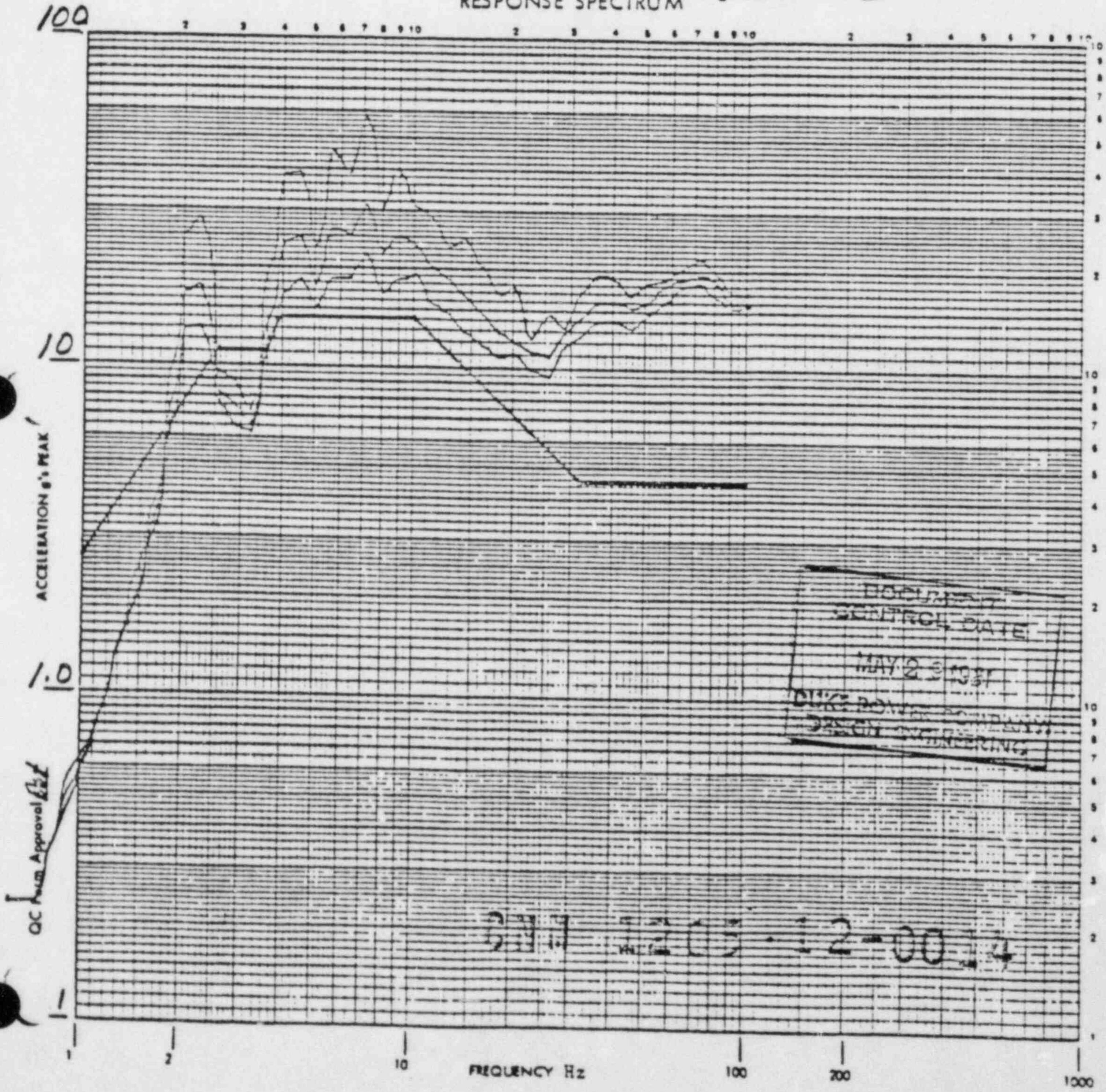
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-1-78 Damping 5 % Axis of Test X-Y [X] Z-Y [ ]

3rd SSE 2.0 HORIZ. [X] VERT. [ ]

RESPONSE SPECTRUM



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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 41

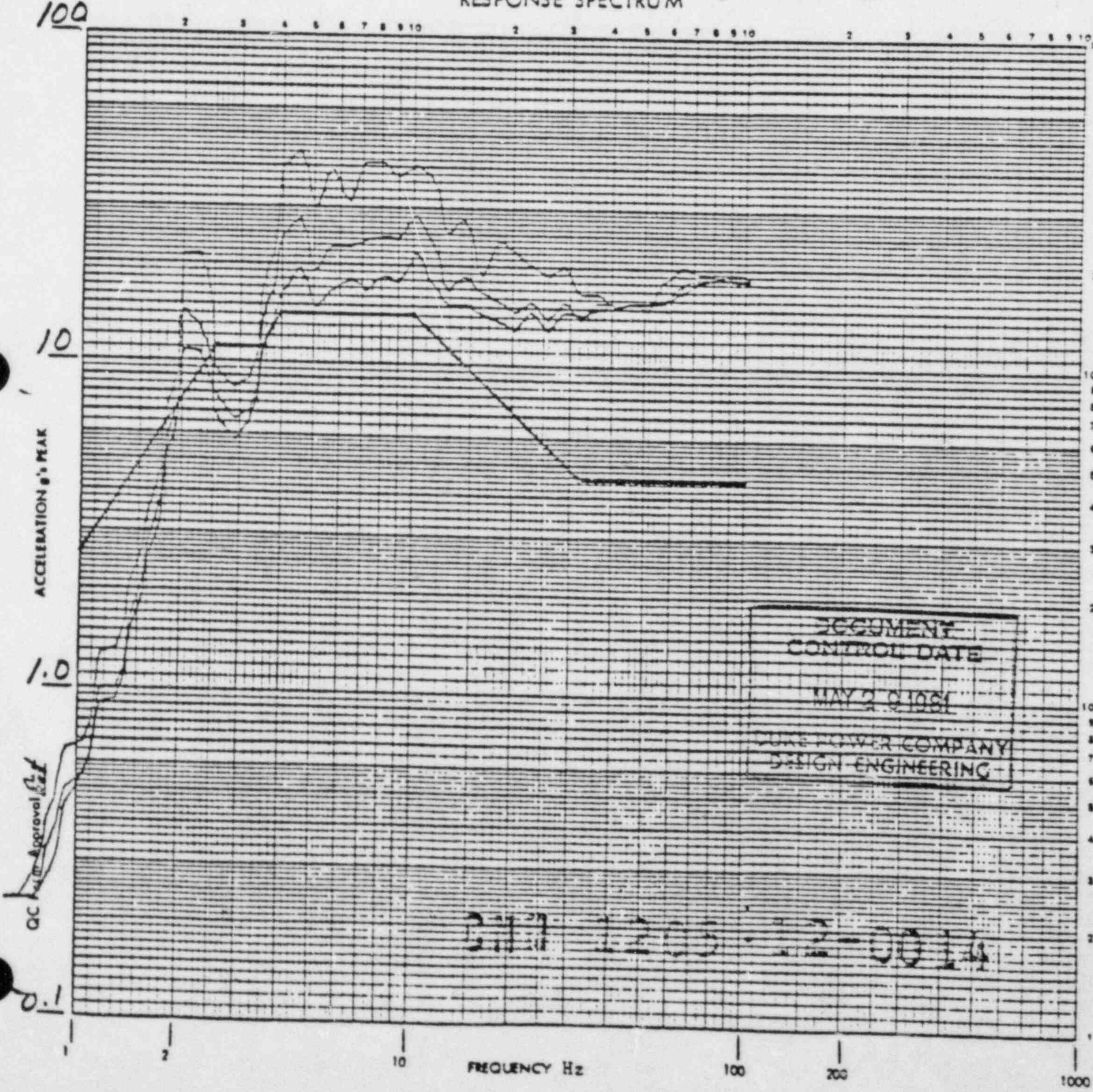
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-14-78 Damping 5 % Axis of Test X-Y ☒ Z-Y ☐

3/0 SSE 2.0HZ HORIZ. ☐ VERT. ☒

RESPONSE SPECTRUM



DOCUMENT CONTROL DATE
MAY 29 1981
DUKE POWER COMPANY
DESIGN ENGINEERING

CNR 1205-12-0014

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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 42

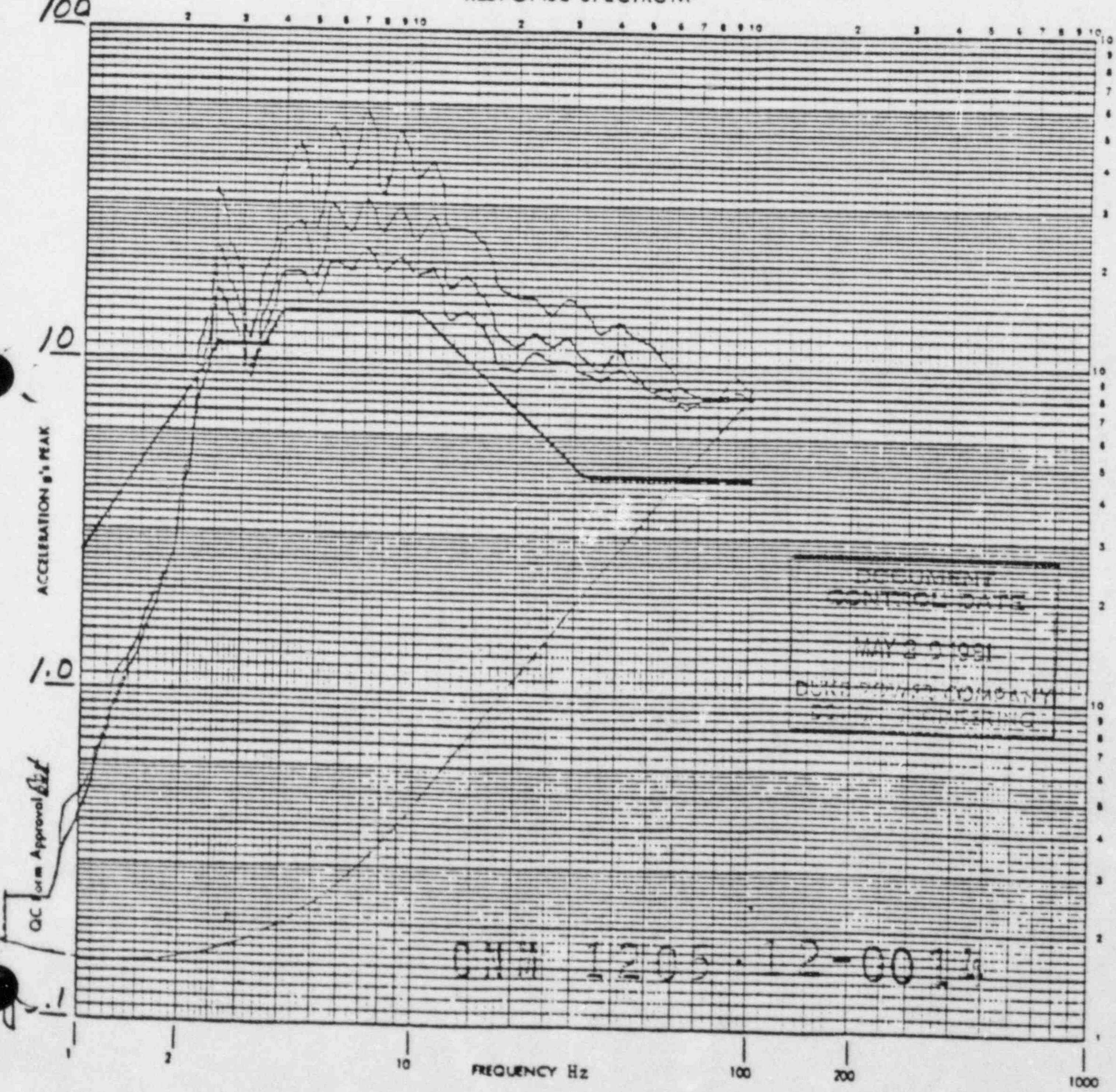
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-1-78 Damping 5 % Axis of Test X-Y ☒ Z-J ☐

4th SSE 25th HORIZ. ☒ VERT. ☐

RESPONSE SPECTRUM



CNS 1205.12-0014

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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 43

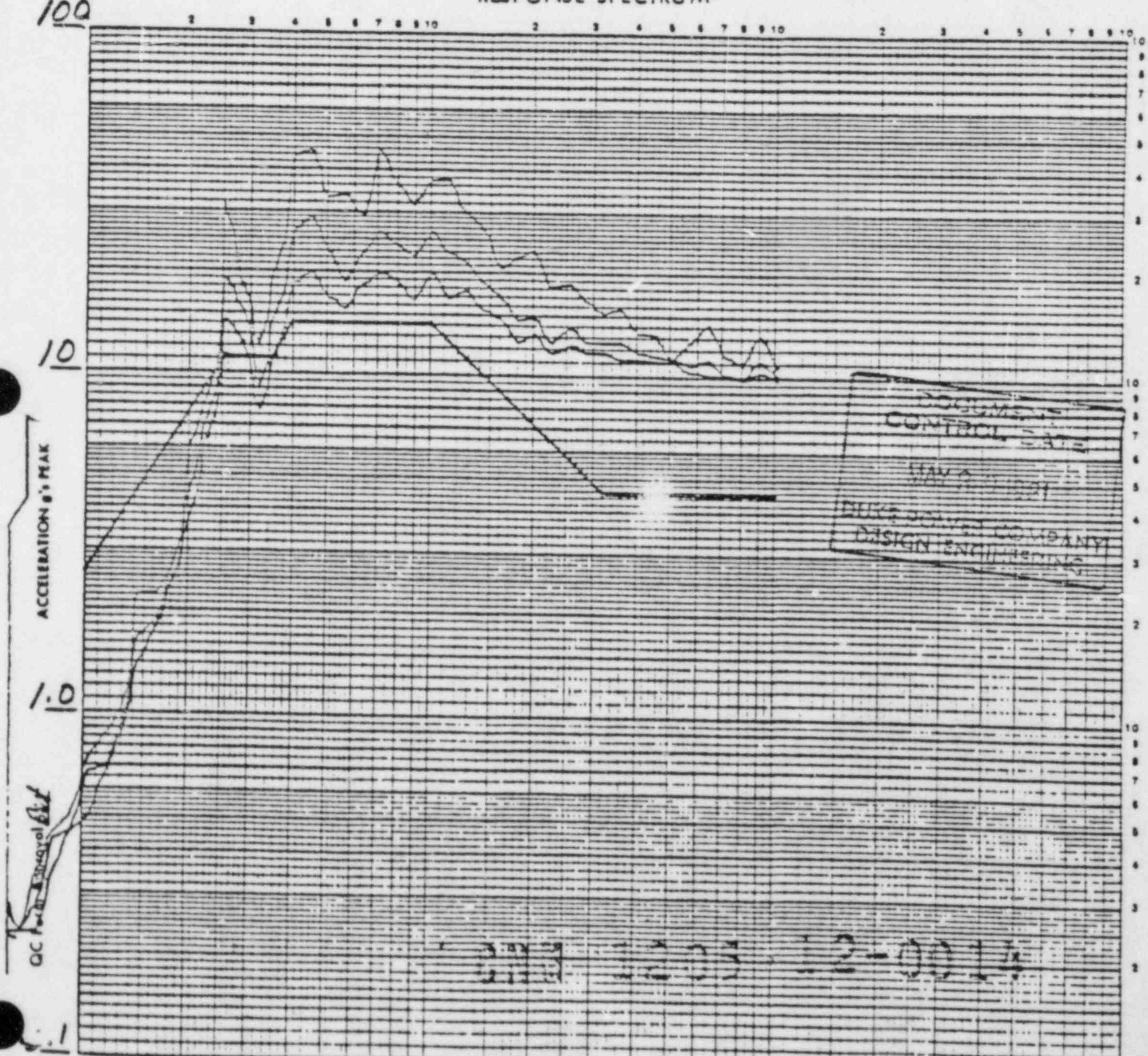
Full Scale 100 g Accel. No. ______ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-1-78 Damping 5 % Axis of Test X-Y ☒ Z-Y ☐

4th SSE 25Hz HORIZ. ☐ VERT. ☒

RESPONSE SPECTRUM



CNS 1205.12-0014

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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 44

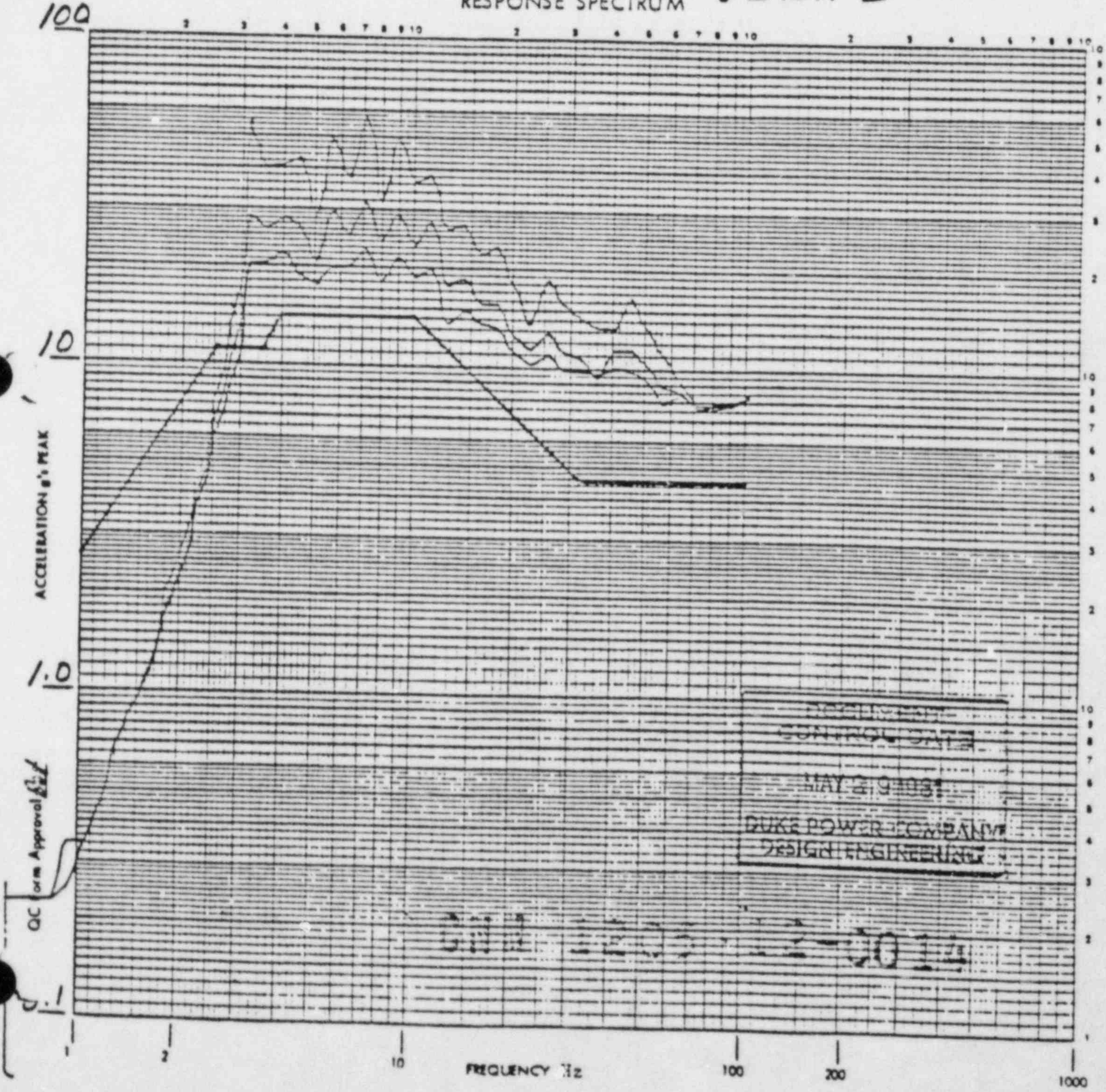
Full Scale 100 g Accel. No. ________ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-11-78 Damping 5 % Axis of Test X-Y ☒ Z-Y ☐

5TH SSE 3.15Hz HORIZ. ☒ VERT. ☐

RESPONSE SPECTRUM



GNI 1205.12-0014

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WYLE LABORATORIES

Report No. 57530

CUSTOMER NUCLEAR VALVE Job No. 57530 Page No. 45

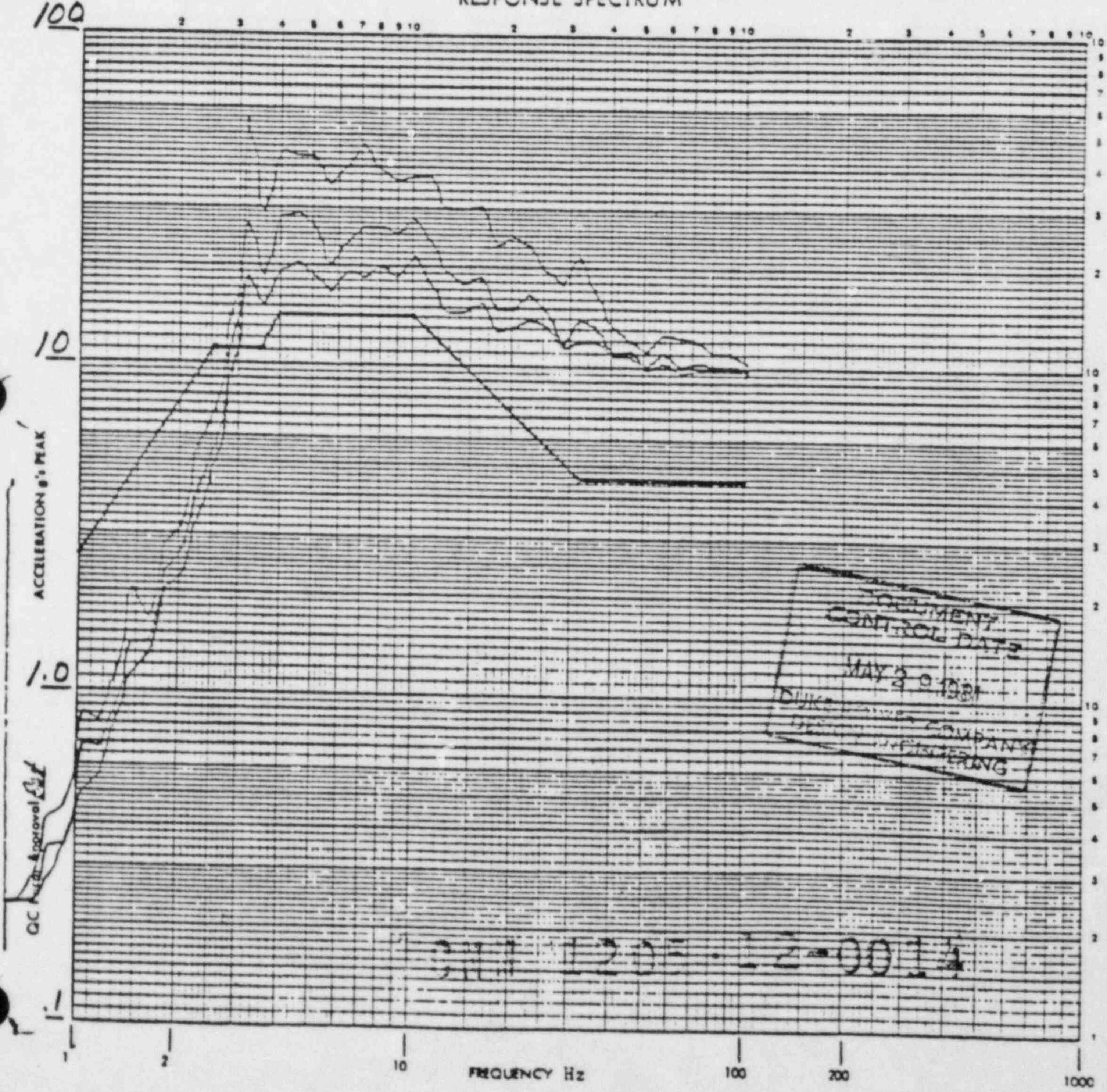
Full Scale 100 g Accel. No. ________ Control (X) Response ( )

Operator MEEHAN Specimen HYDRALIC VALVE OPERATOR

Date 2-11-78 Damping 5 % Axis of Test X-Y ☒ Z-Y ☐

5TH SSE 3.15Hz HORIZ. ☐ VERT. ☒

RESPONSE SPECTRUM



Form 00194 (6-81) DUKE POWER COMPANY

Attachment 3

Dev./Station ______ Unit ______ File No. ______

Subject Feedwater Isolation Valves - SQRT

______ By ______ Date ______

Sheet No. ___ of ___ Problem No. ______ Checked By ______ Date ______

8A. Identification	Location	Governing Load	Seismic Stress	Total[(2)] Stress (ksi)	Stress Allowable (ksi)
Body	Main run	Seismic + Normal	(1)	9.62	40.5
Body	Neck	Seismic + Normal	(1)	6.34	40.5
Body	Thread	Seismic + Normal	(1)	6.95	40.5
Yoke	Yoke	Seismic + Normal	(1)	7.08	32.4
Yoke	Adj. to Yoke clamp	Seismic + Normal	(1)	15.47	32.4
Clamp	Yoke	Seismic + Normal	(1)	8.63	32.4
bolt	clamp	Seismic + Normal	(1)	26.3	103.5

(1) See seismic report (NSR 74040) for stresses.

(2) Faulted (SSE) condition

Attachment 4

Dav./Station ______ Unit ____ File No. ______
Subject Feedwater Isolation Valves - SQRT
______ By ______ Date ______
Sheet No. ___ of ___ Problem No. ______ Checked By ______ Date ______

8B.	Maximum Critical Deflection	Location	Max. Allowable Deflection
	0.0071"	Operater/Yoke	(1)

(1) The maximum critical deflection of the operator about the yoke is less than valve/operator machining tolerances, and therefore acceptable.

SPECIFIC ITEM #12 PRESSURIZER PORV

STATUS: This item was closed out during the SQRT Audit.

RESOLUTION SUMMARY: No resolution is required for this item.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba Nuclear Station   TYPE:

1. Utility: Duke Power Company   PWR: √

2. NSSS: Westinghouse   BWR: ______

3. A/E: Duke Power Company   Other ______

II. Component Name: Pressurizer Power Operated Relief Valves (Pres. PORVS)

1. Scope: [ ] NSSS   [√] BOP   [ ] Other

2. Model Number: CZG5-25-3BW-4BW-31MN63   Quantity: ______

3. Size or Range: 3" x 4" Globe

4. Vendor: Control Components, Inc.

5. If the component is a cabinet or panel, name and model Number of the devices included: N/A

6. Physical Description:

   a. Appearance: Air Operator, T-Globe, Forged SS Body

   b. Dimensions: 13.94" end-to-end, 63.6" height

   c. Weight: 830.3 lbs.

7. Location: Building: Reactor

   Elevation: 635' 1 3/8" pipeline centerline

8. Field Mounting Conditions
   [ ] Bolt (No. ___,) Size ___)
   [ ] Weld (Length ___)
   [√] Welded into pipeline

9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

   Welded into horizontal pipeline, valve stem vertical up direction

10. a. System is which located: NC

    b. Functional Description: Overpressure protection for NC system

    c. Is the equipment required for [ ] Hot Standby [√] Cold Shutdown

    [ ] Both   [ ] Neither   [ ] Other ______

II. Pertinent Reference/Design Specifications for Qualification Requirements: CNS-1205.10-1

(a.) Seismic Input

b. Hydrodynamic Load Input

c. Fatigue Considerations

d. Service Conditions

e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[√] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[ ] Test [√] Analysis [ ] Combination of Test and Analysis

Qualification Report*: Seismic Report 18789 -1 & -2, Revision F

(No., Title and Date): dated 9/10/80

Company that Prepared Report: Control Components, Inc.

Company that Reviewed Report: EDS Nuclear/Duke Power

Where Report is filed or available: CNM-1205.10-0108

Applicable Codes And/Or Standards: ASME Section III

V. Vibration Input:

1. Loads considered:
   a. [√] Seismic only
   b. [√] Hydrodynamic only

   Not combined at same time.

   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [√] SRSS [ ] ________ (other, specify)

3. Required Response Spectra** (attach the graphs): N/A

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE ______ SSE See Attachment

5. Required Acceleration in Each Direct:

[ ] ZPA [ ] Other ________ (specify)

OBE S/S = 1.6g F/B = 1.6g V = 2.1g

SSE S/S = 3.0g F/B = 3.0g V = 4.0g
Generic Values (Plant specifics are attached)

6. Were fatigue effects considered:

[ ] Yes [√] No

If yes, describe how they were treated in overall qualification program: ____________

____

____

VI If Qualification by Test, then Complete:

1. [ ] Single Frequency [ ] Multi-Frequency [ ] random
[ ] sine beat
[ ] ________

2. [ ] Single Axis [ ] Multi-Frequency
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ________ SSE ________ Other Natural Frequency Test Static Deflection Test (specify)

4. Frequency Range: Natural Frequency Test: 0-76 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 19 cps F/B = ________ V = ________

6. Method of Determining Natural Frequencies

[√] Lab Test [ ] In-Situ Test [√] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)

[ ] No

8. Maximum Input g Level Test:

OBE S/S = ____________ F/B = ______________ V = ______________

SSE S/S = ____________ F/B = ______________ V = ______________

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ___________

B. Orientation and Fixturing: Valve supported at weld ends

10. Functional Operability verified:

[√] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Acceptable as is

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (If appropriate ______________________________)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[√] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 19 cps F/B = ______________ V = ______________

3. Model Type: [ ] 3D [√] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ________

4. [ ] Computer Codes: N/A

Frequency Range and No. of modes - 0-76 hertz (18 modes)

[√] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum [√] SRSS [ ] Other: ______ (specify)

6. Damping:

OBE ______ SSE ______ Basis for the damping used: ______

7. Support Considerations in the model: None

8. Critical Structural Elements:

A	Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
	Body-Bonnet	Joint Studs	Normal		37718 psi	39870 psi
			OBE		39682 psi	39870 psi
			SSE		42779 psi	59805 psi

B.	Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
	.0077 inches	End of yoke	.06 inches (by calculation) .17 inches (by static defl. test)

9. Failure Modes: ______

10. Margins Available: [√] Input Spectrum See Attached Sheet [ ] Stress or Deflection

Form 00181 (6-81)

DUKE POWER COMPANY

Dev./Station ____ Unit ____ File No. ____

Subject ____

By R.C. Giles Date 2/13/84

Sheet No. ___ of ___ Problem No. ____ Checked By ____ Date ____

SUMMARY OF PORV ACCELERATIONS

VALVE TAG NUMBER	DIRECTION	MAX. ACCELERATION (g) OBE	MAX. ACCELERATION (g) SSE	ALLOWABLE SSE ACCELERATION (g)	MARGIN (%)
1NC-36B	X	1.005	1.884	3.0	37
	Y	.225	.422	4.0	89
	Z	.701	1.314	3.0	56
	RESULTANT (X,Y,Z)	1.246	2.336	5.831	60
1NC-34A	X	.909	1.704	3.0	43
	Y	.250	.469	4.0	88
	Z	.658	1.234	3.0	58
	RESULTANT	1.150	2.156	5.831	63
1NC-32B	X	1.255	2.353	3.0	22
	Y	.349	.654	4.0	84
	Z	.980	1.834	3.0	39
	RESULTANT	1.630	3.056	5.831	48

NOTES:
1) VALUES REPORTED ARE AT VALVE/OPERATOR C.G. LOCATED 26.21 INCHES FROM BOTTOM OF VALVE.
2) SSE VALUES ARE SCALED FROM 1% CRITICAL DAMPING OBE RESULTS. [SSE = 1.875 (OBE)]

SPECIFIC ITEM #13 CONTAINMENT ISOLATION BUTTERFLY VALVE

STATUS: This item was closed out during the SQRT Audit.

RESOLUTION SUMMARY: No resolution is required for this item.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba Nuclear Station   TYPE:

1. Utility: Duke Power Co.   PWR: √

2. NSSS: Westinghouse   BWR: ______

3. A/E: Duke Power/Design Engr Dept   Other ______

II. Component Name: Containment Isolation Valve

1. Scope: [ ] NSSS   [√] BOP   [ ] Other

2. Model Number: 9220   Quantity: 20/unit

3. Size or Range: 12" & 24"

4. Vendor: Fisher Controls

5. If the component is a cabinet or panel, name and model Number of the devices included: N/A

6. Physical Description:

   a. Appearance: Butterfly Valve/Operator

   b. Dimensions: (24") 63¼" x 61" x 18½"

   c. Weight: 1210 lbs

7. Location: Building: Reactor Building

   Elevation: various

8. Field Mounting Conditions
   [√] Bolt (No. (20) (24" Valve) / (12) (12" Valve), Size (1½) (24" Valve) / (7/8) (12" Valve))
   [ ] Weld (Length ____)
   [ ] ______

9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

   Mounted in pipe on wall of containment vessel

10. a. System is which located: Containment Purge Ventilation (VP) Cont. Air Ret. Exch. & H_2Skimmer (VX)

    b. Functional Description: Isolation Valve for Containment

    c. Is the equipment required for [√] Hot Standby [√] Cold Shutdown

    [ ] Both   [ ] Neither   [ ] Other ______

II. Pertinent Reference/Design Specifications for Qualification Requirements: Duke Design Specification CNS-1205.02-5 dated July 5, 1974, including Addendums 1 thru 6

(a.) Seismic Input

b. Hydrodynamic Load Input

c. Fatigue Considerations

d. Service Conditions

e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[√] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method: (For Qualification of Solenoids-See Att #1)

[ ] Test [√] Analysis [ ] Combination of Test and Analysis

Qualification Report*: Seismic Report

(No., Title and Date): CD74-25; Seismic Analysis (12" & 24") BF Valves Nov. 17, 1978

Company that Prepared Report: Fisher Controls Co

Company that Reviewed Report: EDS-Nuclear,Inc.

Where Report is filed or available: Duke Power Co (ref CNM-1205.02-238)

Applicable Codes And/Or Standards: ASME Section III, Class 2, 1974 Ed.

V. Vibration Input:

1. Loads considered:
   a. [√] Seismic
   b. [ ] Hydrodynamic only
   c. [√] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: N/A

[ ] Absolute Sum [ ] SRSS [ ] ________ (other, specify)

3. Required Response Spectra** (attach the graphs): Seismic load factors (SLF)

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: N/A OBE ________ SSE ______________

5. Required Acceleration in Each Direct:

[ ] ZPA [√] Other Seismic load factors (SLF)
(specify)

* OBE S/S = 1.6 g/0.711 (x) F/B = 1.6 g/0.57 (z) V = 1.06 g/0.10 (y)

* SSE S/S = 3 g/1.33 (x) F/B = 3 g/1.069 (z) V = 2 g/0.19 (y)

* Qualified Acceleration/Plant Specification Acceleration

6. Were fatigue effects considered:

[ ] Yes [√] No

If yes, describe how they were treated in overall qualification program: N/A

VI. If Qualification by Test, then Complete: N/A

1. [ ] Single Frequency [ ] Multi-Frequency [ ] random
[ ] sine beat
[ ] ____________

2. [ ] Single Axis [ ] Multi-Frequency
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ________ ___ SSE ____________ Other ____________________
(specify)

4. Frequency Range: ______________________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = __________ F/B = ______________ V = ____________

6. Method of Determining Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)

[ ] No

8. Maximum Input g Level Test:

OBE S/S = __________ F/B = __________ V = __________

SSE S/S = __________ F/B = __________ V = __________

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] __________

B. Orientation and Fixturing: __________

10. Functional Operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: __________

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (If appropriate __________)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [√] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 4.54 Hz F/B = __________ V = 45.4 Hz (24" Valve)

3. Model Type: [√] 3D [ ] 2D [ ] 1D

[ ] Finite Element [√] Beam

[ ] Closed Form Solution [ ] Other ________

4. [√] Computer Codes: Seismic 4

Frequency Range and No. of modes N/A

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum [√] SRSS [ ] Other: ____________ (specify)

6. Damping:

OBE _______. SSE _____ Basis for the damping used: ___________

7. Support Considerations in the model: Valve installed in horiz. pipeline

8. Critical Structural Elements:

A.	Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

See Attachment 3

B.	Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

See Attachment 3

9. Failure Modes: None

10. Margins Available: [ ] Input Spectrum [√] Stress or Deflection

Seismic and Dynamic Qualification Summary of Equipment
(Qualification of Valve Solenoids)

Attachment 1

n/a I. Plant Name: ____________ TYPE:

1. Utility: ____________ PWR: ____________
2. NSSS: ____________ BWR: ____________
3. A/E: ____________ Other ____________

n/a II. Component Name: ____________

1. Scope: [ ] NSSS [ ] BOP [ ] Other
2. Model Number: ____________ Quantity: ____________
3. Size or Range: ____________
4. Vendor: ____________
5. If the component is a cabinet or panel, name and model Number of the devices included: ____________

   ____
6. Physical Description:
   a. Appearance: ____________
   b. Dimensions: ____________
   c. Weight: ____________
7. Location: Building: ____________

   Elevation: ____________
8. Field Mounting Conditions [ ] Bolt (No. ____,) Size ____)
   [ ] Weld (Length ____)
   [ ] ____________
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

   ____
10. a. System is which located: ____________
    b. Functional Description: ____________
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

    [ ] Both [ ] Neither [ ] Other ____________

11. Pertinent Reference/Design Specifications for Qualification Requirements: ____________________

____

a. Seismic Input

b. Hydrodynamic Load Input

c. Fatigue Considerations

d. Service Conditions

e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[√] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[√] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: Qualification Test Report

(No., Title and Date): AQS21678/TR-rev. A; "Qualification Tests/Solenoids," July 1979

Company that Prepared Report: Isomedix, Inc.

Company that Reviewed Report: Automatic Switch Company

Where Report is filed or available: Duke Power Company (ref. CNM 1205.02-499)

Applicable Codes And/Or Standards: IEEE 323-1974; IEEE 382-1972; IEEE 344-1975; IEEE 382/ANSI N278.2.1-1977

V. Vibration Input:

1. Loads considered: a. [√] Seismic

b. [ ] Hydrodynamic only

c. [√] Vibration from normal operation

d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS: N/A

[ ] Absolute Sum [ ] SRSS [ ] ____________________ (other, specify)

3. Required Response Spectra** (attach the graphs): Application of sinusoidal inputs in each axis

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: N/A OBE _______ SSE _______

5. Required Acceleration in Each Direct:

[ ] ZPA [√] Other Seismic load factors (SLF)
(specify)

OBE S/S = 1.6 g's F/B = 1.6 g's V = 1.07 g's

SSE S/S = 3 g's F/B = 3 g's V = 2 g's

6. Were fatigue effects considered:

[√] Yes [ ] No

If yes, describe how they were treated in overall qualification program: Vibration endurance considered in conjunction with seismic loadings. Also, valves cycled 40,000 times at maxi operating ΔP.

VI. If Qualification by Test, then Complete:

1. [√] Single Frequency [ ] Multi-Frequency [ ] random
[√] sine beat
[ ] _______

2. [√] Single Axis [ ] Multi-Frequency
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 2 SSE 1 Other _______
(specify)

4. Frequency Range: 1-33 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
N/A

S/S = _______ F/B = _______ V = _______

6. Method of Determining Natural Frequencies N/A

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test N/A

[ ] Yes (Attach TRS & RRS graphs)

[ ] No

8. Maximum Input g Level Test:

OBE S/S = 3 g's F/B = 3 g's V = 3 g's

SSE S/S = 7 g's F/B = 7 g's V = 4.2 g's

9. Laboratory Mounting:

A. [√] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ___________

B. Orientation and Fixturing: Vertical & Upright

10. Functional Operability verified:

[√] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ______________________

See Attachment 2

12. Other tests performed (such as aging or fragility test, including results):
Fragility - See Attachment 2

13. Failure Modes (If appropriate N/A)

14. Margins Available: [√] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ____________ F/B = ______________ V = ______________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ________

4. [ ] Computer Codes: ______________________

Frequency Range and No. of modes

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: ____________ (specify)

6. Damping:

OBE ______ SSE _____ Basis for the damping used: __________

7. Support Considerations in the model: ______________________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: ______________________

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

Attachment 2
(21 pgs)

Summary of SEISMIC TESTS conducted at Automatic Switch Co.

The nine valves* were seismic fragility tested per Para 9.4.2 .4.2.3 of ASCO Qualification Specification AQS-21678 Revision B (Appendix A). They were individually mounted with solenoids in vertical upright position and rigidly fastened to the seismic shaker for sinusoidal vibration in horizontal and vertical axes.

The valves were connected electrically, inlet to instrument grade air supply, and cylinder port to small reservoir. They were tested with single frequency sinusoidal motion at one-third octave intervals from 1 to 33 Hz to minimum limit shown of Fig. 9.1 of ASCO Qualification Specification AQS-21678 Revision B to a maximum of 10g or onset of malfunction, which is defined as a change of 10% of inlet pressure from the nominal pressure at the cylinder port.

Acceleration forces (g-levels) were limited by the machine capability of 6" maximum displacement, 40"/sec. maximum velocity and an arbitrarily selected 10g maximum acceleration. See Figure attached.

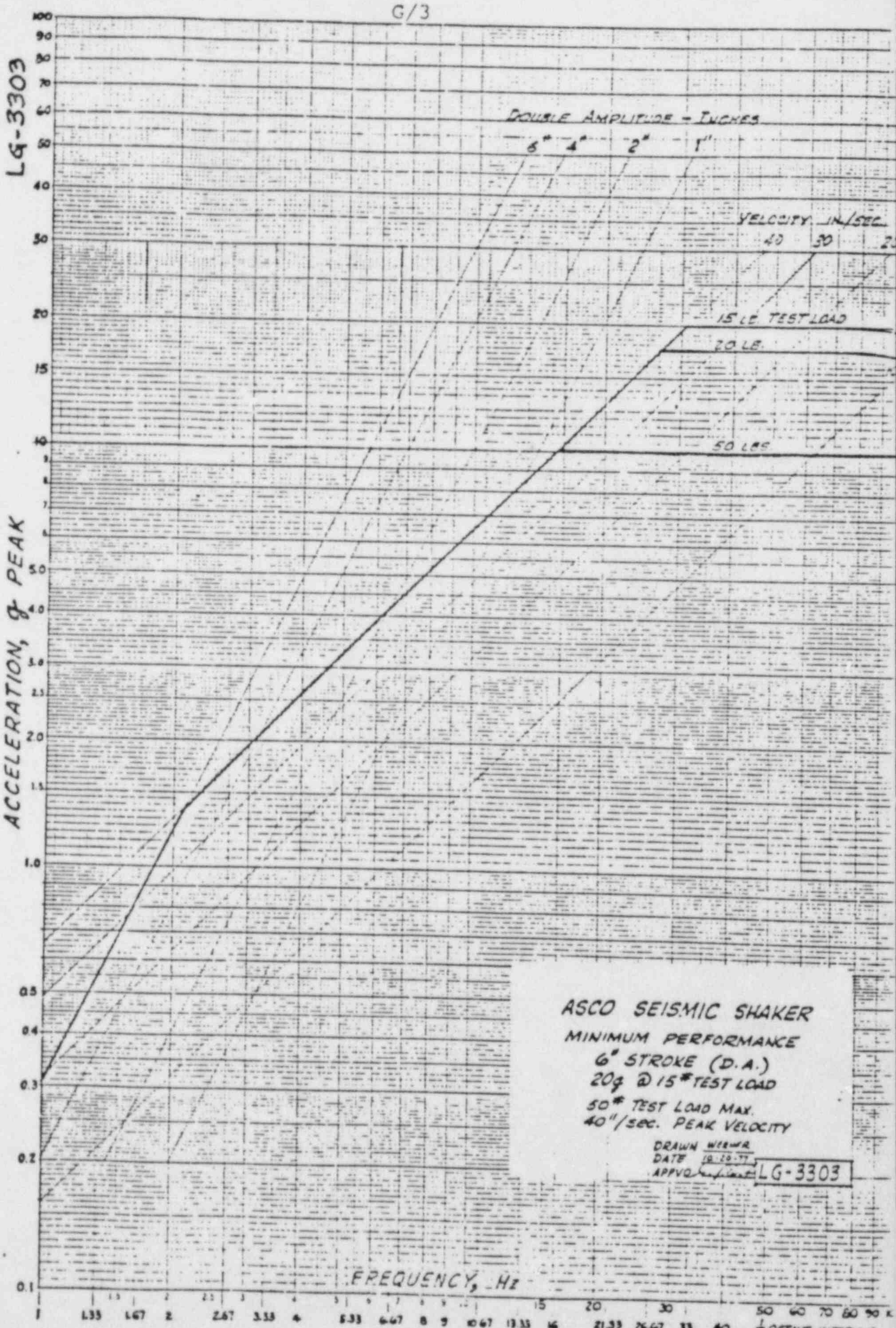
The seven valves which comprise the generic families to be qualified passed the functional requirements. Following is the summary of the g-levels reached in energized and de-energized states and pressures:

* Two of the nine valves (valves No. 3 & 7) were tested for resultant information only. Specific references and data pertaining to valves No. 3 & 7 (standard valves, not specially constructed for nuclear power plant applications) are not included in this report.

VALVE NO.	DESCRIPTION	PRESSURE	G-LEVEL ENERGIZED	G-LEVEL DE-ENERGIZED
1	HV-206-381-6F	7" water	10	7.0
	DC	125 psi	10	5.5
2	NP8344A71E	10 psi	10	8.5
	DC	125 psi	10	10
4	HVA-206-380-3RF	7"	10	4.7
	AC	150 psi	10	6.5
5	NP8320A184E	7" water	10	10
	AC	150 psi	10	10
6	NP831665E	10 psi	10	10
	DC	175 psi	10	10
8	NP8321A5E	10 psi	10	10
	DC	200 psi	10	10
9	NP8323A39E	7" water	10	9.0
	AC/DC	40 psi	10	8.8

NOTE:

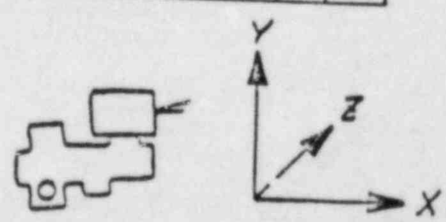
Where a 10g value is listed above, there was no change in cylinder port pressure from the nominal (10g was the maximum acceleration input during this testing). Where a value of less than 10g is listed, the cylinder port pressure differed from the nominal by 10% at the indicated g-level.


G/3
LG-3303
DOUBLE AMPLITUDE - INCHES
6" 4" 2" 1"
VELOCITY IN./SEC.
40 30
15 LB. TEST LOAD
20 LB.
50 LBS
ACCELERATION, g PEAK
FREQUENCY, Hz
1/3 OCTAVE INTERVALS
ASCO SEISMIC SHAKER
MINIMUM PERFORMANCE
6" STROKE (D.A.)
20g @ 15# TEST LOAD
50# TEST LOAD MAX.
40"/sec. PEAK VELOCITY
DRAWN
DATE
APPVD
LG-3303

g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY	g MACHINE LIMIT	Y-AXIS						Z-AXIS						X-AXIS					
		% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)					
		DE-ENER			ENER			DE-ENER			ENER			DE-ENER			ENER		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
HZ	g	PSI			PSI			PSI			PSI			PSI			PSI		
		0	6	12.5	125	119	112	0	6	12.5	125	119	112	0	6	12.5	125	119	112
1	.31	OK			OK			OK			OK			OK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6																		
5 1/3	3.5																		
6 2/3	4.3																		
8	5.2	↓																	
10 2/3	6.9	5.5	5.5	5.5															
13 1/3	8.6	6.0	6.0	6.0															
16	10	5.5	5.5	5.5															
21 1/3																			
26 2/3			↓	↓															
33		↓	6.3	6.7															
40	↓	3.5	7.0	8.5	↓			↓			↓			↓			↓		

TEST VALVE No. 1 CAT No. HV 206-381-6F



SOLENOID ATTITUDE Vertical & Upright

INLET PRESSURE 125 PSIG

TEST VOLTS OR CURRENT .154 Amps DC

LWO # 2907

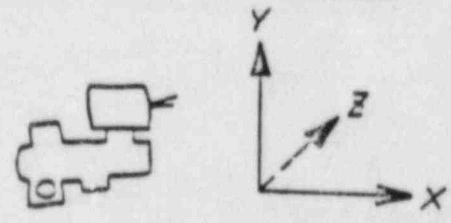
G/3

g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY	g MACHINE LIMIT	Y-AXIS						Z-AXIS						X-AXIS					
		% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)					
		DE-ENER			ENER			DE-ENER			ENER			DE-ENER			ENER		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
HZ	g	"W.C.			"W.C.			"W.C.			"W.C.			"W.C.			"W.C.		
		0	.35	.70	7"	6.7	6.3	0	.35	.70	7"	6.7	6.3	0	.35	.70	7"	6.7	6.3
1	.31	OK			OK			OK			OK			OK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6																		
5 1/3	3.5																		
6 2/3	4.3																		
8	5.2																		
10 2/3	6.9																		
13 1/3	8.6	↓																	
16	10	9.9	10	OK															
21 1/3		7.0	10	OK															
26 2/3		7.0	7.0	7.0															
33		OK																	
40	↓	OK			↓			↓			↓			↓			↓		

TEST VALVE No. 1 CAT No. HV 206-381-6F

SOLENOID ATTITUDE Vertical & Upright



INLET PRESSURE 7" W.C.

TEST VOLTS OR CURRENT 154 AMPS DC

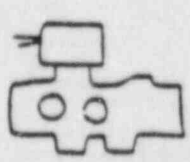
LWO # 2907

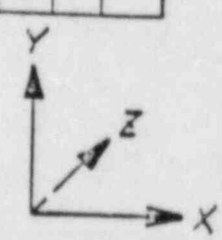
g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY	MACHINE LIMIT	Y-AXIS						Z-AXIS						X-AXIS					
		% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)					
		DE-ENER			ENER			DE-ENER			ENER			DE-ENER			ENER		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
HZ	g	PSI			PSI			PSI			PSI			PSI			PSI		
		0	6	12.5	125	119	112	0	6	12.5	125	119	112	0	6	12.5	125	119	112
1	.31	OK			OK			OK			OK			OK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6																		
5 1/3	3.5																		
6 2/3	4.3																		
8	5.2																		
10 2/3	6.9																		
13 1/3	8.6																		
16	10																		
21 1/3																			
26 2/3																			
33																			
40	↓	↓			↓			↓			↓			↓			↓		

TEST VALVE No. 2 CAT No. 8344A71E

SOLENOID ATTITUDE VERTICAL & UPRIGHT





INLET PRESSURE 125 PSIG

TEST VOLTS OR CURRENT .074 AMPS DC

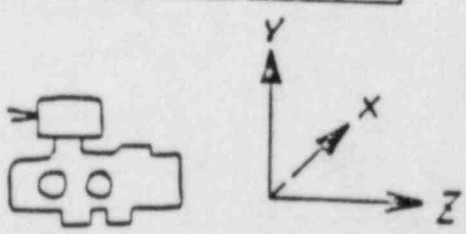
LWO #2823

g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY	MACHINE LIMIT	Y-AXIS						Z-AXIS						X-AXIS					
		% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)					
		DE-ENER			ENER			DE-ENER			ENER			DE-ENER			ENER		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
HZ	g	PSI			PSI			PSI			PSI			PSI			PSI		
		0	.5	1	10	9.5	9	0	.5	1	10	9.5	9	0	.5	1	10	9.5	9
1	.31	OK			OK			OK			OK			OK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6																		
5 1/3	3.5																		
6 2/3	4.3																		
8	5.2																		
10 2/3	6.9																		
13 1/3	8.6	↓																	
16	10	8.7	8.7	9															
21 1/3		8.7	8.7	9															
26 2/3		8.9	8.9	9															
33		7	7	8.5															
40	↓	9	9	9.5	↓			↓			↓			↓			↓		

TEST VALVE No. 2 CAT No. NP8344A71E

SOLENOID ATTITUDE Vertical & Upright



INLET PRESSURE 10 PSIG

TEST VOLTS OR CURRENT .074 AMPS DC

LWO # 2823

AQS-21678/TR
REVISION A

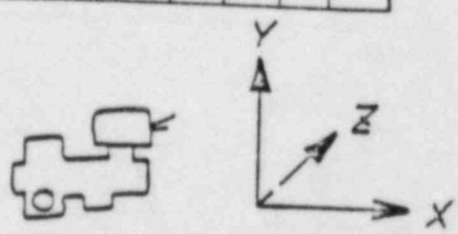
AQS-21678/TR
REVISION A

g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY HZ	g MACHINE LIMIT	Y-AXIS % CHANGE FROM P(INLET) DE-ENER 0			Y-AXIS ENER 0			Z-AXIS % CHANGE FROM P(INLET) DE-ENER 0			Z-AXIS ENER 0			X-AXIS % CHANGE FROM P(INLET) DE-ENER 0			X-AXIS ENER 0		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
		PSI 0	8	15	PSI 150	142	135	PSI 0	8	15	PSI 150	142	135	PSI 0	8	15	PSI 150	142	135
1	.31	OK			OK			OK			OK			OK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6																		
5 1/3	3.5																		
6 2/3	4.3																		
8	5.2																		
10 2/3	6.9	↓																	
13 1/3	8.6	6.8	7.2	7.5															
16	10	6.8	9.2	9.7															
21 1/3		7.1	9.5	10															
26 2/3		7.8	9.5	10															
33		5.5	6.5	6.5															
40	↓	5.7	9.0	9.8	↓			↓			↓			↓			↓		

TEST VALVE No. 4 CAT No. 206-380-3RF

SOLENOID ATTITUDE Vertical & Upright



INLET PRESSURE 150 PSIG

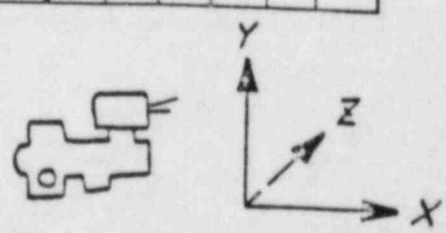
TEST VOLTS OR CURRENT 102/60

LWO # 2907

g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY	g MACHINE LIMIT	Y-AXIS						Z-AXIS						X-AXIS					
		% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)					
		DE-ENER			ENER			DE-ENER			ENER			DE-ENER			ENER		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
HZ	g	"W.C.			"W.C.			"W.C.			"W.C.			"W.C.			"W.C.		
		0	.35	.70	7	6.7	6.3	0	.35	.70	7	6.7	6.3	0	.35	.70	7	6.7	6.3
1	.31	OK			OK			OK			OK			OK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6	↓																	
5 1/3	3.5	3.2	3.5	OK															
6 2/3	4.3	3.0	3.3	5.0															
8	5.2	3.5	4.5	4.8															
10 2/3	6.9	4.0	4.7	5.3															
13 1/3	8.6	4.2	5.5	5.7															
16	10	4.3	4.5	5.3															
21 1/3		4.5	5.5	6.2															
26 2/3		3.0	3.7	4.7															
33		2.5	3.2	5.0															
40	↓	4.7	7.2	10	↓			↓			↓			↓			↓		

TEST VALVE No. 4 CAT No. 206-380-3RF



SOLENOID ATTITUDE VERTICAL & UPRIGHT

INLET PRESSURE 7" W.C.

TEST VOLTS OR CURRENT 102/60

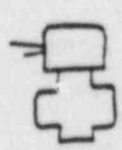
LWO # 2907

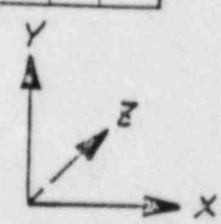
g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY	g MACHINE LIMIT	Y-AXIS						Z-AXIS						X-AXIS					
		% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)					
		DE-ENER			ENER			DE-ENER			ENER			DE-ENER			ENER		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
HZ	g	PSI			PSI			PSI			PSI			PSI			PSI		
		0	8	15	150	142	135	0	8	15	150	142	135	0	8	15	150	142	135
1	.31	OK			OK			OK			OK			OK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6																		
5 1/3	3.5																		
6 2/3	4.3																		
8	5.2																		
10 2/3	6.9																		
13 1/3	8.6																		
16	10																		
21 1/3																			
26 2/3																			
33																			
40	↓	↓			↓			↓			↓			↓			↓		

TEST VALVE No. 5 CAT No. 8320A184E

SOLENOID ATTITUDE VERTICAL & UPRIGHT





INLET PRESSURE 150 PSIG

TEST VOLTS OR CURRENT 102/60

LWO # 2687

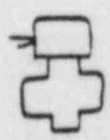
G/1

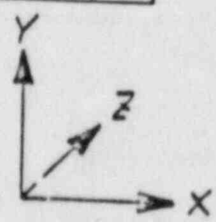
g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY	g MACHINE LIMIT	Y-AXIS						Z-AXIS						X-AXIS					
		% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)					
		DE-ENER			ENER			DE-ENER			ENER			DE-ENER			ENER		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
HZ	g	"W.C.			"W.C.			"W.C.			"W.C.			"W.C.			"W.C.		
X	X		.035	.07	7	6.7	6.3		.035	.07	7	6.7	6.3		.035	.07	7	6.7	6.3
1	.31	OK			OK			OK			OK			OK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6																		
5 1/3	3.5																		
6 2/3	4.3																		
8	5.2																		
10 2/3	6.9																		
13 1/3	8.6																		
16	10																		
21 1/3																			
26 2/3																			
33																			
40	↓	↓			↓			↓			↓			↓			↓		

TEST VALVE No. 5 CAT No. 8320A184E

SOLENOID ATTITUDE VERTICAL & UPRIGHT





INLET PRESSURE 7" W.C.

TEST VOLTS OR CURRENT 102/60

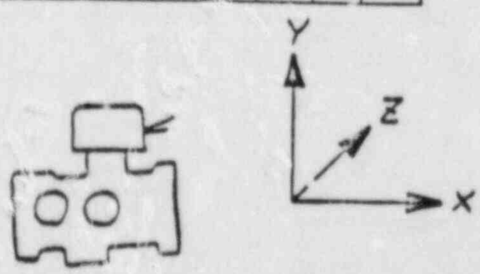
LWO # 2687

g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY	MACHINE LIMIT	Y-AXIS						Z-AXIS						X-AXIS					
		% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)					
		DE-ENER			ENER			DE-ENER			ENER			DE-ENER			ENER		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
HZ	g	PSI			PSI			PSI			PSI			PSI			PSI		
		0	.5	1	10	9.5	9	0	.5	1	10	9.5	9	0	.5	1	10	9.5	9
1	.31	OK			OK			OK			OK			OK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6																		
5 1/3	3.5																		
6 2/3	4.3																		
8	5.2																		
10 2/3	6.9																		
13 1/3	8.6																		
16	10																		
21 1/3																			
26 2/3																			
33																			
40	↓	↓			↓			↓			↓			↓			↓		

TEST VALVE No. 6 CAT No. 831665E

SOLENOID ATTITUDE VERTICAL & UPRIGHT



INLET PRESSURE 10 PSIG

TEST VOLTS OR CURRENT .074 AMPS DC

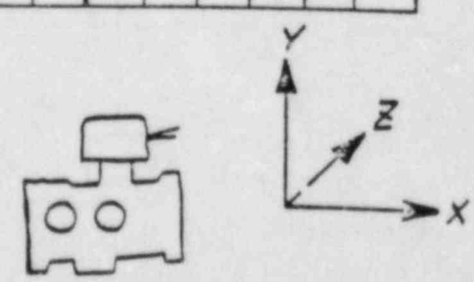
LWO # 2776

g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY	MACHINE LIMIT	Y-AXIS						Z-AXIS						X-AXIS					
		% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)					
		DE-ENER			ENER			DE-ENER			ENER			DE-ENER			ENER		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
HZ	g	PSI			PSI			PSI			PSI			PSI			PSI		
X	X	0	9	17.5	175	166	158	0	9	17.5	175	166	158	0	9	17.5	175	166	158
1	.31	OK			OK			OK			OK			OK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6																		
5 1/3	3.5																		
6 2/3	4.3																		
8	5.2																		
10 2/3	6.9																		
13 1/3	8.6																		
16	10																		
21 1/3																			
26 2/3																			
33																			
40	↓	↓			↓			↓			↓			↓			↓		

TEST VALVE No. 6 CAT No. 831665E

SOLENOID ATTITUDE VERTICAL & UPRIGHT



INLET PRESSURE 175 PSIG

TEST VOLTS OR CURRENT .074 AMPS DC

LWO # 2776

AQS-21678/TR
REVISION A

AQS-21678/TR
REVISION A

g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY	g MACHINE LIMIT	Y-AXIS						Z-AXIS						X-AXIS					
		% CHANGE FROM P (INLET)						% CHANGE FROM P (INLET)						% CHANGE FROM P (INLET)					
		DE-ENER			ENER			DE-ENER			ENER			DE-ENER			ENER		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
HZ	g	PSI			PSI			PSI			PSI			PSI			PSI		
		0	10	20	200	190	180	0	10	20	200	190	180	0	10	20	200	190	180
1	.31	OK			OK			OK			OK			CK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6																		
5 1/3	3.5																		
6 2/3	4.3																		
8	5.2																		
10 2/3	6.9																		
13 1/3	8.6																		
16	10																		
21 1/3																			
26 2/3																			
33																			
40	↓	↓			↓			↓			↓			↓			↓		

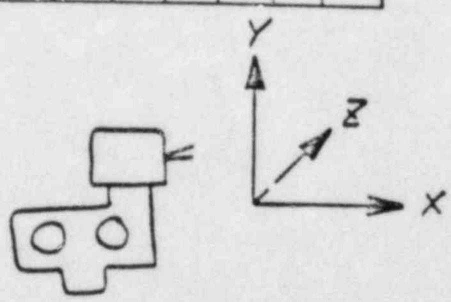
TEST VALVE No. 8 CAT No. 8321A5E

SOLENOID ATTITUDE VERTICAL & UPRIGHT

INLET PRESSURE 200 PSIG

TEST VOLTS OR CURRENT .074 AMPS DC

LWO # 2703

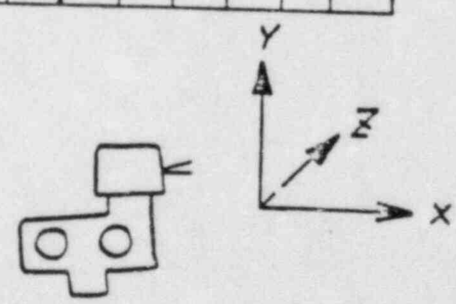


g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY HZ	g MACHINE LIMIT	Y-AXIS						Z-AXIS						X-AXIS					
		% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)					
		DE-ENER			ENER			DE-ENER			ENER			DE-ENER			ENER		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
		PSI			PSI			PSI			PSI			PSI			PSI		
		0	.5	1	10	9.5	9	0	.5	1	10	9.5	9	0	.5	1	10	9.5	9
1	.31	OK			OK			OK			OK			OK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6																		
5 1/3	3.5																		
6 2/3	4.3																		
8	5.2																		
10 2/3	6.9																		
13 1/3	8.6																		
16	10																		
21 1/3																			
26 2/3																			
33																			
40	↓	↓			↓			↓			↓			↓			↓		

TEST VALVE No. 8 CAT No. 8321A5E

SOLENOID ATTITUDE VERTICAL & UPRIGHT



INLET PRESSURE 10 PSIG

TEST VOLTS OR CURRENT .074 AMPS DC

LWO # 2703

g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY HZ	g MACHINE LIMIT g	Y-AXIS						Z-AXIS						X-AXIS					
		% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)					
		DE-ENER			ENER			DE-ENER			ENER			DE-ENER			ENER		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
		PSI			PSI			PSI			PSI			PSI			PSI		
		0	2	4	40	38	36	0	2	4	40	38	36	0	2	4	40	38	36
1	.31	OK			OK			OK			OK			OK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6																		
5 1/3	3.5																		
6 2/3	4.3																		
8	5.2																		
10 2/3	6.9																		
13 1/3	8.6	▼																	
16	10	7.5	7.5	8.8															
21 1/3		OK																	
26 2/3																			
33																			
40	▼	▼			▼			▼			▼			▼			▼		

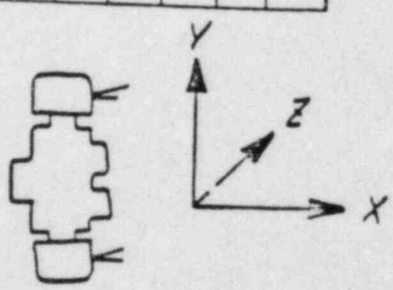
TEST VALVE No. 9 CAT No. 8323A39E

SOLENOID ATTITUDE VERTICAL & UPRIGHT

INLET PRESSURE 40 PSIG

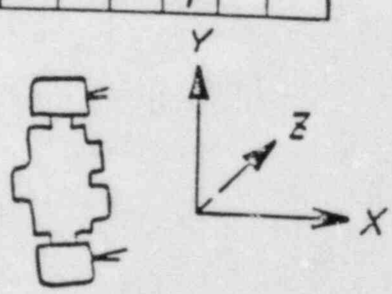
TEST VOLTS OR CURRENT 102/60 AC – .074 AMPS DC

LWO # 2834



g-LEVELS REACHED FOR INDICATED CYLINDER PRESSURE INCREASE AND/OR DECREASE

FREQUENCY	MACHINE LIMIT	Y-AXIS						Z-AXIS						X-AXIS					
		% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)						% CHANGE FROM P(INLET)					
		DE-ENER			ENER			DE-ENER			ENER			DE-ENER			ENER		
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
HZ	g	"W.C.			"W.C.			"W.C.			"W.C.			"W.C.			"W.C.		
X	X	0	.35	.7	7	6.7	6.3	0	.35	.7	7	6.7	6.3	0	.35	.7	7	6.7	6.3
1	.31	OK			OK			OK			OK			OK			OK		
1 1/3	.54																		
1 2/3	.85																		
2	1.23																		
2 2/3	1.7																		
3 1/3	2.2																		
4	2.6																		
5 1/3	3.5																		
6 2/3	4.3																		
8	5.2																		
10 2/3	6.9																		
13 1/3	8.6	▼																	
16	10	8.7	8.7	9															
21 1/3		OK																	
26 2/3																			
33																			
40	▼	▼			▼			▼			▼			▼			▼		



TEST VALVE No. 9 CAT No. 8323A39E

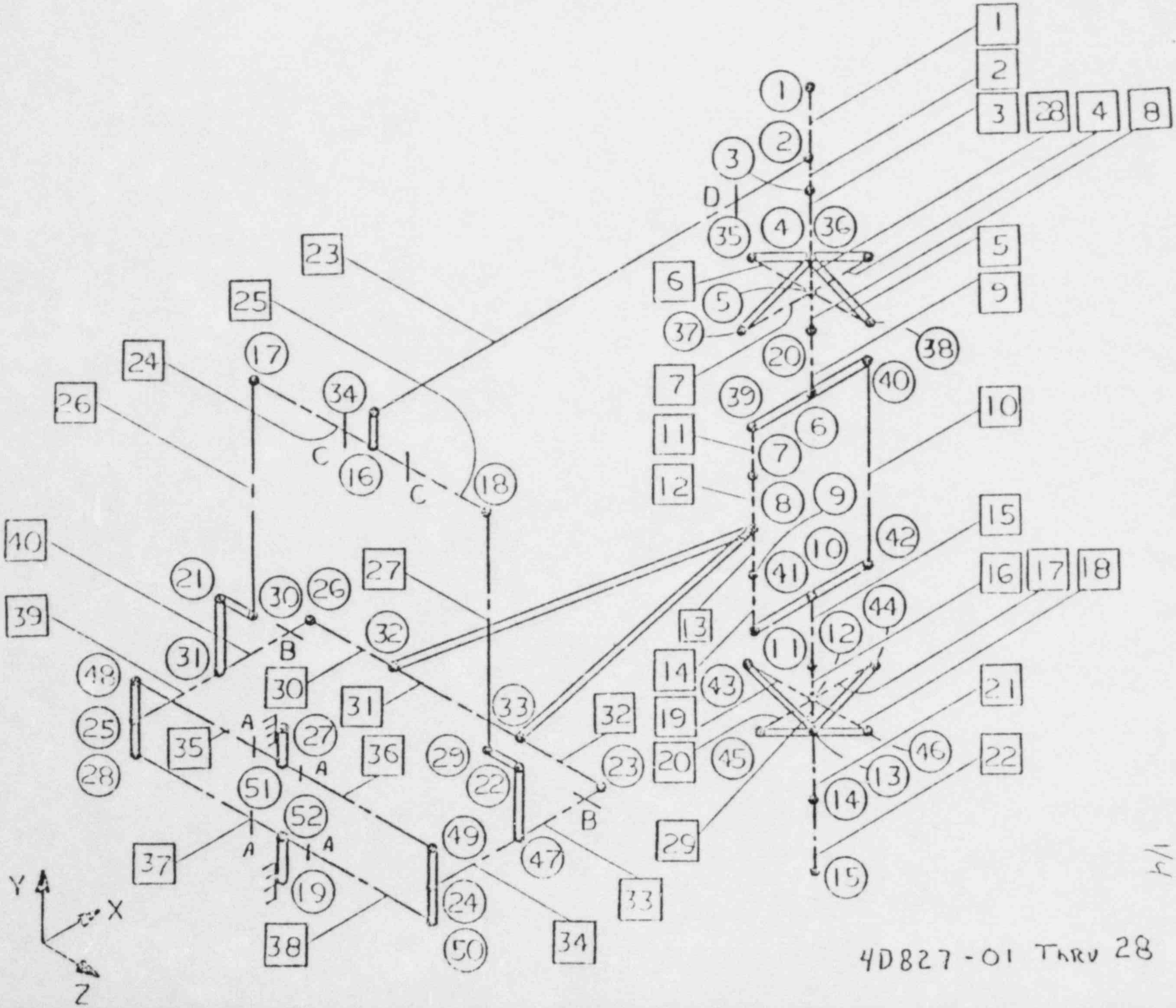
SOLENOID ATTITUDE VERTICAL & UPRIGHT

INLET PRESSURE 7" W.C.

TEST VOLTS OR CURRENT 102/60 AC - .074 AMPS DC

LWO #2834

Attachment 3
1/4



4D827-01 Thru 28

E V A L U A T I O N O F V A L V E

DEFORMATION RESPONSE OF COMBINED STATIC SEISMIC AND OPERATIONAL LOADS

JOINT NO.	DEFLECTION X	DEFLECTION Y	DEFLECTION Z	ROTATION X	ROTATION Y	ROTATION Z
1	0.020870	-0.003524	0.007847	0.000105	0.000701	-0.000512
2	0.013964	-0.003512	0.006365	0.000117	0.000701	-0.000523
3	0.013131	-0.003510	0.006167	0.000118	0.000705	-0.000523
4	0.005697	-0.003467	-0.004863	0.000075	0.000744	-0.000522
5	0.004854	-0.003466	-0.004751	0.000070	0.000746	-0.000522
6	0.004074	-0.003462	-0.004718	0.000068	0.000759	-0.000521
7	0.001300	-0.002214	-0.002249	0.000040	0.000390	-0.000516
8	-0.000935	-0.002213	-0.001941	0.000039	0.000194	-0.000512
9	-0.000737	-0.002214	-0.002151	0.000039	0.000321	-0.000512
10	-0.002909	-0.003471	-0.004791	0.000039	0.000762	-0.000518
11	-0.002964	-0.003472	-0.004807	0.000039	0.000762	-0.000519
12	-0.003070	-0.003472	-0.004830	0.000038	0.000762	-0.000515
13	-0.003475	-0.003473	-0.004866	0.000038	0.000762	-0.000515
14	-0.006239	-0.003474	-0.005035	0.000037	0.000762	-0.000513
15	-0.009963	-0.003475	-0.005221	0.000037	0.000762	-0.000513
16	0.013535	-0.000736	0.003244	0.000055	0.000657	-0.000662
17	0.014667	-0.000802	0.003248	0.000106	0.000615	-0.000741
18	0.011820	-0.000870	0.003243	0.000107	0.000588	-0.000577
19	0.0	0.0	0.0	0.0	0.0	0.0
20	0.004402	-0.003463	-0.004727	0.000051	0.000758	-0.000521
21	0.003326	-0.000749	0.001236	0.000095	0.000415	-0.000376
22	0.002666	-0.000862	0.001229	0.000093	0.000410	-0.000353
23	0.001816	-0.001544	-0.001689	0.000034	0.000406	-0.000354
24	0.001811	-0.000122	0.000012	0.000009	0.000402	-0.000349
25	-0.002143	0.000088	-0.000011	0.000007	0.000414	-0.000371
26	-0.002151	-0.001537	-0.001693	0.000035	0.000405	-0.000377
27	0.0	0.0	0.0	0.0	0.0	0.0
28	-0.001950	0.000088	-0.000015	0.000007	0.000414	-0.000371
29	0.002450	-0.000868	0.001229	0.000093	0.000410	-0.000353
30	0.003085	-0.000808	0.001236	0.000095	0.000415	-0.000376
31	-0.002148	-0.000799	-0.000692	0.000095	0.000415	-0.000376
32	-0.001121	-0.001508	-0.001694	0.000039	0.000194	-0.000512
33	-0.000903	-0.001882	-0.001690	0.000039	0.000194	-0.000512
34	0.013946	-0.000739	0.003237	0.000055	0.000657	-0.000662
35	0.006390	-0.002078	0.002767	0.000075	0.000744	-0.000522
36	0.006360	-0.004924	-0.006748	0.000075	0.000744	-0.000522
37	0.003650	-0.002163	0.002757	0.000075	0.000744	-0.000522
38	0.003650	-0.004404	-0.006748	0.000075	0.000744	-0.000522
39	0.002648	-0.002216	[illegible]	0.000068	0.000759	-0.000521
40	0.002566	-0.005011	-0.006645	0.000068	0.000759	-0.000521
41	-0.001004	-0.002220	-0.002044	0.000039	0.000762	-0.000518
42	-0.001008	[illegible]	[illegible]	0.000039	0.000762	-0.000516
43	-0.004094	[illegible]	[illegible]	0.000038	0.000762	-0.000515
44	-0.004464	[illegible]	-0.006917	0.000038	0.000762	-0.000515
45	-0.001806	-0.002088	-0.002749	0.000038	0.000762	-0.000515
46	[illegible]	[illegible]	-0.006817	0.000038	0.000762	-0.000515
47	0.001815	[illegible]	-0.000875	0.000093	0.000410	-0.000353
48	0.002665	0.000088	0.000029	0.000007	0.000414	-0.000371
49	0.002322	[illegible]	0.000032	0.000009	0.000402	-0.000349
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BEAM STRESS FOR COMBINED STATIC AND OPERATIONAL LOADS

ELM NO.	JNT NO.	STRESS NO.	COORDINATES C1	C3/2	C	STRESS/10(3) SMAX	SAL	MATERIAL DESCRIPTION	SMAX /SAL	NOTE
23	34	3	-3.00	-0.25	0.0	1.7	18.0	AISI 1020 HR STL	0.09	
24	17	4	1.75	-0.38	0.0	1.1	18.0	AISI 1020 HR STL	0.06	
25	16	3	-1.75	-0.38	0.0	1.1	18.0	AISI 1020 HR STL	0.06	
26	30	3	-1.50	-1.50	0.0	2.1	18.0	AISI 1020 HR STL	0.12	
27	29	4	-1.50	1.50	0.0	1.4	18.0	AISI 1020 HR STL	0.08	
30	26	5	0.0	0.44	0.47	1.4	18.0	AISI 1020 HR STL	0.08	
31	33	4	5.00	-0.44	0.0	0.0	18.0	AISI 1020 HR STL	0.00	
32	23	6	0.0	0.44	0.47	1.2	18.0	AISI 1020 HR STL	0.07	
33	67	7	-0.34	3.42	0.91	2.2	18.0	AISI 1020 HR STL	0.12	
34	24	7	-0.34	3.42	0.91	3.1	18.0	AISI 1020 HR STL	0.17	
35	51	6	0.0	-3.36	1.10	3.5	18.0	AISI 1020 HR STL	0.19	
36	51	6	0.0	0.56	1.10	2.9	18.0	AISI 1020 HR STL	0.16	
37	52	5	0.0	0.56	1.10	1.8	18.0	AISI 1020 HR STL	0.10	
38	52	2	-3.00	0.56	0.0	2.3	18.0	AISI 1020 HR STL	0.13	
39	21	7	-0.34	3.42	0.41	2.4	18.0	AISI 1020 HR STL	0.13	
40	31	10	-0.34	-3.42	0.91	1.5	18.0	AISI 1020 HR STL	0.03	

BOLTED JOINT STRESS FOR COMBINED STATIC AND OPERATIONAL LOADS
(N=NUMBER OF BOLTS, AREA=AREA PER BOLT)

BOLT JNT	JOINT DESCRIPTION LOC.	TYPE	N	AREA	BOLT Q.	STRESS/10(3) SMAX	SAL	MATERIAL DESCRIPTION	SMAX /SAL	NOTE
19	A	RAD	4	0.31	2	6.2	55.2	BOLTING SAE GR5	0.11	
23	B	CIRC	4	0.31	3	6.0	55.2	BOLTING SAE GR5	0.11	
16	C	RAD	4	0.13	2	2.1	55.2	BOLTING SAE GR5	0.04	
2	D	CIRC	4	0.31	4	0.5	55.2	BOLTING SAE GR5	0.01	

THIS EQUIPMENT IS ACCEPTABLE FOR THE SPECIFIED SEISMIC DISTURBANCE

THIS REPORT HAS BEEN PREPARED BY /

ROBERT F. JONDA

Robert F. Jarda

FISHER CONTROLS COMPANY

SPECIFIC ITEM #14 4KV ESSENTIAL SWITCHGEAR

PART 1: a) A detailed description of a relay chatter problem as indicated in the Wyle test report is needed (reference Wyle Report Number 42686-2).

STATUS: This item has been resolved.

RESOLUTION SUMMARY: Last page of Gould-Brown Boveri Report 33-50465 describes the anomaly and explains the basis of concluding that the chatter was not a function of seismic. A copy of Test Program Summary page of Wyle report and last page of Gould-Brown Report are attached.

PART 1: b) A detailed description of a circuit breaker problem as noted in the Wyle test report is needed (reference Wyle Report Number 42686-1).

STATUS: This item has been resolved.

RESOLUTION SUMMARY: It should be noted that test report (42686-1), only relates to the 4KV switchgear qualification in that some devices' qualifications are based on the test represented. Therefore the anomaly concerning the load center breaker does not relate to this audit. However, in response to the comment, please reference paragraph 4.2.3.1 of the Seismic Summary Report for details of the anomaly relating to two (2) K2000 circuit breakers. The details include the cause of this anomaly and satisfactory corrective action for it. A copy of the Test Program Summary page of the Wyle Report and a copy of page 9 of the Gould Seismic Summary Report are attached.

PART 2: Justification is needed for the acceptance of the anomalics discussed in PART 1.

STATUS: This item has been resolved.

RESOLUTION SUMMARY: These justifications are included in the Gould-Brown Boveri test report mentioned above.

SPECIFIC ITEM #14 4KV ESSENTIAL SWITCHGEAR

PART 3: A 4-unit specimen was tested. Justification is needed for extending to more than 4 units.

a. Assure that any additional units do not use common wall.

b. Address torsional mode due to multiple units.

STATUS: This item is resolved.

RESOLUTION SUMMARY: The attached March 23, 1984 letter from C. E. Kunkel of BBC Brown Boveri, Inc. resolved both parts of Comment #3.

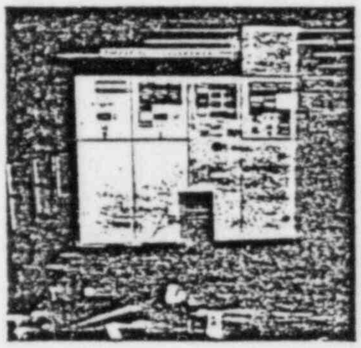
PART 4: Some devices' qualifications are not completely documented.

STATUS: This item has been resolved.

RESOLUTION SUMMARY: All devices are seismically qualified as indicated in the attached Seismic Evaluation Table and Notes 4.1 through 4.5.

It should also be noted that the term "certified" in the above table means that the acceleration levels for the device equals or exceeds the required acceleration levels for both horizontal and vertical directions, and that the device must be able to perform its intended functions during and following application of the acceleration levels.

REFERENCE:
COMMENT 1a



SEISMIC SIMULATION
Test Report

REPORT NO. 42686-2

WYLE JOB NO. 42686-02

CUSTOMER P. O. NO. J-81027C

PAGE 1 OF 209 PAGE REPORT

DATE May 31, 1974

SPECIFICATION (S) See References in Section 7.0

1.0 CUSTOMER ITE Imperial Corporation, Switchgear Division

ADDRESS 1900 Hamilton Street, Philadelphia, Pennsylvania 19130

2.0 TEST SPECIMEN Four Frames of 5 HK Switchgear

S.O. No. 960-4107-102

3.0 MANUFACTURER ITE Imperial

4.0 SUMMARY

Four frames of 5 HK Switchgear, hereinafter called the specimen, was subjected to a Seismic Simulation Test Program as required by the ITE Imperial Corporation Purchase Order Number J-81027C and Wyle Laboratories' Seismic Test Procedure 540/1761/ES, Revision A, for Class IE Equipment for ITE Imperial Corporation Switchgear Division.

It was demonstrated that the specimen possessed sufficient integrity to withstand, without compromise of structure, the prescribed simulated seismic environment.

The electrical monitoring revealed chatter present on certain relays. The results are summarized in Tables I and II, and the recorded data were furnished to the customer for his evaluation.

Ala. Professional Eng.
License No. 7112

STATE OF ALABAMA } ss.
COUNTY OF MADISON

William W. Holbrook, being duly sworn, deposes and says: The information contained in this report is the result of complete and carefully conducted tests and is to the best of his knowledge true and correct in all respects.

SUBSCRIBED and sworn to before me this 3rd day of June, 19 74

Notary Public in and for the County of Madison, State of Alabama.

My Commission expires Oct. 17, 19 76

TEST BY Special Projects

PROJ. ENGINEER H. Jordan

WYLE Q. A. B.R. Shadrick

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP
HUNTSVILLE, ALABAMA

Figure 4

Test Program Summary Page Prepared by the Testing Laboratory for the 5HK-250 Switchgear Test Specimen

COMMENTS & CONCLUSIONS

"A"

D.O. 960-4107-102
5HK Switchgear
Multiple Frequency Test, Curve A
MC 13 & 14
Westinghouse Type COV-8 Voltage Controlled Overcurrent Relays-
(Catalog # 1876244)
Struthers-Dunn Auxiliary Relay (Catalog # 219BBXP)

Monitor circuit MC13 was connected to monitor the normally closed contact of the Struthers-Dunn auxiliary relay (#219BBXP), and monitor circuit MC14 was connected to monitor the normally open contact. The monitoring circuitry consisted of both the oscillogram and the chatter detector.

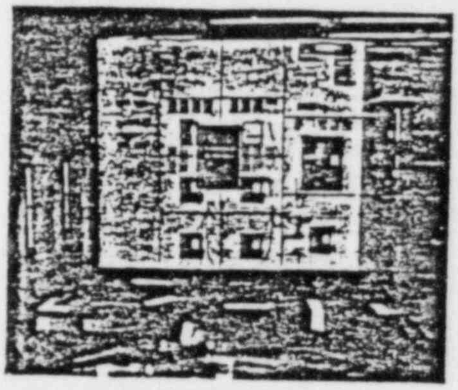
The auxiliary relay was controlled by three (3) Westinghouse Type COV-8 relays (#1876244), device 51V. In other words, when the output contacts of the COV relay closed, the auxiliary relay would pick up.

The oscillogram and chatter detector showed indications of auxiliary relay contact bounce during full SSE side to side and vertical, and front to back and vertical, multiple frequency, curve A, tests. The bounce always occurred in electrical condition "C", the condition during which the COV relays and, hence the auxiliary relay, were operated.

The auxiliary relay contact bounce indications are believed to be the result of the COV contacts bouncing open. This bouncing of the COV contacts occurred supposedly because the auxiliary relay operating coil did not draw sufficient current to operate the target and seal-in element of the COV relay. The following points lend support to this supposition.

a. When one of the COV relays was disconnected from the auxiliary relay and reconnected to an appropriately sized loading resistor, the output contacts of the COV relay no longer bounced and the target operated properly. No target occurred with the COV relays connected to the auxiliary relay.

b. The auxiliary relay contacts did not bounce in the de-energized state, i.e. during electrical conditions "A" and "B" such a relay is more susceptible to bounce in the de-energized state than in the energized state. Hence, it is reasoned that the auxiliary relay contacts themselves did not bounce during electrical condition "C" when the relay was energized.



SEISMIC SIMULATION
Test Report

REPORT NO. 42686-1

WYLE JOB NO. 42686.01

CUSTOMER P. O. NO. J-81027C

PAGE 1 OF 215 PAGE REPORT

DATE May 10, 1974

SPECIFICATION (S) See References in Section 7.0

1.0 CUSTOMER ITE Imperial Corporation, Switchgear Division

ADDRESS 1900 Hamilton Street, Philadelphia, Pennsylvania 19130

2.0 TEST SPECIMEN Four Frames of Low Voltage Switchgear S.O. No. 960-4107-101

3.0 MANUFACTURER ITE Imperial

4.0 SUMMARY

Four frames of Low Voltage Switchgear, hereinafter called the specimen was subjected to a Seismic Simulation Test Program as required by the ITE Imperial Corporation Purchase Order Number J-81027C and Wyle Laboratories' Seismic Test Procedure 540/1761/ES, Revision A, for Class IE Equipment for ITE Imperial Corporation Switchgear Division.

It was demonstrated that the specimen possessed sufficient integrity to withstand, without compromise of structure, the prescribed simulated seismic environment. However, minor problems with the circuit breakers were encountered during seismic simulation. These problems are described in paragraph 6.2 and paragraph 6.3.2.

The electrical monitoring revealed chatter present on certain relays. The results are presented in Tables I and II, and the recorded data were furnished to the customer for his evaluation.

STATE OF ALABAMA } ss.
COUNTY OF MADISON

Ala. Professional Eng. License No. 7112

William W. Holbrook, being duly sworn, deposes and says: The information contained in this report is the result of complete and carefully conducted tests and is to the best of his knowledge true and correct in all respects.

SUBSCRIBED and sworn to before me this ___ day of ___ 19 74

Notary Public in and for the County of Madison, State of Alabama.

My Commission expires Oct 17, 1976

TEST BY Special Projects

PROJ. ENGINEER H. Jordan

WYLE Q. A. B.R. Shadrick

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP
HUNTSVILLE, ALABAMA

Figure 4

Test Program Summary Page Prepared by the Testing Laboratory for the K-Line Switchgear Test Specimen

4.0 Test Results (Continued)

4.2 Test Axis No. 2 (Side-to-Side/Vertical) (Continued)

4.2.2 Multi-Frequency Tests

There were a total of fourteen (14) random multifrequency (RMF) tests performed to obtain the seventeen (17) random multi-frequency qualification tests described in paragraph 3.2.3.

The test specimen successfully withstood all fourteen (14) of the random multi-frequency tests. There was no structural degradation of the switchgear framework, nor any malfunctioning of the power circuit breakers, in either the static or dynamic modes of operation.

At the completion of the random multi-frequency tests in this test axis, and at interim points throughout the testing sequence, the power circuit breakers were checked for dynamic operation; the results of which indicated no loss or impairment of device function.

4.2.3.1 Sine Dwell at Resonance

On two successive sine dwells, (at 23 Hz and at 30 Hz), the two type K2000 circuit breakers failed to close when electrically signaled. A post-test analysis of the K2000 breakers identified the cause of this malfunction as an inadvertent engagement of the slow close mechanism such that when electrically signaled for a normal close function, the breakers went into a slow close mode of operation. This problem has been alleviated by the addition of a bias spring attached to the slow close pin of type K2000 circuit breakers.

4.2.3.2 Curve 3

The test specimen successfully withstood the eighteen (18) single frequency dwell tests described in paragraph 3.2.4.2. There was no structural degradation of the switchgear framework, nor any malfunctioning of the power circuit breakers in either the static or dynamic modes.

Brown Boveri

Switchgear Products Division

BBC Brown Boveri, Inc.
Rte. 309 & Norristown Road
Spring House, PA 19477
Phone: (215) 628-7400

March 23, 1984

Ted Moleff
Duke Power Company
P. O. Box 33189
Charlotte, N.C. 28242

Dear Ted,

As we discussed, the questions raised about HK switchgear are not difficult to resolve.

The first issue, regarding construction, can be resolved by inspection. The side sheets of the equipment are formed to provide the structural support thus there is a double side sheet at each bolted interface.

The second area of concern is the equivalency of a 4 unit test sample to a longer lineup installed at the station. In power switchgear, with a height-to-depth ratio well below 2 providing good front-to-back stability and the effect of interframe bolting in providing substantial damping in interframe force transmission, there has been little controversy about long lineup "snaking" or beam-type amplification effects until recently. In response to recent concerns we have conducted comparison tests between a four frame and twenty two frame lineup and have extensive results documented by an independent laboratory, which verify that no amplification due to long lineups will occur.

Our documentation reference for this issue is proprietary test report no. 46387-1 and can be audited with proper arrangement through our Sales Offic .

C. E. Kunkel, Manager
Product Analysis & Qualification

CEK/jm

cc: J. W. Detwiler
W. D. Wagner

REFERENCE:
COMMENT/RESPONSE 4
(5 sheets)

SEISMIC EVALUATION TABLE
of
Class 1E Resale Components

SEISMIC CERTIFICATION REPORT
G-BB Report No. 33-50465

Ref. Pc. No.	Component Description	Type-(Manufacturer) Catalog Number	Reference Accelerometers		Reqd. Accel. Level	Component Documentation		Comments	
			No. – Dir.	ZPAF		Test Report Reference No.	Avail. Accel. Level	Certification	Cert. Notes
1	Power Circuit Breaker	5HK-250 (IL) C35221-777-03	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.1
2	No Entry	–	–	–	–	–	–	–	–
3	Circuit Breaker	EF (IA) EF 2-B070	–	–	0.55V 0.83H	Test Program No. 42686-1	1.5V 1.5H	Certified	4.2
4	AC Voltmeter	(IS) S73105320	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
5	Voltmeter Switch	C77 (IS) 3001-6EE2-3002	–	–	0.55V 0.83H	Test Program 42686-2	0.8V 1.7H	Certified	4.2
6	Control Switch	C77 (IS) 1001-1CC1-0002	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
7	Indicating Light	ET-16 (GE) 0116B6708G3D	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
8	Indicating Light	ET-16 (GE) 0116B6708G3E	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
9	Test Switch	FT-1 (WE) 129A 510G01	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
10	Test Switch	FT-1 (WE) 129A 514 G01	–	–	0.55V 0.83H	Test Program 42686-2	0.8V 1.7H	Certified	4.2
11	Test Switch	FT-1 (WE) 129A 501 G01	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
12	No Entry	–	–	–	–	–	–	–	–

Ref. Pc. No.	Component Description	Type-(Manufac r) Catalog Number	Reference Accelerometers		Reqd. Accel. Level	Component Documentation		Comments	
			No. – Dir.	ZPAF		Test Report Reference No.	Avail. Accel. Level	Certification	Cert. Notes
13	Test Block	PK-2 (GE) 6422120G3	–	–	0.55V 0.83H	Test Program No. 42686-3	1.2V 1.9H	Certified	4.2
14	Test Block	PK-2 (GE) 6422120G4	–	–	0.55V 0.83H	Test Program No. 42686-3	1.2V 1.9H	Certified	4.2
15	Test Block	SJK (SC) 20K04S3	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
16	Test Block	SJK (SC) SBK-43	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
17	Watthour Meter	D4B3F (WE) 246C715G17	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
18	Volt. Cont. Overcurr. Relay	COV-8 (WE) 1876244	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
19	Differential	SA-1 (WE) 290B225A10	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
20	Current Transformer	MCS-25 (IL) 401572 -K2	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1. 7H	Certified	4.2
21	Current Transformer	MCS-25 (IL) 401572-K3	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
22	Current Transformer	MCS-25 (IL) 401572-K4	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
23	Current Transformer	MCS-25 (IL) 401572-K6	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
24	Transformer	MC-5 (IL) 401437-K9	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2

Ref. Pc. No.	Component Description	Type-(Manufacturer) Catalog Number	Reference Accelerometers		Reqd. Accel. Level	Component Documentation		Comments	
			No. – Dir.	ZPAF		Test Report Reference No.	Avail. Accel. Level	Certification	Cert. Notes
25	Ground Sensor	GS (IR) 302L021	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
26	Potential Transformer	JVM-3 (GE) 643X88	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
27	P. T. Primary Fuse	EJ-1 (GE) 9F60BBD002	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
28	AMP Transducer	IR (FW Bell) IR 2101T	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
29	NO ENTRY	–	–	–	–	–	–	–	–
30	Lockout Relay	LOR (ES) 7803D	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7V	Certified	4.2
31	Resistor	ADJ (IS) 279055-C61	–	–	0.55V 0.83H	Test Report No. R-09161-CI	3.5V 3.5H	Certified	4.3
32	Terminal Block	ZWM (SC) ZWM-25008	–	–	0.55V 0.83H	Test Program No. 42686-1	1.5V 1.5H	Certified	4.2
33	Overcurrent Relay (GRD)	GR-5 (IR) 202D6141UL	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
34	Overcurrent Relay (GRD)	51D (IR) 223S6140	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
35	Overcurrent Relay	51Y (IR) 223T2340	–	–	0.55V 0.83H	Test Program No. 42686-3	1.2V 1.9H	Certified	4.2
36	Overcurrent Relay	51Y (IR) 223T2341	–	–	0.55V 0.83H	Test Program No. 42686-3	1.2V 1.9H	Certified	4.2

Ref. Pc. No.	Component Description	Type-(Manufacturer) Catalog Number	Reference Accelerometers		Reqd. Accel. Level	Component Documentation		Comments	
			No. – Dir.	ZPAF		Test Report Reference No.	Avail. Accel. Level	Certification	Cert. Notes
37	Overcurrent Relay	51L (IR) 223T5541	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
38	Overcurrent Relay	51L (IR) 223T5341	–	–	0.55V 0.83H	Test Program No. 42686-2	0.8V 1.7H	Certified	4.2
39	Overcurrent Relay	50 (IR) 218T0641	–	–	0.55V 0.83H	Test Program No. 42686-3	1.2V 1.9H	Certified	4.2
40	Timing Relay	SAM (GE) 12SAM11A21A-S	8 – V 10 – H	501 SRS	1.80V 2.50H	G.E. Letter dated 10/28/77	4.0V 4.0H	Certified	4.5
41	Sync. Check Relay	IJS (GE) 12IJS52G1A-S	–	–	0.55V 0.83H	Test Program No. 44079-1	2.8V 2.0H	Certified	4.2
42	No Entry	–	–	–	–	–	–	–	–
43	No Entry	–	–	–	–	–	–	–	–
44	No Entry	–	–	–	–	–	–	–	–
45	No Entry	–	–	–	–	–	–	–	–
46	No Entry	–	–	–	–	–	–	–	–
47	No Entry	–	–	–	–	–	–	–	–
48	No Entry	–	–	–	–	–	–	–	–

4.0 Certification Notes for Class 1E Components

4.1 The power circuit breaker requiring certification is installed in the basic 5HK-250 switchboard in the standard manner and location for which it was designed and is seismically equivalent to a power circuit breaker similarly installed and located in the referenced switchgear test program. The Available Acceleration Levels shown are the test inputs to the base of the switchgear test specimen.

4.2 The component to be certified is installed in a similar manner and location as a seismically equivalent item included in the referenced switchgear test program. The Available Acceleration Levels shown are the test input levels to the base of the switchgear test specimen.

4.3 The component to be certified is seismically equivalent to a type tested specimen of the referenced test report. The Available Acceleration Levels shown were those present at the test sample while mounted on a rigid test fixture.

4.4 Certification of this relay is based upon manufacturer supplied data. The referenced Westinghouse letter indicates the applicability of this data to the relay requiring certification. The Available Acceleration Levels shown were those present at the test sample while mounted on a rigid test fixture.

4.5 Certification of this relay is based upon manufacturer supplied information. The referenced G.E. letter indicates the seismic capability of the relay, (in relation to IEEE P501), and provides evidence of the equivalency to the particular relay tested. Certification of the relay is limited to the use of the relay's normally open contacts.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba   TYPE:

1. Utility: Duke Power Co.   PWR: √

2. NSSS: Westinghouse   BWR: ______

3. A/E: N/A   Other ______

II. Component Name: 4160 Volt Essential Switchgear

1. Scope: [ ] NSSS   [√] BOP   [ ] Other

2. Model Number: 5HK   Quantity: 2 Switchgear Groups

3. Size or Range: 4160V

4. Vendor: Brown Boveri Electric

5. If the component is a cabinet or panel, name and model Number of the devices included: Each group includes fifteen(15) 5HK250 air magnetic circuit breakers. See attached drawings CNM-1312.02-11, 12 for additional components

6. Physical Description:

   a. Appearance: Switchgear

   b. Dimensions: 80"H x 56"D X 39'-0"L

   c. Weight: 20,000 lbs. (estimated)

7. Location: Building: Auxiliary

   Elevation: 560 (1ETB) 577 (1ETA)

8. Field Mounting Conditions   [ ] Bolt (No. ____,) Size ____)
   [ ] Weld (Length ____)
   [√] See attached drawings CN-1214-1, CNM-1312.02-11,12

9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

   Floor Mounted

10. a. System is which located: EPC

    b. Functional Description: Provides switching/tripping for 4KV Class 1E loads

    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

    [√] Both   [ ] Neither   [ ] Other ______

EL401140/1

II. Pertinent Reference/Design Specifications for Qualification Requirements: CNS-1312.02-1 and Revisions 1 and 2

a. Seismic Input

b. Hydrodynamic Load Input

c. Fatigue Considerations

d. Service Conditions

e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[√] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[√] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 33-50465, Seismic Certification Report (Addendum II)

(No., Title and Date): for Class 1E Electrical Equipment, September 1981

Company that Prepared Report: Gould-Brown Boveri

Company that Reviewed Report: Duke Power Company

Where Report is filed or available: Duke drawing file No. CNM-1312.02-66

Applicable Codes And/Or Standards: IEEE 323-1971, IEEE 344-1971

V. Vibration Input:

1. Loads considered:
   a. [√] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [√] N/A (other, specify)

3. Required Response Spectra** (attach the graphs): See attached

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 1% SSE 1%

5. Required Acceleration in Each Direct:

[√] ZPA [ ] Other ________ (specify)

OBE S/S = .19 F/B = .19 V = .095

SSE S/S = .36 F/B = .36 V = .1781

6. Were fatigue effects considered:

[ ] Yes [√] No

If yes, describe how they were treated in overall qualification program: ________

____

____

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [√] Multi-Frequency [ ] random
[ ] sine beat
[ ] ________

2. [ ] Single Axis [ ] Multi-Frequency
[√] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 9 F/B 8 S/S SSE 6 F/B 6 S/S Other ________ (specify)

4. Frequency Range: .5 to 50 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
See Gould Seismic Summary Report Test No. 42686-2, pages 7 through 10

S/S = ________ F/B = ________ V = ________

6. Method of Determining Natural Frequencies

[√] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[√] Yes (Attach TRS & RRS graphs)

[ ] No

8. Maximum Input g Level Test: See attachment for Q VI.7

OBE S/S = ____________ F/B = ________________ V = ______________

SSE S/S = ____________ F/B = ________________ V = ______________

9. Laboratory Mounting:

A. [√] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ____________

B. Orientation and Fixturing: Simulated actual in-service installation

10. Functional Operability verified:

[√] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: N/A

12. Other tests performed (such as aging or fragility test, including results):
N/A

13. Failure Modes (If appropriate N/A)

14. Margins Available: [ ] Input Spectrum [ ] Fragility N/A

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ____________ F/B = ________________ V = ______________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ________

4. [ ] Computer Codes: ______________________________

Frequency Range and no. of modes

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: ____________ (specify)

6. Damping:

OBE ______ SSE ______ Basis for the damping used: __________

7. Support Considerations in the model: ____________________

8. Critical Structural Elements:

A. Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B. Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

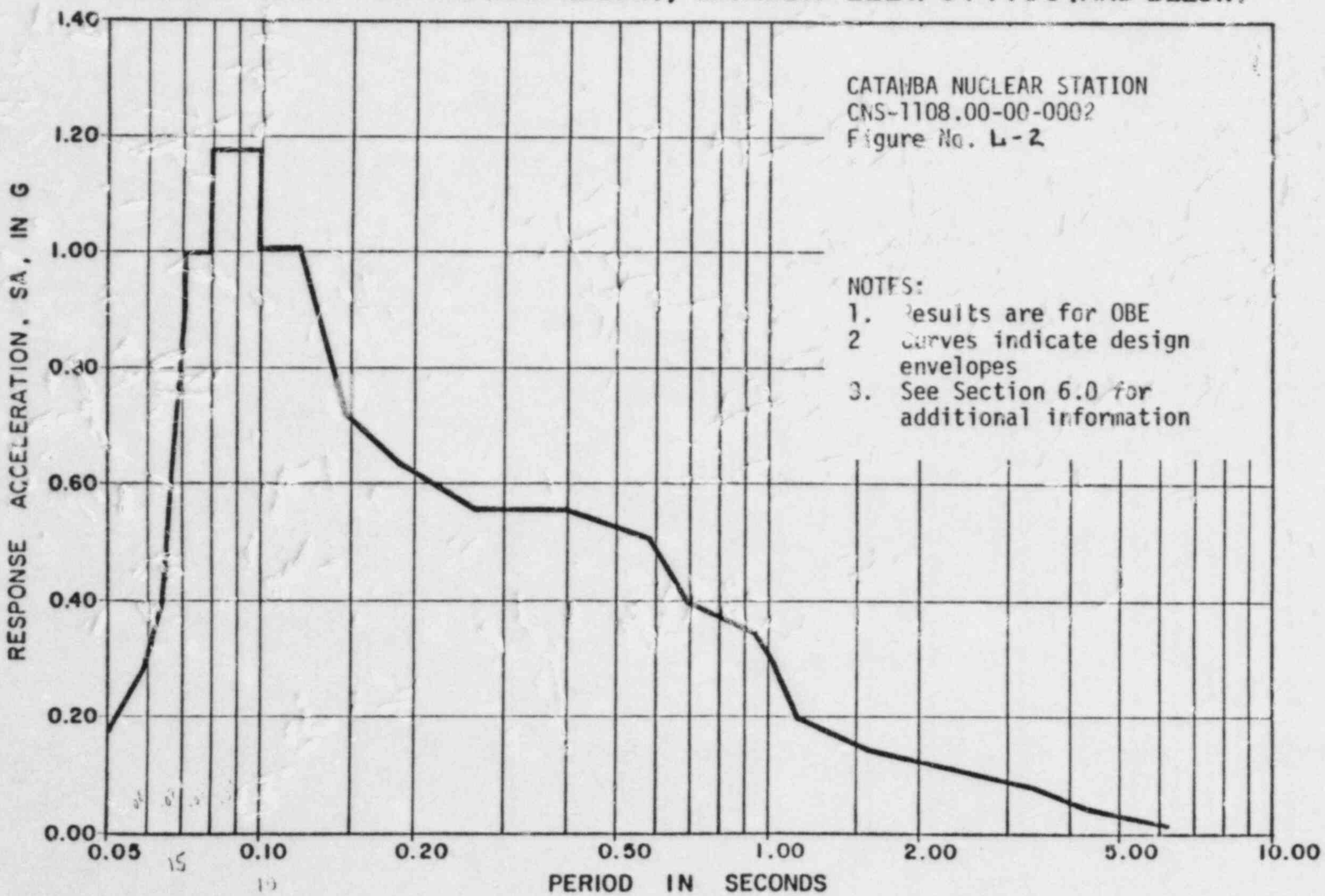
9. Failure Modes: ______________________________

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

MCGUIRE & CATAWBA AUX BLDG N-S & E-W OBE

COMPOSITE RESPONSE SPECTRA, DAMPING = 0.010

MCGUIRE ELEV. 750+00 (AND BELOW), CATAWBA ELEV. 577+00 (AND BELOW)



Attachment for Q I.3

Revision 4: October 1, 1982
Date: December 5, 1980

Figure 1

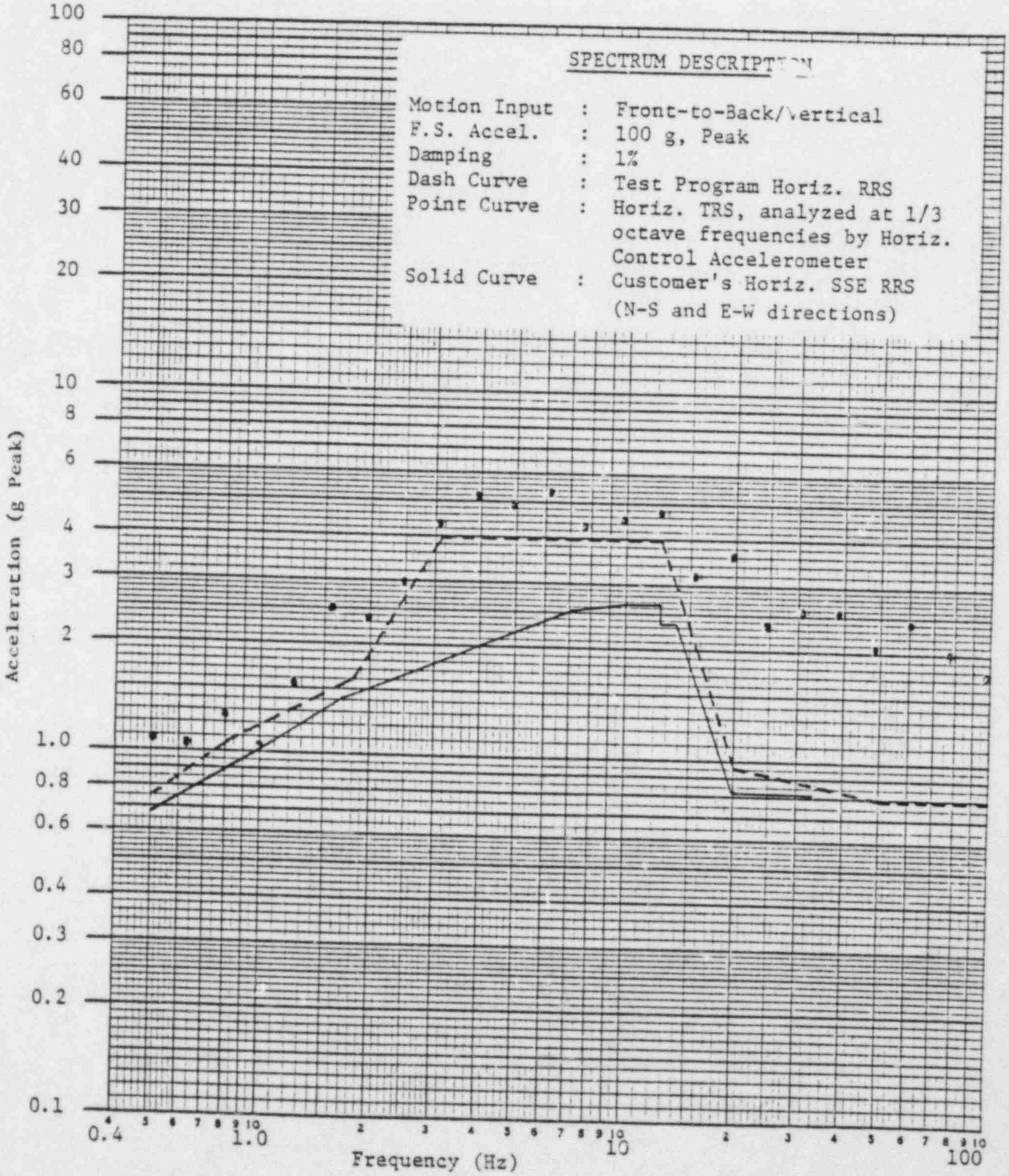


Figure 1

COMPARISON OF THE CUSTOMER'S HORIZONTAL SSE RRS TO THE HORIZONTAL FRONT-TO-BACK TRS OF THE 5HK-250 SWITCHGEAR TEST SPECIMEN

Q. VI. 7

Figure 2

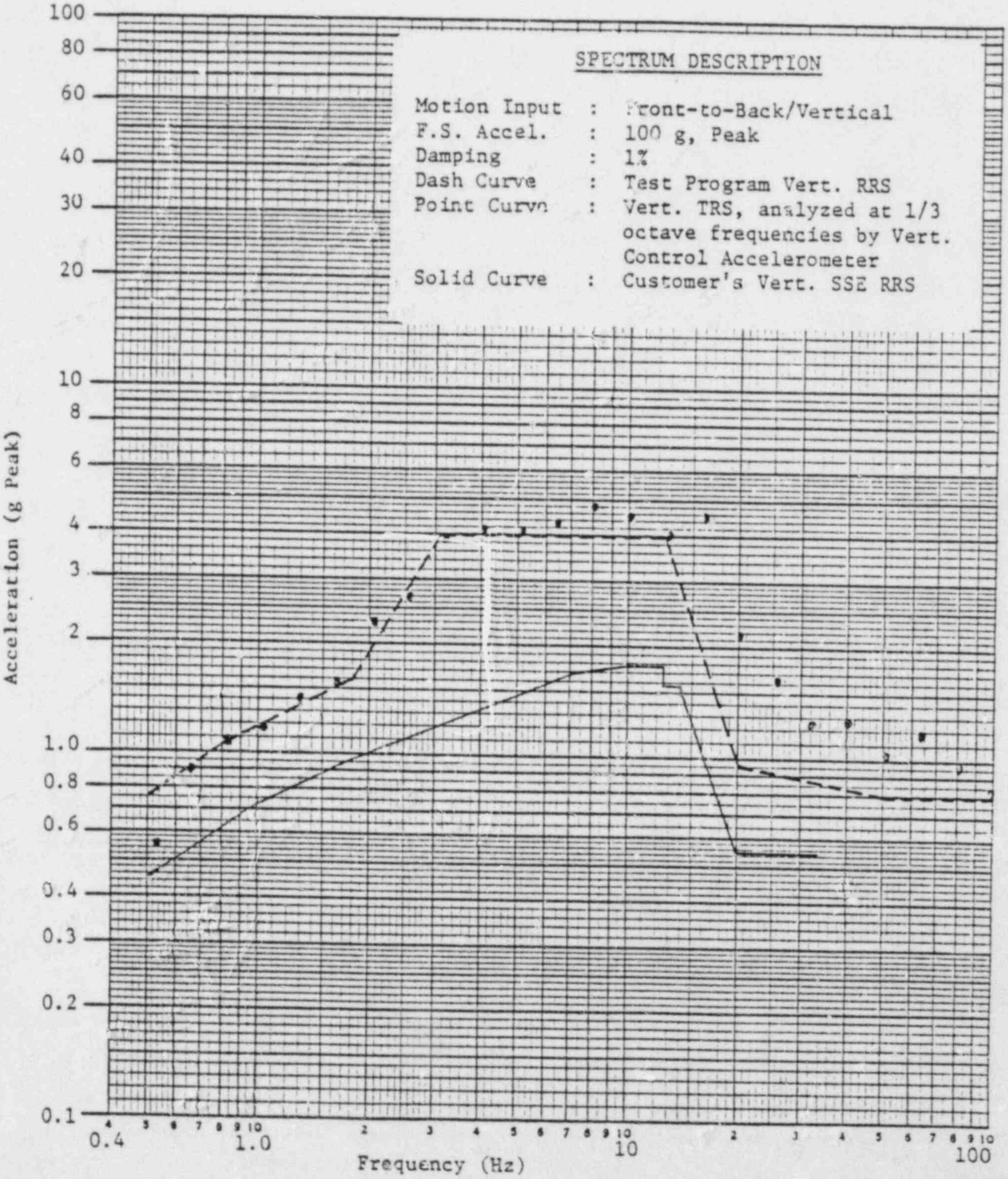


Figure 2

COMPARISON OF THE CUSTOMER'S VERTICAL SSE RRS TO THE VERTICAL TRS OF THE 5HK-250 SWITCHGEAR TEST SPECIMEN

Q VI.7

Spectrum Reference Source;
Test Program No. 42686-2
Run No. 76, HCA

Figure 3

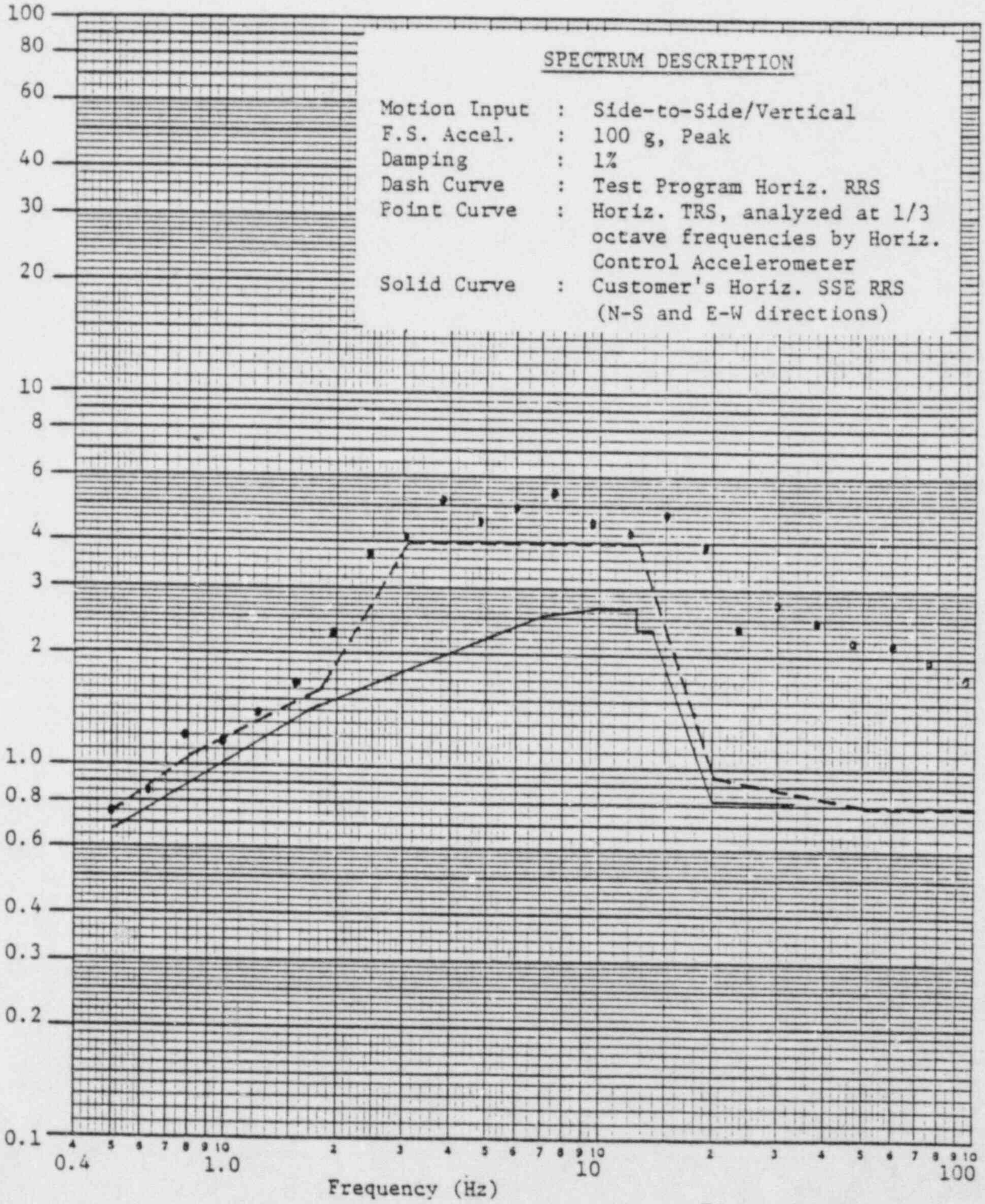


Figure 3

COMPARISON OF THE CUSTOMER'S HORIZONTAL SSE RRS TO THE HORIZONTAL SIDE-TO-SIDE TRS OF THE 5HK-250 SWITCHGEAR TEST SPECIMEN

Q.VI.7

DOCUMENT/ PAGE PULLED

ANO. 8404200271

NO. OF PAGES 3

REASON

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    OTHER ______
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SPECIFIC ITEM #15   600V MOTOR CONTROL CENTERS (MCC)

PART 1: SQRT form should be revised to:

1. Show all equipment elevations

2. Show all seismic qualification documentation

STATUS: SQRT form has been revised

RESOLUTION SUMMARY: Table 1 represents the revision to the SQRT form and lists the documents required to show seismic qualification of the Catawba MCC's.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba　　　　TYPE:

1. Utility: Duke Power Co.　　　　PWR: √
2. NSSS: Westinghouse　　　　BWR: ______
3. A/E: N/A　　　　Other ______

II. Component Name: 600 Volt Essential Motor Control Centers

1. Scope: [ ] NSSS　[√] BOP　[ ] Other
2. Model Number: 1035U　　　Quantity: ______
3. Size or Range: N/A ______
4. Vendor: Nelson Electric
5. If the component is a cabinet or panel, name and model Number of the devices included: 1035 U Class

   For MCC#1EMXA, a typical MCC, see attached Bill of Material CNM-1314.01-0084 and One Line List CNLT-1752-01.01
6. Physical Description:
   a. Appearance: CABINETS. See Attached O/L Dwg. CNM-1314.01-47
   b. Dimensions: 91½"Hx24'Wx20"D per Vertical Structure
   c. Weight: ~ 810# per Vertical Structure
7. Location: Building: Auxiliary Building

   Elevation: 560, 577, 594
8. Field Mounting Conditions　[ ] Bolt (No. ____,) Size ____)
   [ ] Weld (Length ____)
   [√] see attached Dwg. CN1214-1
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

   Floor
10. a. System is which located: EPE
    b. Functional Description: Provides power to 600VAC Class 1E loads
    c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

       [√] Both　[ ] Neither　[ ] Other ______

II. Pertinent Reference/Design Specifications for Qualification Requirements: ______

Specification CNS-1314.01-1, 11-12-74

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[√] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[√] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: See Attached Table I

(No., Title and Date): ______

Company that Prepared Report: NELSON ELECTRIC (T-1035, 3-20-75)

Company that Reviewed Report: DUKE POWER

Where Report is filed or available: CNM-1314.01-0242

Applicable Codes And/Or Standards: IEEE 344-1971

V. Vibration Input:

1. Loads considered:
   a. [√] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [√] N/A (other, specify)

3. Required Response Spectra** (attach the graphs): See attached

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 1% SSE 1%

5. Required Acceleration in Each Direct:

[√] ZPA [ ] Other ____________ (specify)

OBE S/S = .19 F/B = .19 V = .095

SSE S/S = .36 F/B = .36 V = .178

6. Were fatigue effects considered:

[ ] Yes [√] No

If yes, describe how they were treated in overall qualification program: ____________

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [√] Multi-Frequency [ ] random
[ ] sine beat
[ ] ____________

2. [ ] Single Axis [√] Multi-Frequency
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:
OBE F/B 8 S/S 5 SSE F/B 2 S/S 1 Other ____________ (specify)

4. Frequency Range: 1.25 to 40 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
See SAA Report No. SAA-78-0105 page 4.0
S/S = 9,33 F/B = 15 V = N/A

6. Method of Determining Natural Frequencies

[√] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[√] Yes (Attach TRS & RRS graphs)

[ ] No

8. Maximum Input g Level Test: See graphs

OBE S/S = ____________ F/B = ________________ V = ______________

SSE S/S = ____________ F/B = ________________ V = ______________

9. Laboratory Mounting:

A. [√] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ___________

B. Orientation and Fixturing: Simulated actual in-service installation

10. Functional Operability verified:

[√] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: N/A

12. Other tests performed (such as aging or fragility test, including results):
N/A

13. Failure Modes (If appropriate N/A)

14. Margins Available: [ ] Input Spectrum [ ] Fragility N/A

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ____________ F/B = ________________ V = ______________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ________

4. [ ] Computer Codes: ______________________________

Frequency Range and No. of modes

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: ______________ (specify)

6. Damping:

OBE _______ SSE _____ Basis for the damping used: __________

7. Support Considerations in the model: ______________________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: ______________________________

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

TABLE 1

SEISMIC QUALIFICATION DOCUMENTATION

FOR 600 VAC MOTOR CONTROL CENTERS

TYPE OF UNIT	TEST PLAN(S)	DUKE FILE NUMBER	QUAL. ELEV.	WYLE T.R	DUKE SPEC. NO.
CIRCUITS BREAKERS					
150A FDR (1/2X)	73-10-09, 8-27-74	MCM-1314.01-248	MC 784	53776	MCS-1314.01, 8-8-73
150A FDR (1X) w/Aux.	74-05-23, 10-21-74	(Nelson Electric	CAT 611	(Rev.A 6-14-74)	"
150A Dual FDR	78-0715, 7-15-78	T-1035-31	"	53376A	"
150A Main w/Aux & KKI	"	3-20-75)	"	(Addendum 1	"
225A Main & FDR	"	"	"	to Rev. A	"
400 & 600A FDR	"	"	"	2-5-75)	"
400, 600, & 800A Main	"	"	"	"	"
600 A. Main w/Aux. Sw.	"	"	"	"	"
250A Main w/Aux. Sw.	78-0106, 1-6-78	CNM-1314.01-242	CAT 611	58281	CNS-1314.01, 11-12-74
A Main (2) LB-(1)KB	"	(Nelson Electric	"	(4-5-78)	"
800A Main w/Aux. Sw.	"	T-1035.36	"	"	"
		11-7-78)			
NON-REVERSING STARTERS					
Sizes 1, 2, 3, 4, & 5	73-10-09, 8-27-74	MCM-1314.01-248	MC 784	53776 and	MCS-1314.01, 8-8-73
Size 2 w/side Mtd. Int'lk	74-05-23, 10-21-74	"	CAT 611	53776A	"
	78-0715, 7-15-78				
Sizes 1, 2, 3, 4, & 5 with FLSHR & EXTRA OL	78-0106, 1-6-78	CNM-1314.01-242	CAT 600	58281	CNS-1314.01, 11-12-74

TABLE 1

SEISMIC QUALIFICATION DOCUMENTATION

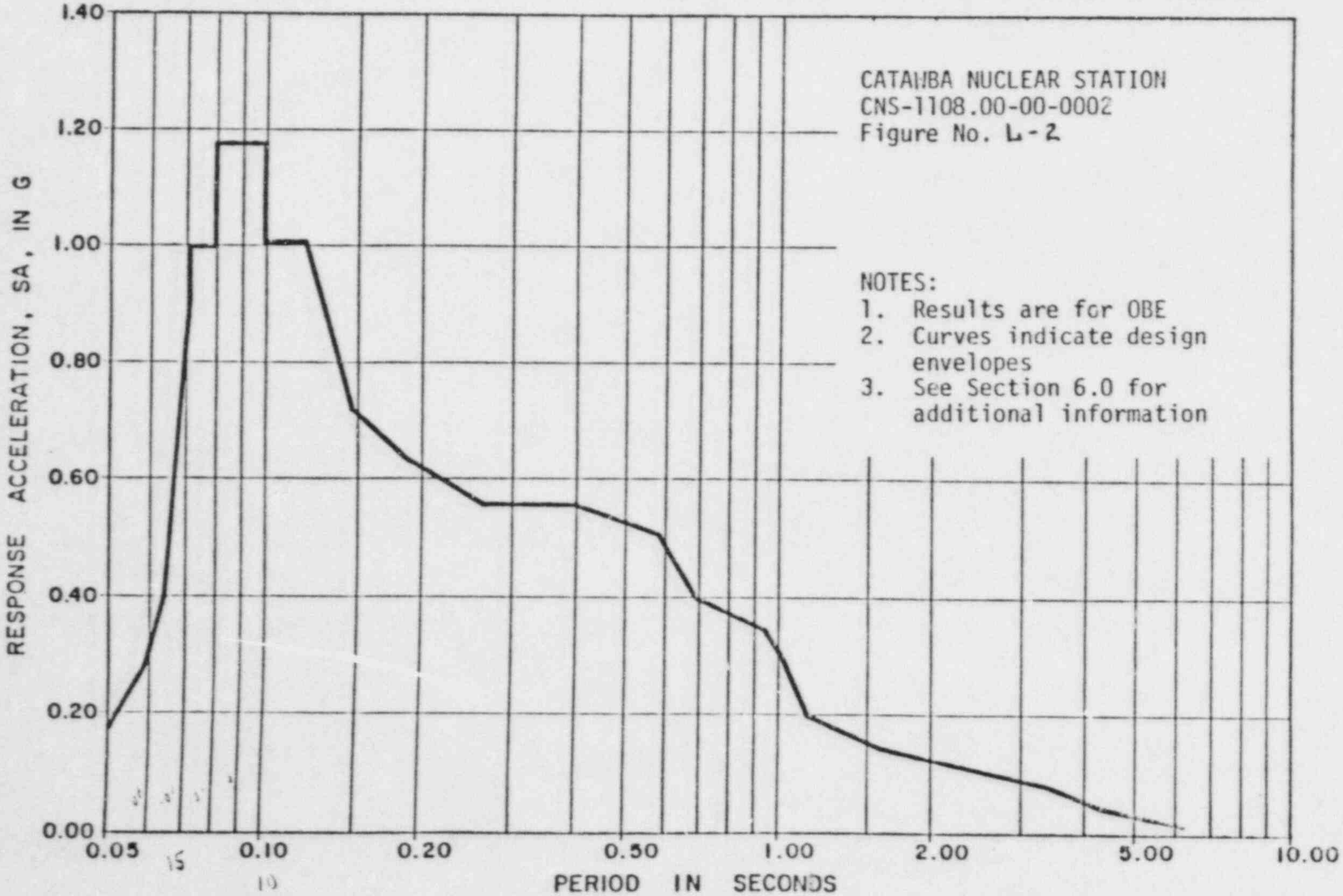
FOR 600 VAC MOTOR CONTROL CENTERS

TYPE OF UNIT	TEST PLAN(S)	DUKE FILE NUMBER	QUAL. ELEV.	WYLE T.R	DUKE SPEC. NO.
REVERSING STARTERS					
Size 1 & 2	73-10-09, 8-27-74 74-05-23, 10-21-74 78-0715, 7-15-78	MCM-1314.01-248	MC 784 CAT-611	53776 and 53776A	MCS-1314.01, 8-8-73
Size 1 & 2 with FLSHR	78-0106, 1-6-78	CNM-1314.01-242	CAT 600	58281	CNS-1314.01, 11-12-74
CONTACTORS					
Size 2 Size 2-2P	73-10-09, 8-27-74 74-05-23, 10-21-74 78-0715, 7-15-78	MCM-1314.01-248	MC 784 CAT 611	53776 53776A	MCS-1314.01, 8-8-73
Size 1, 3, & 4	78-0106, 1-6-78	CNM-1314.01-242	CAT 600	58281	CNS-1314.01, 11-12-74

MCGUIRE & CATAWBA AUX BLDG N-S & E-W OBE

COMPOSITE RESPONSE SPECTRA, DAMPING = 0.010

MCGUIRE ELEV. 750+00 (AND BELOW), CATAWBA ELEV. 577+00 (AND BELOW)



Revision 4: October 1, 1982
Date: December 5, 1980

WYLE LABORATORIES

Report No. 53776

Customer NELSON ELECT Job No. 53776

Page No. 70

Channel Identification T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 2101 Control 1

Response ( )

Full Scale 100 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N #1

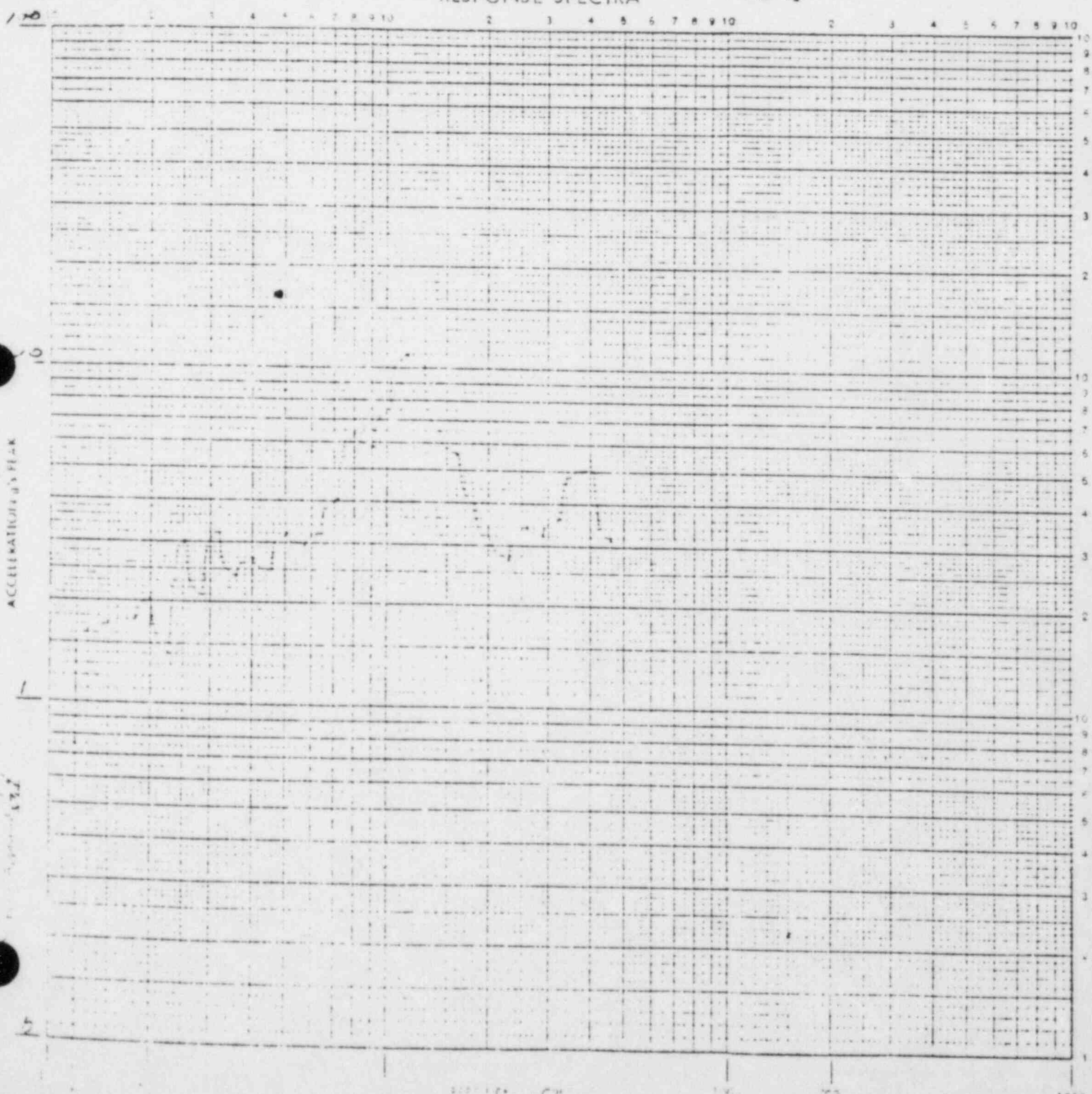
Operator GOAD

~~P/N~~ CONFIGURATION #1

Date 2-25-74 Polarity + Q 50

Axis of Test HORIZ 3-4

RESPONSE SPECTRA SSE



WYLE LABORATORIES

Customer NELSON ELECT Job No. 53776 Report No. 53776

Page No. 71

Channel Identification: T.R 1 Trk. No. 2 Accel. No. 2

Transducer S/N 1556 Control 4 Response ( )

Full Scale 100 G Cal Voltage 500 MVPK/ 1 G

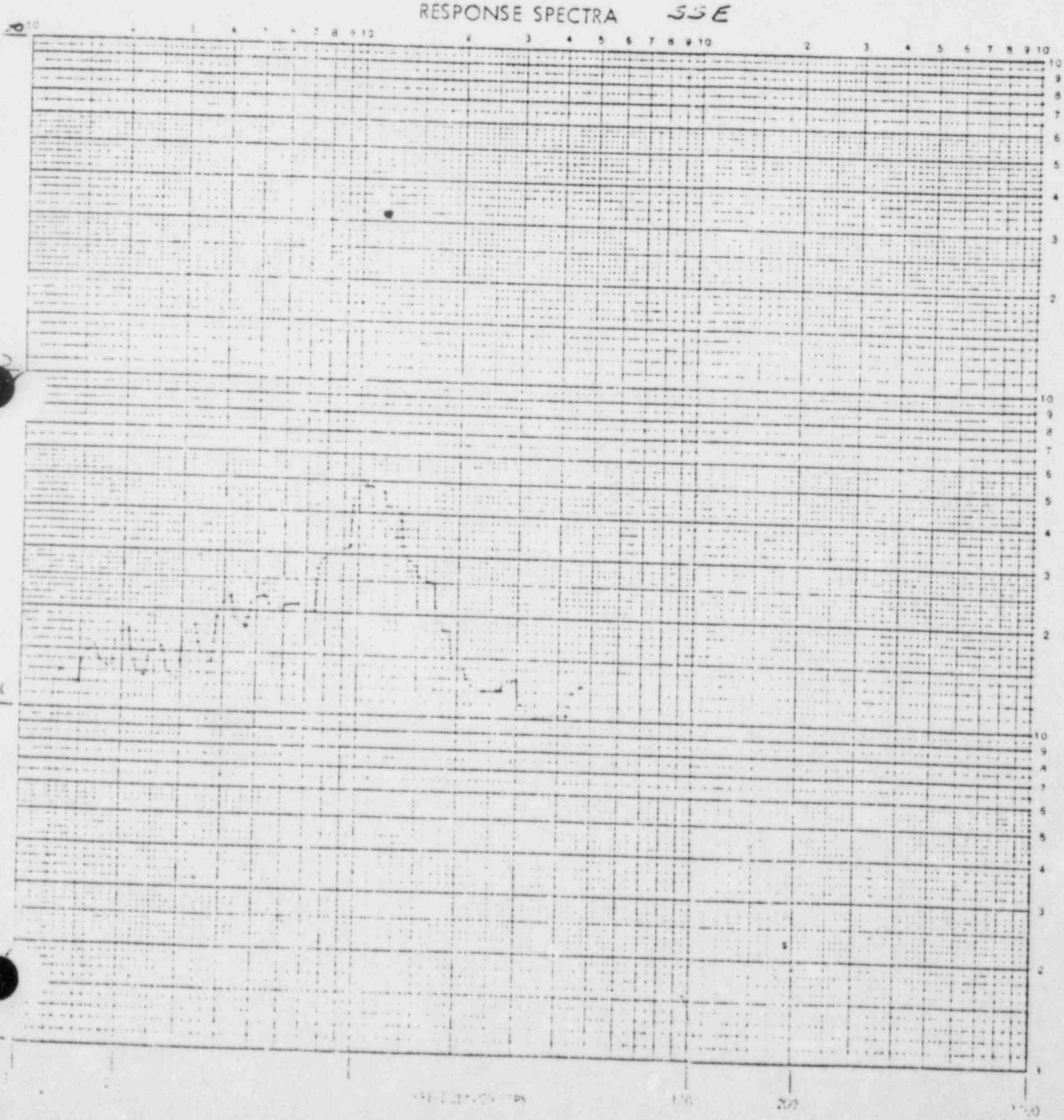
Mode OFF Specimen S/N #1

Operator GOAD

CONFIGURATION #1

Date 3-28-74 Polarity + Q 50 Axis of Test VERT Z-Y

RESPONSE SPECTRA SSE



WYLE LABORATORIES

Report No. 53776

Customer BELSON ELECT Job No. 53776

Page No. 92

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 2101 Control ✓ Response ( )

Full Scale 100 G Cal Voltage 5.00 MVPK/ 1 G

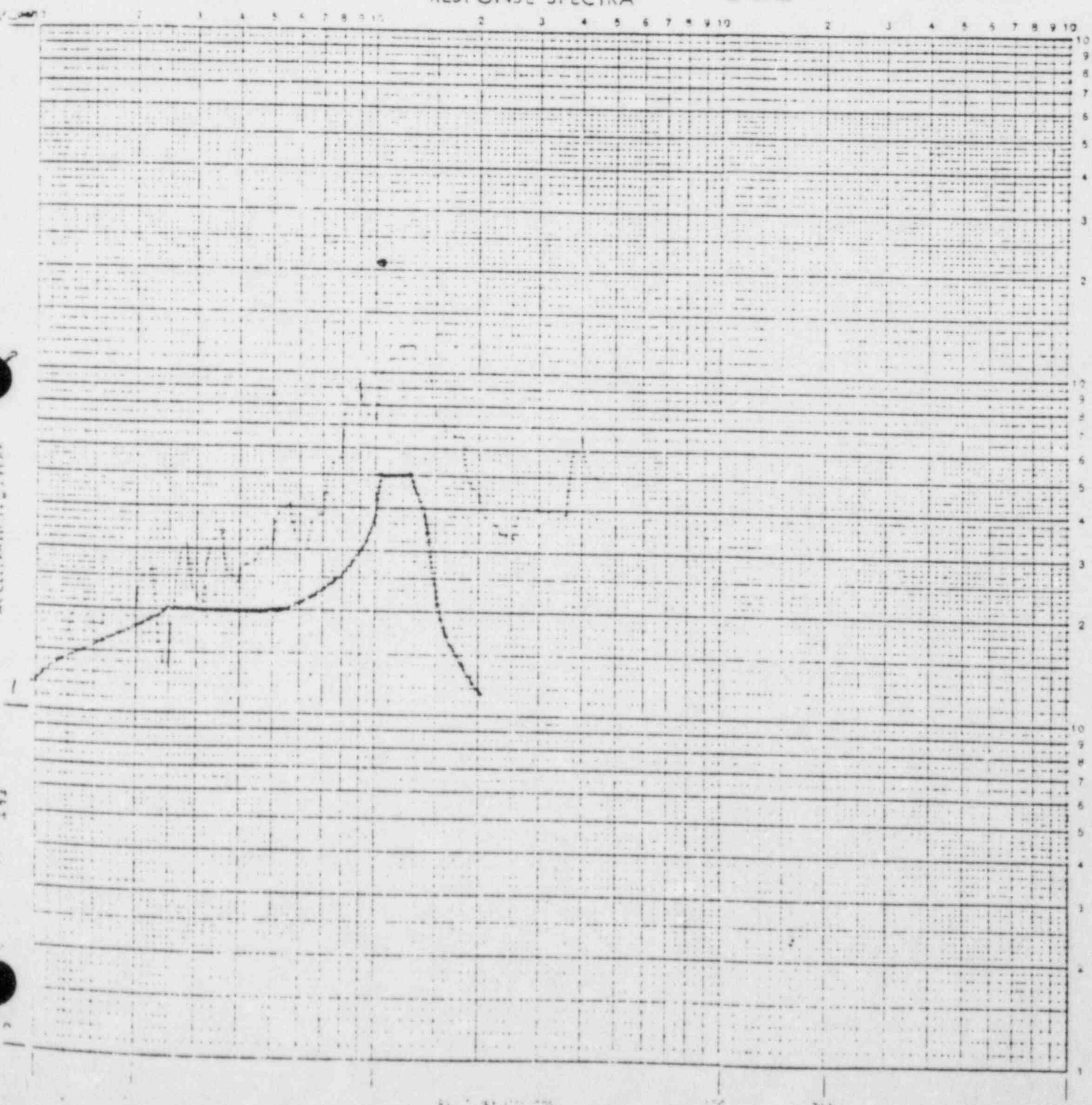
Mode OFF Specimen S/N #1

Operator GOAD

CONFIGURATION #1

Date 3-25-74 Polarity ± Q 50 Axis of Test Horiz X-2

RESPONSE SPECTRA SSE



WYLE LABORATORIES

Customer NELSON ELECT Job No. 53776

Report No. 53776

Page No. 93

Channel Identification: T R 1 Trk. No. 2 Accel. No. 2

Transducer S/N 1556 Control (T) Response ( )

Full Scale 100 G Cal Voltage 500 MVPK 1 G

Mode REF

Specimen S/N #1

Operator GORO

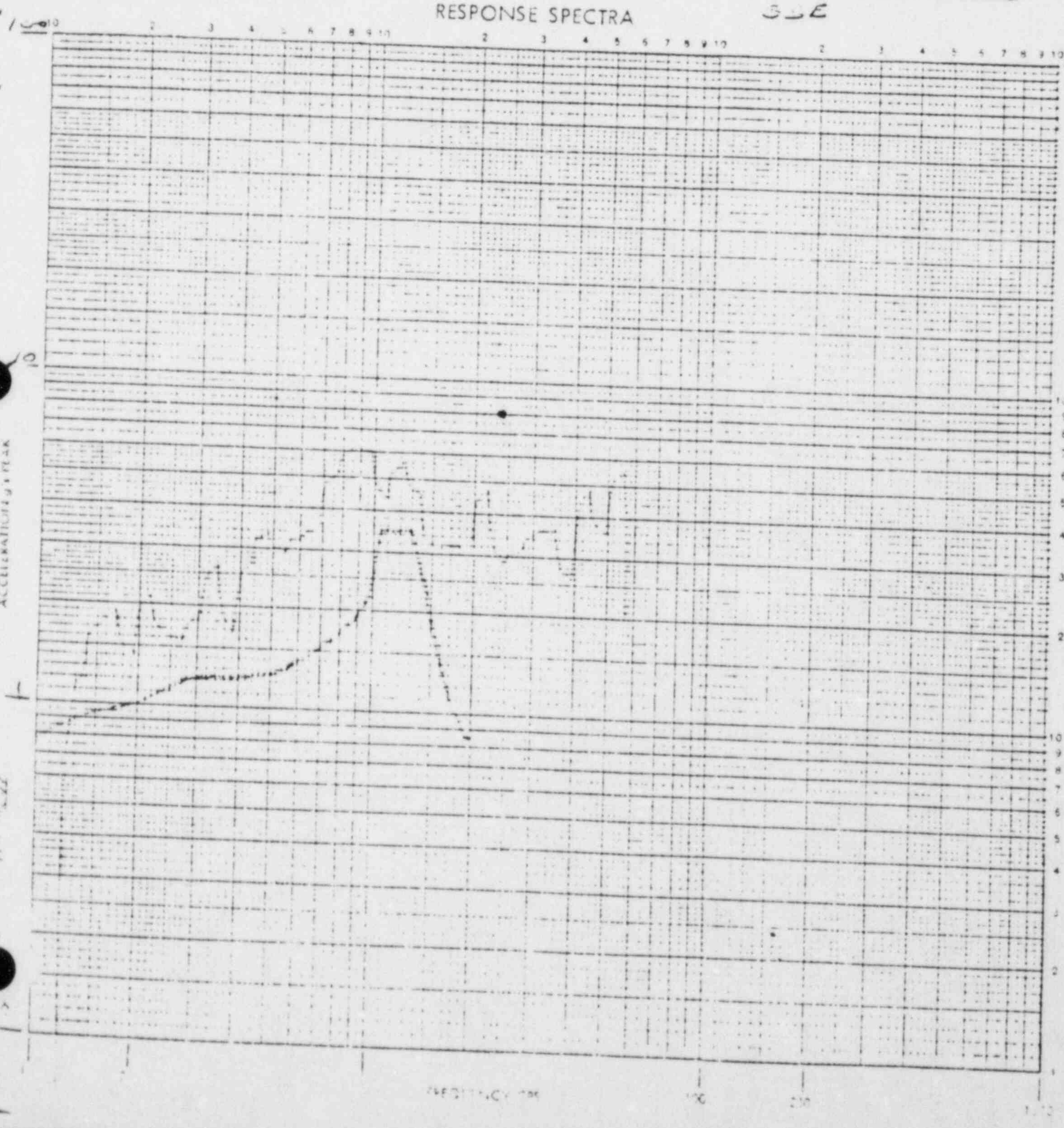
P N CONFIGURATION #1

Date 3-25-84 Polarity ± Q 50

Axis of Test VERT X-Z

SSE

RESPONSE SPECTRA

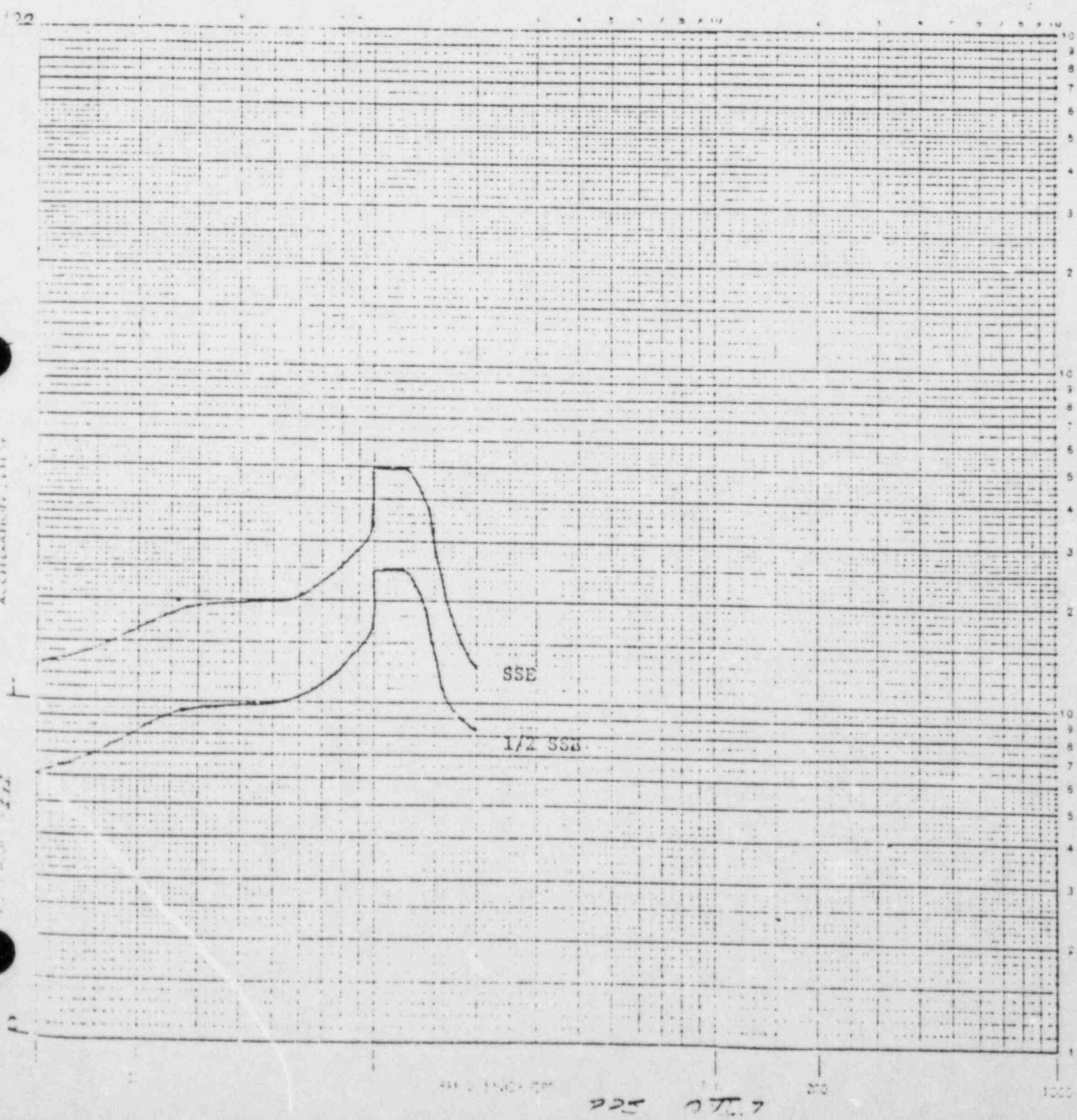


DATA SHEET

WYLE LABORATORIES

FIGURE 1

Horizontal Response Spectra



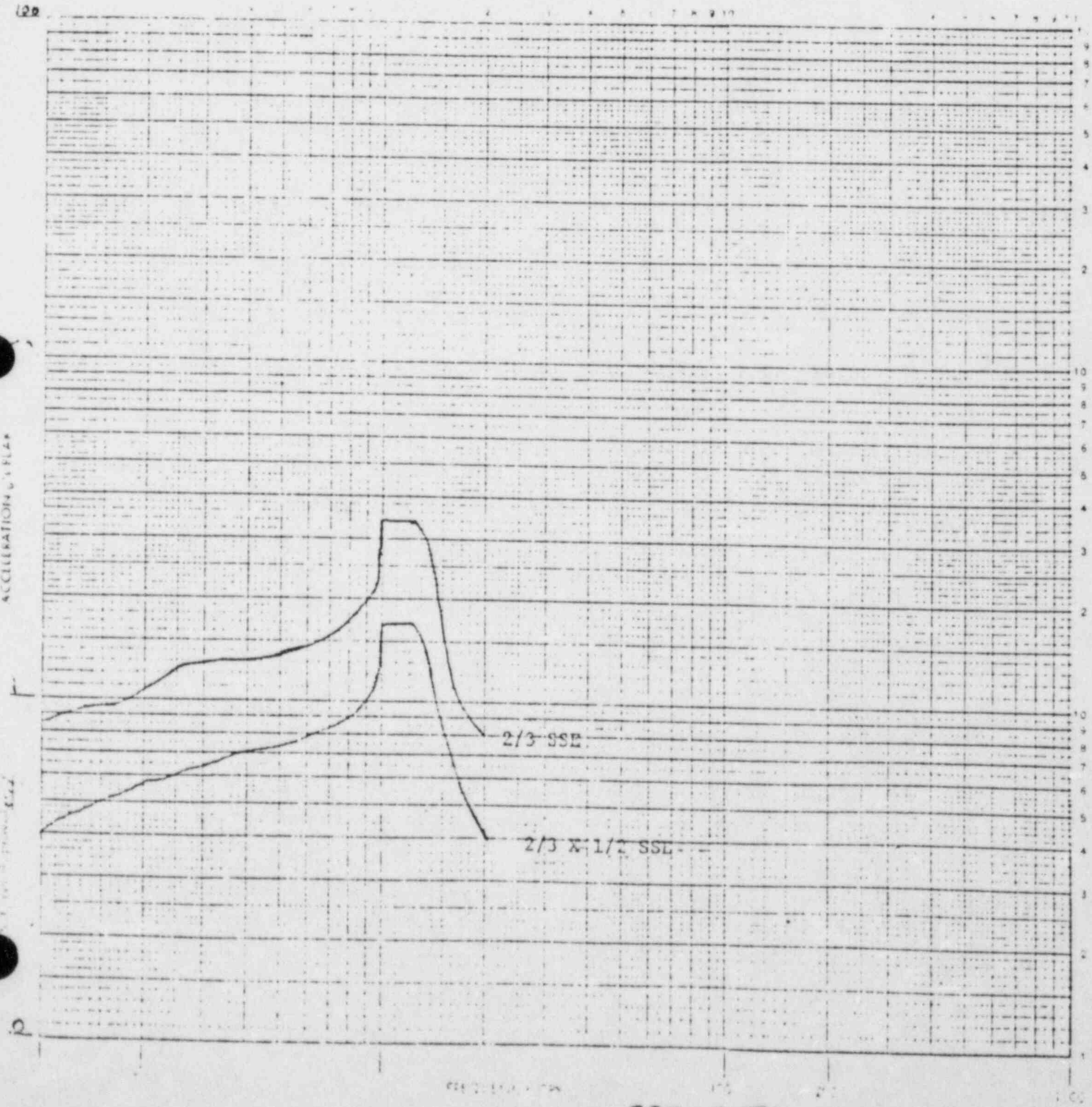
DATA SHEET

Attachment for Q V. 3

WYLE LABORATORIES

FIGURE 2

Vertical Response Spectra



LIST NUMBER 2C

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
ELECTRICAL ONE-LINE LIST
CNLT-1752-01.01
1EMXA

QA CONDITION 1

CONSISTING OF PAGES 1- 7

ONE-LINE LIST NO.	REV NO.	TOTAL COMPTS	THE FOLLOWING COMPARTMENTS CONTAIN REVISIONS	DRAWN/ DATE	CHECKED/ DATE	APPROVED/ DATE
CNLT-1752-01.01	16	2	F01C R07D	J.C. Pallen 1/03/84	C.W. Whitlock 1/05/84	D.M. Clark 1-13-84
CNLT-1752-01.01	15	2	R04B R05D	DCP 12/23/83	JEH 12/29/83	DMC 12/29/83
CNLT-1752-01.01	14	1	R02B	CWW 6/22/83	LSW 6/22/83	DMC 6/22/83

ORIGINAL ISSUE

ONE-LINE LIST NO.	REV NO.	DRAWN	DATE	CHECKED	DATE	INSP	DATE	APPR	DATE
CNLT-1752-01.01	00	RCG	6/13/80	BKA	6/13/80	AOH	6/13/80	DLP	6/13/80

1EMXA
MOTOR CONTROL CENTER
(600VAC ESS AUX PWR SYS)
AB BLDG ELEV 577+00 COORD LOC FF-54

FILE PRINT
MUST BE
SIGNED OUT

NOTES

A CHANGES MADE TO "REFERENCE INFORMATION" SINCE THE LAST REVISION WILL BE IDENTIFIED BY AN "*" SUFFIX. REFERENCE INFORMATION ON THE COVERSHEET, LIST 2B, IS IDENTIFIED AS: EQUIPMENT TITLE, EQUIPMENT LOCATION, GENERAL NOTES AND SPECIFIC NOTES. REFERENCE INFORMATION ON THE ONE-LINE LIST IS IDENTIFIED AS: NORMAL AND ALTERNATE POWER SOURCE- BUS/COMPARTMENT, EQUIPMENT LOCATION, DUKE DRAWINGS AND MCC UV RELAY.

B MATERIAL REQUIRED TO IMPLEMENT CHANGES IDENTIFIED FOR CURRENT REVISION (SUFFIXED BY ASTERISKS) ARE TO BE OBTAINED BY REFERRAL TO DUKE BILL OF MATERIAL DRAWING NUMBER CNBM-1752-00.01 AND/OR SPECIFIC NOTES AS REFERENCED.

C GENERIC BILL OF MATERIAL MARK NUMBER REFERENCES HAVE BEEN PROVIDED AS NECESSARY IN THE REMARKS FIELDS SHOWN ON THE ONE-LINE LIST AND IN THE SPECIFIC NOTES LISTED ON THE COVER SHEET. ALL MARK NUMBERS REFERENCED IN THIS MANNER ARE SHOWN ON DRAWING NO CNBM-1752-00.01 UNLESS OTHERWISE SPECIFIED.

42 THE COMPARTMENT ORIGINALLY LOCATED IN 1EMXA (2EMXA) F08D SHALL BE EXCHANGED WITH THE COMPARTMENT ORIGINALLY LOCATED IN 1EMXL (2EMXL) F09C. THE ASSOCIATED DOORS SHALL ALSO BE EXCHANGED.

LIST NUMBER 2C REVISION 16

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
ELECTRICAL ONE-LINE LIST
CNLT-1752-01.01
1EMXA

QA CONDITION 1

MOTOR CONTROL CENTER
AB BLDG ELEV 577+00 COORD LOC FF-54

NORMAL POWER SOURCE
BUS 1ELXA
COMPT 4C

MOTOR CTL CTR ONE-LINE DWG NO. 1
MOTOR CTL CTR DUKE BILL OF MAT'L CNBM-1752-01.01
MOTOR CTL CTR WIRE TAB DWG NO. CNWT-1752-01.01
MOTOR CTL CTR UNDERVOLTAGE RELAY DOI-175C117

ALTERNATE POWER SOURCE
BUS NONE
COMPT NONE

REV	BUS COMPT NAMEPLATE	SYS	S-CL	TRN	BLDG ELEV COORD SF	HP/FLA LRA/KW KVA	TYPE UNIT OL HTR Y-PHASE	NEMA SIZE X	BREAKER TYPE FRAME CONT POLE	BREAKER TRIP MAG- POS ELEM	BREAKER CATALOG # TRIP UNIT	AUX- CONTS STR BKR FUSE SIZE	CABLE SIZE/CLASS	ONE-LINE DWG NO. VEND WIRING DIAG DUKE WIRING DIAG REMARKS
12 09 08	1EMXA F06A AC EMERGENCY LIGHTING TRANSFORMER 1ELA	ELA	NE	A	AB 577+00	30.00	CCNTR	3 2.0	HFB 150 60 3	TM	HFB3060	X8	1-3/C #6 P	ALJ-372-NC3A-A CNM 1314.01-0252 D1 MARK NO 75
12 07 00	1EMXA F05A INCOMING BREAKER FED FROM LOAD CENTER 1ELXA	EPE	1E	A			IBKRN	3.0	MC 800 800 3	8000 HI IM	MC3800FM A8MC800	2A&2B	2-3/C-500MCM P	ALJ-372-NOPA CNM 1314.01-0064 R2
12 07 03	1EMXA F05B MOTOR CONTROL CENTER 1EMXS NORMAL SUPPLY	EPE	1E	A	AB		FDBKR	1.0	HFB 150 60 3	TM	HFB3060	2A&2B	1-3/C #6 P	ALJ-372-NHCA CNM 1314.01-0018 R1 MARK NO 1,2
12 07 00	1EMXA R02E CONTROL POWER TRANSFORMER	EPE	1E	A			CFPT	0.5					C	ALJ-372-NXOF CNM 1314.01-0038 R3
12 07 01	1EMXA F04A FDR A - VITAL INST & CONT SPARE CHGR AC POWER PNL 1EMS	EPL	1E	A	AB 554+00 DD-56	33.00 32.92	FDBKR	1.0	HFB 150 60 3	TM	HFB3060		1-3/C #6 P	ALJ-372-NJCA CNM 1314.01-0058 R1
12 07 00	1EMXA F04B 125V DC VITAL INST & CONTROL BATTERY CHARGER 1ECA	EPL	1E	A	AB 554+00 DD-56	33.00 32.92	FDBKR	0.5	HFB 150 60 3	TM	HFB3060		1-3/C #6 P	ALJ-372-NFCA CNM 1314.01-0017 R1
12 07 00	1EMXA F02B ND PUMP 1A SUCTION FROM FWST VALVE 1FW27A	FW	1E	A	AB 524+0 FF-53 1.00	7.80 13.00 80.00	CFVR 2445	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA F02C REFUELING WATER LOOP ISOLATION VALVE 1FW1A	FW	1E	A	AB 550+00 KK-52 1.00	1.10 2.10 10.00	CFVR 2425	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3

REV	BUS COMPT NAMEPLATE	SYS	S-CL	TRN	BLDG ELEV COORD SF	HP/FLA LRA/KW KVA	TYPE UNIT OL HTR Y-PHASE	NEMA SIZE X	--BREAKER-- TYPE FRAME CONT POLE	TRIP MAG- POS ELEM	CATALOG # TRIP UNIT	AUX- CONTS STR BKR FUSE SIZE	---CABLE--- SIZE/CLASS	ONE-LINE DWG NO. VEND WIRING DIAG DUKE WIRING DIAG REMARKS
12 07 00	1EMXA F02D RX BLDG DRAIN HDR OUTSIDE CONT ISOL VALVE 1KC430A	KC	1E	A	AB 554+0 GG-52 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 01	1EMXA F07A REACTOR BLDG NON-ESS RETURN HDR ISOL VALVE 1KC3A	KC	1E	A	AB 567+7 HH-57 1.00	1.80 3.60 17.00	CFVR 2432	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
12 07 01	1EMXA F08B TRN 1A SUP TO RX BLDG NON-ESS HDR ISOL VALVE 1KC230A	KC	1E	A	AB 586+5 JJ-55 1.00	3.60 5.50 40.00	CFVR 2435	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
14 12 07	1EMXA R02B TRAIN 1A MIN. FLOW CONTROL VALVE 1KCC37A	KC	1E	A	AB 577+00 GG-56 1.00	1.80 3.60 17.00	CFVR 2432	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C #10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
12 07 01	1EMXA R02C AUX BLDG NON-ESS RETURN HEADER ISOL VALVE 1KC1A	KC	1E	A	AB 567+7 HH-57 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
12 07 00	1EMXA R03A ND HX 1A COOLING WATER SUPPLY ISOL VALVE 1KC56A	KC	1E	A	AB 589+9 KK-51 1.00	0.33 0.76 4.00	CFVR 2415	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 06	1EMXA R03B NCDT HX CLNG WATER RTN OUTSIDE CONT ISOL VALVE 1KC333A	KC	1E	A	AB 567+00 JJ-51 1.00	0.38 1.40 5.10	CFVR 2422	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA R03C NCDT HX COOLING WATER SUPPLY CONT ISOL VALVE 1KC320A	KC	1E	A	AB 566+9 JJ-50 1.00	0.38 1.40 5.10	CFVR 2422	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 01	1EMXA R03D TRN 1A SUP TO AUX BLDG NON-ESS HDR ISOL VALVE 1KC50A	KC	1E	A	AB 584+9 HH-55 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
12 07 00	1EMXA F01A ND HX 1A OUTLET TO LETDOWN HX ISOL VALVE 1ND24A	ND	1E	A	AB 574+4 LL-52 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3

REV	BUS COMPT NAMEPLATE	SYS	S-CL	TRN	BLDG ELEV COORD SF	HP/FLA LRA/KW KVA	TYPE UNIT OL HTR Y-PHASE	NEMA SIZE X	BREAKER TYPE FRAME CONT POLE	TRIP MAG- POS ELEM	CATALOG # TRIP UNIT	AUX- CONTS STR BKR FUSE SIZE	CABLE SIZE/CLASS	ONE-LINE DWG NO. VEND WIRING DIAG DUKE WIRING DIAG REMARKS
12 07 00	1EMXA F01B ND PUMP 1A MINIFLOW VALVE 1ND25A	ND	1E	A	AB 536+0 FF-53 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
16 12 11	1EMXA F01C ND TRAIN 1A HOTLEG INJECTION RETURN ISOL VALVE 1ND32A	ND	1E	A	AB 568+0 LL-52 1.00	3.60 5.50* 10.00	CFVR 2435	1 * 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA F02A ND HX 1A OUTLET TO CENT CHRG PUMPS ISOL VALVE 1ND28A	ND	1E	A	AB 571+0 LL-52 1.00	5.40 7.50 59.00	CFVR 2439	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA R05A SAFETY INJ PUMPS COLD LEG INJ HDR ISOL VALVE 1NI162A	NI	1E	A	AB 566+9 JJ-51 1.00	3.60 5.50 40.00	CFVR 2435	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA R05B BORON INJECTION TANK DISCHARGE ISOL VALVE 1NI9A	NI	1E	A	AB 570+0 JJ-52 1.00	3.60 5.50 40.00	CFVR 2435	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA R05C ACCUM N2 SUPPLY OUTSIDE CONT ISOL VALVE 1NI47A	NI	1E	A	AB 582+0 HH-52 1.00	0.33 0.76 4.00	CFVR 2415	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA R06B SAFETY INJECTION PUMP 1A SUCTION VALVE 1NI103A	NI	1E	A	AB 550+0 GG-53 1.00	1.10 2.10 10.00	CFVR 2425	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 06	1EMXA R06C SAFETY INJ PUMP 1A COLD LEG INJ LINE ISOL VALVE 1NI118A	NI	1E	A	AB 553+00 GG-53 1.00	1.80 3.60 17.00	CFVR 2432	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 06	1EMXA R07B SAFETY INJ PUMP SUCTION XOVER FROM NV VALVE 1NI332A	NI	1E	A	AB 552+03 GG-53 1.00	1.10 2.10 10.00	CFVR 2425	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA R07C SAFETY INJ PUMP 1A HOT LEG INJ HEADER ISOL VALVE 1NI121A	NI	1E	A	AB 561+1 GG-52 1.00	3.60 5.50 40.00	CFVR 2435	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3

REV	BUS COMPT NAMEPLATE	SYS	S-CL	TRN	BLDG ELEV COORD SF	HP/FLA LRA/KW KVA	TYPE UNIT OL HTR Y-PHASE	NEMA SIZE X	BREAKER TYPE FRAME CONT POLE	BREAKER TRIP MAG- POS ELEM	BREAKER CATALOG # TRIP UNIT	AUX- CONTS STR BKR FUSE SIZE	CABLE SIZE/CLASS	ONE-LINE DWG NO. VEND WIRING DIAG DUKE WIRING DIAG REMARKS
16 12 11	1EMXA R07D ND HEADER 1A TO NC COLD LEG LOOPS A&B VALVE 1NI173A	NI	1E	A	AB 566+10 HH-52 1.00	4.40 8.00* 58.00	CFVR 2441	1 * 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 06	1EMXA R08A SAFETY INJECTION PUMP 1A MINIFLOW ISOL VALVE 1NI115A	NI	1E	A	AB 549+08 GG-53 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 06	1EMXA R08B SAFETY INJ PUMP 1B MINIFLOW LINE ISOL VALVE 1NI144A	NI	1E	A	AB 548+00 HH-54 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 06	1EMXA R08C UHI CHECK VALVE TEST LINE ISOL VALVE 1NI258A	NI	1E	A	UH 561+01 HH-45 1.00	0.33 0.76 4.00	CFVR 2415	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 06	1EMXA R08D ND PUMP 1A SUCTION FROM CONTAINMENT SUMP VALVE 1NI185A	NI	1E	A	AB 546+0 FF-53 1.00	12.00 17.50 124.00	CFVR 2448	2 1.5	HFB 150 30 3	TM	HFB3030	X7/X7	1-3/C#10 C	ALJ-372-NR2A CNM 1314.01-0011 R2
12 07 00	1EMXA F01D NS PUMP 1A SUCTION FROM FWST ISOL VALVE 1NS20A	NS	1E	A	AB 533+6 GG-56 1.00	7.80 13.00 80.00	CFVR 2445	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA F03A NS PUMP 1A SUCTION FROM CONTAINMENT SUMP VALVE 1NS18A	NS	1E	A	AB 533+6 FF-56 1.00	7.80 13.00 80.00	CFVR 2445	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA F08A ND PUMP 1A DISCH TO CONT SPRAY HDR ISOL VALVE 1NS43A	NS	1E	A	AB 585+0 HH-52 1.00	5.40 7.50 59.00	CFVR 2452	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA R06A NS SPRAY HEADER 1A CONTAINMENT ISOL VALVE 1NS32A	NS	1E	A	AB 585+0 HH-52 1.00	1.10 2.10 10.00	CFVR 2425	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA R07A NS SPRAY HEADER 1A CONTAINMENT ISOL VALVE 1NS29A	NS	1E	A	AB 585+0 HH-51 1.00	1.10 2.10 10.00	CFVR 2425	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3

REV	BUS COMPT SYS S-CL TRN NAMEPLATE	BLDG ELEV COORD SF	HP/FLA LRA/KW KVA	TYPE UNIT OL HTR Y-PHASE	NEMA SIZE X	-------BREAKER------- TYPE FRAME CONT POLE	TRIP MAG- POS ELEM	CATALOG # TRIP UNIT	AUX- CONTS STR BKR FUSE SIZE	----CABLE---- SIZE/CLASS	ONE-LINE DWG NO. VEND WIRING DIAG DUKE WIRING DIAG REMARKS
12 07 06	1EMXA R01A NV 1E A CENT CHRG PUMPS RECIRCULATION ISOL VALVE 1NV203A	AB 553+06 JJ-55 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
12 07 06	1EMXA R01B NV 1E A CHARGING LINE OUTSIDE CONT ISOL VALVE 1NV312A	AB 553+00 HH-52 1.00	1.80 3.60 17.00	CFVR 2432	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
12 07 01	1EMXA R01C NV 1E A NC PUMP 1B SEAL SUP OUTSIDE CONT ISOL VALVE 1NV55A	AB 561+1 HH-55 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
12 07 03	1EMXA R02A NV 1E A BORIC ACID TRANSFER PUMP MOTOR 1A	AB 560+00 PP-59 1.25	17.60 54.00 15.50	CFVNR 2453 FH45	2 1.0	HFB 150 40 3	TM	HFB3040	X8	1-3/C #6 P	ALJ-372-NS2A-A CNM 1314.01-0144 R0
12 07 00	1EMXA R04A NV 1E A CENT CHARGING PUMP SUCTION FROM FWST VALVE 1NV252A	AB 554+1 HH-53 1.00	1.10 2.10 10.00	CFVR 2425	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
15 12 07	1EMXA R04B NV 1E A NC PUMP 1C SEAL SUP OUTSIDE CONT ISOL VALVE 1NV66A	AB 557+0 JJ-51 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
12 07 01	1EMXA R04C NV 1E A NC PUMP 1D SEAL SUP OUTSIDE CONT ISOL VALVE 1NV77A	AB 557+0 JJ-51 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
12 07 01	1EMXA R04D NV 1E A VCT OUTLET ISOLATION VALVE 1NV188A	AB 561+1 JJ-50 1.00	0.38 1.40 5.10	CFVR 2422	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
15 12 07	1EMXA R05D NV 1E A NC PUMP 1A SEAL SUP OUTSIDE CONT ISOL VALVE 1NV44A	AB 561+1 JJ-51 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
12 07 06	1EMXA F03B RN 1E A RN HEADER 1A SUPPLY ISOLATION VALVE 1RN67A	AB 589+03 QQ-54 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
ELECTRICAL ONE-LINE LIST
CNLT-1752-01.01
1EMXA

REV	BUS	COMPT	SYS	S-CL	TRN	NAMEPLATE	BLDG ELEV COORD SF	HP/FLA LRA/KW KVA	TYPE UNIT OL HTR Y-PHASE	NEMA SIZE X	BREAKER TYPE FRAME CONT POLE	BREAKER TRIP MAG- POS ELEM	BREAKER CATALOG # TRIP UNIT	AUX- CONTS STR BKR FUSE SIZE	CABLE SIZE/CLASS	ONE-LINE DWG NO. VEND WIRING DIAG DUKE WIRING DIAG REMARKS
12 07 00	1EMXA	F03C	RN	1E	A	KC HEAT EXCHANGER A INLET ISOLATION VALVE 1RN287A	AB 589+3 KK-56 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
12 07 06	1EMXA	F03D	RN	1E	A	AUX BLDG,FUEL HDLG & RAD AREA SUP HDR ISOL VALVE 1RN839A	AB 598+00 JJ-55 1.00	0.13 0.44 2.10	CFVR 2411	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C #10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA	F07B	RN	1E	A	NS HEAT EXCHANGER A INLET ISOLATION VALVE 1RN144A	AB 585+9 MM-52 1.00	0.33 0.76 4.00	CFVR 2415	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA	F07C	RN	1E	A	NS HEAT EXCHANGER A OUTLET ISOLATION VALVE 1RN148A	AB 585+9 NN-54 1.00	0.33 0.76 4.00	CFVR 2415	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C #10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA	F08C	RN	1E	A	NON-ESSENTIAL SUPPLY HEADER ISOL VALVE 1RN49A	AB 585+1 PP-53 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 06	1EMXA	R01D	RN	1E	A	RN SUPPLY CROSSOVER ISOL VALVE 1RN47A	AB 585+01 PP-54 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 00	1EMXA	R02D	RN	1E	A	NON-ESSENTIAL RETURN HEADER ISOL VALVE 1RN51A	AB 585+9 PP-55 1.00	0.67 1.84 9.52	CFVR 2424	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C#10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 06	1EMXA	F04F	TE	1E	A	CA PUMP TURB EXH TO CA PUMP SUMP 1 ISOL VALVE 1TE33A	AB 530+01 BB-51 1.00	1.10 2.10 10.00	CFVR 2425	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C #10 C	ALJ-372-NR1A-A CNM 1314.01-0133 R0
12 11 10	1EMXA	F07D	VE	1E	A	ANNULUS VENT DAMPER 1AVS-D-4	AB 603+07 KK-52 1.00	0.13 0.36 2.60	CFVR 2411	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C #10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 07 01	1EMXA	F06C	VF	1E	A	FUEL POOL FILTER UNIT 1A MINI FLOW OUTLET VALVE 1VF1A	FP 1.00	0.13 0.44 2.10	CFVR 2411	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C #10 C	ALJ-372-NR1A CNM 1314.01-0010 R3

REV	BUS	COMPT	SYS	S-CL	TRN	NAMEPLATE	BLDG ELEV COORD SF	HP/FLA LRA/KW KVA	TYPE UNIT OL HTR Y-PHASE	NEMA SIZE X	BREAKER TYPE FRAME CONT POLE	TRIP MAG- POS ELEM	CATALOG # TRIP UNIT	AUX- CONTS STR BKR FUSE SIZE	CABLE SIZE/CLASS	ONE-LINE DWG NO. VEND WIRING DIAG DUKE WIRING DIAG REMARKS
12 07 01	1EMXA	F06D	VF	1E	A	FUEL POOL FILTER UNIT 1A MINI FLOW INLET VALVE 1VF3A	AB 1.00	0.13 0.44 2.10	CFVR 2411	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7	1-3/C #10 C	ALJ-372-NR1A CNM 1314.01-0010 R3
12 08 07	1EMXA	F04C	WL	1E	A	LIQUID RADWASTE ND AND NS SUMP PUMP MOTOR 1A	AB 522+00 GG-57 1.15	10.00 10.00 54.00	CFVNR 2448 FH40	1 1.0	HFB 150 30 3	TM	HFB3030	X8	1-3/C #10 C	ALJ-372-NS1A CNM 1314.01-0005 R2
12 07 00	1EMXA	F04D	ZZZ	1E	A	SPARE 100 AMP FEEDER BREAKER			FDBKR	0.5	150 100 3	TM	HFB3100			ALJ-372-NFCA CNM 1314.01-0017 R1
12 07 00	1EMXA	F04E	ZZZ	1E	A	SPARE SIZE 2 CFVR STARTER			CFVR	2 1.5	HFB 150 50 3	TM	HFB3050	X7/X7		ALJ-372-NR2A CNM 1314.01-0011 R2
12 08 07	1EMXA	F05C	ZZZ	1E	A	SPARE SIZE 2 CFVNR STARTER			CFVNR	2 1.0	HFB 150 50 3	TM	HFB3050	X8		ALJ-372-NS2A CNM 1314.01-0006 R3
12 08 07	1EMXA	F05D	ZZZ	1E	A	SPARE SIZE 1 CFVNR STARTER			CFVNR	1 1.0	HFB 150 30 3	TM	HFB3030	X8		ALJ-372-NS1A CNM 1314.01-0005 R2
12 08 07	1EMXA	F06B	ZZZ	1E	A	SPARE SIZE 1 CFVNR STARTER			CFVNR	1 1.0	HFB 150 30 3	TM	HFB3030	X8		ALJ-372-NS1A CNM 1314.01-0005 R2
12 07 05	1EMXA	F08D	ZZZ	1E	A	SPARE SIZE 1 CFVNR STARTER			CFVNR	1 1.5	HFB 150 20 3	TM	HFB3020	X8 20		ALJ-372-PS1A CNM 1314.01-0021 R2 NOTE 42
13 12 07	1EMXA	R06D	ZZZ	1E	A	SPARE SIZE 1 CFVR STARTER			CFVR	1 1.5	HFB 150 20 3	TM	HFB3020	X7/X7		ALJ-372-NR1A-A CNM 1314.01-0133 R0

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SPECIFIC ITEM #16   120VAC ESSENTIAL PANEL BOARD TRANSFORMERS

PART 1: Justify the use of low grade mounting in field vs higher grade mounting in qualification.

STATUS: This item is resolved.

RESOLUTION SUMMARY: The calculation (File No. CNC-1139.14-19, "Seismic Anchorage of Electrical Equipment) shows that a 1/2" ϕ A-307 bolt (which is the bolt used to anchor the transformer) is quite satisfactory.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba TYPE:

1. Utility: Duke Power Co. PWR: ✓

2. NSSS: Westinghouse BWR: ______

3. A/E: N/A Other ______

II. Component Name: 120VAC Essential Panelboard Transformers

1. Scope: [ ] NSSS [√] BOP [ ] Other

2. Model Number: N/A Quantity: 3 (Unit 1)

3. Size or Range: 15KVA, Single Phase, 600/120V

4. Vendor: Square D (Sorgel)

5. If the component is a cabinet or panel, name and model Number of the devices included: N/A No devices included

6. Physical Description:

a. Appearance: Transformer

b. Dimensions: 16"W x 22"D x 31"H

c. Weight: 268 lbs.

7. Location: Building: Auxiliary Building

Elevation: 560/577/594

8. Field Mounting Conditions
[✓] Bolt (No. 4 ,) Size ½"Ø)
[ ] Weld (Length ____)
[✓] See Attached Drawings
CN-1214-3, CNM-1308.03-1

9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

Floor mounted

10. a. System is which located: EPY

b. Functional Description: Provide Power to 120VAC essential panelboard

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

[√] Both [ ] Neither [ ] Other ______

EL40114N/1

11. Pertinent Reference/Design Specifications for Qualification Requirements: CNS-1308.03-00-0001, dated 01-02-78

(No Amendments)

(a.) Seismic Input

b. Hydrodynamic Load Input

c. Fatigue Considerations

d. Service Conditions

e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[√] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[√] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 43205-1, Seismic Qualification of

(No., Title and Date): Class 1 Transformers, 07-20-78

Company that Prepared Report: Square D Company

Company that Reviewed Report: Duke Power Company

Where Report is filed or available: Duke drawing file No. CNM-1308.03-0011

Applicable Codes And/Or Standards: IEEE 344-1975 (Paragraph 8.5)
IEEE 323-1971

V. Vibration Input:

1. Loads considered:
   a. [√] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [√] N/A (other, specify)

3. Required Response Spectra** (attach the graphs): ________

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 1% SSE 1%

5. Required Acceleration in Each Direct:

[√] ZPA [ ] Other ____________ (specify)

OBE S/S = .22 F/B = .22 V = .15

SSE S/S = .41 F/B = .41 V = .27

6. Were fatigue effects considered:

[ ] Yes [√] No

If yes, describe how they were treated in overall qualification program: ____________

VI. If Qualification by Test, then Complete:*

1. [ ] Single Frequency [√] Multi-Frequency [ ] random
[ ] sine beat
[ ] ____________

2. [ ] Single Axis [ ] Multi-Frequency
[√] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:
OBE 5 F/B 5 S/S SSE 1 F/B 1 S/S Other ____________ (specify)

4. Frequency Range: 1 to 31.5 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 9.1, 8.6 F/B = 10.4 V = 32.5, 32.2, 25.7, 9.1

6. Method of Determining Natural Frequencies

[√] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[√] Yes (Attach TRS & RRS graphs)

[ ] No

*A similar 3Ø transformer was tested under Wylie Test Report No. 43205-1. Square D/Sorgel documentation address similarity between the tested Transformer and the in-service Transformer.

8. Maximum Input g Level Test: See attachment to Q VI.7

OBE S/S = ____________ F/B = ________________ V = ______________

SSE S/S = ____________ F/B = ________________ V = ______________

9. Laboratory Mounting:

A. [√] Bolt (No. 4, Size ½"Ø)

[ ] Weld (Length ___) [ ] ____________

B. Orientation and Fixturing: Simulated Acutal in-service mounting

10. Functional Operability verified:

[√] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: N/A

12. Other tests performed (such as aging or fragility test, including results):
N/A

13. Failure Modes (If appropriate N/A)

14. Margins Available: [ ] Input Spectrum [ ] Fragility N/A

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ____________ F/B = ________________ V = ______________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ________

4. [ ] Computer Codes: ______________________

Frequency Range and No. of modes

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: ____________ (specify)

6. Damping:

OBE ________ SSE ______ Basis for the damping used: ____________

7. Support Considerations in the model: ______________________

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

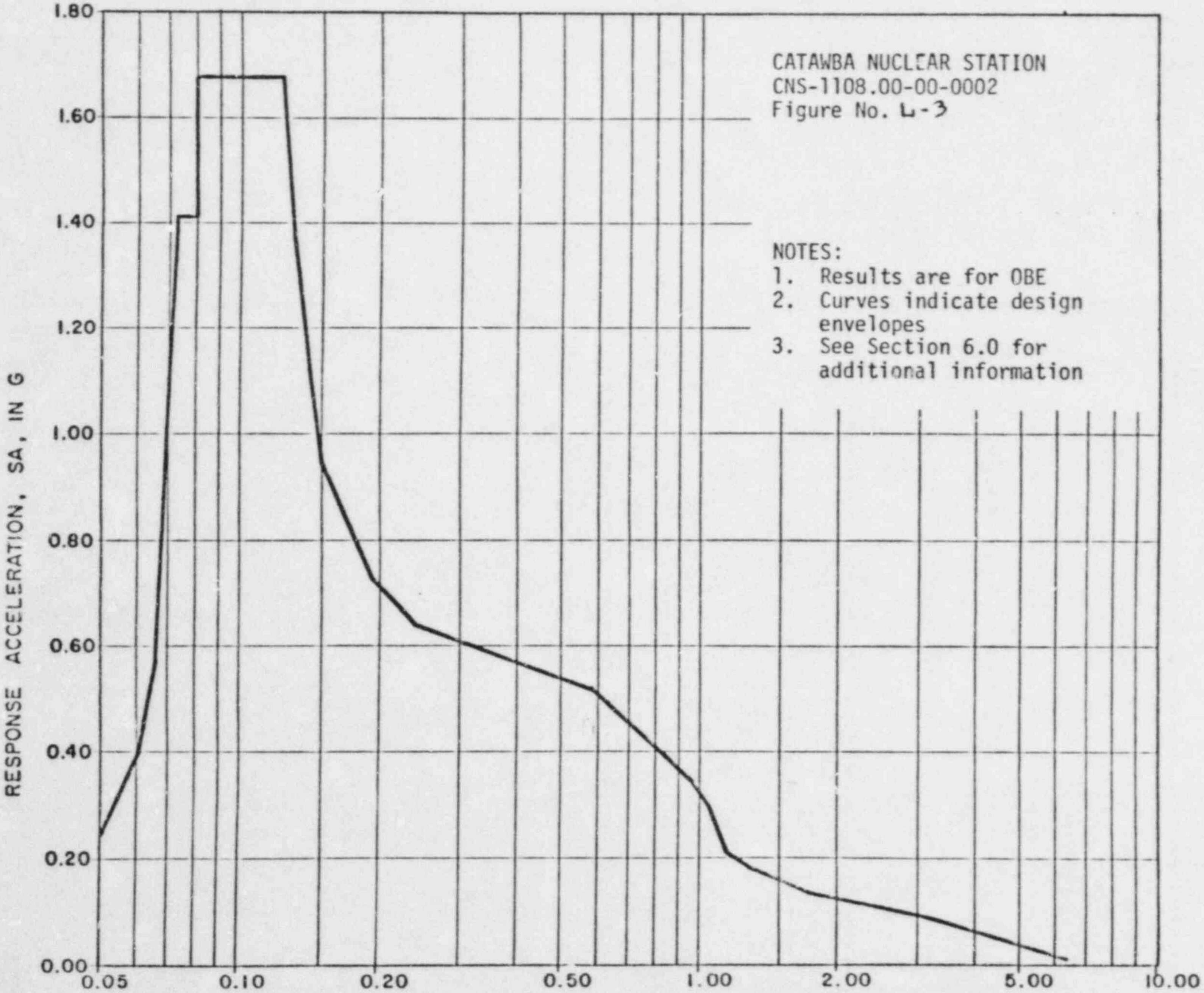
9. Failure Modes: ______________________

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

MCGUIRE & CATAWBA AUX BLDG N-S & E-W OBE

COMPOSITE RESPONSE SPECTRA, DAMPING= 0.010

MCGUIRE ELEV. 767+00 (AND BELOW), CATAWBA ELEV. 594+00 (AND BELOW)

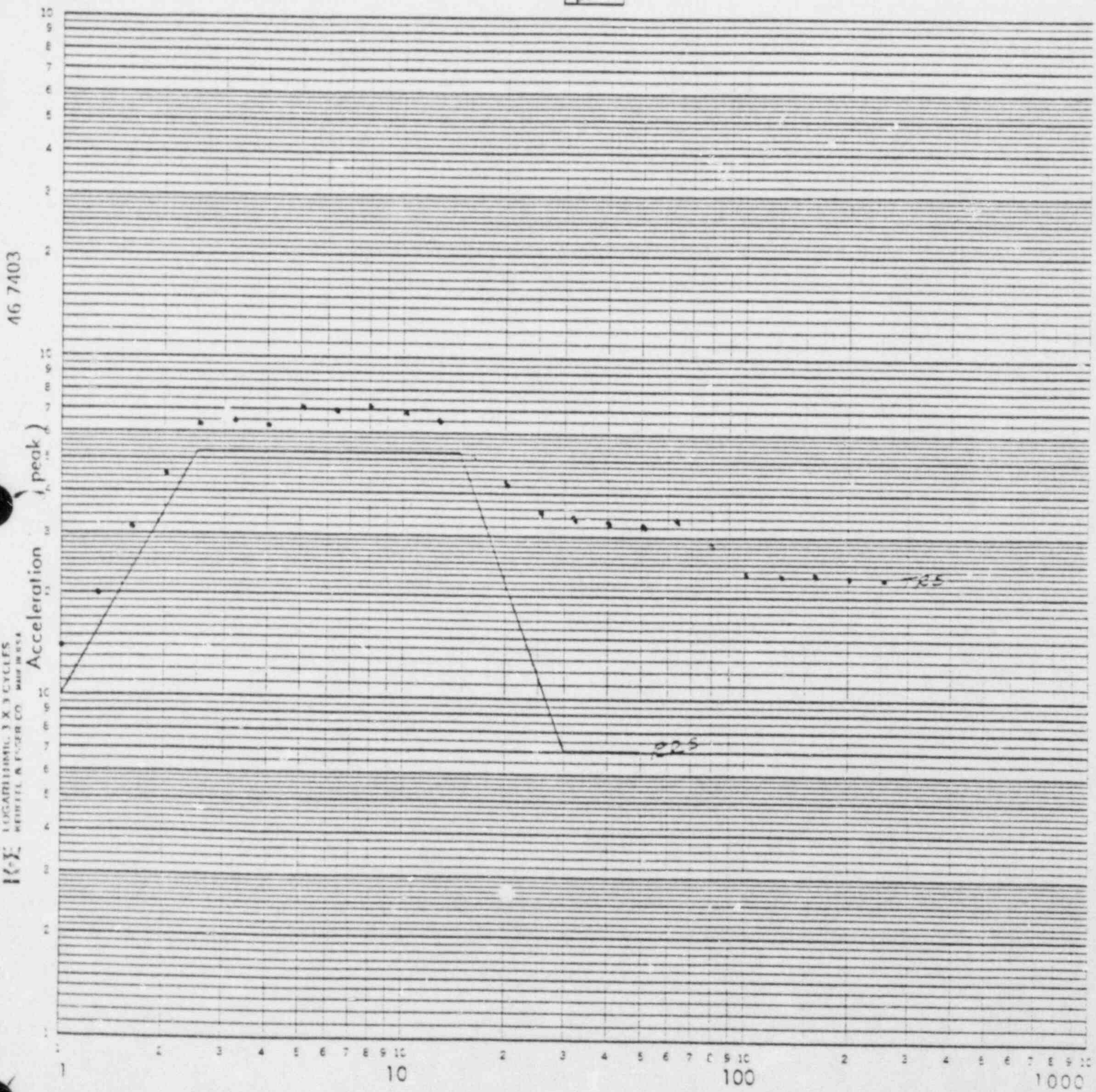


Revision 4: October 1, 1982
Date: December 5, 1980

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 2 %



AXIS F-B & V

LOCATION NO. VCA

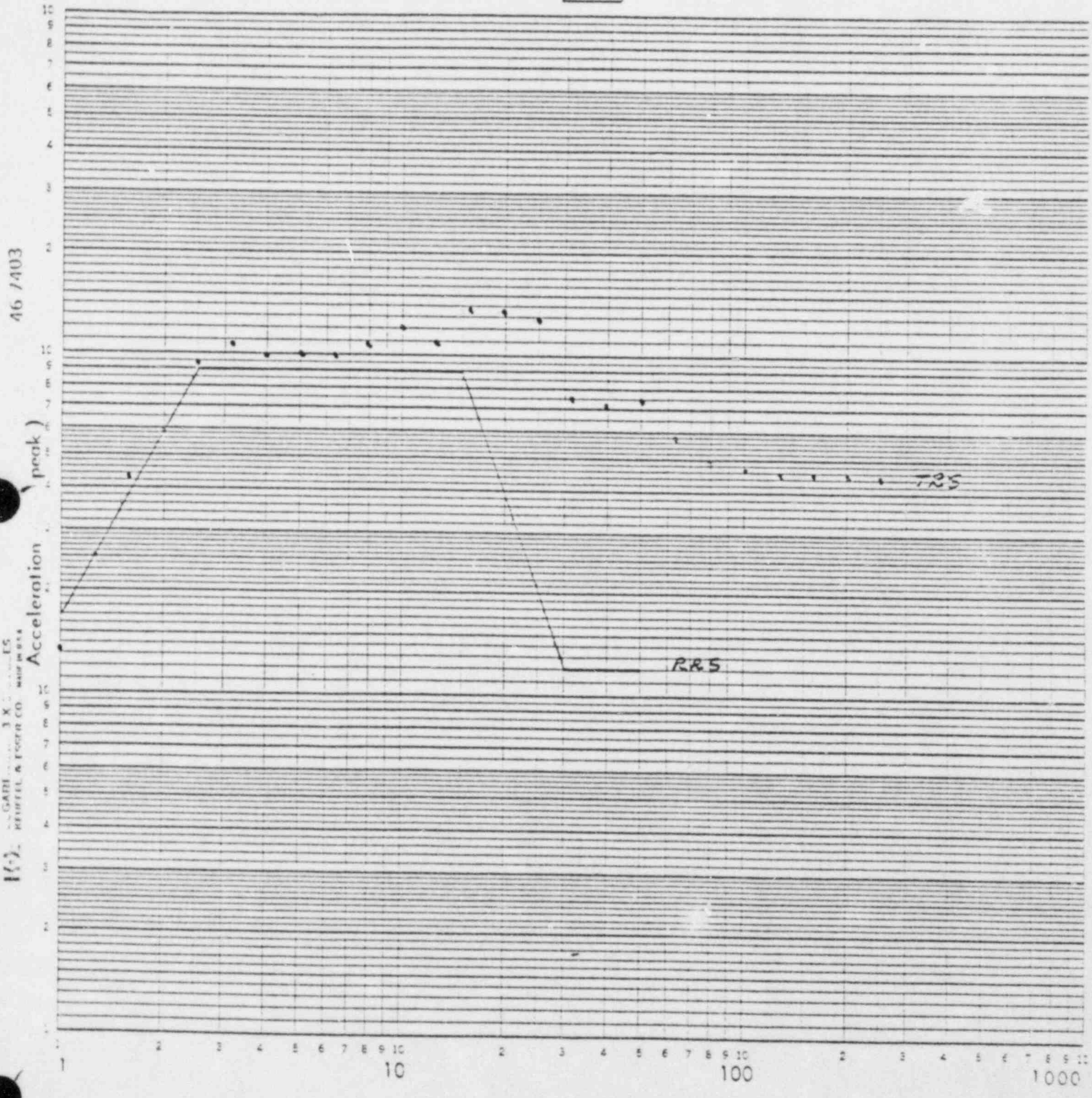
TEST RUN NO. 13

Attachment to Question II-7 SSE-V

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 2%



AXIS F-B & V

LOCATION NO. HCA

TEST RUN NO. 18

Attachment to Question VI 7

SSE - Horz.

TRANSFORMER SPECIFICATIONS:

KVA 15 PHASE 1 HERTZ 60

HIGH VOLTAGE 600 H.V. TAPS (4)-2½% 2+,2-

LOW VOLTAGE 120 TYPE S NET WT. 268 LBS.

220° C INS. SYSTEM FOR 80 °C RISE

WITH WEATHER SHIELD

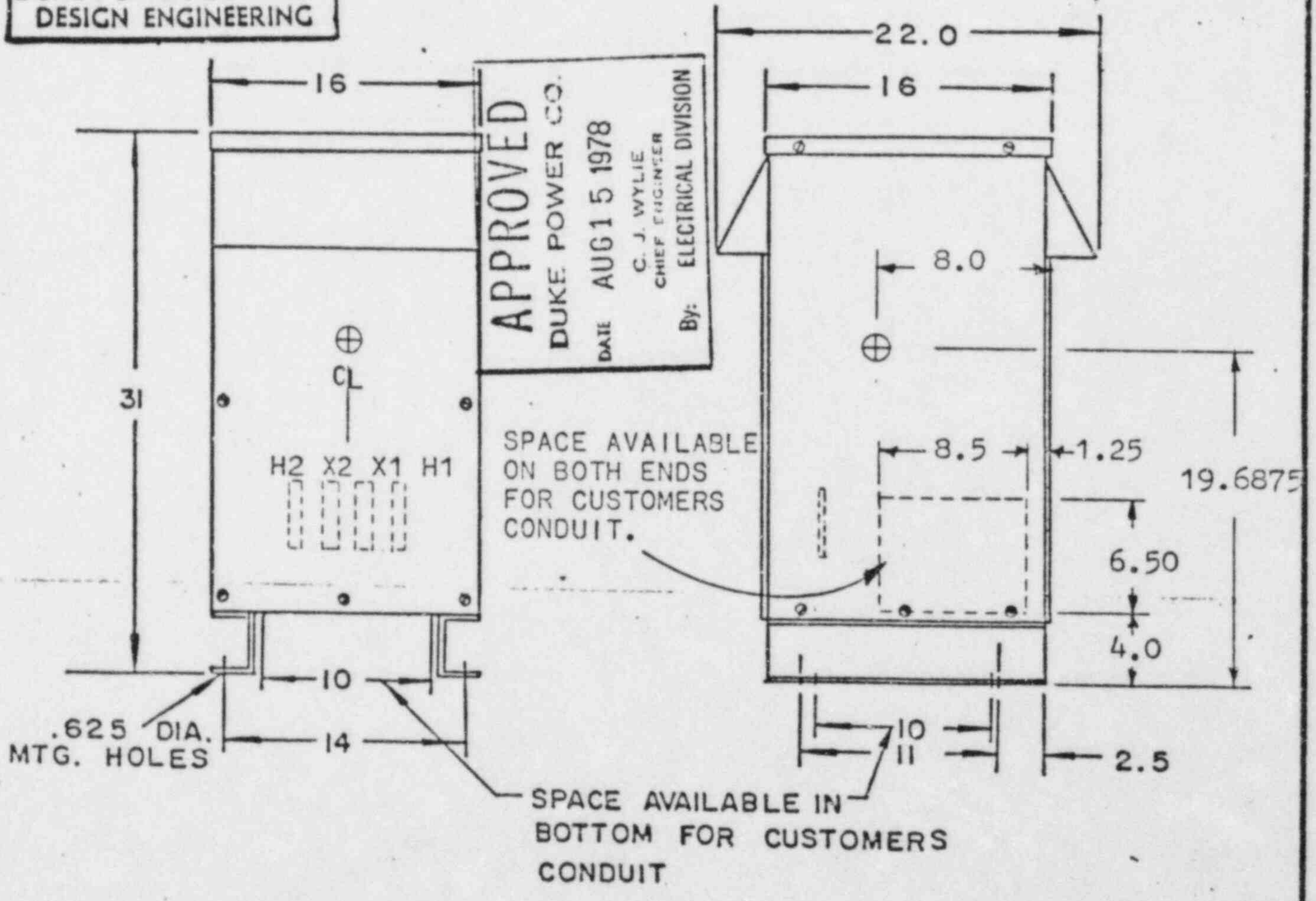
NUCLEAR SAFETY RELATED

⊕ - DENOTES CENTER OF GRAVITY.

DOCUMENT CONTROL DATE
AUG 1 1 1978
DUKE POWER COMPANY
DESIGN ENGINEERING

CNM 1308-03-1

APPROVED
DUKE POWER CO.
DATE AUG 1 5 1978
By: C. J. WYLIE CHIEF ENGINEER ELECTRICAL DIVISION



361

REV. 2--8.0 WAS 10.187 WT. WAS 225 POUNDS JIM 7-17-78

REV. 1--ADDED CUSTOMER ENTRANCE-TERM. BD.-CENTER OF GRAVITY

SORGEL TRANSFORMERS SQUARE D COMPANY MILWAUKEE WISCONSIN		DIMENSION PRINT FOR SINGLE PHASE INSULATED TRANSFORMER SEISMIC 1E
DRAWN BY: JIM	A-94032-2	
ORDER NO.		
DATE: 2/15/78		

DOCUMENT/ PAGE PULLED

ANO. 8404200271

NO. OF PAGES 2

REASON

☐ PAGE ILLEGIBLE

☐ HARD COPY FILED AT. PDR CF

OTHER ______

☐ BETTER COPY REQUESTED ON __/__/__

☑ PAGE TOO LARGE TO FILM

☑ HARD COPY FILED AT: PDR (CF)

OTHER ______

☐ FILMED ON APERTURE CARD NO 8404200271-05 thru 06

SPECIFIC ITEM #17 MAIN CONTROL BOARDS

PART 1: Examine local plate areas for stress and acceleration levels.

STATUS: Analysis has been performed and is being added to calculation CNC-1381.05-00-0029

RESOLUTION SUMMARY: Analyses of a worst case plate (large unstiffened area and heavily loaded) showed that the local plate stresses were within allowables. Also frequency analyses showed that the natural frequency of the local plate was above 20.0 Hz indicating that the local plate would not modify the previously calculated response spectra.

PART 2: Provide favorable tabulated comparison of mode shapes between modal test and finite element analysis.

STATUS: The comparison has been tabulated and is being added to calculation CNC-1381.05-00-0029.

RESOLUTION SUMMARY: Copies of the mode shape comparisons are attached.

PART 3: Some analysis documents need to be revised.

STATUS: Revisions to the original analysis (CNC-1381.05-00-0029) are nearing completion. Revisions to the subsequent parametric study analysis (CNC-1381.05-00-0044) will begin shortly and should be completed by April 30, 1984.

RESOLUTION SUMMARY: The revisions being made are related to items discussed in parts 1 and 2 of this item.

PART 4: Conduct as-built weld survey to assure compliance with analysis.

STATUS: Weld survey in progress.

RESOLUTION SUMMARY: Any weld deficiencies noted during the as-built condition and the analysis will be in compliance.

SPECIFIC ITEM #17 MAIN CONTROL BOARDS

PART 5. Westinghouse WCAP-8687, Supp. 2-E15A presents the test results of two different seismic tests on Hagan Optimac Recorders - the Lot 1 test in which the recorders failed and the Lot 2 test in which the recorders had been modified to withstand the seismic test. A concern was raised as to whether or not the Hagan Optimac Recorders used on the Main Control Boards have received the seismic modifications as described in the WCAP-8687, Supp. 2-E15A, page 12.

STATUS: This item has been resolved.

RESOLUTION SUMMARY: In Westinghouse letter Catawba-3630, it is confirmed that all safety-related Hagan Optimac Recorders are built to the baseline design document which includes the seismic modifications described in WCAP-8687, Supp. 2-E15A, page 12. Therefore, all safety-related Hagan Optimac Recorders shipped to Catawba were seismically modified before the recorders left the factory.

SPECIFIC ITEM #17 MAIN CONTROL BOARDS

PART 2 ATTACHMENT: Comparison of mode shapes for Group A Main Control Boards.

Form 00181 (4-81)

DUKE POWER COMPANY

Dev./Station CATAWBA Unit 1&2 File No. CNC-1381.05-00-0009

Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION

By MDW Date 3-9-83

Sheet No. 41 of ____ Problem No. ____ Checked By GGC Date 4-12-83

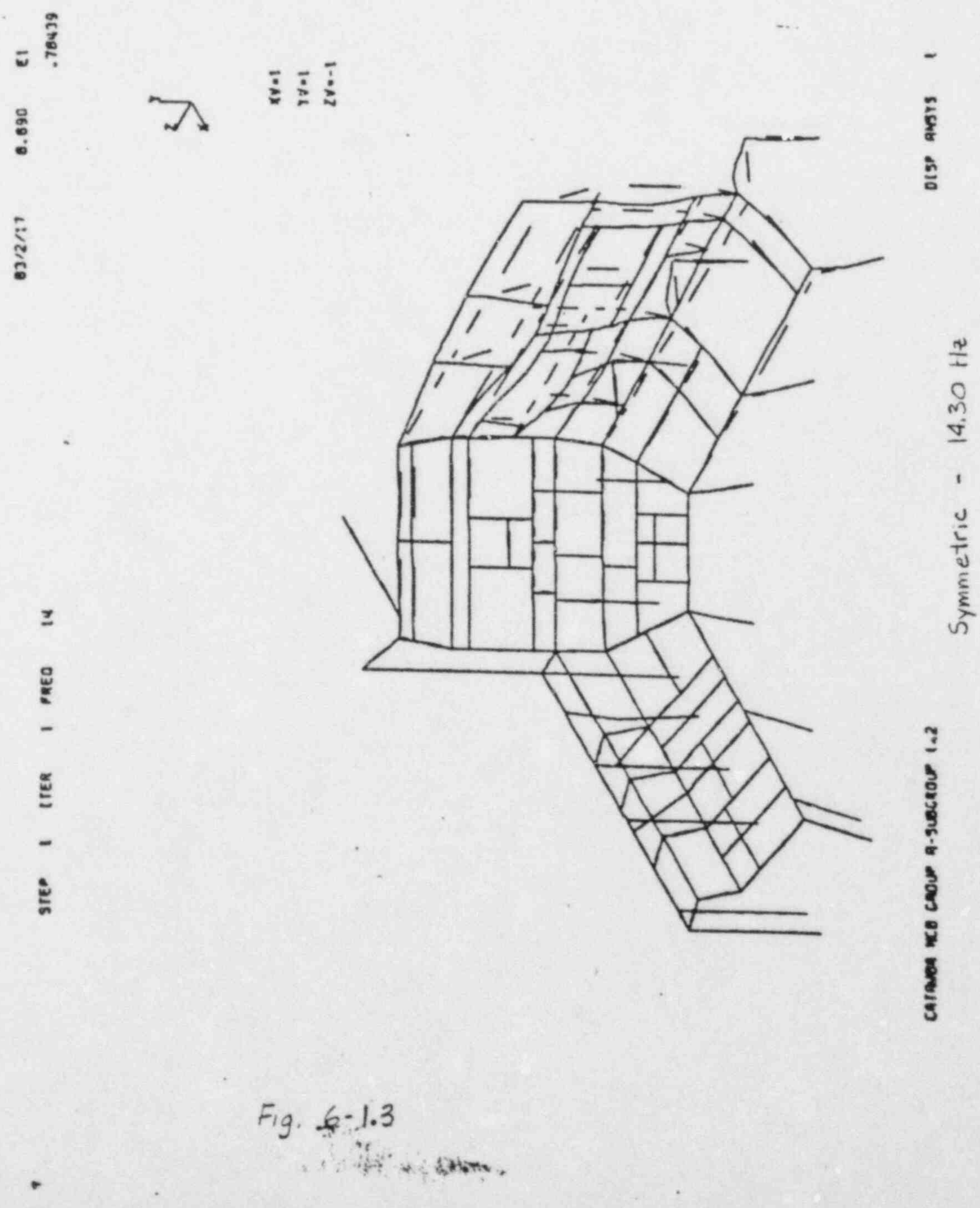


Fig. 6-1.3

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station: CATAWBA N.S. Unit: 1&2 File No.: CNC-1381.05-00-0029

Subject: MCB SEISMIC ANALYSIS QUALIFICATION

By: MDW Date: 4/9/84

Sheet No. ___ of ___ Problem No. ___ Checked By ___ Date ___

Group A - Mode Shape Comparision

MODE 1

Analytical Model f = 14.30 Hz				Test Model f = 14.57 Hz			
Node	X	Y	Z	Node	X	Y	Z
8	-0.146	0.491	-	4	0.377	0.447	-0.032
9	0.331	0.510	-	5	0.539	0.327	-0.021
10	0.765	0.667	-	6	0.984	0.479	-0.011
11	0.002	0.713	-	7	0.119	0.720	0.029
16	0.629	0.517	-0.003	10	1.0	0.367	
17	0.957	0.381	-0.009	17	0.879	0.370	
18	1.0	0.332	-0.012	24	0.729	0.352	
19	0.767	0.274	-0.016	35	0.540	0.336	
20	0.044	0.067	-0.022	49	0.033	0.191	
28	0.542	0.518	-0.021	8	0.669	0.353	
30	0.540	0.565	-0.004	14	0.541	0.295	
32	0.374	0.338	-0.010	28	0.585	0.274	
33	0.415	0.277	-0.012	32	0.355	0.255	
34	0.233	0.149	-0.015	37	0.186	0.200	
35	0.029	0.066	-0.019	46	0.041	0.172	
36	-0.065	0.404	-0.004	13	0.258	0.363	
37	0.602	0.397	-0.020	15	0.652	0.328	
44	-0.067	0.220	-0.006	27	0.160	0.325	
46	-0.027	0.159	-0.008	31	0.136	0.289	
48	0.008	0.057	-0.009	45	0.074	0.301	
49	0.759	0.332	-0.027	22	0.709	0.275	
51	0.948	0.277	-0.027	33	0.614	0.257	
52	0.592	0.149	-0.026	38	0.399	0.267	
57	0.001	0.676	0.001	18	0.060	0.607	
58	0.001	0.509	0.002	36	0.065	0.483	
65	0.001	0.084	0.002	50	-0.005	0.246	
91	-0.024	0.064	-0.009	20	0.071	0.294	

DUKE POWER COMPANY

Form 00181

Dev./Station CATAWBA Unit 1&2 File No. CNC-1381.05-00-0002

Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION

By MDW Date 3-9-83

Sheet No. 42 of ____ Problem No. ____ Checked By GGC Date 4-12-83

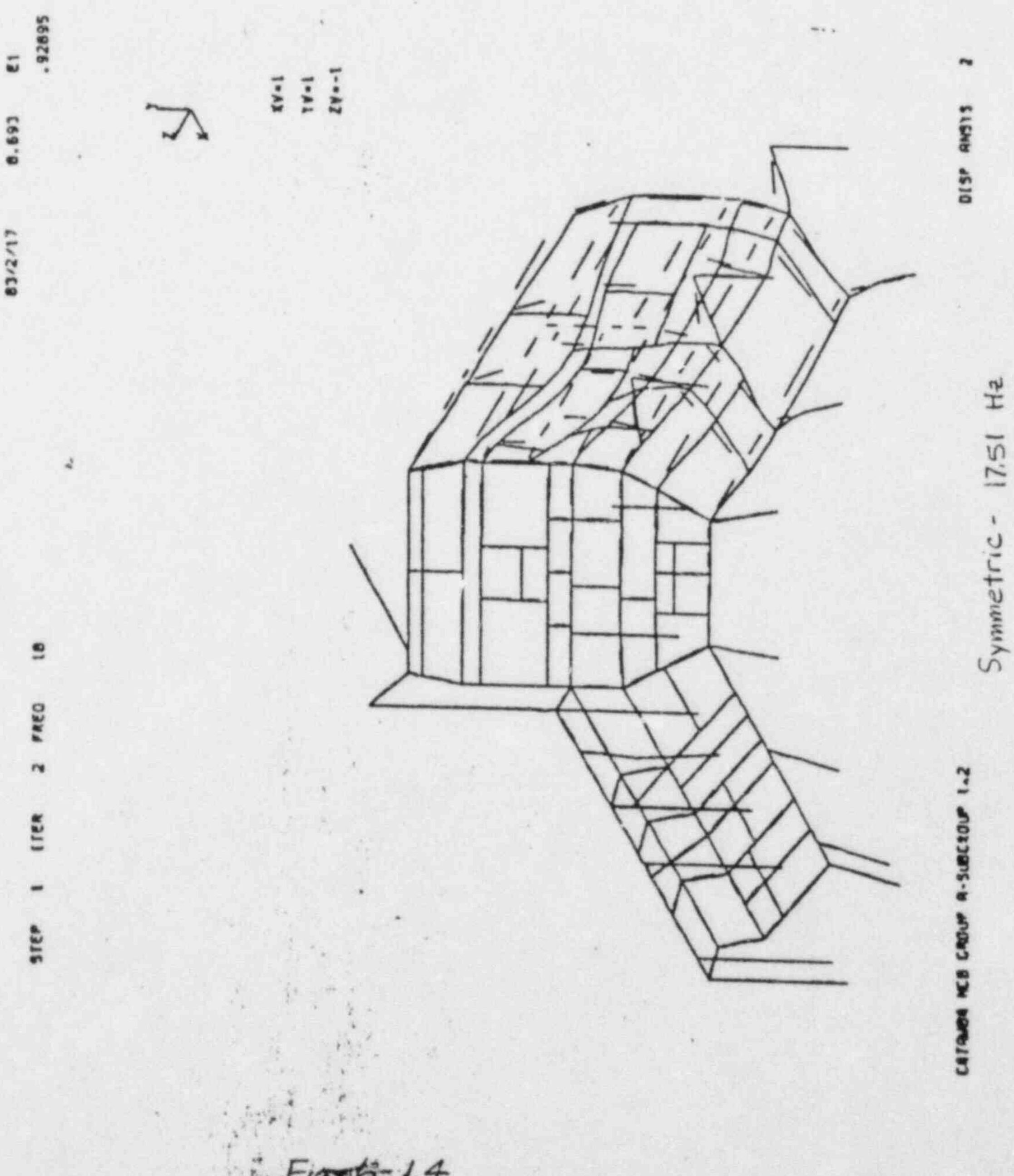


Fig. 6-1.4

0J02961202

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station: CATAWBA N.S. Unit: 1&2 File No.: CNC-1381.05-00-0029

Subject: MCB SEISMIC ANALYSIS QUALIFICATION

By: MDW Date: 4/9/84

Sheet No. ___ of ___ Problem No. ___ Checked By ___ Date ___

GROUP A

MODE 2

Analytical Model f = 17.51

Node	X	Y	Z
8	0.121	-0.336	-
9	0.001	-0.371	-
10	-0.065	-0.376	-
11	0.0	-0.397	-
16	0.003	-0.417	0.0
17	0.630	-0.461	0.0
18	0.802	-0.465	-0.001
19	0.684	-0.396	-0.001
20	0.021	-0.035	-0.004
22	0.043	-0.423	-0.006
30	0.272	-0.556	-0.001
32	0.449	-0.446	-0.002
33	0.500	-0.292	-0.003
34	0.272	-0.109	-0.002
35	0.024	-0.035	-0.001
36	0.273	-0.558	0.004
37	0.306	-0.431	-0.007
44	0.206	-0.532	0.008
46	0.164	-0.381	0.010
48	0.019	-0.038	0.012
49	0.670	-0.465	-0.008
51	1.0	-0.293	-0.008
52	0.641	-0.109	-0.007
57	0.001	-0.268	-0.001
58	0.0	-0.186	-0.001
63	0.001	-0.028	-0.001
91	0.043	-0.106	0.011

Test Model f = 16.83

Node	X	Y	Z
4	0.042	0.130	-0.013
5	0.167	0.181	-0.028
6	0.348	0.205	0.005
7	0.049	0.359	0.024
10	0.595	0.181	
17	0.711	0.180	
24	0.820	0.185	
35	0.544	0.146	
49	0.007	0.087	
8	0.310	0.167	
14	0.352	0.170	
28	0.623	0.147	
32	0.352	0.134	
37	0.212	0.135	
46	0.010	0.139	
13	0.029	0.086	
15	0.567	0.145	
27	0.026	0.079	
31	0.025	0.081	
45	0.002	0.099	
22	0.904	0.146	
33	0.711	0.146	
38	0.434	0.146	
18	0.064	0.361	
36	0.062	0.283	
50	0.004	0.157	
20	0.009	0.089	

Form 00184 (6-81)

DUKE POWER COMPANY

Dev./Station CATAWBA Unit #2 File No. CNC-1331.05-00-0020

Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION

By MDW Date 3-9-83

Sheet No. 43 of ____ Problem No. ____ Checked By GGC Date 4-12-83

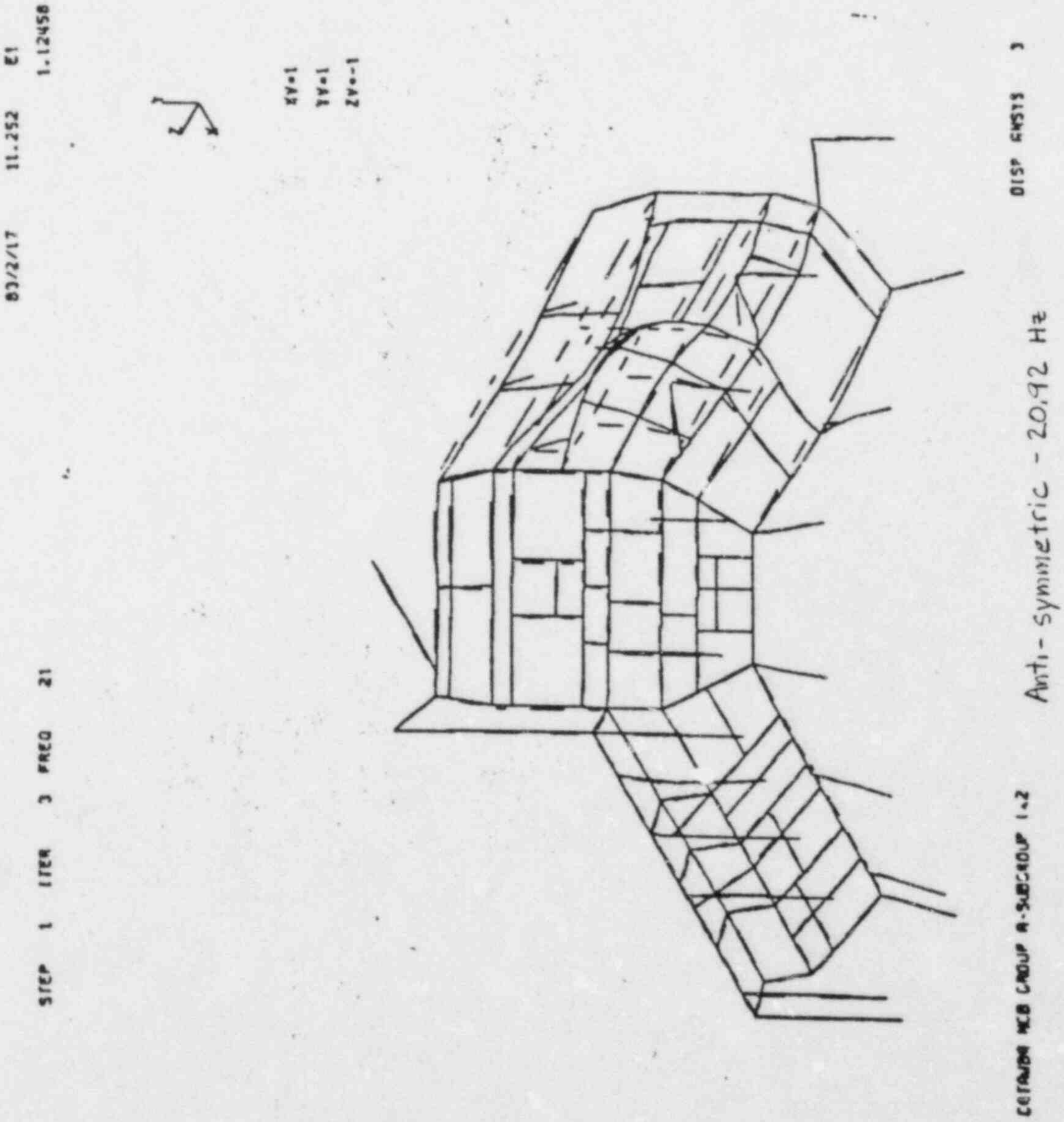


Fig. 6-1.5

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station CATAWBA N.S. Unit 1&2 File No. CNC-1381.05-00-0029

Subject MCB SEISMIC ANALYSIS QUALIFICATION

By MDW Date 9/84

Sheet No. __ of __ Problem No. ______ Checked By ______ Date ______

GROUP A

MODE 3.

Analytical Model f = 20.92				Test Model f = 20.64			
Node	X	Y	Z	Node	X	Y	Z
8	-	-	-0.015	4	0.174	-0.320	0.068
9	-	-	-0.005	5	0.401	-0.282	-0.005
10	-	-	0.001	6	0.086	-0.254	0.012
11	-	-	-0.002	7	0.012	-0.221	-0.021
16	-0.188	0.152	-0.001	10	0.083	-0.231	
17	-0.528	0.437	0.004	17	0.122	-0.230	
18	-0.558	0.495	0.006	24	-0.127	-0.204	
19	-0.404	0.463	0.007	35	-0.121	-0.223	
20	0.060	0.112	0.013	49	-0.022	0.328	
28	-0.047	0.158	0.005	8	0.304	-0.213	
30	-0.015	0.397	0.004	14	-0.431	-0.267	
32	0.164	0.491	-0.002	28	-0.410	-0.186	
33	0.462	0.455	-0.004	32	-0.396	-0.280	
34	0.306	0.258	-0.006	37	-0.330	-0.240	
35	0.053	0.112	-0.010	46	-0.029	0.288	
36	-0.180	0.353	-0.016	13	0.105	-0.502	
37	0.104	0.384	0.005	15	0.153	-0.174	
44	-0.140	0.417	-0.014	27	0.035	0.478	
46	-0.077	-0.313	-0.018	31	0.030	0.444	
48	0.022	0.105	-0.014	45	-0.016	0.267	
49	0.227	0.493	0.013	22	-0.390	-0.160	
51	1.0	0.454	0.011	33	-0.968	-0.227	
52	0.772	0.258	0.009	38	-1.0	-0.226	
57	0.0	0.273	-0.001	18	-0.007	-0.280	
58	0.0	0.339	0.0	36	-0.018	-0.279	
63	0.001	0.131	0.001	50	-0.025	0.259	
91	-0.046	0.127	-0.018	20	0.024	0.372	

SPECIFIC ITEM #17 MAIN CONTROL BOARDS

PART 2 ATTACHMENT: Comparison of mode shapes for Group B Main Control Boards.

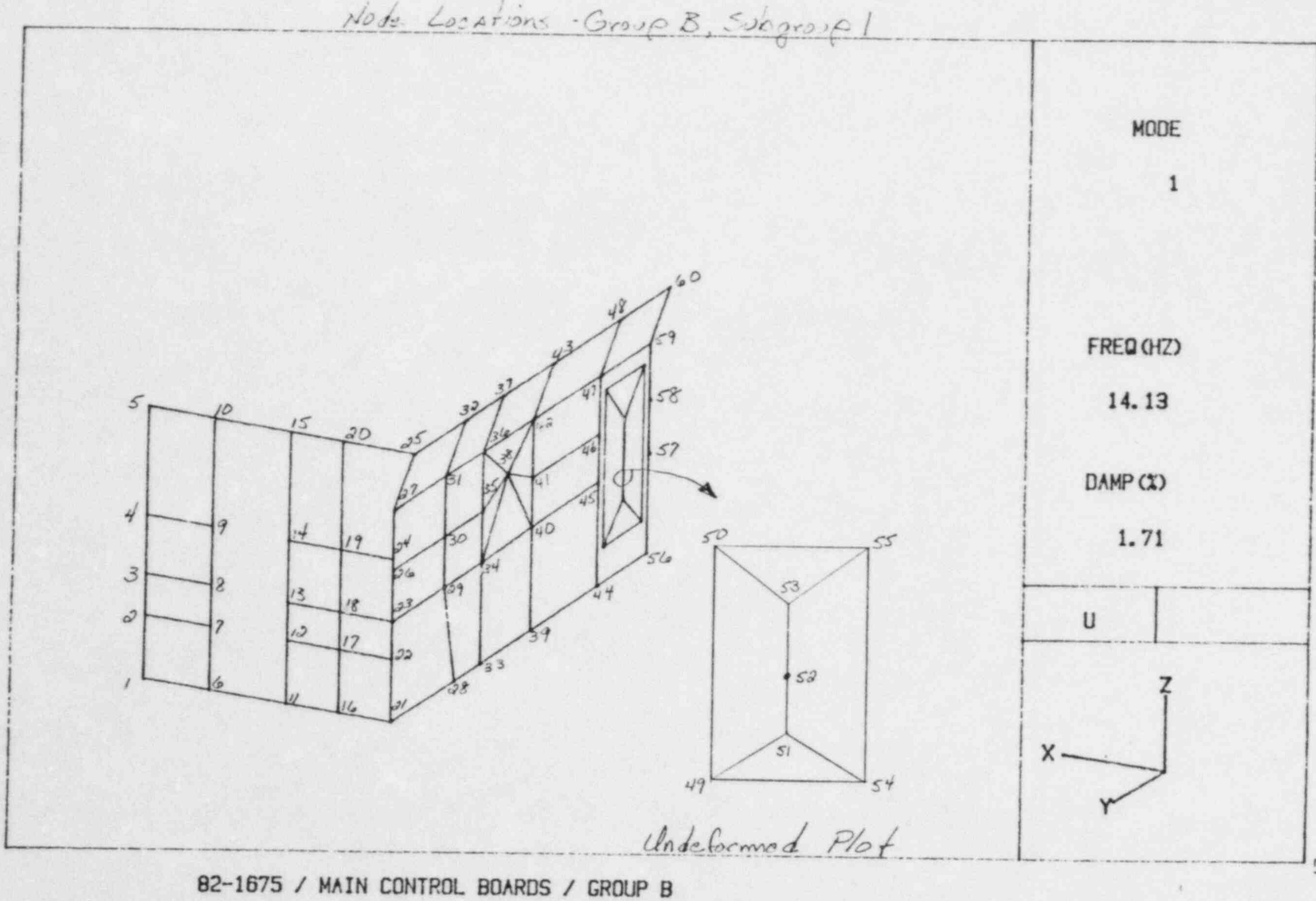
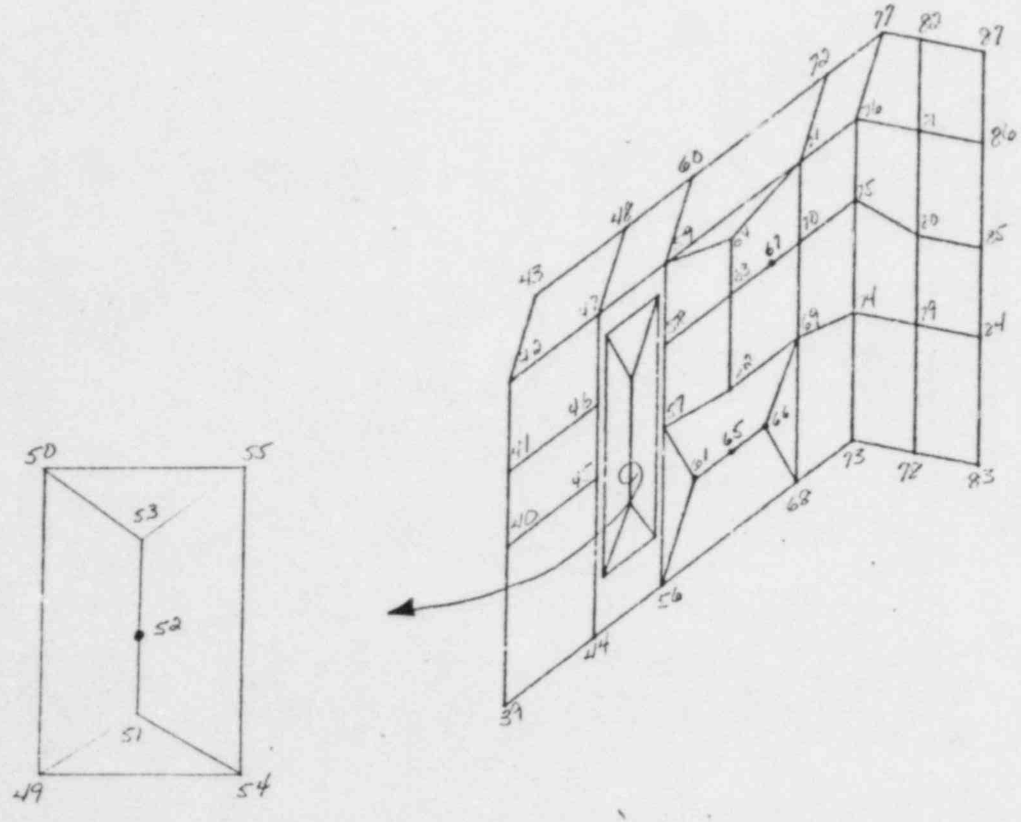


Figure 3.19 Illustration of Group B, Subgroup 1 Control Boards

Node Locations - Group B, Subgroup 2



MODE

1

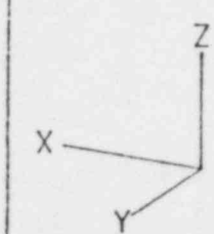
FREQ (HZ)

13.94

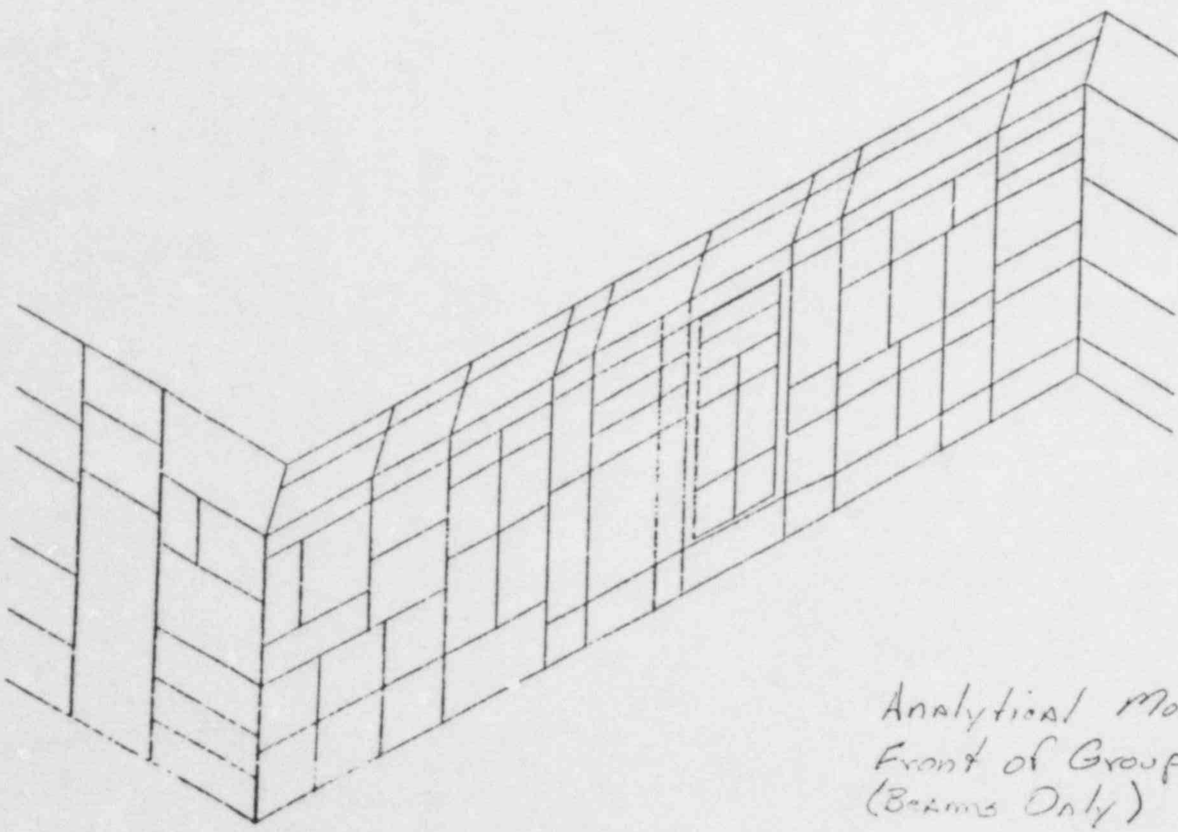
DAMP (%)

3.34

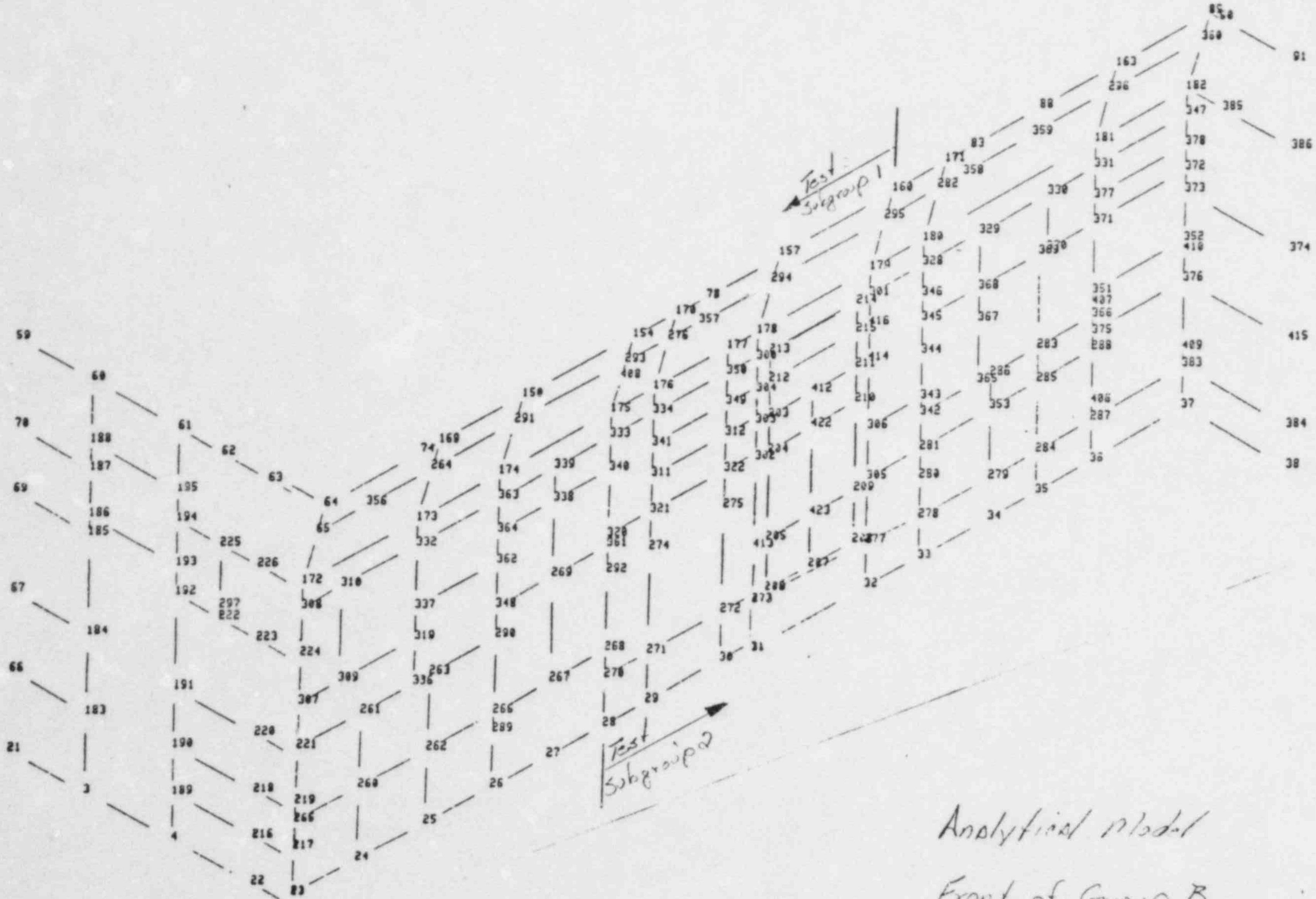
U	S



Undeformed Plot



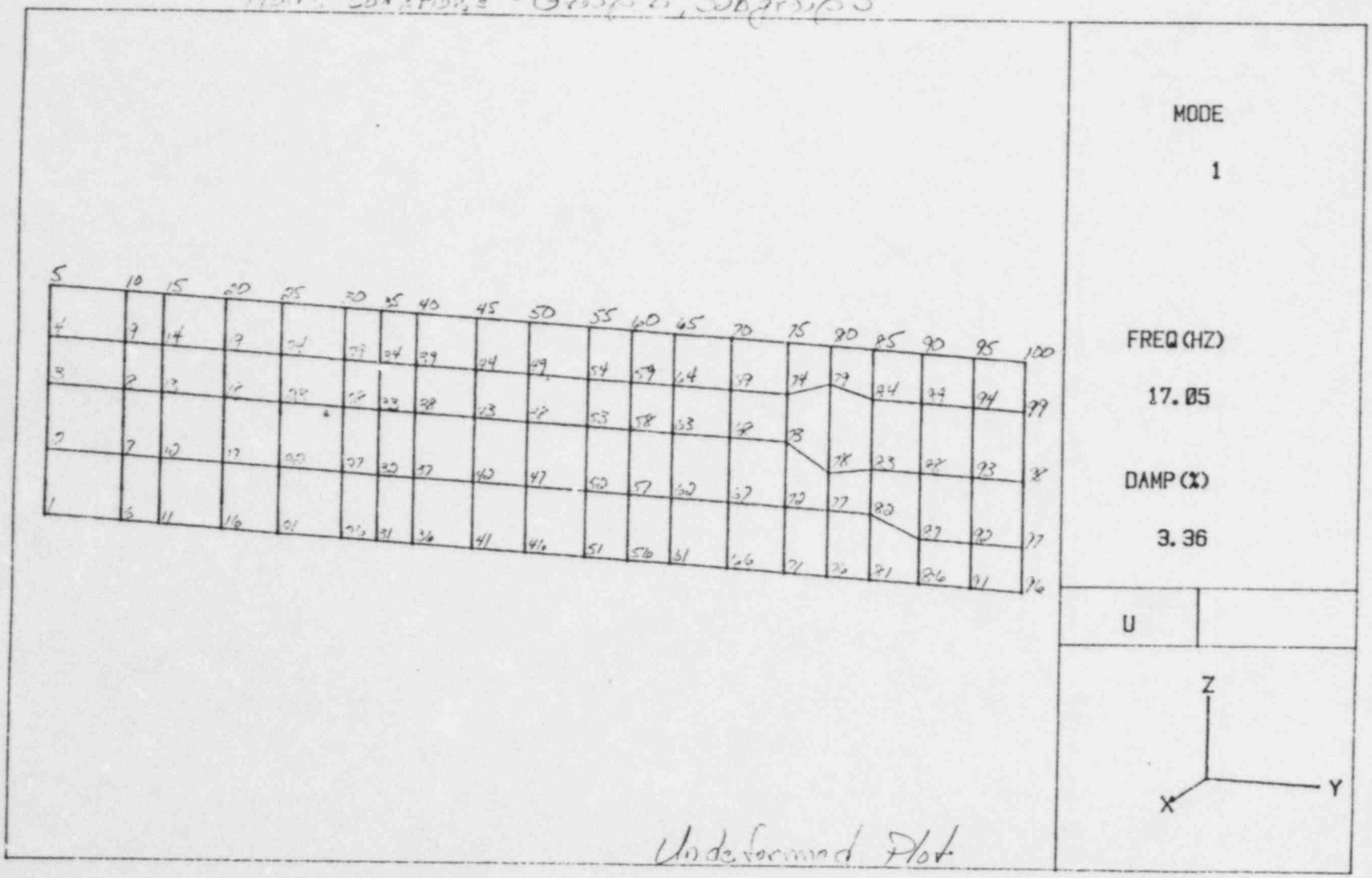
Analytical Model
Front of Group B
(Beams Only)



Analytical Model

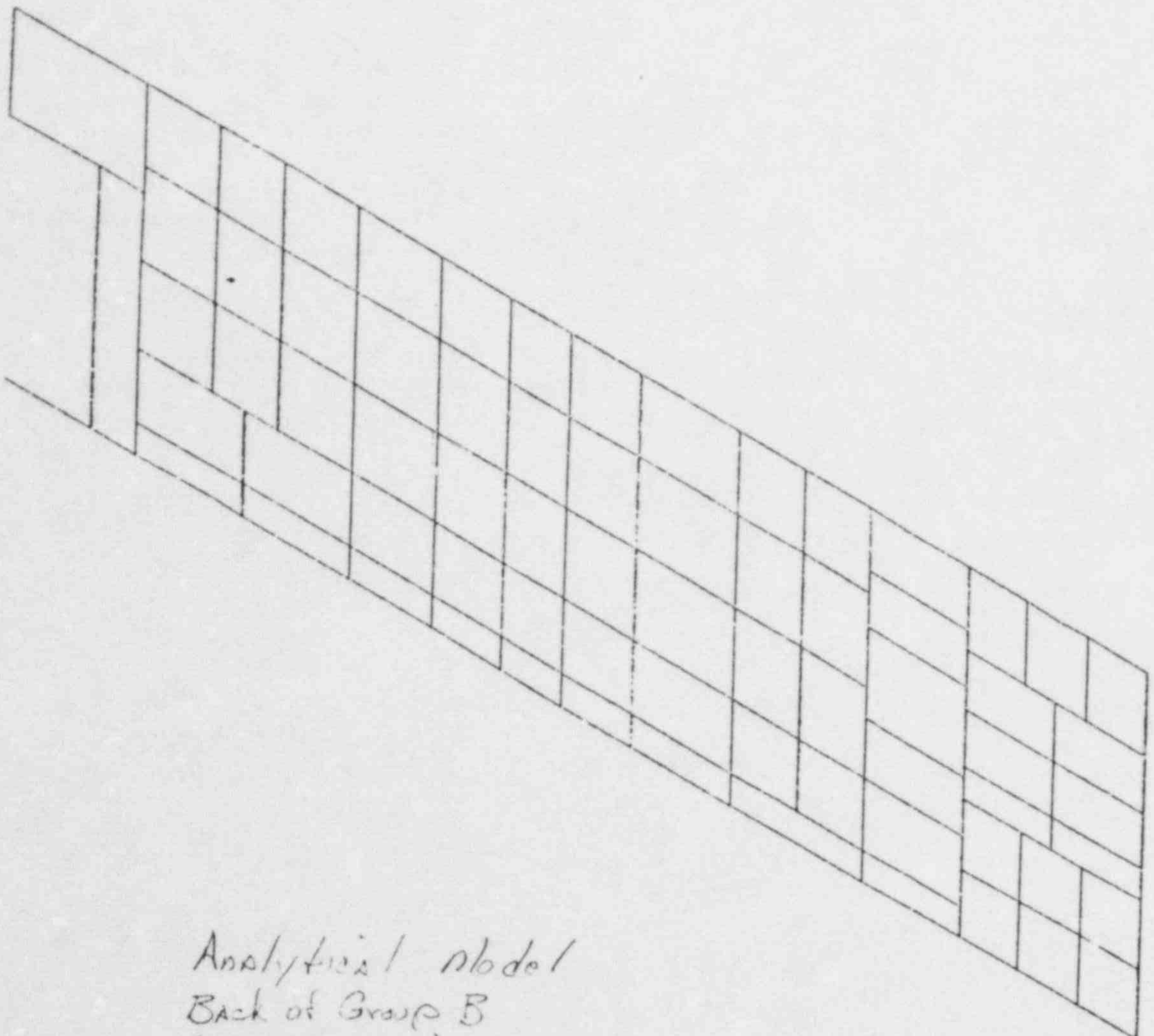
Front of Group B
Node Numbers

Node Locations - Group B, Subgroup 3

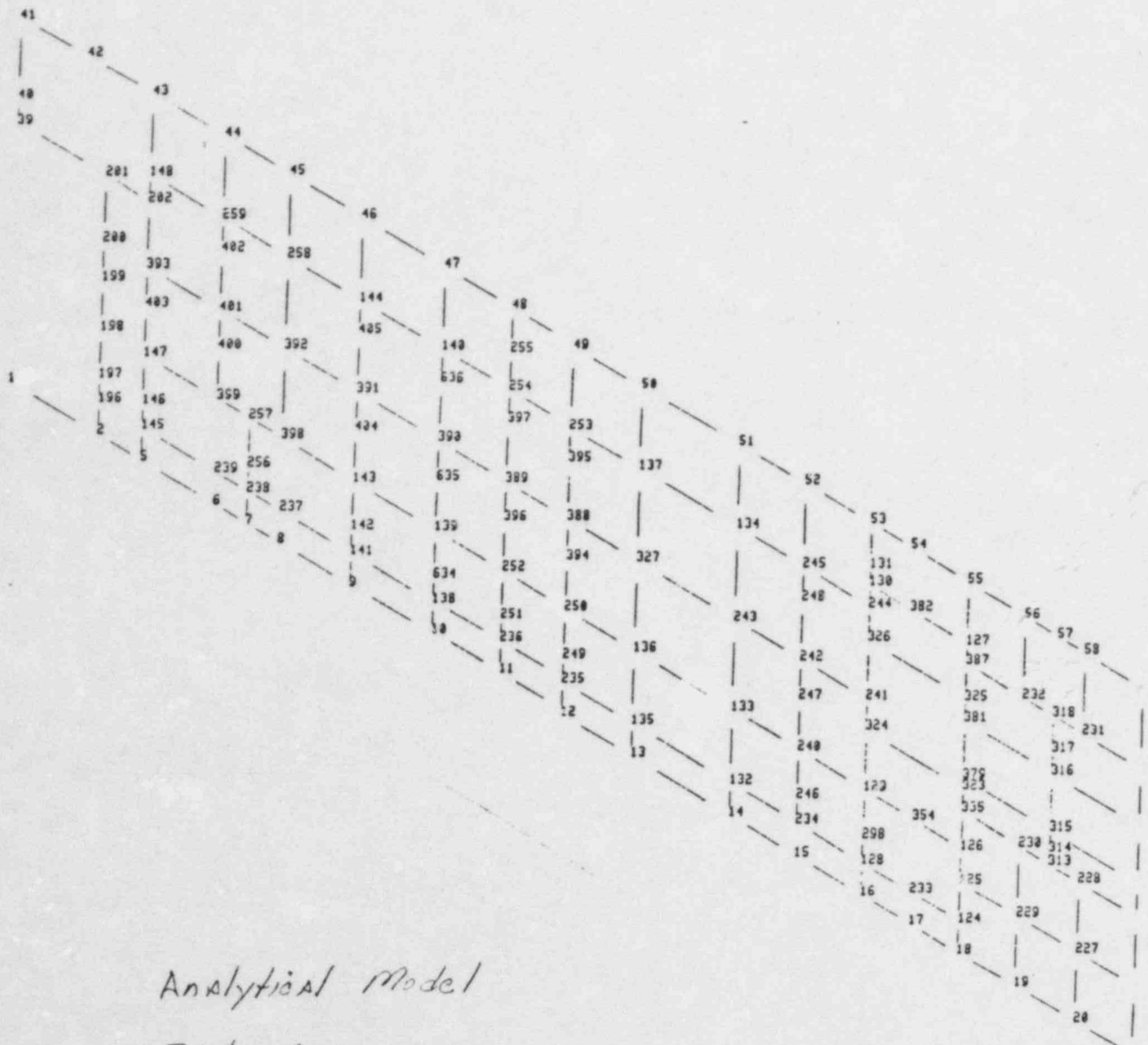


82-1675 / MAIN CONTROL BOARDS / GROUP B

Figure 3.21 Illustration of Group B, Subgroup 3 Control Boards



Analytical Model
Back of Group B
(Beams Only)



Analytical Model

Back of Group B
Node Numbers

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station Catawba N.S. Unit 1&2 File No. CNC 1381.05-02-0009

Subject

By JMR Date 4/9/84

Sheet No. __ of __ Problem No. __ Checked By __ Date __

Group B Mode Shape Comparison

Analytical Results f = 13.55 Hz			Test Results (Subgroup) f = 14.13 Hz		
Node	Direction	Relative Displacement	Node	Direction	Relative Displacement
21	Z	0.000	1	Y	-0.008
66	Z	0.000	2	Y	-0.006
67	Z	0.000	3	Y	-0.012
69	Z	0.000	4	Y	-0.025
59	Z	0.000	5	Y	-0.005
3	Z	0.000	6	Y	-0.042
183	Z	0.050	7	Y	0.124
184	Z	0.176	8	Y	0.189
185	Z	0.325	9	Y	0.411
60	Z	0.000	10	Y	0.068
4	Z	0.000	11	Y	0.111
190	Z	0.416	12	Y	0.825
191	Z	0.822	13	Y	1.000
195	Z	1.000	14	Y	0.417
61	Z	0.000	15	Y	-0.068
88	Z	0.000	16	Y	-0.014
212	Z	0.076	17	Y	0.334
220	Z	0.106	18	Y	0.353
222	Z	0.091	19	Y	0.424
63	Z	0.000	20	Y	0.008
23	Z	0.000	21	Y	-0.001
217	Z	0.000	22	Y	-0.006
26	Z	0.000	23	Y	-0.006
26	Z	0.000	24	Y	-0.007
64	Z	0.000	25	Y	-0.005

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station CATAWBA Unit #2 File No. CNC-1381.05-00-0029

Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION

By JMR Date 3/23/83

Sheet No. 62 of ____ Problem No. ____ Checked By GGC Date 4-13-83

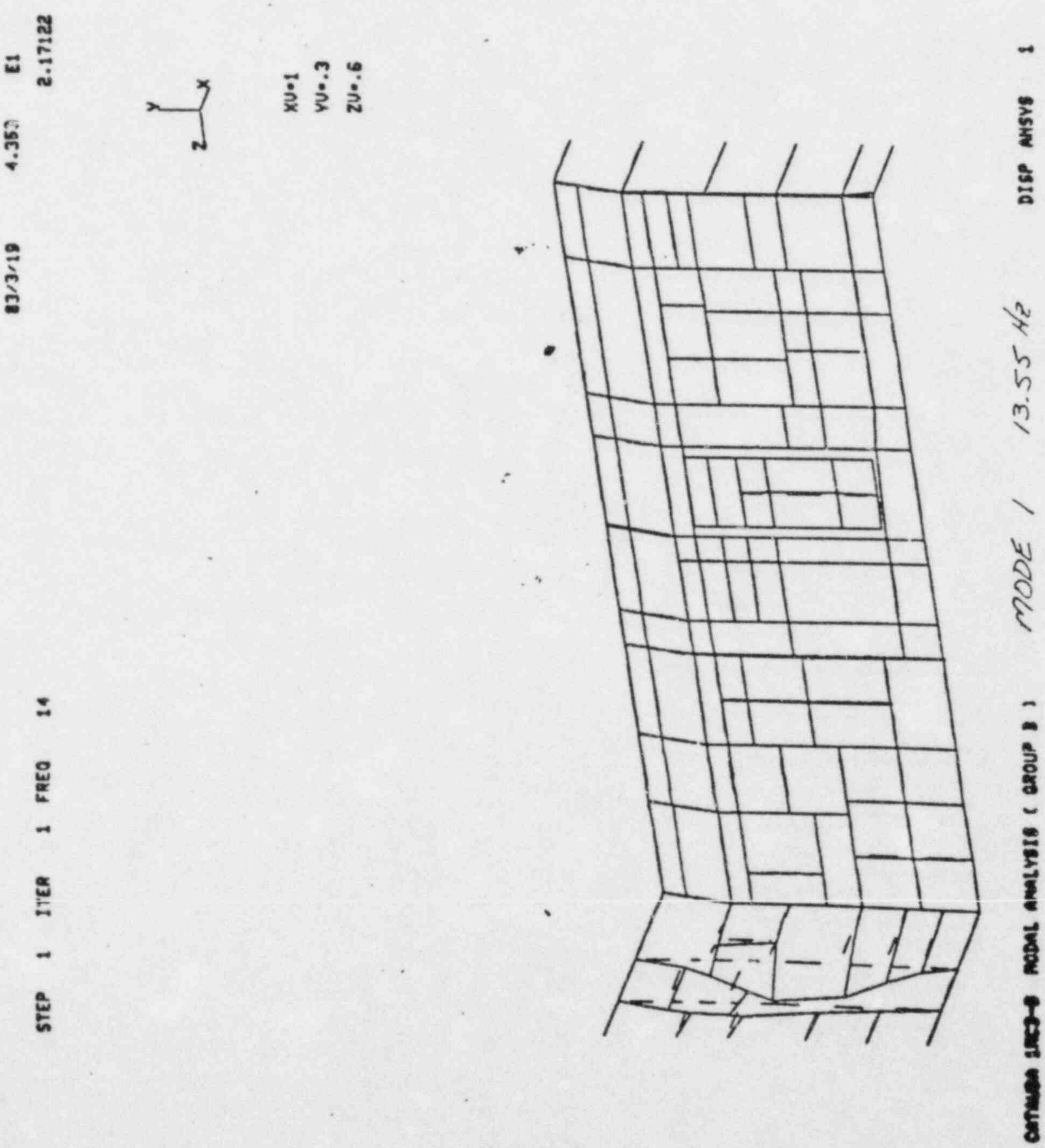


Fig 6-2.8

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station Catawba N.S. Unit 1&2 File No. CNC 1381.05-[illegible]

Subject

By JMR Date 4/9/84

Sheet No. ___ of ___ Problem No. ___ Checked By ___ Date ___

Group B Mode Shape Comparison

Analytical Results f = 13.68 Hz			Test Results (Subgroup 2) f = 13.94		
Node	Direction	Relative Displacement	Node	Direction	Relative Displacement
31	X	0.000	44	X	0.011
325	X	0.043	45	X	0.173
318	X	0.055	46	X	0.181
178	X	0.051	47	X	0.113
157	X	0.000	48	X	0.007
306	X	0.010	49	X	0.228
313	X	0.060	50	X	0.175
483	X	1.000	51	X	0.762
486	X	0.722	52	X	1.000
416	X	0.282	53	X	0.547
303	X	0.128	54	X	0.165
314	X	0.235	55	X	0.240
38	X	0.000	56	X	0.051
306	Y	0.606	57	X	0.347
414	Y	0.478	58	Y	0.319
177	Y	0.146	59	Y	0.185
180	Y	0.000	60	Y	0.009
378	Y	0.073	61	Y	0.237
286	Y	0.257	62	Y	0.399
362	Y	0.301	63	Y	0.358
387	Y	0.218	64	Y	0.275
377	Y	0.039	65	Y	0.239
384	Y	0.022	66	Y	0.161
367	Y	0.156	67	Y	0.061
36	Y	0.000	68	X	0.011

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station CATAWBA Unit #2 File No. CNC-1381.05-00-0029

Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION

By JMR Date 3/23/83

Sheet No. 63 of ____ Problem No. ____ Checked By GSC Date 4-13-83

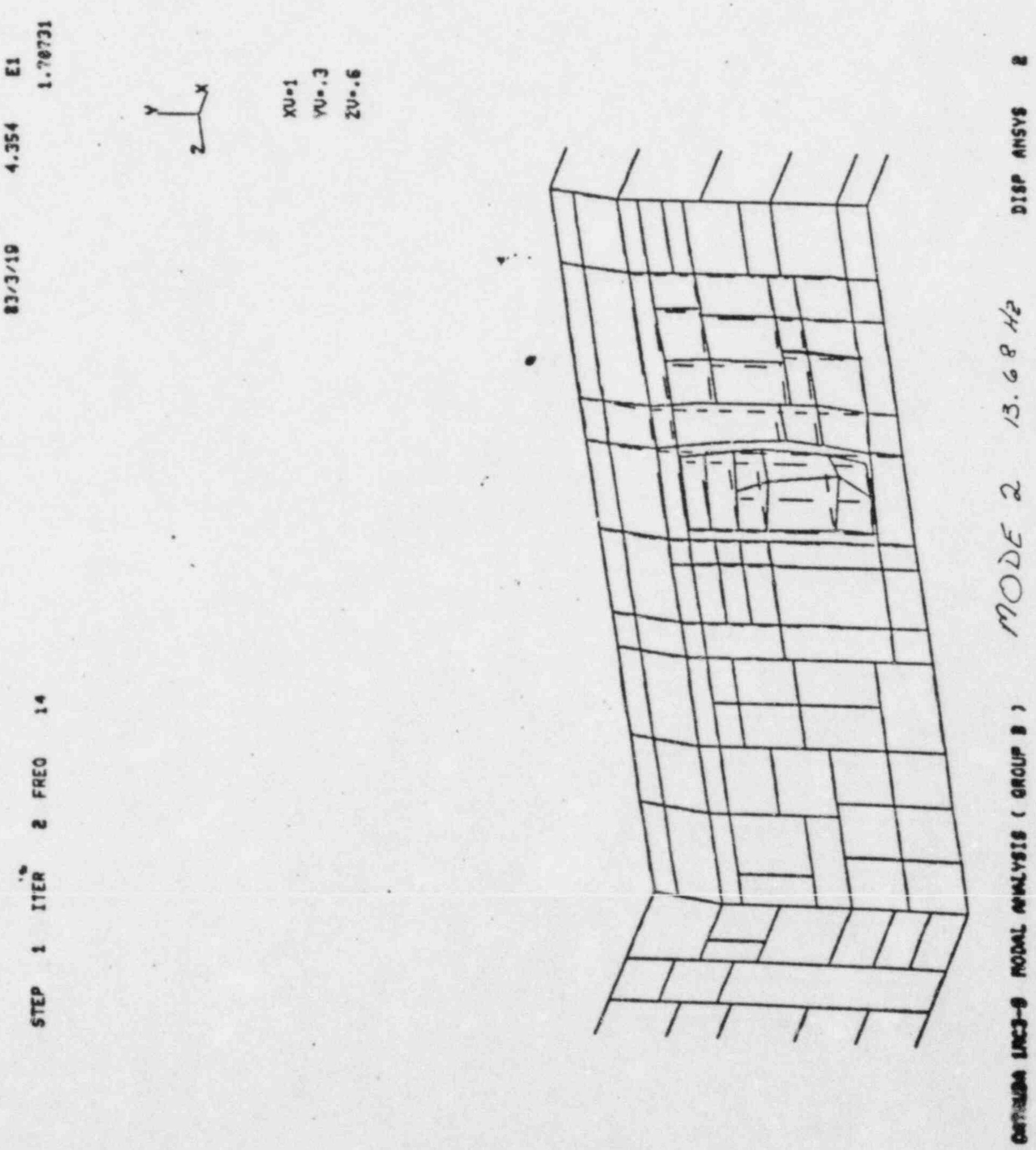


Fig 6-2.9

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station Catawba N.S. Unit #2 File No. CNC 1381.05-00-0009

Subject

By JMR Date 4/9/84

Sheet No. ___ of ___ Problem No. ___ Checked By ___ Date ___

Group 3 Mode Shape Comparison

Analytical Results for 16.0[illegible] Hz			Test Results for 17.05 Hz (Subgroup 3)		
Node	Direction	Relative Displacement	Node	Direction	Relative Displacement
12	Y	0.000	46	X	0.018
250	Y	0.309	47	X	0.146
388	Y	0.486	48	X	0.396
253	Y	0.269	49	X	0.284
49	Y	0.000	50	Y	0.003
13	Y	0.000	51	Y	0.027
136	Y	0.598	52	Y	0.654
387	Y	1.000	53	Y	1.000
137	Y	0.509	54	Y	0.586
50	Y	0.000	55	X	0.005
14	Y	0.000	61	X	0.017
133	Y	0.503	62	X	0.671
243	Y	0.371	63	Y	0.830
134	Y	0.447	64	Y	0.500
51	Y	0.000	65	Y	0.004
15	Y	0.000	66	Y	0.006
[illegible]	Y	0.097	67	Y	[illegible]
[illegible]	Y	0.155	68	Y	0.309
[illegible]	Y	0.073	69	Y	0.256
52	Y	0.000	70	Y	0.007

Dev./Station CATAWBA Unit #2 File No. CNC-1381.05-00-0029

Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION

By JMR Date 3/23/83

Sheet No. 64 of ____ Problem No. ________ Checked By GGC Date 4-13-83

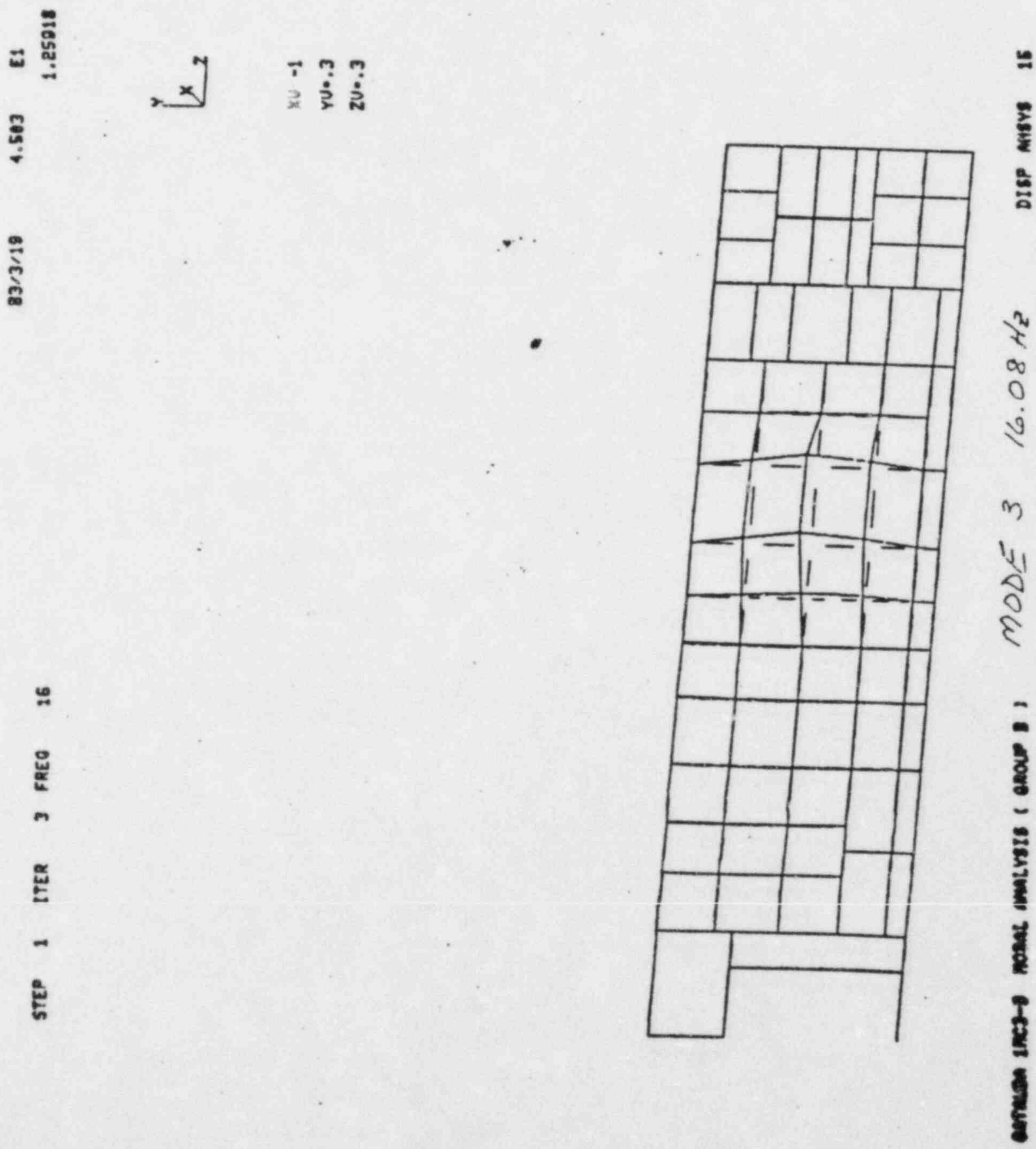


Fig 6-2.10

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station Catawba N.S Unit 1+2 File No. CNC 1381.05-00-0029

Subject

By JMR Date 4/19/84

Sheet No. __ of __ Problem No. __ Checked By __ Date __

Group B Mode Shape Comparison

Analytical Results f = 17.16 Hz			Test Results f = 16.76 Hz (Subgroup 2)		
Node	Directions	Relative Displacement	Node	Direction	Relative Displacement
31	X	0.000	44	X	-0.014
225	X	0.006	45	X	-0.173
310	Y	0.005	46	X	-0.186
178	Y	0.002	47	X	-0.137
157	Y	0.000	48	X	-0.005
206	Y	0.002	49	X	-0.248
212	Y	0.003	50	X	-0.143
403	Y	1.000	51	X	-0.867
405	Y	0.412	52	X	-1.000
416	Y	-0.016	53	X	-0.563
202	Y	-0.005	54	X	-0.136
214	Y	-0.024	55	X	-0.155
36	X	0.000	56	X	-0.014
306	Y	-0.032	57	Y	-0.247
414	Y	-0.033	58	X	-0.210
177	Y	-0.017	59	Y	-0.176
160	Y	0.000	60	X	-0.002

DUKE POWER COMPANY

Form 00181 (6-81)

Dev./Station CATAWBA Unit #2 File No. CNC-1381.05-00-0029

Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION

By JMR Date 3/23/83

Sheet No. 65 of ____ Problem No. ____ Checked By GGC Date 4-13-83

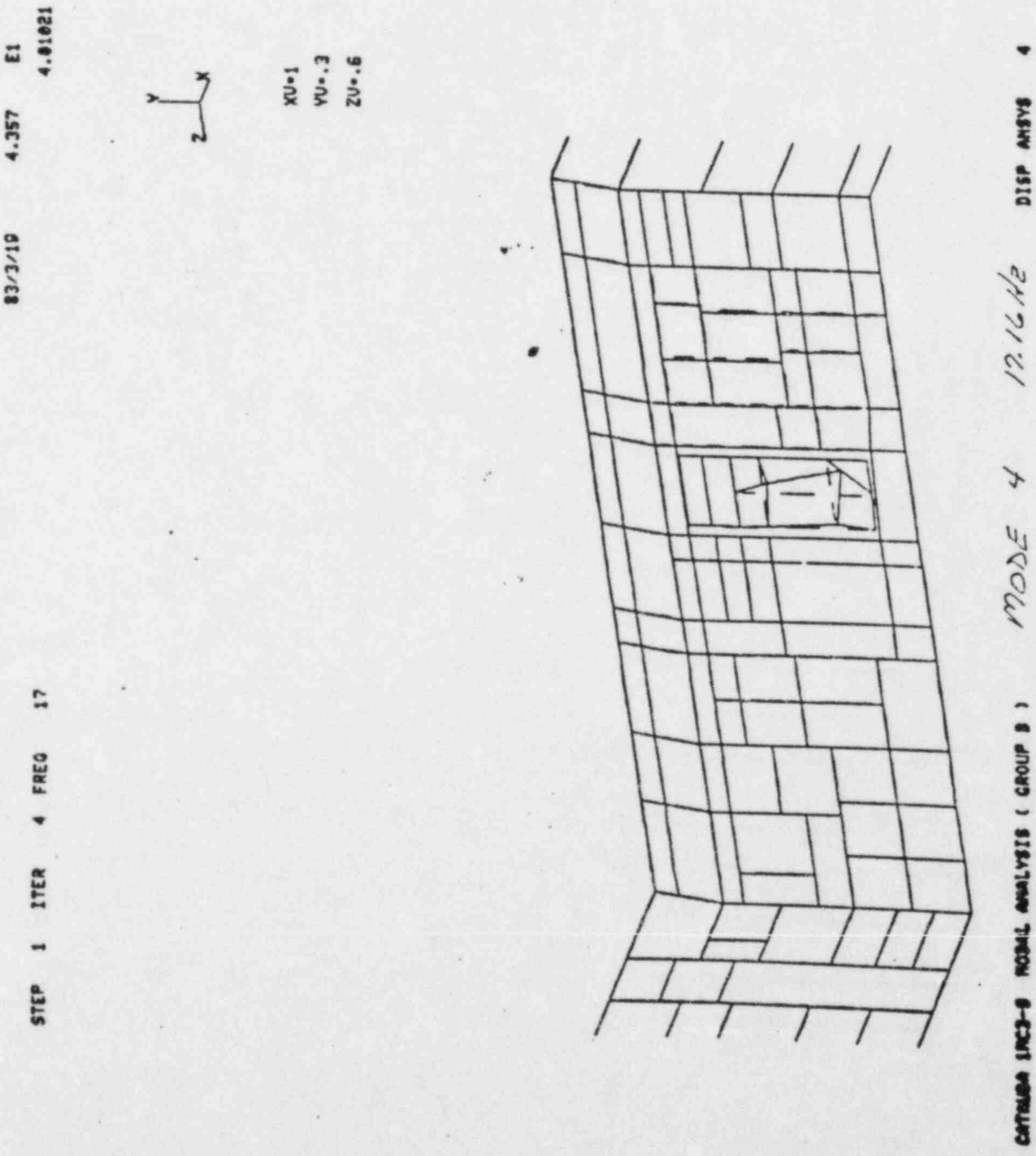


Fig 6-2.11

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station Catawba N.S. Unit 1&2 File No. CNC 1201.05-00-0009

Subject

By JMR Date 4/9/84

Sheet No. __ of __ Problem No. ______ Checked By ______ Date

Group B Mode Shape Comparison

Analytical Results f: 23.49 Hz			Test Results f: 22.87 (Subgroup 2)		
Node	Direction	Relative Displacement	Node	Direction	Relative Displacement
31	Y	0.000	44	X	0.056
275	Y	-0.059	45	X	0.331
312	Y	-0.076	46	Y	0.363
173	Y	-0.063	47	X	-0.200
157	Y	0.000	48	X	-0.013
223	Y	-0.012	49	X	0.345
213	Y	-0.075	50	X	-0.347
402	Y	1.000	51	X	1.000
400	Y	-0.256	52	X	0.665
412	Y	-0.339	53	Y	0.184
202	X	-0.132	54	X	-0.292
214	Y	-0.195	55	Y	-0.409
[illegible]	Y	0.000	56	Y	-0.049
[illegible]	Y	-0.729	57	Y	-0.315
[illegible]	Y	-0.559	58	Y	-0.649
[illegible]	X	-0.094	59	X	-0.416
[illegible]	Y	0.000	60	X	-0.016
253	Y	-0.005	61	Y	-0.349
[illegible]	Y	0.315	62	Y	-0.047
[illegible]	Y	0.260	63	X	0.033
360	X	0.099	64	Y	-0.035
217	Y	0.042	65	Y	-0.045
264	Y	0.041	66	Y	0.304
362	Y	0.212	67	Y	0.650
36	Y	0.000	68	Y	0.041
366	Y	0.057	69	Y	0.447
371	X	0.078	70	X	0.433

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station CATAWBA Unit #2 File No. CNC-1381.05-00-0029

Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION

By JMR Date 3/23/83

Sheet No. 66 of ____ Problem No. ____ Checked By GGC Date 4-13-83

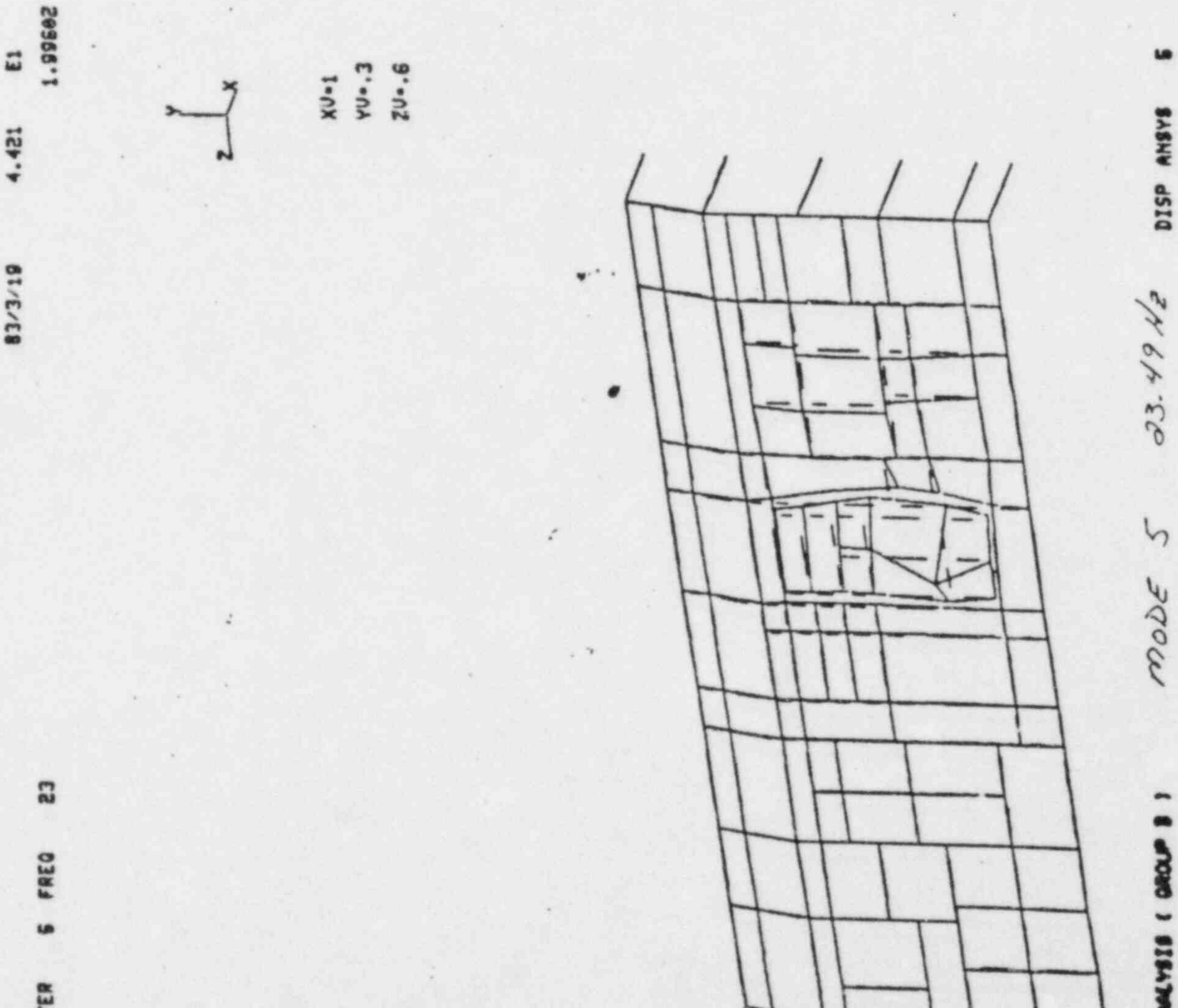


Fig 6-2.12

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station Catawba NS Unit 1&2 File No. 4/9/84

Subject

By Date

Sheet No. of Problem No. Checked By Date

Group B Mode Shape Comparison

Analytical Results f = 24.70 Hz			Test Results f = 22.79 Hz (Subgroup 3)		
Node	Direction	Relative Displacement	Node	Direction	Relative Displacement
11	X	0.000	41	X	0.013
256	X	-0.124	42	X	0.181
329	X	-0.175	43	X	0.214
254	X	-0.075	44	X	0.157
46	X	0.000	45	X	0.001
12	Y	0.000	46	X	0.012
[illegible]	Y	-0.447	47	X	0.113
[illegible]	Y	-0.784	48	X	0.354
[illegible]	Y	-0.387	49	X	0.888
49	Y	0.000	50	X	0.005
13	X	0.000	51	X	0.005
136	X	-0.395	52	X	0.135
327	X	-0.752	53	Y	0.290
137	X	-0.357	54	X	0.274
50	X	0.000	55	Y	0.005
14	Y	0.000	61	X	-0.004
133	Y	0.444	62	X	-0.869
343	Y	1.000	63	X	-1.000
134	Y	0.337	64	X	-0.542
51	Y	0.000	65	X	-0.005
15	X	0.000	66	X	-0.008
[illegible]	X	0.152	67	Y	-0.397
[illegible]	X	0.320	68	X	-0.433
[illegible]	X	0.131	69	X	-0.376
52	X	0.000	70	X	-0.010

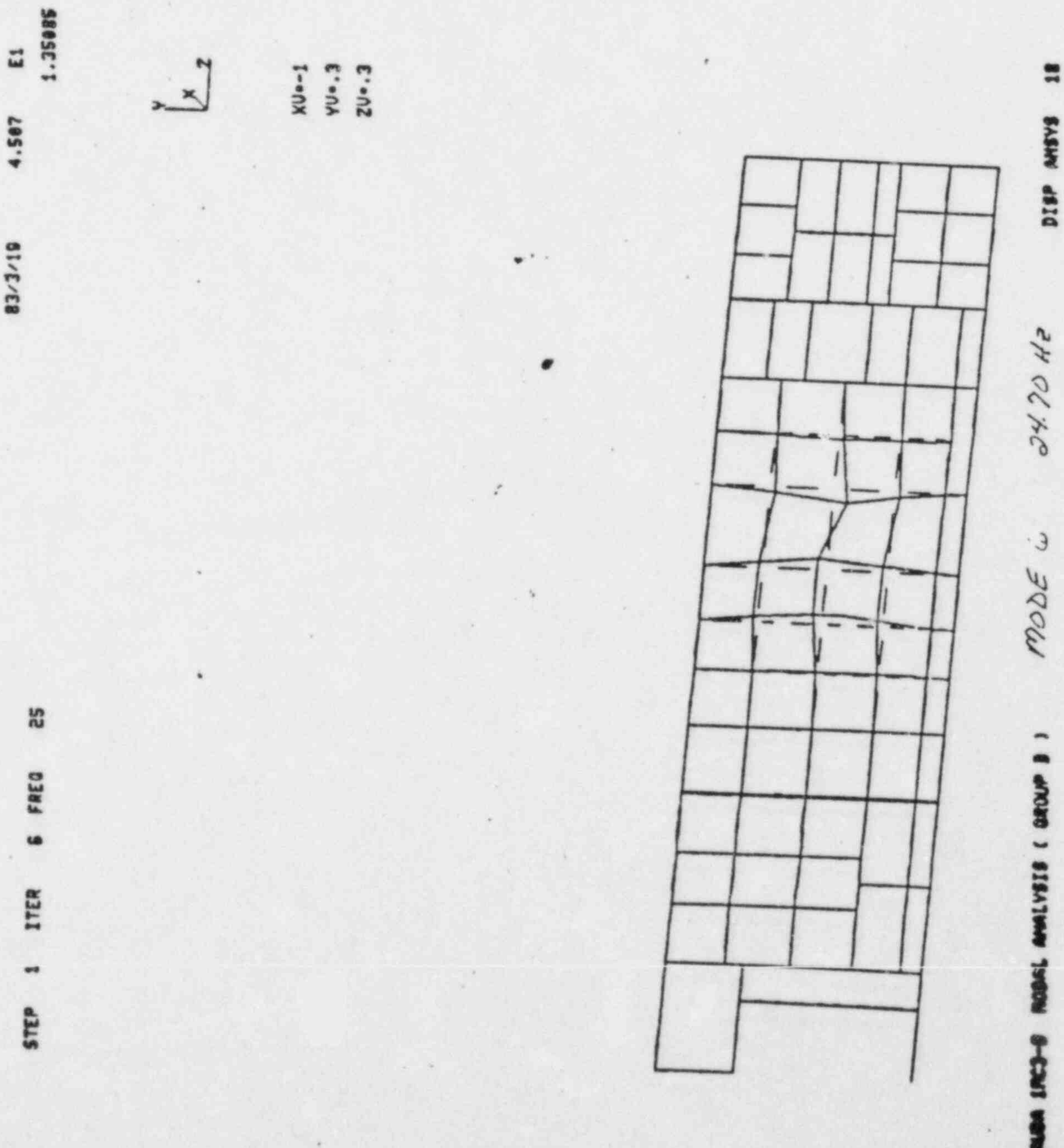

83/3/19 4.507 E1 1.35085
XV=-1
YV=.3
ZV=.3
STEP 1 ITER 6 FREQ 25
DISP ANSYS 18
CATAWBA 1MC3-B MODAL ANALYSIS (GROUP B)
MODE 6 24.70 Hz

Fig 6-2.13

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station: Catawba N.S Unit: 1+2 File No.: CNC 1381.05-00-0009

Subject:

By: JMR Date: 4/10/84

Sheet No. __ of __ Problem No. __ Checked By __ Date __

Group B Mode Shape Comparison

Analytical Results f = 28.63			Test Results f = 27.09 (Subgroup 5)		
Node	Direction	Relative Displacement	Node	Direction	Relative Displacement
1	X	0.000	1	X	0.000
—	—	—	2	X	-0.002
—	—	—	3	X	0.002
3?	X	0.000	4	X	0.005
41	X	0.000	5	X	0.006
2	X	0.000	6	X	0.002
19?	X	0.747	7	X	0.930
199	X	1.000	8	X	0.922
20?	X	0.822	9	X	1.000
40	X	0.000	10	X	0.074
5	X	0.000	11	X	0.015
14?	X	0.035	12	X	0.224
3?3	X	0.055	13	X	0.244
14?	X	0.029	14	X	0.187
43	X	0.000	15	X	0.004

DUKE POWER COMPANY

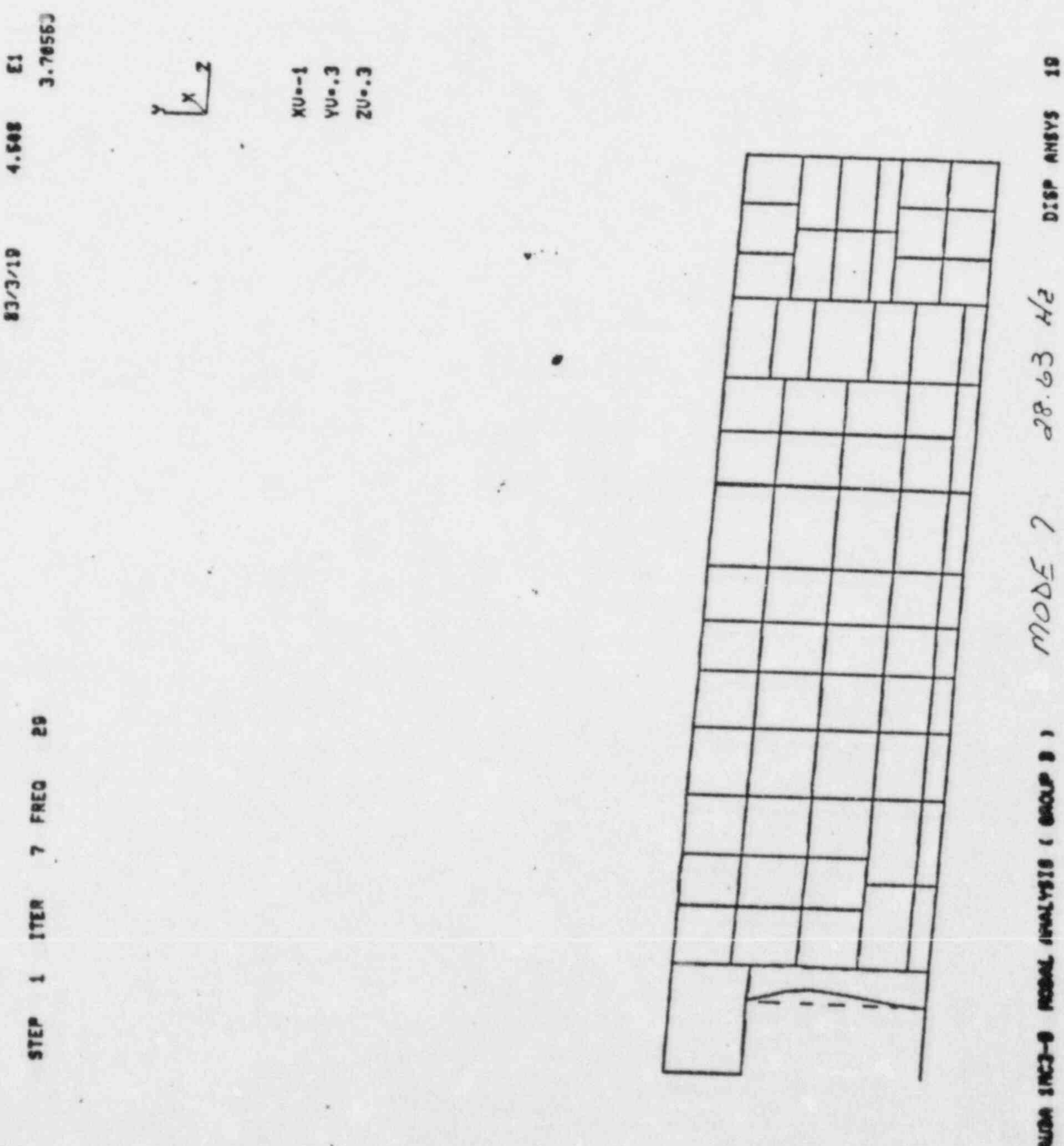
Form 00184 (6-81)

Dev./Station CATAWBA Unit #2 File No. CNC-1381.05-00-0029

Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION

By JMR Date 3/23/83

Sheet No. 62 of ____ Problem No. ____ Checked By GGC Date 4-13-83



6-2.14

SPECIFIC ITEM #17 MAIN CONTROL BOARDS

PART 2 ATTACHMENT: Comparison of mode shapes for Group C Main Control Boards

(Not Required Because Group C Was Rigid.)

SPECIFIC ITEM #17 MAIN CONTROL BOARDS

PART 2 ATTACHMENT: Comparison of mode shapes for Group D Main Control Boards.

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station ______ Unit ____ File No. ______

Subject ______

______ By ______ Date ______

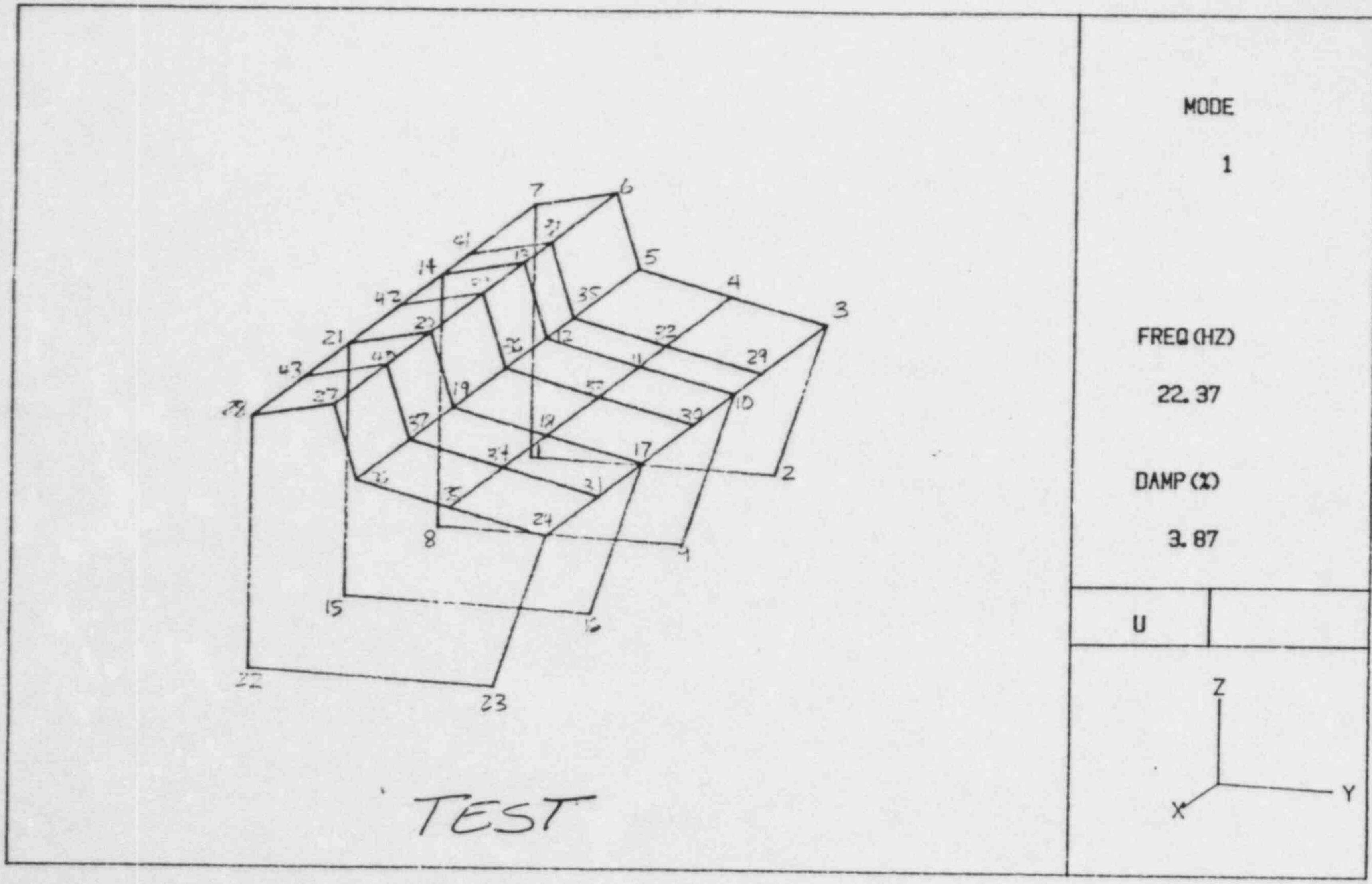
Sheet No. ___ of ____ Problem No. ______ Checked By ______ Date ______

CATAWBA MAIN CONTROL BOARDS - GROUP 1)

- BASED ON THE TRANSFER FUNCTIONS FROM THE MODAL SURVEY BY CCL ON CATAWBA MAIN CONTROL BOARDS, MODES 2, 3, + 6 WERE JUDGED TO BE OF THE MOST SIGNIFICANCE AND HENCE WERE USED TO "TUNE" THE FINITE ELEMENT MODELS

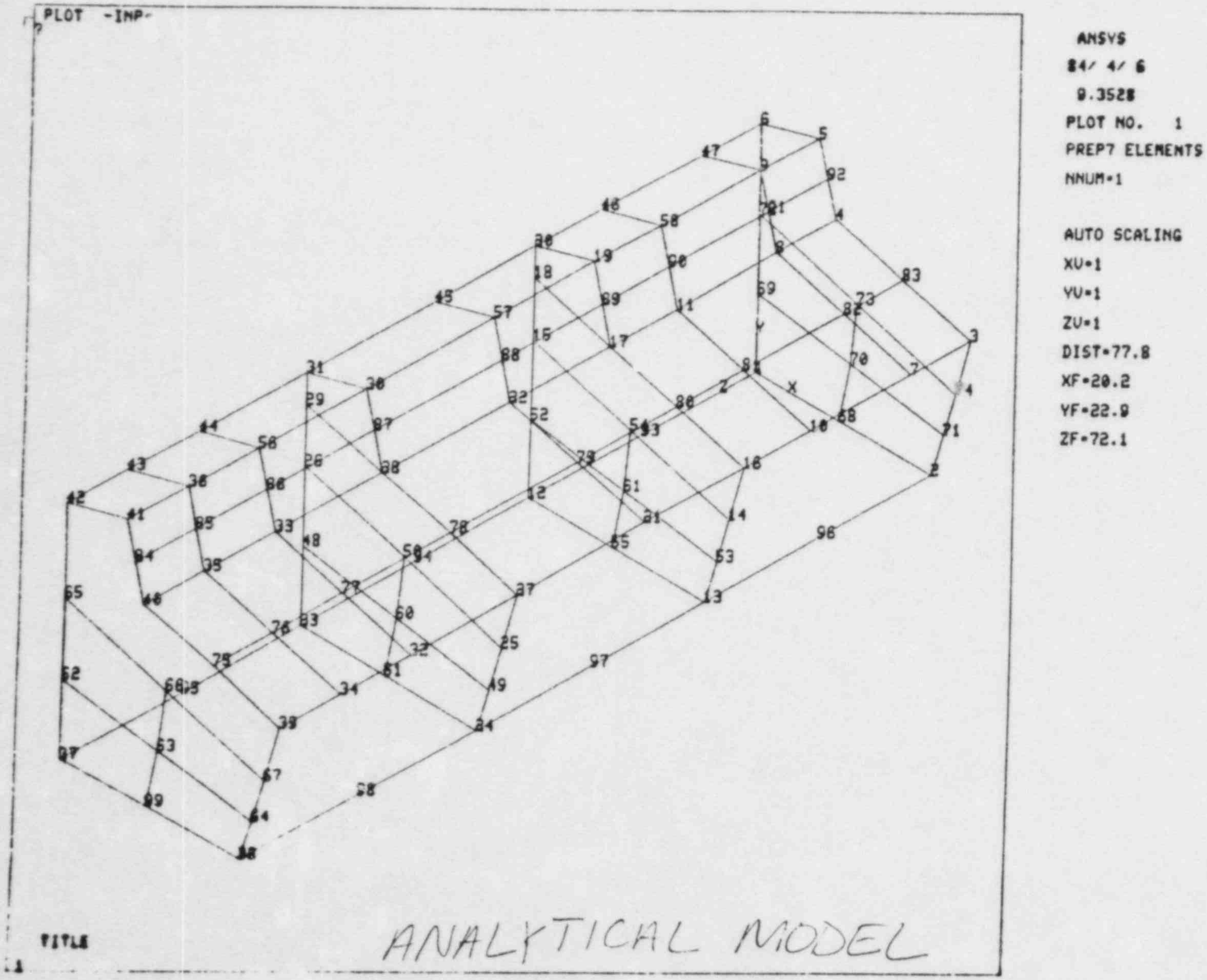
- ATTACHED ARE ANALYTICAL + TEST MODE SHAPES + DIGITIZED DATA (FOR SELECTED POINTS) FOR EACH OF THESE THREE MODES

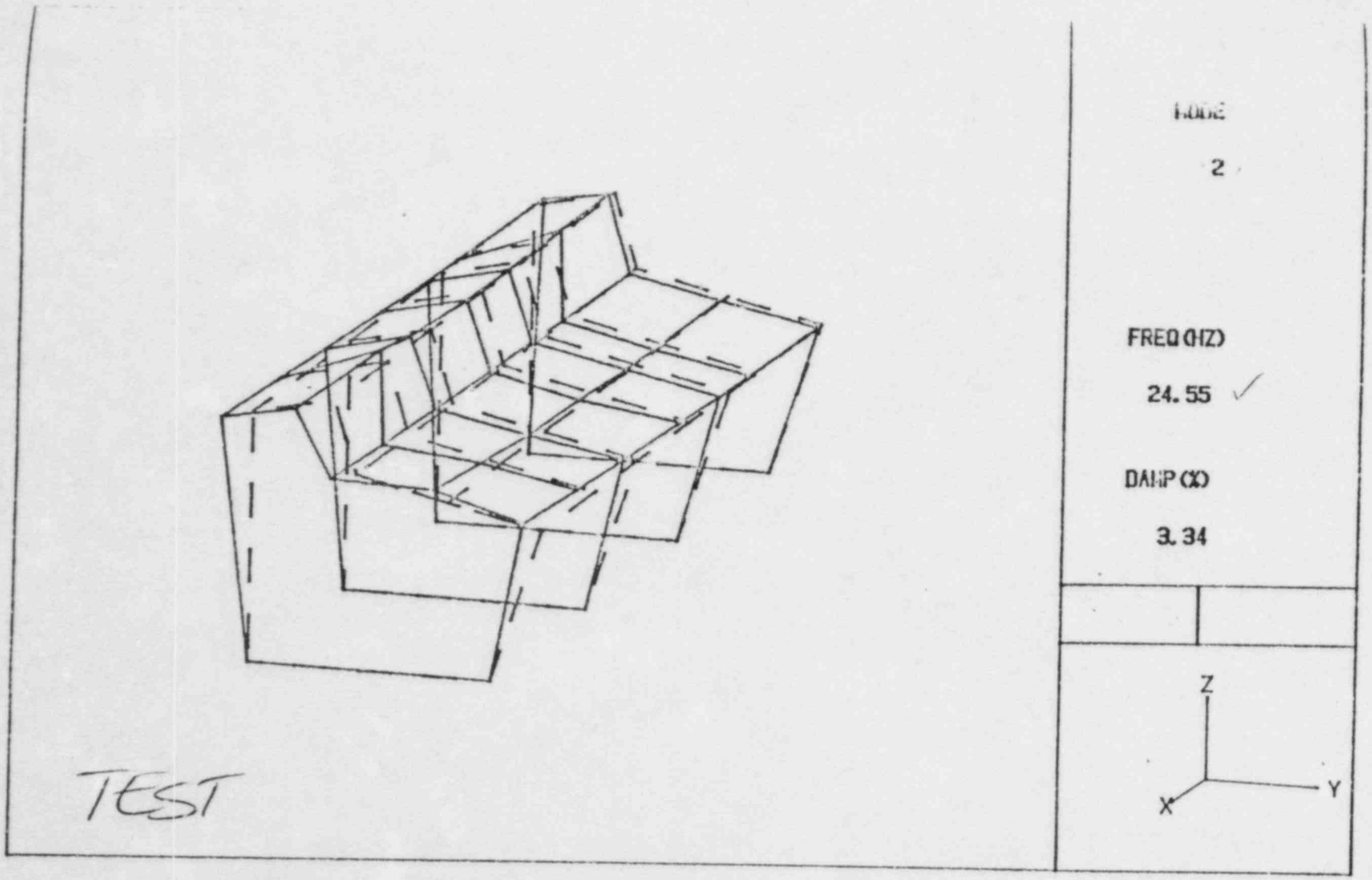
- IT IS NOTED THAT IN SOME CASES, SUCH AS TEST MODE #2 V.S. ANALYTICAL MODE #1, THAT RELATIVE DISPLACEMENTS ARE NOT CLOSELY MATCHED; HOWEVER, THEY BOTH TAKE ON THE SAME SHAPE EXTREMELY WELL. IT IS RECOGNIZED THAT THE TREND SEEN IN THIS ANALYTICAL MODE + THE OTHER TWO MODES CLOSELY DEPICT THE TRENDS OBSERVED IN THE MODAL TEST DATA.



82-1575 / MAIN CONTROL BOARDS / GROUP D

Figure 3.23 Illustration of Group D Control Board


PLOT -INP-
ANSYS
84/ 4/ 6
9.3528
PLOT NO. 1
PREP7 ELEMENTS
NNUM=1
AUTO SCALING
XV=1
YV=1
ZV=1
DIST=77.8
XF=20.2
YF=22.9
ZF=72.1
TITLE
ANALYTICAL MODEL



82-1675 / MAIN CONTROL BOARDS / GROUP D

Figure 6.57 Mode Two, Group D

4

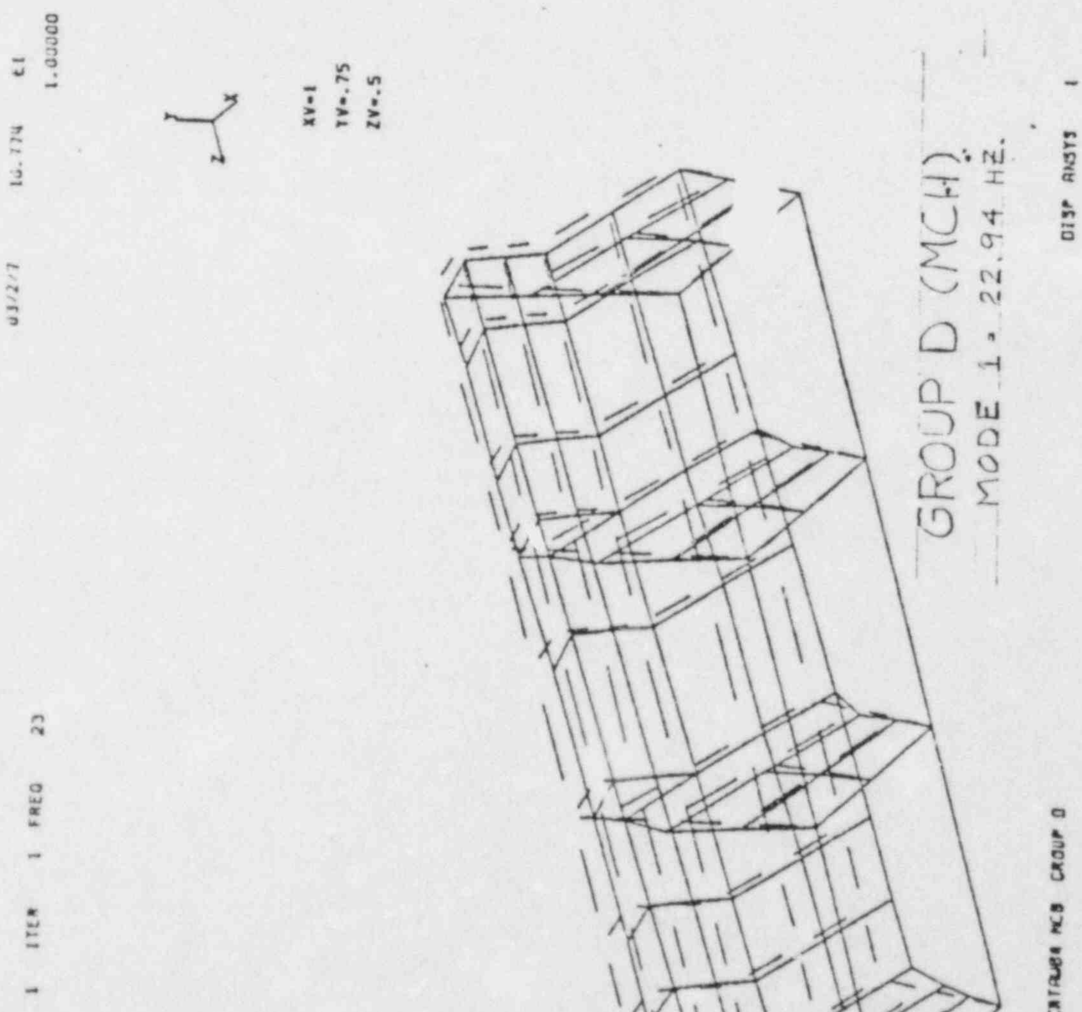
DUKE POWER COMPANY

Station CATAWBA Unit #2 File No. CNC-1331.05-00-0002

Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION

By AGC Date [illegible]

Sheet ___ of ___ Problem No. ________ Checked By [illegible] Date [illegible]



ANALYSIS

Form 00134 (6-81)

Dev./Station ______ Unit ____ File No. ____

Subject ______

______ By ____ Date ____

Sheet No. ___ of ___ Problem No. ______ Checked By ____ Date ____

[illegible] CONTROL BOARDS - GROUP D

TEST (f_2 = 24.55 Hz)

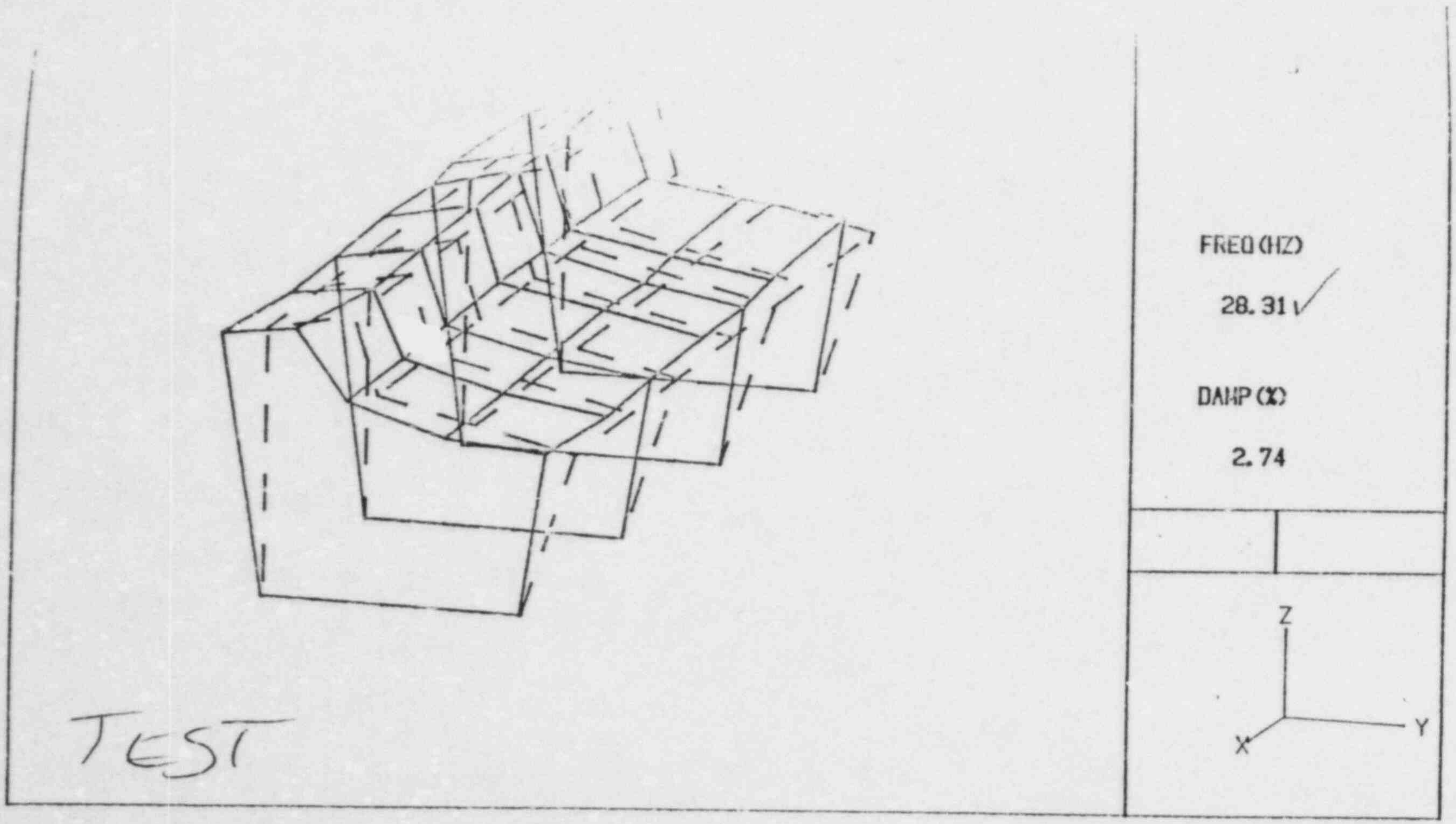
Node	UY	UZ	UX
3	.01	-.03	.23
4	.02	.06	.62
5	.02	—	.56
6	.02	.11	.53
7	.03	—	-.59
10	-.07	.01	.52
11	-.07	.00	.48
12	-.04	—	.64
13	-.07	-.02	.79
14	-.05	—	.80
17	-.23	—	.30
18	-.19	.02	.46
19	-.19	—	.57
20	-.20	.02	.86
21	-.26	—	.92
24	-.32	.26	.34
25	-.39	.21	-.32
26	-.40	—	.54
27	-.64	-.11	.71
28	-.48	—	.75

ANALYSIS (f_1 = 22.94 Hz)

Node	UX	UY	UZ
3	-.15	.04	-.14
83	—	—	—
4	-.16	.00	-.32
5	-.16	.01	-.32
6	-.16	-.01	-.41
16	-.42	.12	-.14
80	—	—	—
17	-.47	-.06	-.31
19	-.48	-.06	-.33
20	-.50	.00	-.41
27	-.67	.18	-.15
78	—	—	—
28	-.74	-.04	-.30
30	-.76	-.06	-.34
31	-.77	-.01	-.40
39	-.88	.27	-.16
75	—	—	—
40	-.95	.04	-.30
41	-1.00	.03	-.35
42	-.98	-.05	-.40

Note: side to side out-of-phase

FRONT-TO-BACK MODE w/ Side-to-Side (Note larger front/back displacement on left [illegible] than right [illegible] test results + analysis)



82-1675 / MAIN CONTROL BOARDS / GROUP D

Figure 5.58 Mode Three, Group D

ATAWBA — Unit 1&2 — File No. CNC-1381.05-00-00

CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION

By — Date

Problem No. — Checked By — Date

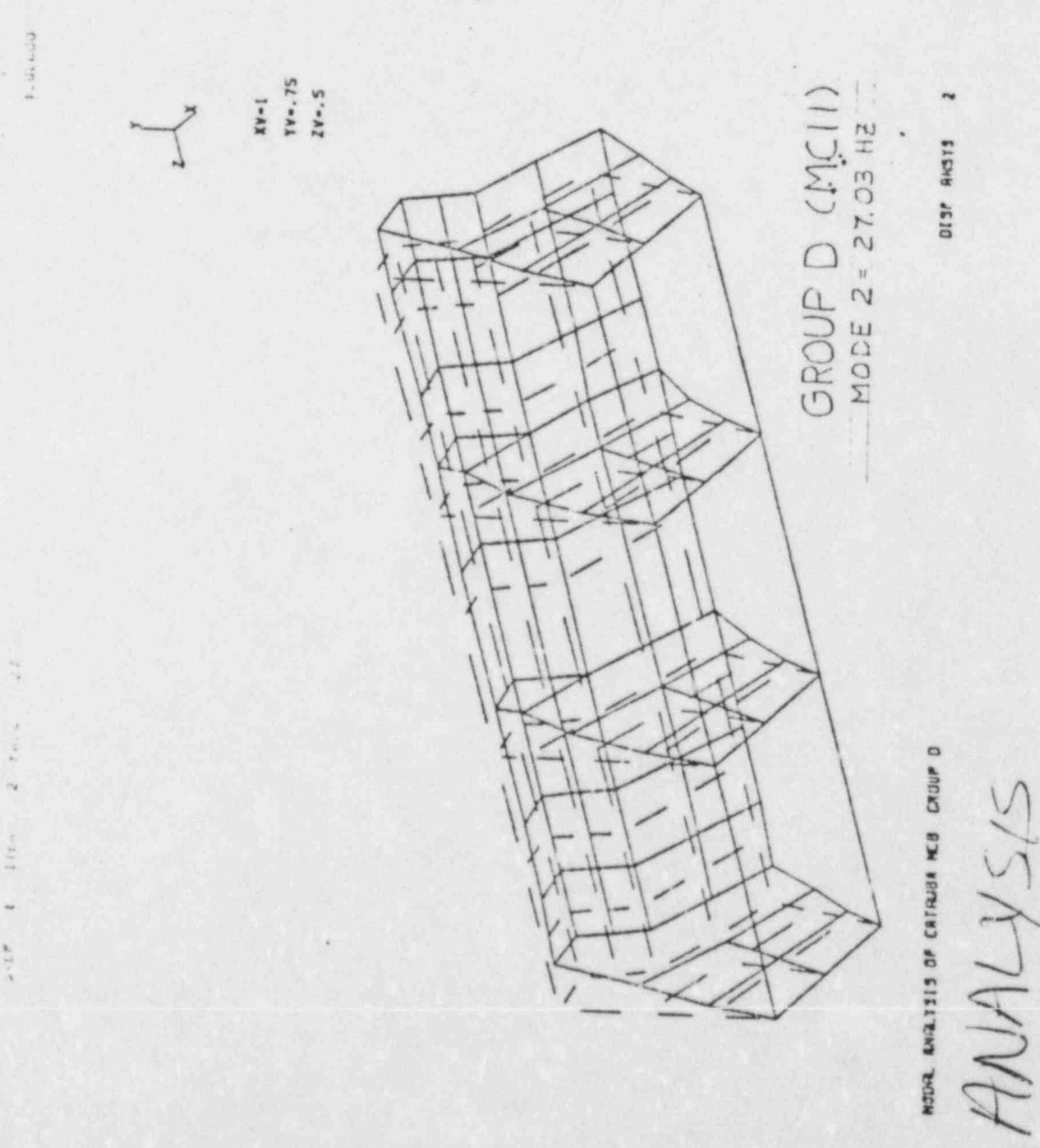


FIG. 6.1.6

Dev./Station ______ Unit ____ File No. ____

Subject ______

______ By ____ Date ____

Sheet No. __ of __ Problem No. ______ Checked By ____ Date ____

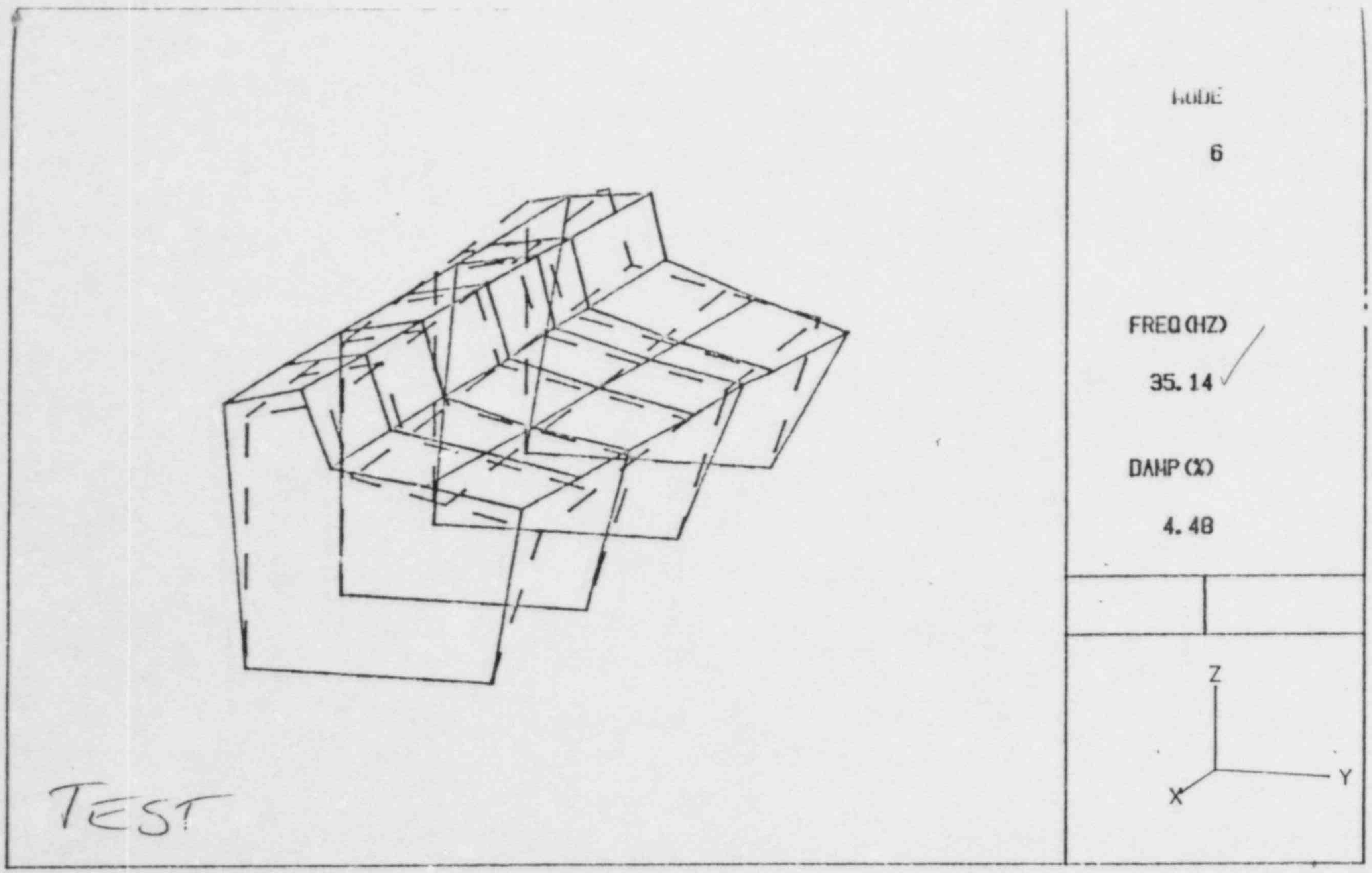
CATAWBA MAIN CONTROL BOARDS - GROUP D (cont'd)

TEST (f_3 = 26.31 Hz)			
Node	UY	UZ	UX
3	-.47	.44	.45
4	-.50	.22	.54
5	.45	—	.52
6	-.64	.24	.55
7	-.67	—	.61
10	-.42	.03	.61
11	-.47	-.05	.59
12	-.52	—	.62
15	-.59	.05	.67
16	-.57	—	.70
17	-.40	—	.54
18	-.42	-.05	.71
19	-.48	—	.73
20	-.56	-.13	.61
21	-.52	—	.66
24	-.46	.11	.51
25	-.46	-.22	.57
26	-.44	—	.63
27	-1.00	-.24	.63
28	-.74	—	.71

ANALYSIS (f_2 = 27.03 Hz)			
Node	UY	UX	UZ
3	.65	-.19	-.84
83	—	—	—
4	.70	-.04	-.92
5	.68	-.05	-.97
6	.67	.01	-.97
16	.55	-.14	-.84
80	—	—	—
17	.61	.09	-.93
19	.62	.09	-.96
20	.64	.01	-.93
27	.41	-.11	-.84
78	—	—	—
28	.47	.11	-.94
30	.48	.11	-.94
31	.50	.02	-.99
39	.23	-.05	-.83
75	—	—	—
40	.26	.03	-.95
41	.27	.03	-.94
42	.27	.03	-1.00

Note: ANALYTICAL + TEST MODES ARE OUT-OF-PHASE

FRONT-TO-BACK COUPLED W/ SIDE TO SIDE



82-1675 / MAIN CONTROL BOARDS / GROUP D

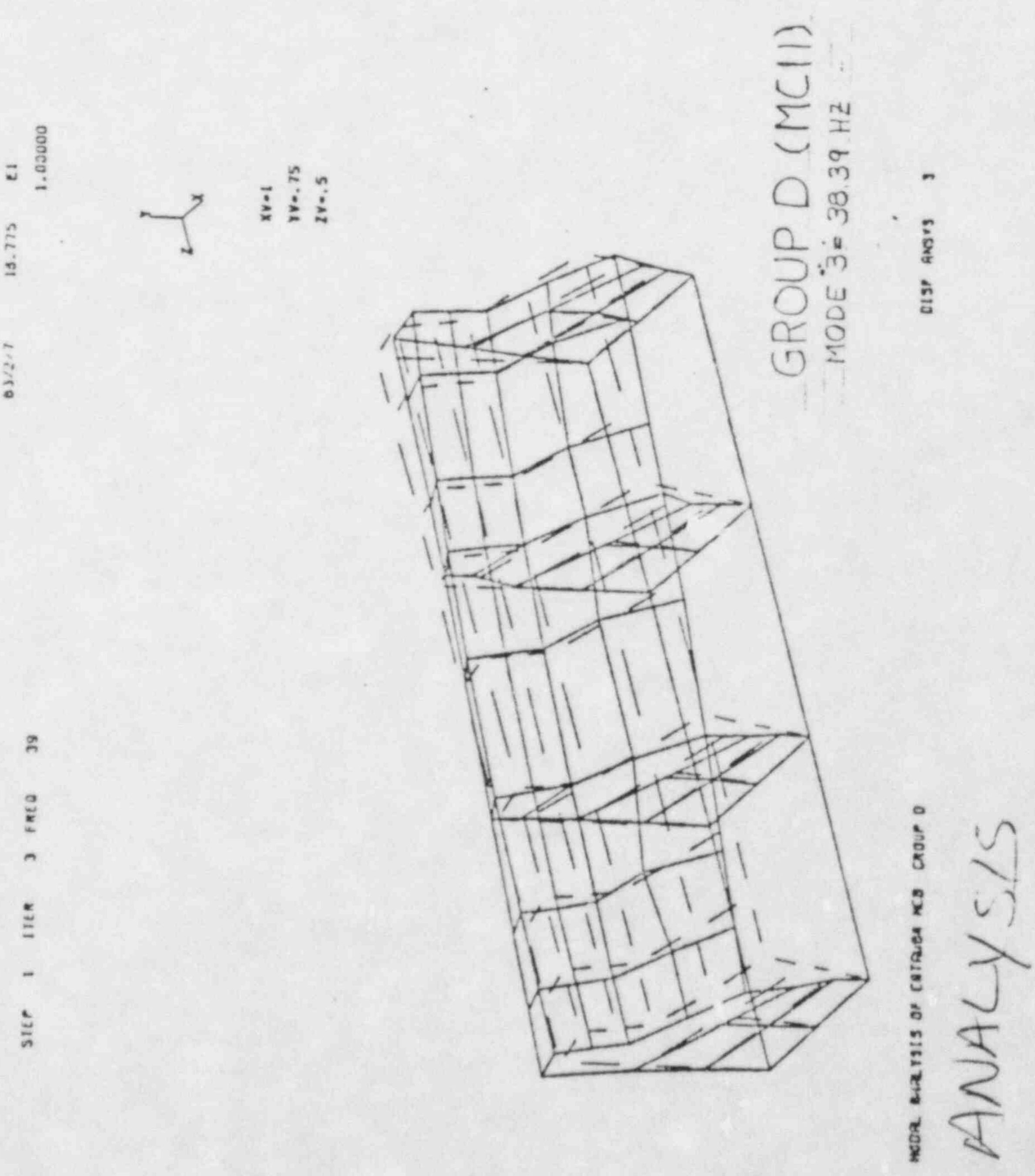
Figure 6.61 Mode Six, Group D

Station CATAWBA Unit #2 File No. CNC-1331.05-00-0005

Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION

By ______ Date 3-__-83

Sheet No. ____ of ____ Problem No. ______ Checked By ______ Date ______



Dev./Station ______ Unit ____ File No. ______
Subject ______
______ By ______ Date ______
Sheet No. ___ of ___ Problem No. ______ Checked By ______ Date ______

CATAWBA MAIN CONTROL BOARDS - GROUP D (cont'd)

TEST (f_{T6} = 35.14 Hz)

Node	UY	UZ	UX
3	-.58	.48	.41
4	-.61	.31	.58
5	-.67	—	.72
6	-.79	.27	.78
7	-.76	—	.84
24	.59	-.49	.45
25	.64	-.31	.57
26	.73	—	.73
27	.91	-.1	.80
28	.85	—	.97

ANALYSIS (f_{T3} = 33.39 Hz)

Node	UX	UY	UZ
3	.90	-.24	.48
83	—	—	—
4	.93	.07	.21
5	.91	.05	.02
6	.91	.02	-.08
39	-.83	.27	.55
75	—	—	—
40	-.86	.21	.08
41	-1.00	.7	.13
42	-.95	-.02	-.02

TORSIONAL MODE (F/B coupled w/ S/S)

SPECIFIC ITEM #17 MAIN CONTROL BOARDS

PART 2 ATTACHMENT: Comparison of mode shapes for Group E Main Control Boards.

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station CATAWBA	Unit 1&2 File No. CNC-1381.05-00-0025
Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION	
By MDW	Date 2/4/83
Sheet No. 91 of ___ Problem No. ___ Checked By GGC	Date 4-13-83

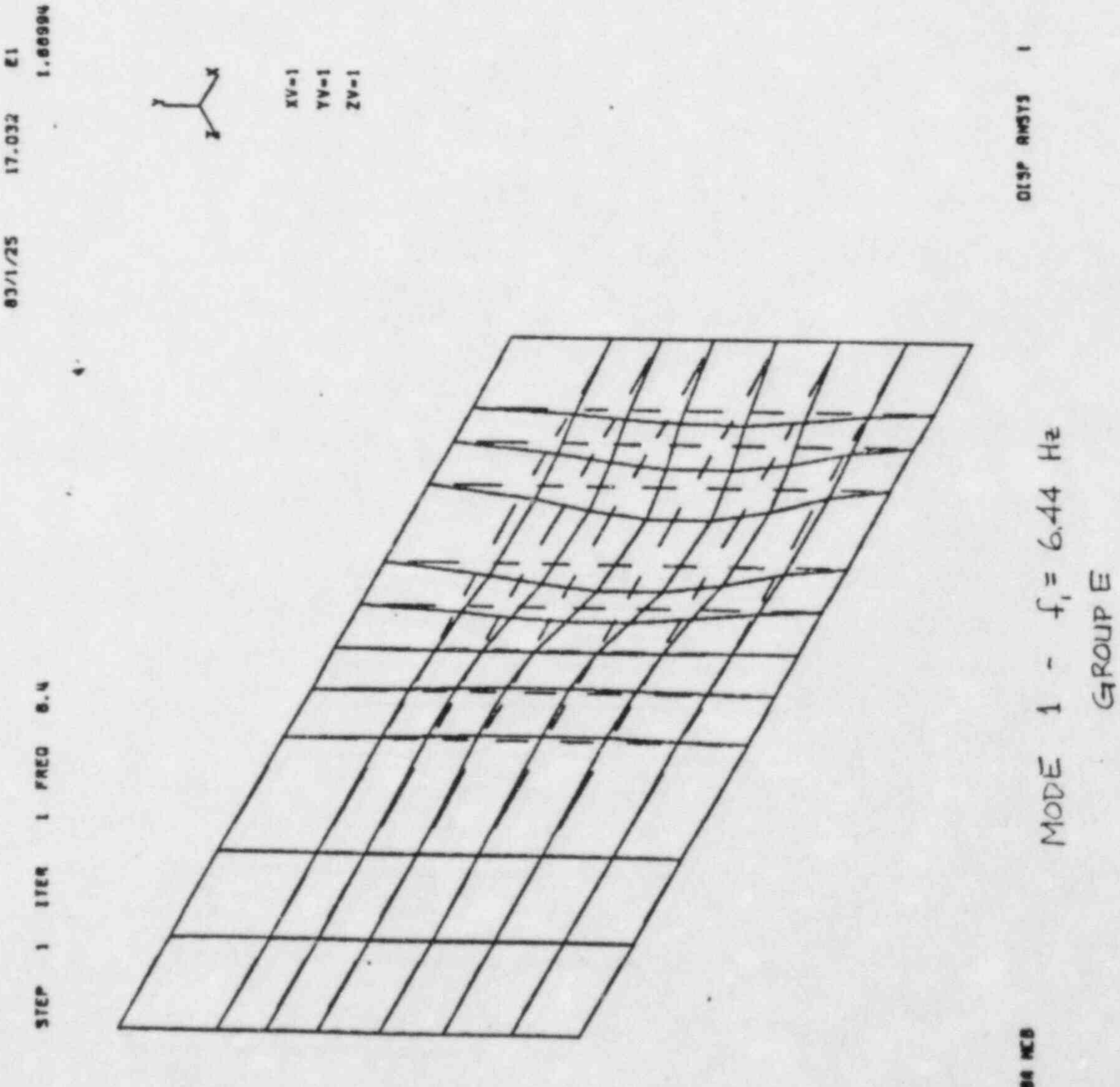


Fig. 6-5.3

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station: CATAWBA N.S. Unit: 1&2 File No. CNC-1381.05-00-0029

Subject: MCB SEISMIC ANALYSIS QUALIFICATION

By: MDW Date: 4/10/84

Sheet No. ___ of ___ Problem No. ___ Checked By ___ Date ___

GROUP E - Mode Shape Comparision

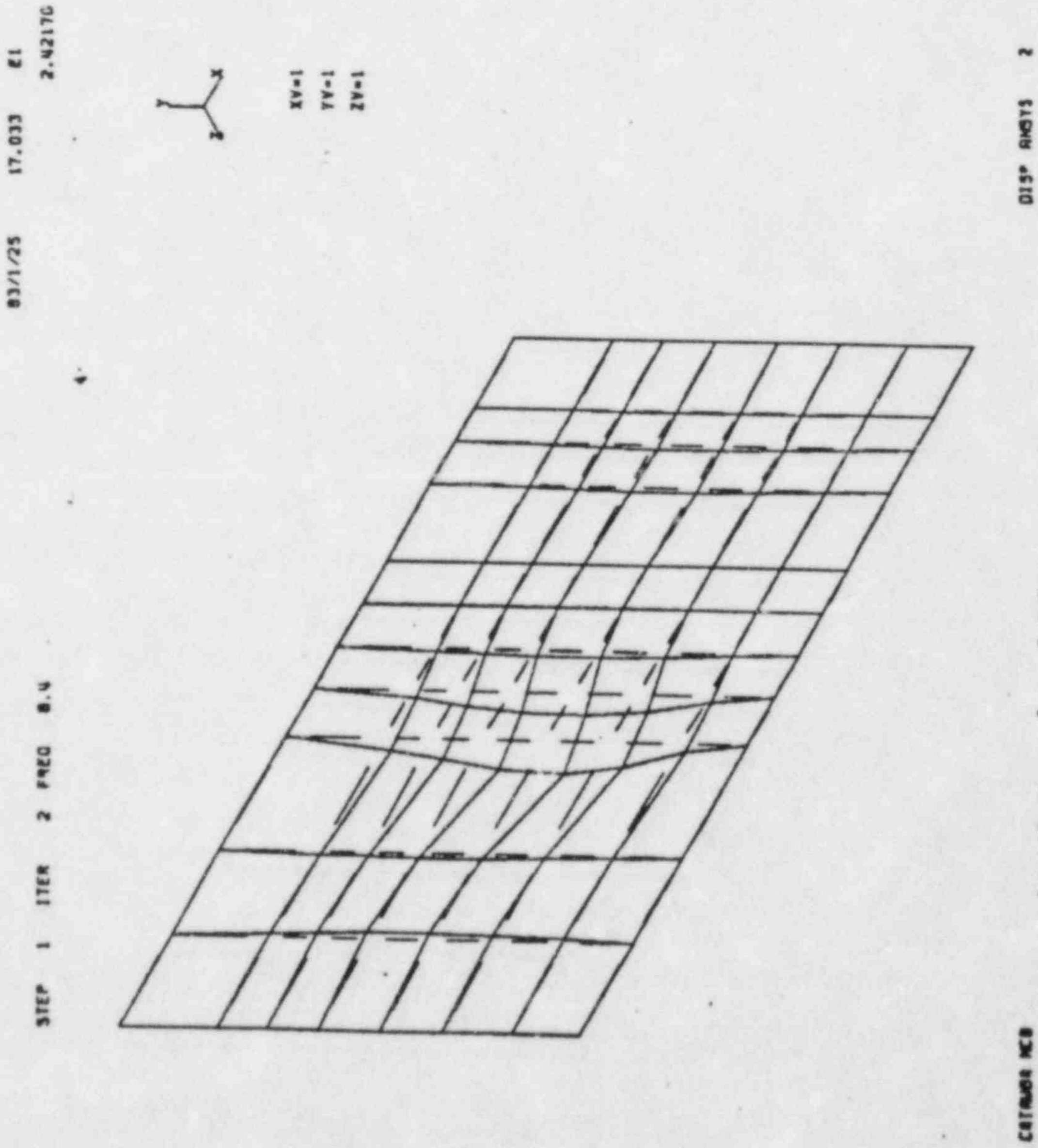
Mode 1

Analytical Model f = 6.44		Test Model f = 6.45	
Node	Z	Node	Z
82	0.308	47	0.095
26	0.020	8	-0.324
38	0.027	9	-0.372
50	0.026	10	-0.351
74	0.014	11	-0.101
27	-0.013	14	-0.123
39	-0.018	15	-0.129
51	-0.018	16	-0.151
75	-0.003	17	-0.054
4	- -	19	-0.011
28	-0.131	20	-0.728
40	-0.179	21	-1.0
52	-0.172	22	-0.958
76	-0.089	23	-0.393
30	0.047	26	-0.405
42	0.067	27	-0.515
54	0.068	28	-0.453
72	0.030	29	-0.165
31	0.316	32	0.643
43	0.447	33	0.731
55	0.451	34	0.603
79	0.207	35	0.288
33	0.711	38	0.720
45	1.0	39	0.708
57	0.985	40	0.758
81	0.434	41	0.277
34	0.553	44	0.251
46	0.894	45	0.383
59	0.756	46	0.322

Form 00184 (G 81)

DUKE POWER COMPANY

Dev./Station CATAWBA	Unit #2	File No. CNC-1381.05-00-0029	
Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION			
	By MDW	Date 2/4/83	
Sheet No. 92 of ___ Problem No. ___	Checked By GGC	Date 4/13/83	



MODE 2 - f_2 = 8.37 Hz
GROUP E

Fig. 6-5.4

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station CATAWBA N.S. Unit 1&2 File No. CNC-1381.05-00-0029

Subject MCB SEISMIC ANALYSIS QUALIFICATION

By MDW Date 4/10/84

Sheet No. ___ of ___ Problem No. ___ Checked By ___ Date ___

GROUP E - MODE 2

Analytical Model f = 8.37 NODE		Test Model f = 8.68 NODE	
26	-0.141	8	-0.792
38	-0.183	9	-1.0
50	-0.175	10	-0.845
74	-0.026	11	-0.349
27	0.083	14	-0.423
39	0.117	15	-0.502
51	0.115	16	-0.410
75	0.052	17	-0.166
4	-	19	-0.011
28	0.758	20	-0.213
40	1.00	21	-0.179
52	0.926	22	-0.101
76	0.392	23	-0.054
30	0.143	26	0.079
42	0.201	27	0.075
54	0.198	28	0.084
78	0.087	29	0.035
31	0.003	32	-0.354
43	0.013	33	-0.361
55	0.021	34	-0.314
79	-0.001	35	-0.184
33	0.072	38	0.250
45	0.102	39	0.278
57	0.104	40	0.324
81	0.044	41	0.095
34	0.087	44	0.277
46	0.120	45	0.448
58	0.115	46	0.414
82	0.047	47	0.167

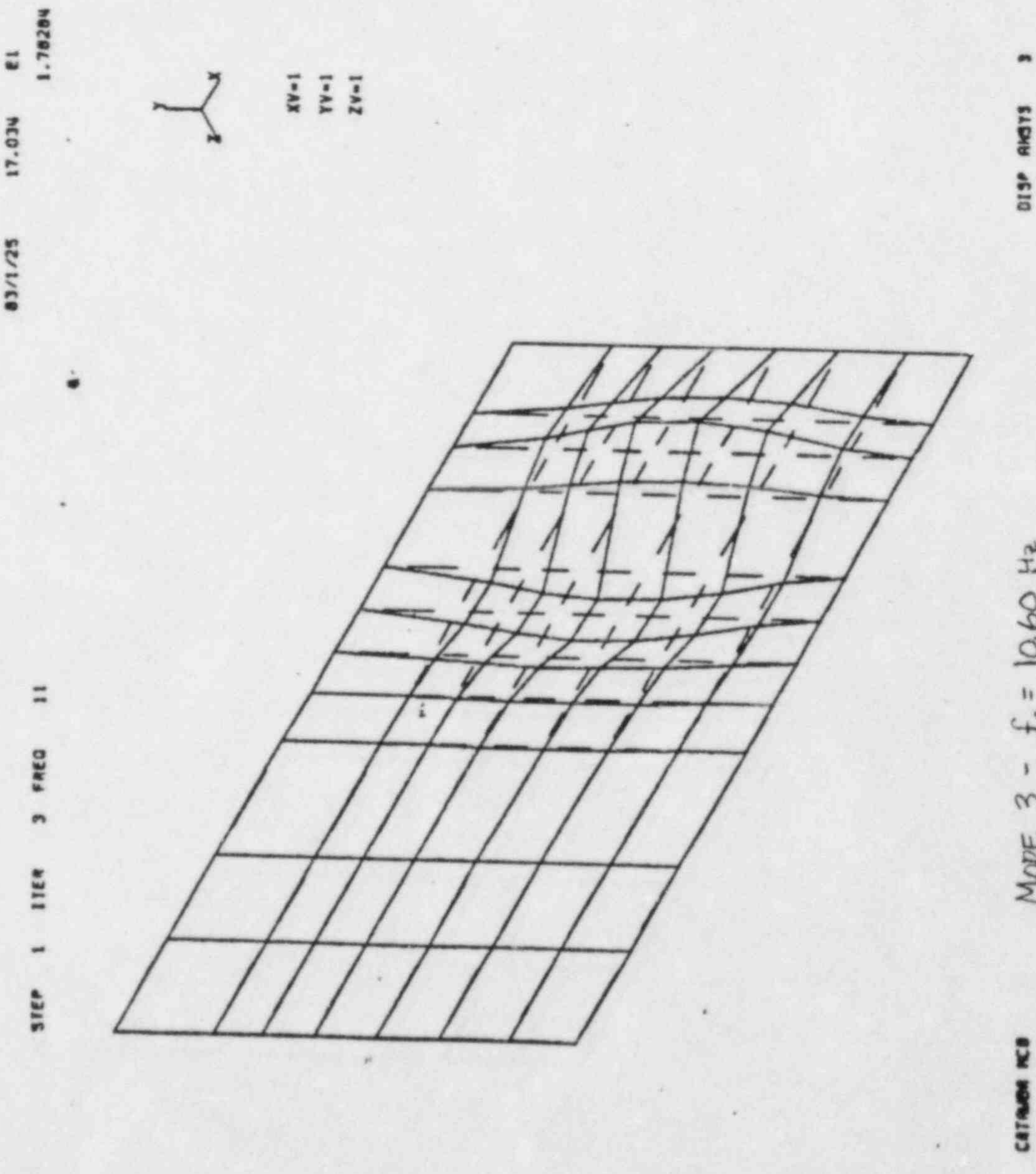
Form 00184 (6 81) DUKE POWER COMPANY

Dev./Station CATAWBA Unit #2 File No. CNC-1381.05-00-0029

Subject MAIN CONTROL BOARD SEISMIC ANALYSIS QUALIFICATION

By MDW Date 2/4/83

Sheet No. 93 of ___ Problem No. ___ Checked By GGC Date 4/13/83



MODE 3 - f_3 = 10.60 Hz
GROUP E

Fig. 6-5.5

DUKE POWER COMPANY

Form 00184 (6-81)

Dev./Station CATAWBA I/C. Unit 1+2 File No. CNC-1381.05-00-0029

Subject MCB SEISMIC ANALYSIS QUALIFICATION

By MDW Date 4/10/84

Sheet No. __ of __ Problem No. ____ Checked By ____ Date ____

GROUP E - Mode 3

Analytical Model f = 10.60 NODE		Test Model f = 12.084 NODE	
26	0.0	8	0.068
38	-0.001	9	0.076
50	-0.002	10	0.082
74	-0.003	11	0.025
27	0.0	14	-0.132
39	0.001	15	-0.157
51	0.001	16	-0.107
75	0.001	17	-0.045
4		19	-0.006
28	-0.030	20	-0.188
40	-0.049	21	0.014
52	-0.030	22	0.453
76	0.019	23	0.513
30	-0.201	26	-0.563
42	-0.319	27	-0.673
54	-0.320	28	-0.475
78	-0.145	29	-0.178
31	-0.558	32	-0.683
43	-0.850	33	-0.826
55	-0.822	34	-1.0
79	-0.413	35	-0.554
33	0.373	38	0.514
45	0.420	39	0.690
57	0.414	40	0.583
81	0.139	41	0.287
34	0.750	44	-0.332
46	1.0	45	-0.592
58	0.930	46	-0.642
82	0.367	47	-0.279

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba — TYPE:

1. Utility: Duke Power Co. — PWR: √
2. NSSS: Westinghouse — BWR: ______
3. A/E: N/A — Other ______

II. Component Name: Main Control Boards

1. Scope: [ ] NSSS [√] BOP [ ] Other
2. Model Number: ______ Quantity: ______
3. Size or Range: ______
4. Vendor: Frank Electric Co./Duke Power
5. If the component is a cabinet or panel, name and model Number of the devices included: ______
6. Physical Description:
   a. Appearance: See Attached Dwg. CN-1710.01-01
   b. Dimensions: See Attached Dwg. CN-1710.01-01
   c. Weight: ______
7. Location: Building: Auxiliary
   Elevation: 594+00
8. Field Mounting Conditions
   [ ] Bolt (No. ____,) Size ____)
   [√] Weld (Length 1" at 12" spacing)
   [ ] ______
9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]
   Floor
10. a. System is which located: ______
    b. Functional Description: Main Control Boards
    c. Is the equipment required for [√] Hot Standby [√] Cold Shutdown
       [√] Both [ ] Neither [ ] Other ______

11. Pertinent Reference/Design Specifications for Qualification Requirements: CNS-1393.00-00-0002 Rev. #3

a. Seismic Input

b. Hydrodynamic Load Input

c. Fatigue Considerations

d. Service Conditions

e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[√] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method: ***

[ ] Test [√] Analysis [√] Combination of Test and Analysis

Qualification Report*: Main Control Board Seismic Analysis

(No., Title and Date): Qualification CNC-1381.05-00-0029

Company that Prepared Report: Duke Power Co.

Company that Reviewed Report: Duke Power Co.

Where Report is filed or available: Duke Power Co.

Applicable Codes And/Or Standards: IEEE-344-1975

V. Vibration Input:

1. Loads considered: a. [x] Seismic only

b. [ ] Hydrodynamic only

c. [ ] Vibration from normal operation

d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

[ ] Absolute Sum [ ] SRSS [x] SRSS with absolute sum of closely spaced modes (other, specify)

3. Required Response Spectra** (attach the graphs): Fig's 3, F21, F120, F30 and F-132

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.
***See Attachment #1

4. Damping Corresponding to RRS: OBE 2.0% SSE 2.0%

5. Required Acceleration in Each Direct:

[√] ZPA [ ] Other ________ (specify)

OBE S/S = 0.18 NS F/B = 0.20 EW V = 0.09

SSE S/S = 0.33 NS F/B = 0.38 NS V = 0.16

SSE = $\frac{15}{8}$ OBE V = $\frac{2}{3}$ Horiz Ground

6. Were fatigue effects considered:

[ ] Yes [ ] No

If yes, describe how they were treated in overall qualification program: It was decided that there were not enough cycles to warrant a reduction in allowable stresses

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [ ] Multi-Frequency [ ] random
[ ] sine beat
[ ] ________

2. [ ] Single Axis [ ] Multi-Frequency
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ________ SSE ________ Other ________ (specify)

4. Frequency Range: ________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ________ F/B = ________ V = ________

6. Method of Determining Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)

[ ] No

8. Maximum Input g Level Test:

OBE S/S = ________ F/B = ________ V = ________

SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ________

B. Orientation and Fixturing: ________

10. Functional Operability verified:

[ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ________

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (If appropriate ________)

14. Margins Available: [ ] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[√] Static Analysis [ ] Equivalent Static Analysis

[√] Dynamic Analysis: [√] Time-History [√] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

See CNC-1381.05-00-0029

S/S = 18.63 F/B = 6.44 V = 14.30

3. Model Type: [√] 3D [ ] 2D [ ] 1D

[√] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ________

4. [√] Computer Codes: ANSYS

Frequency Range and No. of modes 0-33 Hz, 22 Modes

[√] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [√] Other: SRSS with absolute sum of closely spaced modes (specify)

6. Damping:

OBE 2% SSE 2% Basis for the damping used: Duke Power Co. Nuclear Guide 1.61

7. Support Considerations in the model: Some pinned, mostly fixed

8. Critical Structural Elements:

A.

Identification Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Base Channel (SSE Loads)	SSE + Gravity		27.9 ksi	32.9 ksi (0.9 Fy)

B.

Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
N/A	N/A	N/A

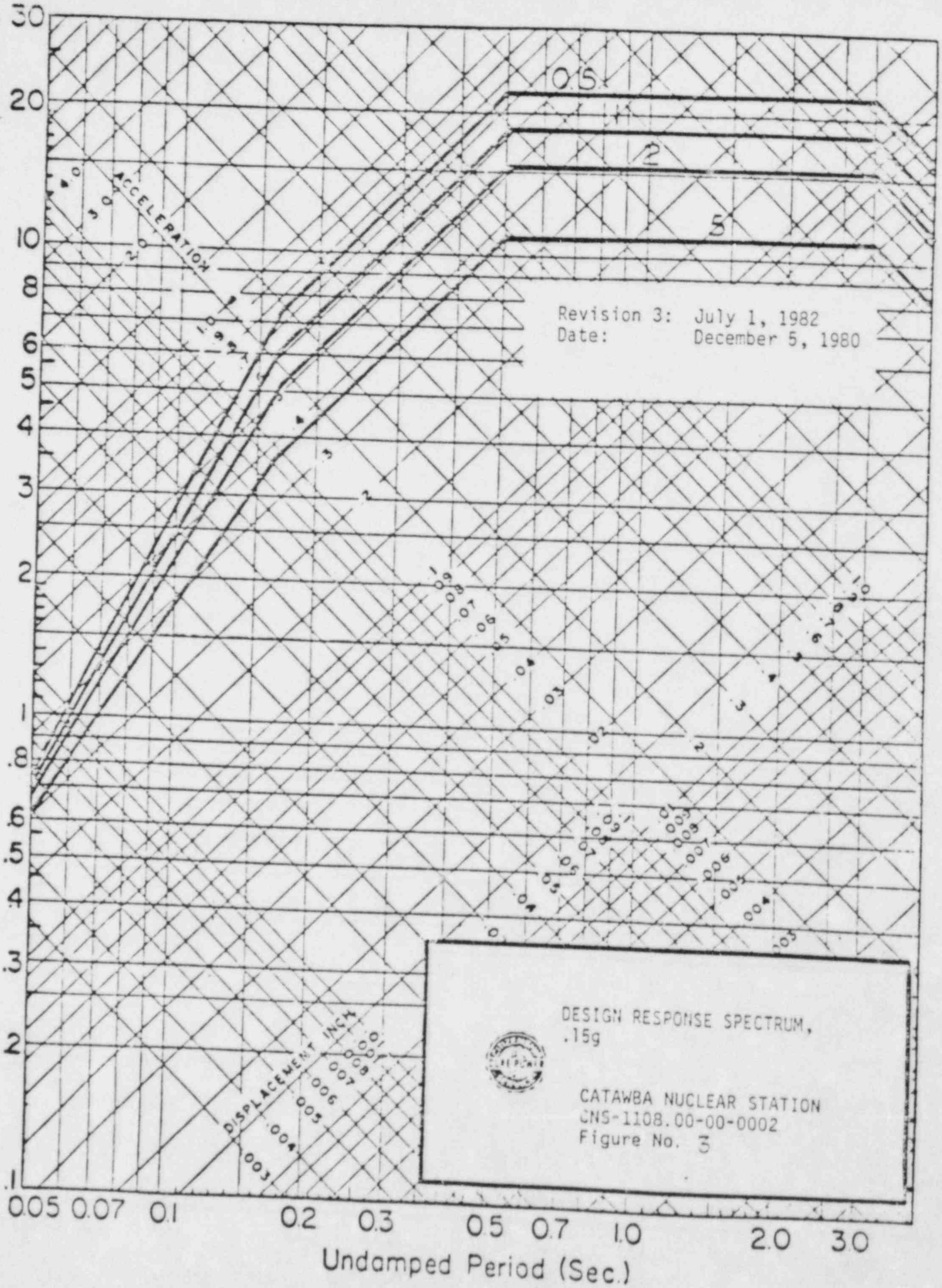
9. Failure Modes: None

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

ATTACHMENT 1

The following is a list of documents associated with the Catawba Main Control Board Seismic Qualification.

SPECIFICATION	QUALIFICATION DOCUMENTS	QUALIFICATION ACTIVITY
CNS-1393.00-00-0002 "Main Control Board Seismic Analysis"	CNC-1381.05-00-0029 "Catawba Nuclear Station Main Control Board Seismic Analysis Qualification"	•Structural Adequacy •Anchoring Adequacy •Generation of RRS's
	CNC-1381.05-00-0044 "Catawba Nuclear Station Seismic Parametric Study of Main Control Boards"	•Determined allowable weight changes before seismic reanalysis is required
	CNC-1381.05-00-0057 "Seismic Response Spectra for Catawba Main Control Boards"	•Contains the response spectra considering the parametric study weight changes
	CNC-1381.05-00-0046 "Seismic Qualification of Catawba Main Control Board Components"	•Qualifies safety devices mounted to the Main Control Boards for operability and mounting •Qualifies non-safety devices for mounting.
CNS-1393.00-00-0003 "Catawba Main Control Board Low Impedance Excitation Tests"	CNM-1393.00-0016 "Modal Survey Report of Main Control Boards for Catawba Nuclear Station" CCL Report No. A-479-82-01	•From in-situ low impedance test, defined the Main Control Board Dynamics for use in calculation CNC-1381.05-00-0029

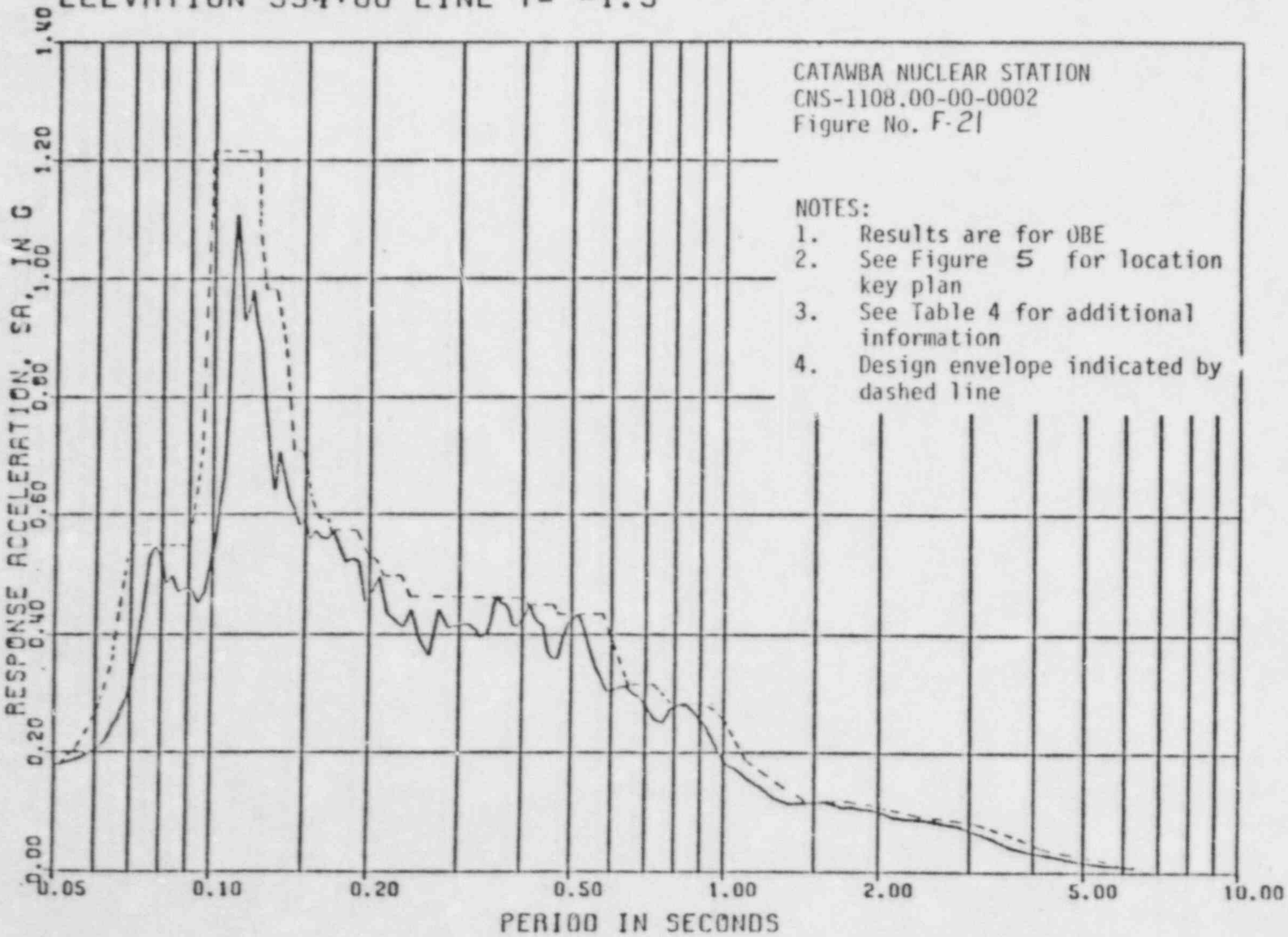


Revision 3: July 1, 1982
Date: December 5, 1980

DESIGN RESPONSE SPECTRUM, .15g

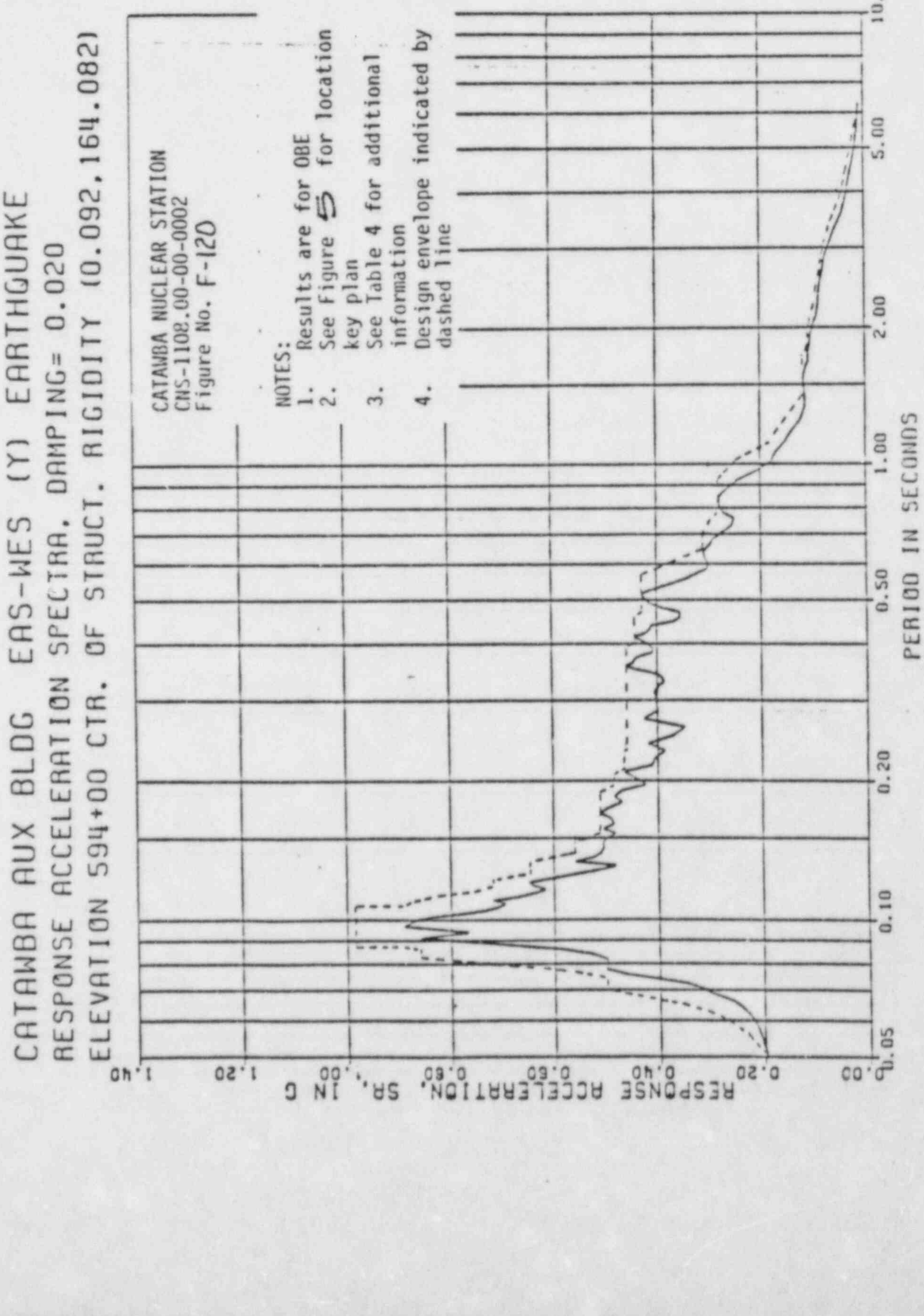
CATAWBA NUCLEAR STATION
CNS-1108.00-00-0002
Figure No. 3

CATAWBA AUX BLDG NOR-SOU (X) EARTHQUAKE
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 594+00 LINE Y= -1.5

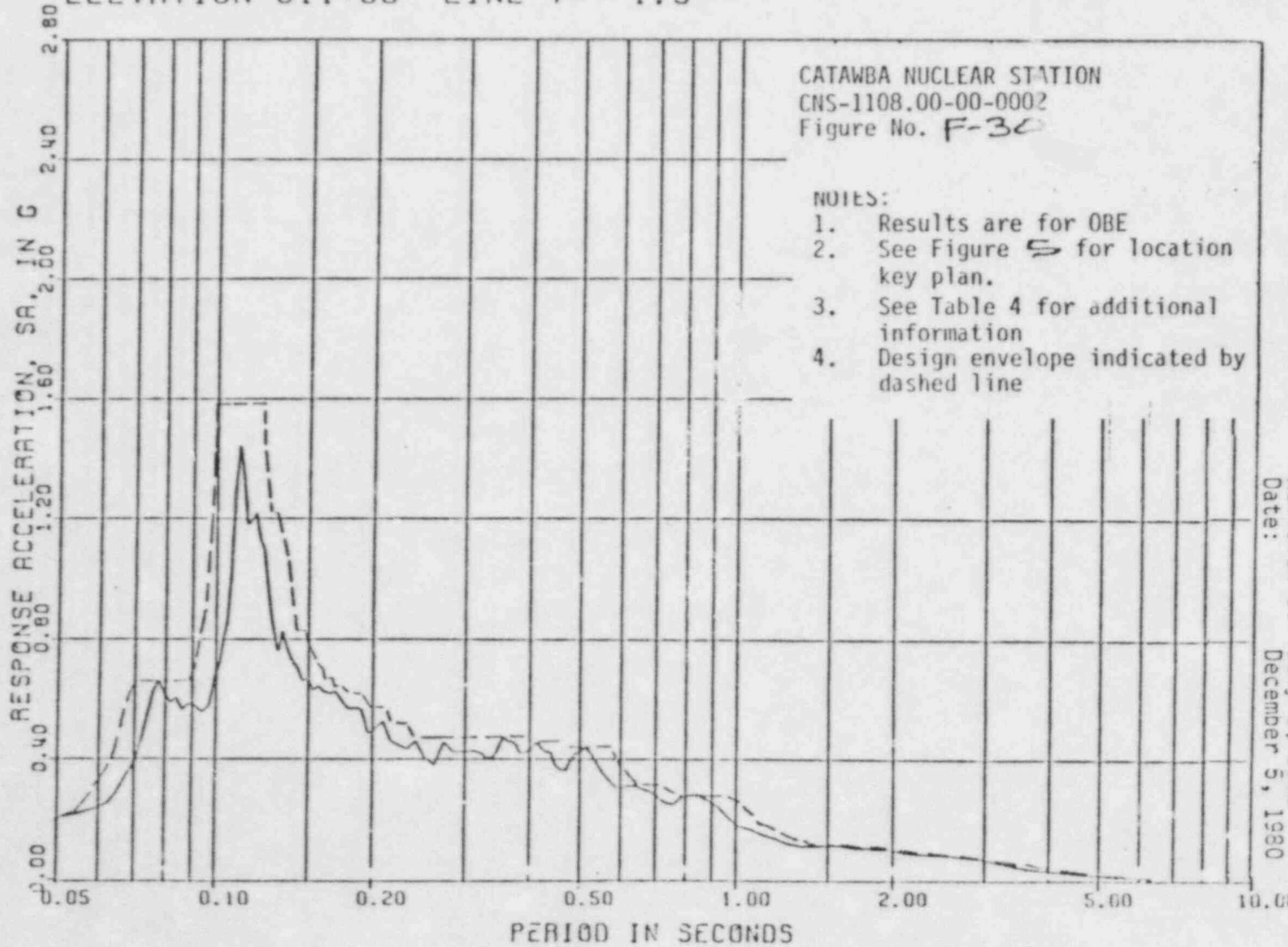


Revision 3: July 1, 1982
Date: December 5, 1980

Revision 3: July 1, 1982
Date: December 5, 1980

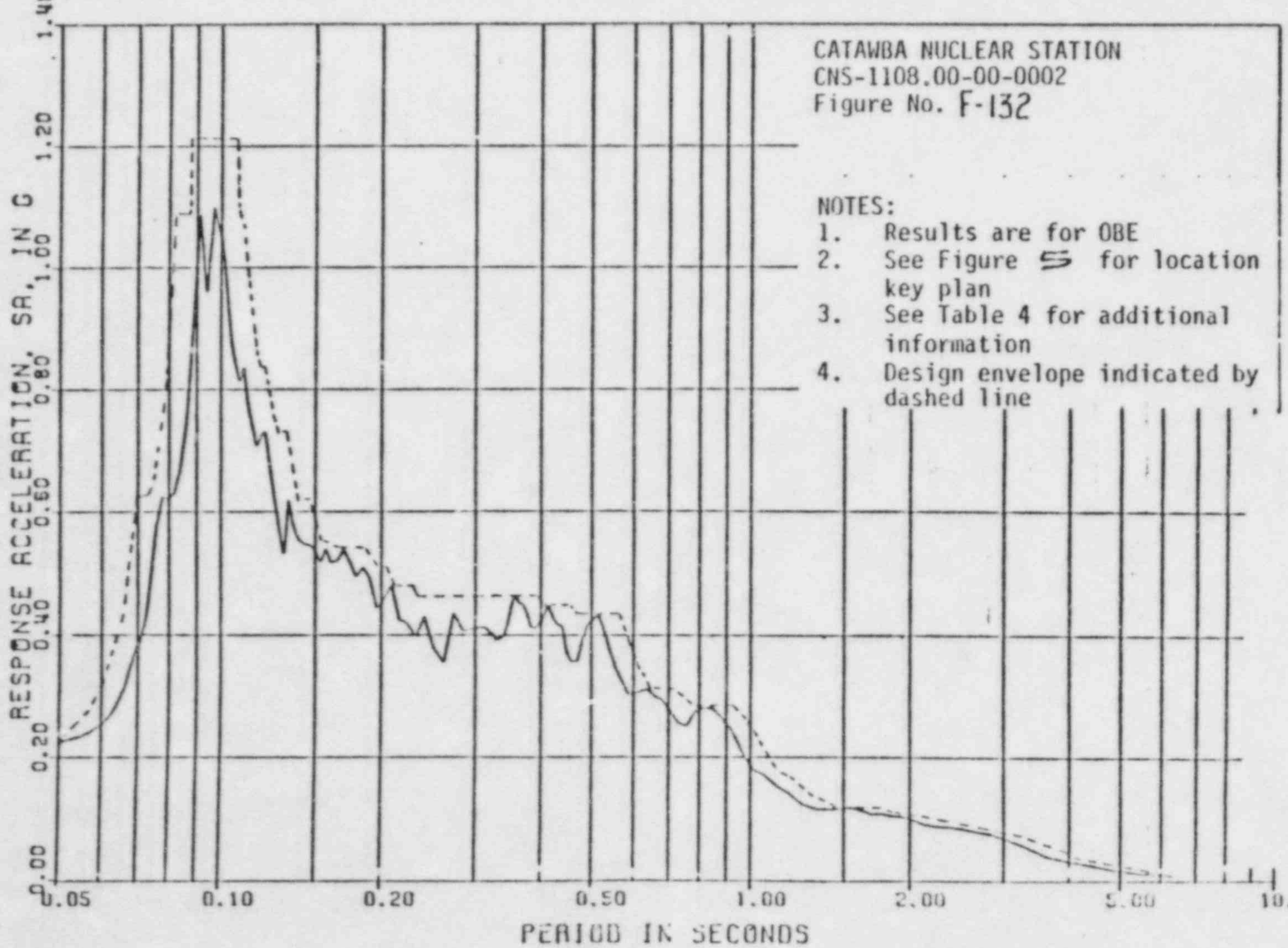


CATAWBA AUXILIARY BLDG. NORTH-SOUTH (X)
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 611+00 LINE Y= -1.5



Revision 3: July 1, 1982
Date: December 5, 1980

CATAWBA AUXILIARY BLDG. EAST-WEST (Y) EA
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 611+00 CTR. OF STRUCT. RIGIDITY (0.147,174,212)



CATAWBA NUCLEAR STATION
CNS-1108.00-00-0002
Figure No. F-132

NOTES:

1. Results are for OBE
2. See Figure 5 for location key plan
3. See Table 4 for additional information
4. Design envelope indicated by dashed line

<u>Seismic and Dynamic Qualification Summary of Equipment</u>

I. Plant Name: Catawba TYPE:

1. Utility: Duke Power Co. PWR: √

2. NSSS: Westinghouse BWR: ______

3. A/E: N/A Other ______

II. Component Name: Main Control Boards

1. Scope: [ ] NSSS [√] BOP [ ] Other

2. Model Number: ______ Quantity: ______

3. Size or Range: ______

4. Vendor: Frank Electric Co/Duke Power

5. If the component is a cabinet or panel, name and model Number of the devices included: ______

6. Physical Description:

a. Appearance: See Attached Dwg. CN-1710.01-01

b. Dimensions: See Attached DWG. CN-1710.01-01

c. Weight: ______

7. Location: Building: Auxiliary

Elevation: 594+00

8. Field Mounting Conditions
[ ] Bolt (No. ____,) Size ____)
[√] Weld (Length 1" at 12" spacing
[ ] ______

9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

Floor

10. a. System is which located: ______

b. Functional Description: Main Control Boards

c. Is the equipment required for [√] Hot Standby [√] Cold Shutdown

[√] Both [ ] Neither [ ] Other ______

II. Pertinent Reference/Design Specifications for Qualification Requirements: CNS-1393.00-00-0002 Rev. #3

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[√] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method: ***

[√] Test [ ] Analysis [√] Combination of Test and Analysis

Qualification Report*: (No., Title and Date): Modal Survey Report for Main Control Boards for Catawba Nuclear Station CNM-1393.00-00-0016, June 30, 1982

Company that Prepared Report: Corporate Consulting & Development Co., Ltd

Company that Reviewed Report: Duke Power Co.

Where Report is filed or available: Duke Power Co.

Applicable Codes And/Or Standards: CNS-1393.00-00-0003 (IEEE 344-1975)

V. Vibration Input:

1. Loads considered:
   a. [√] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a) (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [√] SRSS with absolute sum of closely spaced modes (other, specify)

3. Required Response Spectra** (attach the graphs): Fig's 3, F21, F120, F30 and F132

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.
***See Attachment #1

EL40115R/2

4. Damping Corresponding to RRS: OBE 2.0% SSE 2.0%

5. Required Acceleration in Each Direct:

[√] ZPA [ ] Other ________ (specify)

OBE S/S = 0.18 NS F/B = 0.20 EW V = 0.09

SSE S/S = 0.33 NS F/B = 0.38 NS V = 0.16

SSE = $\frac{15}{8}$ OBE V = $\frac{2}{3}$ Horiz Ground

6. Were fatigue effects considered:

[√] Yes [ ] No

If yes, describe how they were treated in overall qualification program: It was decided that there were not enough cycles to warrant a reduction in allowable stresses.

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [√] Multi-Frequency [√] random
[ ] sine beat
[√] Modal Survey

2. [ ] Single Axis [√] Multi-Frequency
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE ________ SSE ________ Other Low-Level In-Situ Modal Survey (specify)

4. Frequency Range: 0-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

See CNM-1393.00-00-0016
S/S = 20.96 F/B = 6.45 V = 14.57

6. Method of Determining Natural Frequencies

[ ] Lab Test [√] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test N/A

[ ] Yes (Attach TRS & RRS graphs)

[ ] No

8. Maximum input g Level Test: N/A for Modal Survey

OBE S/S = ____________ F/B = ________________ V = ______________

SSE S/S = ____________ F/B = ________________ V = ______________

9. Laboratory Mounting:

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [√] In-Situ

B. Orientation and Fixturing: N/A

10. Functional Operability verified:

[ ] Yes [ ] No [√] Not Applicable

11. Test Results including modifications made: No Modifications.

Test results were: Frequencies, Mode Shapes, and Damping Values

12. Other tests performed (such as aging or fragility test, including results):
N/A

13. Failure Modes (If appropriate None)

14. Margins Available: [ ] Input Spectrum [ ] Fragility N/A

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ____________ F/B = ________________ V = ______________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ________

4. [ ] Computer Codes: ______________________________

Frequency Range and No. of modes

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: ______________ (specify)

6. Damping:

OBE ______ SSE ______ Basis for the damping used: __________

7. Support Considerations in the model: ____________________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

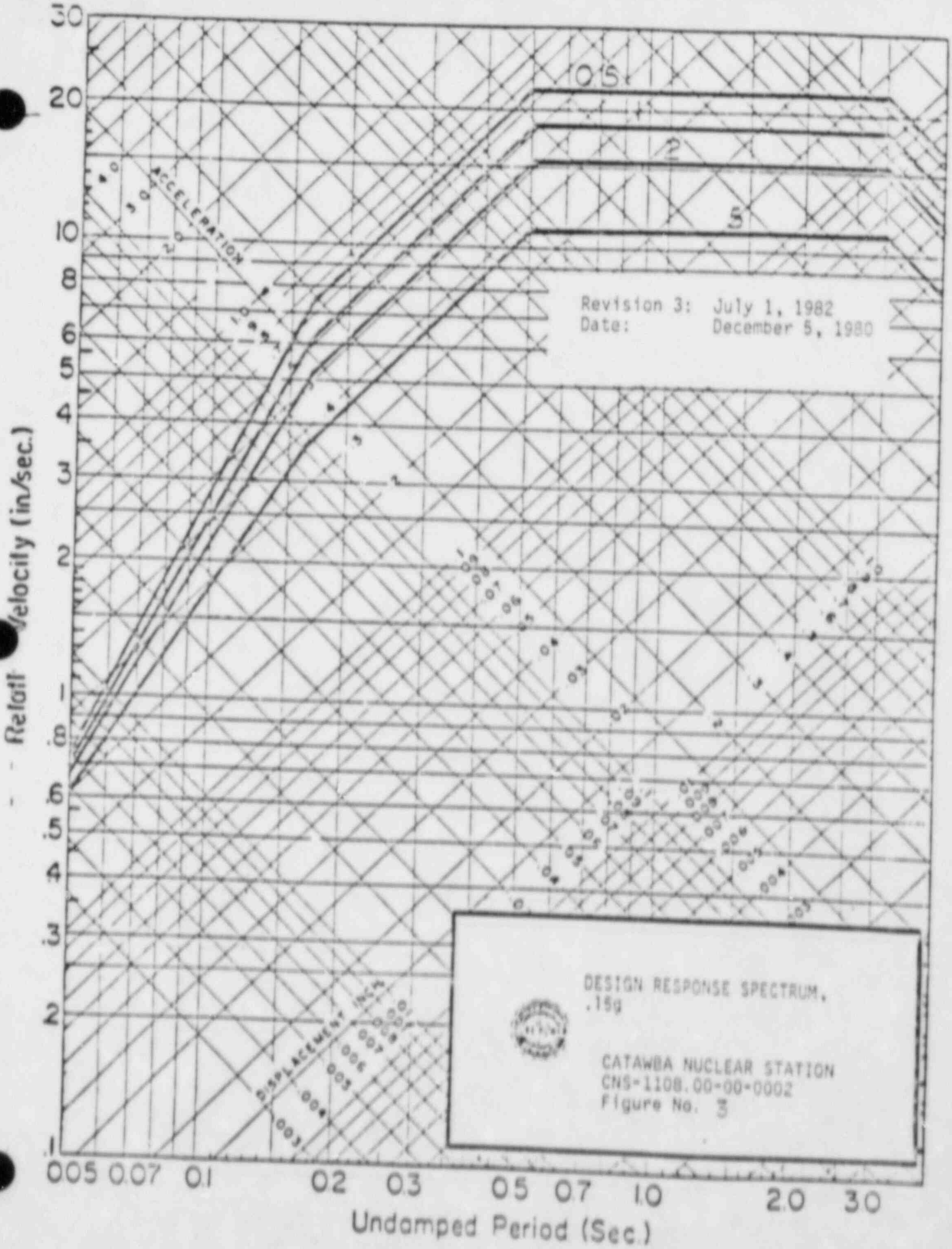
9. Failure Modes: ______________________________

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

ATTACHMENT 1

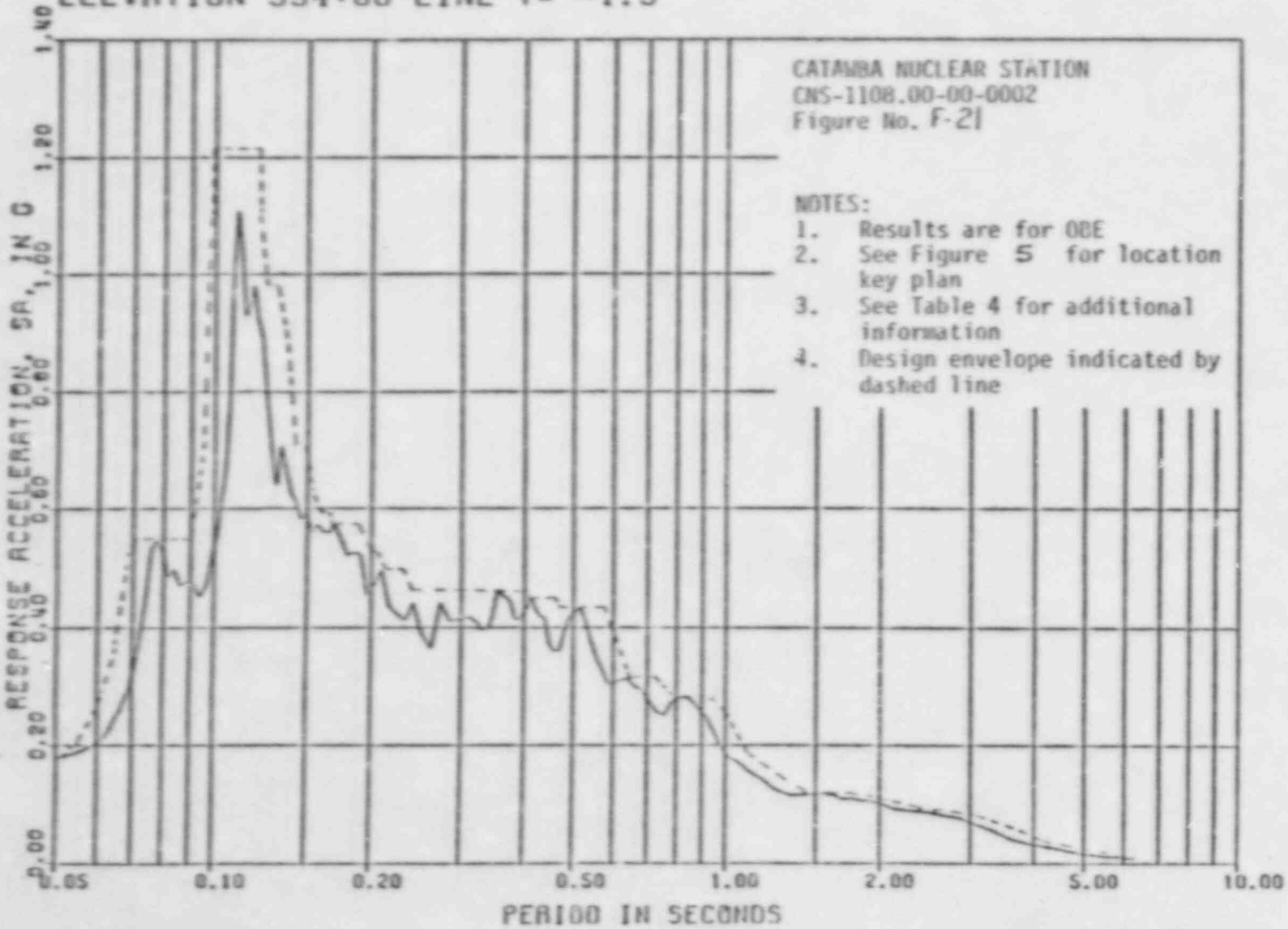
The following is a list of documents associated with the Catawba Main Control Board Seismic Qualification.

SPECIFICATION	QUALIFICATION DOCUMENTS	QUALIFICATION ACTIVITY
CNS-1393.00-00-0002 "Main Control Board Seismic Analysis"	CNC-1381.05-00-0029 "Catawba Nuclear Station Main Control Board Seismic Analysis Qualification"	•Structural Adequacy •Anchoring Adequacy •Generation of RRS's
	CNC-1381.05-00-0044 "Catawba Nuclear Station Seismic Parametric Study of Main Control Boards"	•Determined allowable weight changes before seismic reanalysis is required
	CNC-1381.05-00-0057 "Seismic Response Spectra for Catawba Main Control Boards"	•Contains the response spectra considering the parametric study weight changes
	CNC-1381.05-00-0046 "Seismic Qualification of Catawba Main Control Board Components"	•Qualifies safety devices mounted to the Main Control Boards for operability and mounting •Qualifies non-safety devices for mounting.
CNS-1393.00-00-0003 "Catawba Main Control Board Low Impedance Excitation Tests"	CNM-1393.00-0016 "Modal Survey Report of Main Control Boards for Catawba Nuclear Station" CCL Report No. A-479-82-01	•From in-situ low impedance test, defined the Main Control Board Dynamics for use in calculation CNC-1381.05-00-0029



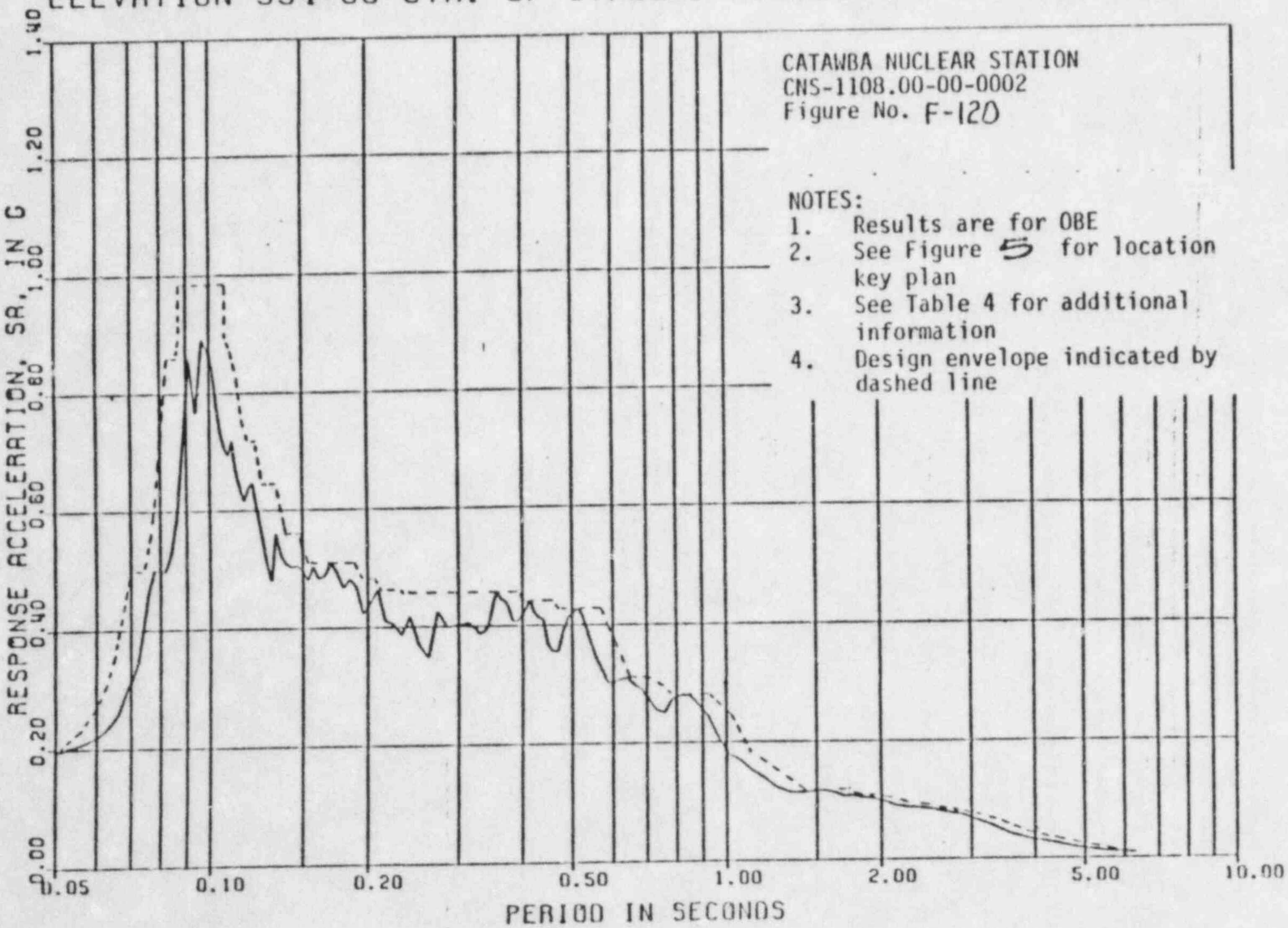
Revision 3: July 1, 1982
Date: December 5, 1980
DESIGN RESPONSE SPECTRUM, .15g
CATAWBA NUCLEAR STATION
CNS-1108.00-00-0002
Figure No. 3
ACCELERATION
DISPLACEMENT (IN.)
0.5
2
5
30
20
10
8
6
5
4
3
2
1
.8
.6
.5
.4
.3
.2
.1
0.05
0.07
0.1
0.2
0.3
0.5
0.7
1.0
2.0
3.0
Relative Velocity (in/sec.)
Undamped Period (Sec.)

CATAWBA AUX BLDG NOR-SOU (X) EARTHQUAKE
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 594+00 LINE Y= -1.5



Revision 3: July 1, 1982
Date: December 5, 1980

CATAWBA AUX BLDG EAS-WES (Y) EARTHQUAKE
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 594+00 CTR. OF STRUCT. RIGIDITY (0.092,164.082)

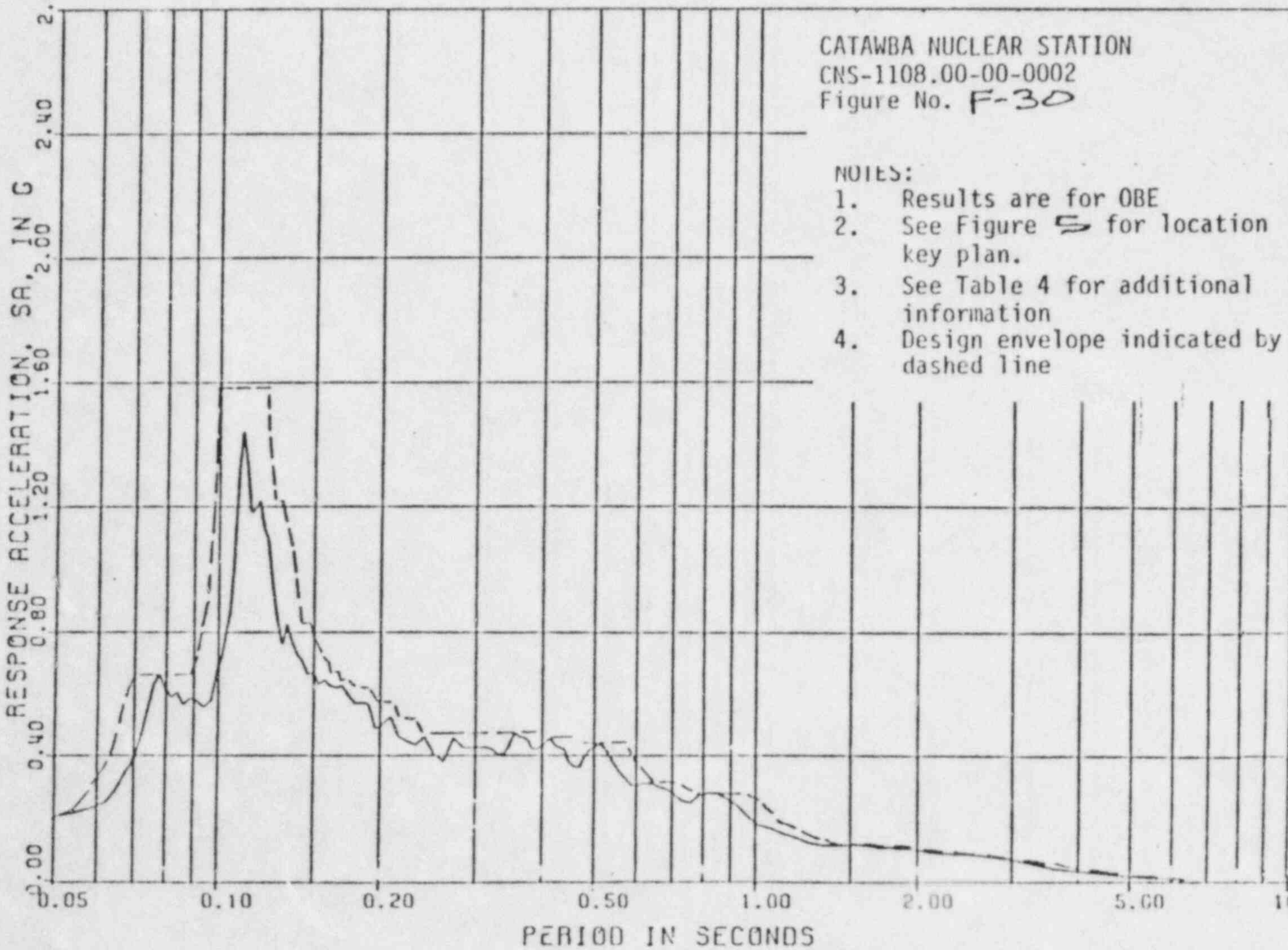


CATAWBA NUCLEAR STATION
CNS-1108.00-00-0002
Figure No. F-120

NOTES:
1. Results are for OBE
2. See Figure 5 for location key plan
3. See Table 4 for additional information
4. Design envelope indicated by dashed line

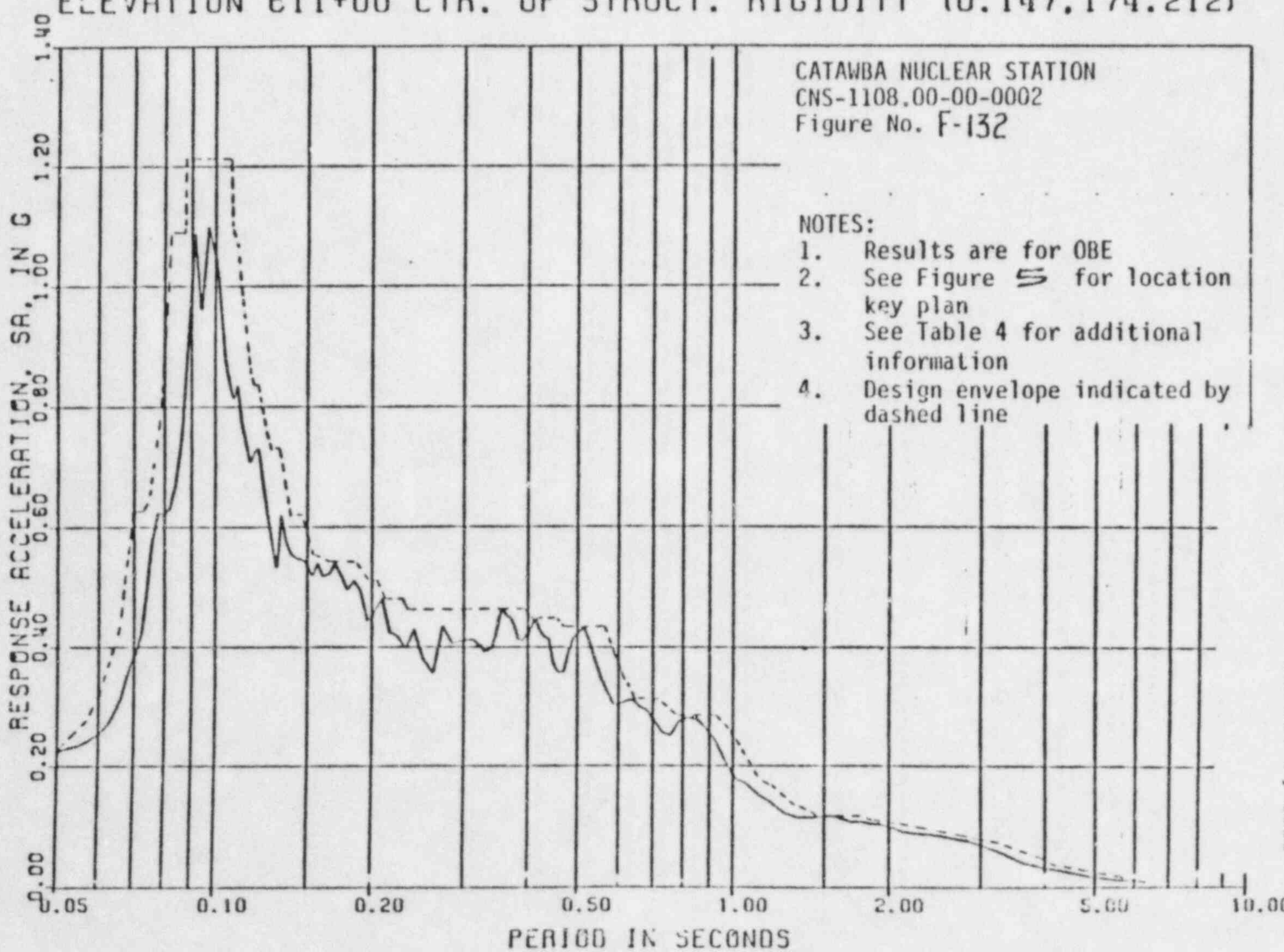
Revision 3: July 1, 1982
Date: December 5, 1980

CATAWBA AUXILIARY BLDG. NØRTH-SØUTH (X)
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 611+00 LINE Y= -1.5



Revision 3: July 1, 1982
Date: December 5, 1980

CATAWBA AUXILIARY BLDG. EAST-WEST (Y) EA
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 611+00 CTR. OF STRUCT. RIGIDITY (0.147,174.212)



Revision 3: July 1, 1982
Date: December 5, 1980

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba TYPE:

1. Utility: Duke Power Co. PWR: √

2. NSSS: Westinghouse BWR: ______

3. A/E: N/A Other ______

II. Component Name: Main Control Boards

1. Scope: [ ] NSSS [√] BOP [ ] Other

2. Model Number: ______ Quantity: ______

3. Size or Range: ______

4. Vendor: Frank Electric Co./Duke Power

5. If the component is a cabinet or panel, name and model Number of the devices included: ______

6. Physical Description:

   a. Appearance: See Attached Dwg. CN-1710.01-01

   b. Dimensions: See Attached Dwg. CN-1710.01-01

   c. Weight: ______

7. Location: Building: Auxiliary

   Elevation: 594+00

8. Field Mounting Conditions [ ] Bolt (No. ____,) Size ____)
   [√] Weld (Length 1" at 12" spacing)
   [ ] ______

9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

   Floor

10. a. System is which located: ______

   b. Functional Description: Main Control Boards

   c. Is the equipment required for [√] Hot Standby [√] Cold Shutdown

   [√] Both [ ] Neither [ ] Other ______

11. Pertinent Reference/Design Specifications for Qualification Requirements: CNS-1393.00-00-0002 Rev. No. 3

a. Seismic Input
b. Hydrodynamic Load Input
c. Fatigue Considerations
d. Service Conditions
e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[√] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method: ***

[√] Test [√] Analysis [√] Combination of Test and Analysis

Qualification Report*: Seismic Qualification of Catawba Main Control

(No., Title and Date): Board Components CNC-1381.05-00-0046

Company that Prepared Report: Duke Power Co.

Company that Reviewed Report: Duke Power Co.

Where Report is filed or available: Duke Power Co.

Applicable Codes And/Or Standards: IEEE 344-1975

V. Vibration Input:

1. Loads considered:
   a. [√] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [√] SRSS with absolute sum of closely spaced modes (other, specify)

3. Required Response Spectra** (attach the graphs): Fig's 3, F21, F120 F30 and F132

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.
***See Attachment No. 1.

4. Damping Corresponding to RRS: OBE 2.0% SSE 2.0%

5. Required Acceleration in Each Direct:

[√] ZPA [ ] Other ____________ (specify)

OBE S/S = 0.18 NS F/B = 0.20 EW V = 0.09

SSE S/S = 0.33 NS F/B = 0.38 EW V = 0.16

SSE = $\frac{15}{8}$ OBE V = $\frac{2}{3}$ Horiz. Ground

6. Were fatigue effects considered:

[√] Yes [ ] No

If yes, describe how they were treated in overall qualification program: It was decided that there were not enough cycles to warrant a reduction in allowable stresses.

VI. If Qualification by Test, then Complete: *

1. [ ] Single Frequency [√] Multi-Frequency [√] random
   [ ] sine beat
   [ ] ____________

2. [ ] Single Axis [√] Multi-Frequency
   [ ] Independent Axis [ ] In-phase motions

3. Number of Qualifications Tests:

OBE 5 SSE 1 Other ____________ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ________ F/B = ________ V = ________

6. Method of Determining Natural Frequencies

[√] Lab Test [ ] In-Situ Test [ ] Analysis

Note:
*The devices mounted to the main control boards were qualified by test. The test results are found in a variety of seismic test reports.

7. TRS enveloping RRS using Multi-Frequency Test

[√] Yes (Attach TRS & RRS graphs) - An example showing that a device is qualified for its mounting location is shown attached as Fig's B.1-1, B.1-2, B.1-4 and B.1-6.

[ ] No

8. Maximum Input g Level Test: N/A

OBE S/S = ____________ F/B = ________________ V = ______________

SSE S/S = ____________ F/B = ________________ V = ______________

9. Laboratory Mounting: - Mounting to Control Boards is the same as Test Mounting

A. [ ] Bolt (No. ___, Size ___)

[ ] Weld (Length ___) [ ] ___________

B. Orientation and Fixturing: ___________________________________

10. Functional Operability verified:

[√] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: N/A

____

12. Other tests performed (such as aging or fragility test, including results):

____

____

13. Failure Modes (If appropriate N/A ___________________________)

14. Margins Available: [√] Input Spectrum [ ] Fragility

VII. If Qualification by Analysis, then complete:

1. Method of Analysis: *

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [√] Response Spectrum

Note:

*The method of analysis used to show that the device mounted to the control board is seismically qualified for its mounting location is to show that the device seismic test (including operability) response spectra envelops the control board response spectra at the device mounting location.

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ____________ F/B = ________________ V = ______________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [√] Other Enveloping

4. [ ] Computer Codes: None

Frequency Range and No. of modes

[√] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [√] Other: None (specify)

6. Damping:

OBE 1% SSE 1% Basis for the damping used: FSAR 3.7

7. Support Considerations in the model: Anchoring Hardware

8. Critical Structural Elements: *

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: None

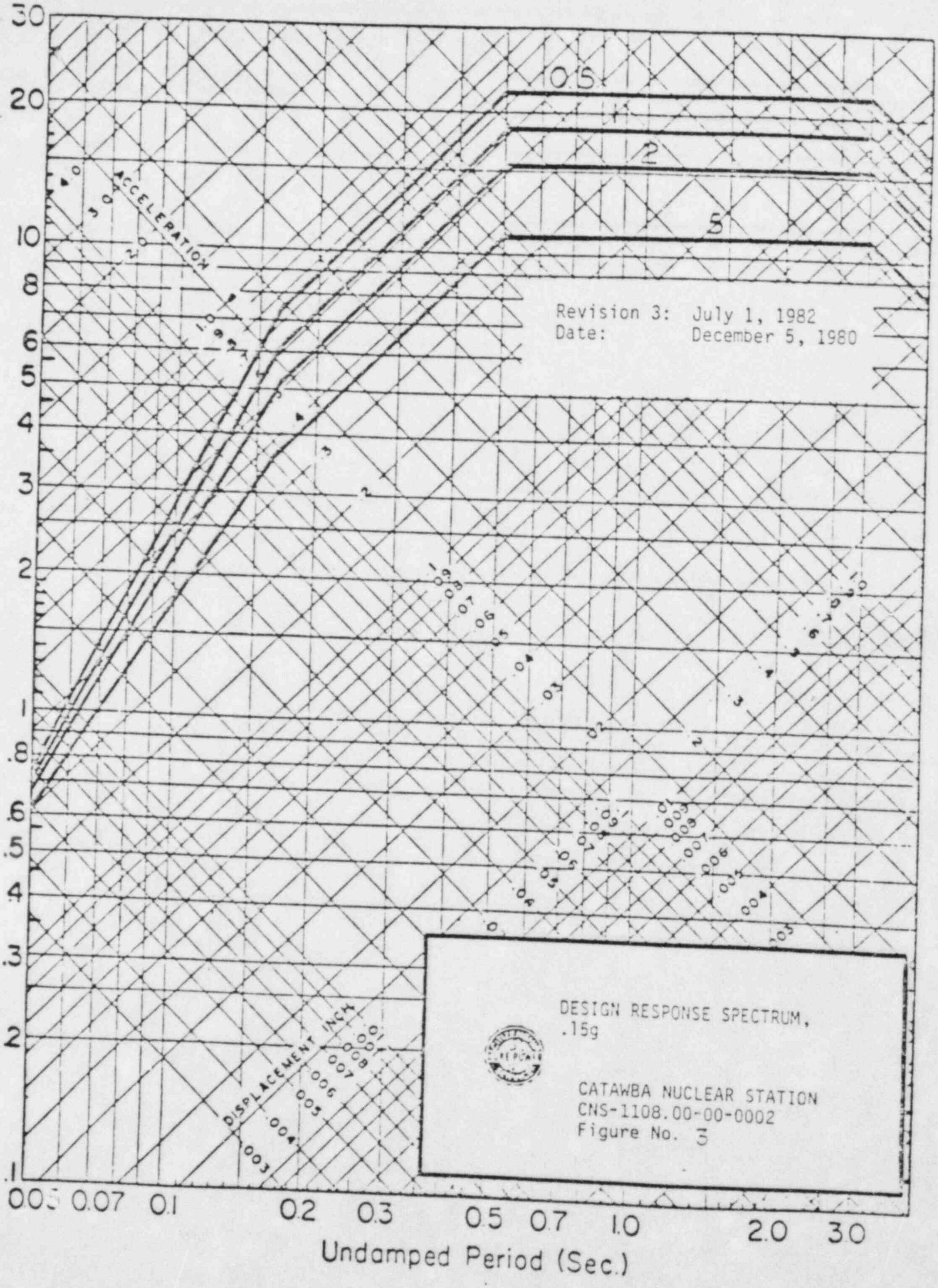
10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

Note:
*An anchoring analysis was performed on the non-safety (QA-4) devices mounted on the control boards to show that they can withstand the control boards' seismic SSE response at the device location. This analysis can be found in calculation CNC-1381.05-00-0029 and calculation CNC-1381.05-00-0044.

ATTACHMENT 1

The following is a list of documents associated with the Catawba Main Control Board Seismic Qualification.

SPECIFICATION	QUALIFICATION DOCUMENTS	QUALIFICATION ACTIVITY
CNS-1393.00-00-0002 "Main Control Board Seismic Analysis"	CNC-1381.05-00-0029 "Catawba Nuclear Station Main Control Board Seismic Analysis Qualification"	•Structural Adequacy •Anchoring Adequacy •Generation of RRS's
	CNC-1381.05-00-0044 "Catawba Nuclear Station Seismic Parametric Study of Main Control Boards"	•Determined allowable weight changes before seismic reanalysis is required
	CNC-1381.05-00-0057 "Seismic Response Spectra for Catawba Main Control Boards"	•Contains the response spectra considering the parametric study weight changes
	CNC-1381.05-00-0046 "Seismic Qualification of Catawba Main Control Board Components"	•Qualifies safety devices mounted to the Main Control Boards for operability and mounting •Qualifies non-safety devices for mounting.
CNS-1393.00-00-0003 "Catawba Main Control Board Low Impedance Excitation Tests"	CNM-1393.00-0016 "Modal Survey Report of Main Control Boards for Catawba Nuclear Station" CCL Report No. A-479-82-01	•From in-situ low impedance test, defined the Main Control Board Dynamics for use in calculation CNC-1381.05-00-0029

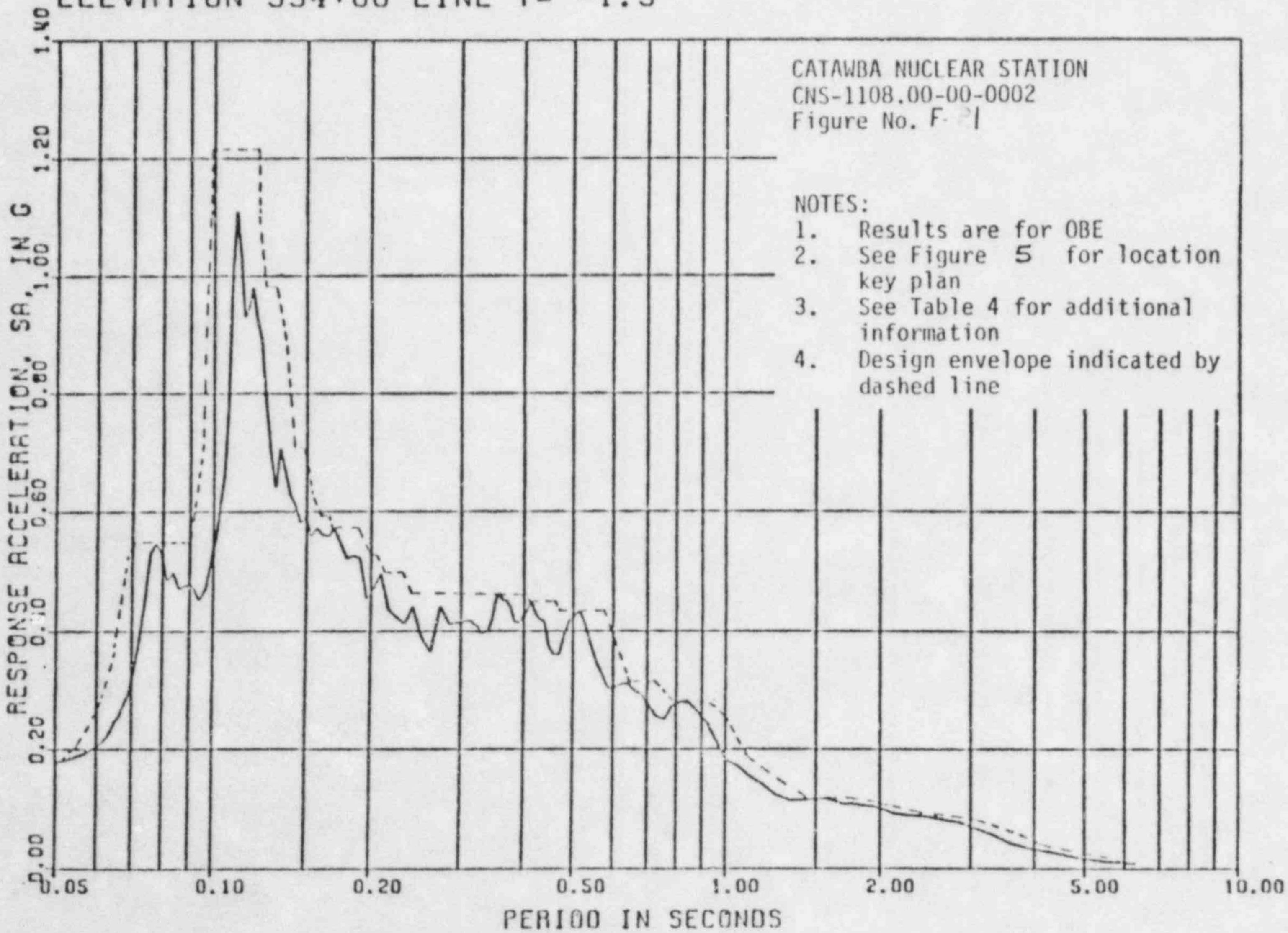


Revision 3: July 1, 1982
Date: December 5, 1980

DESIGN RESPONSE SPECTRUM, .15g

CATAWBA NUCLEAR STATION
CNS-1108.00-00-0002
Figure No. 3

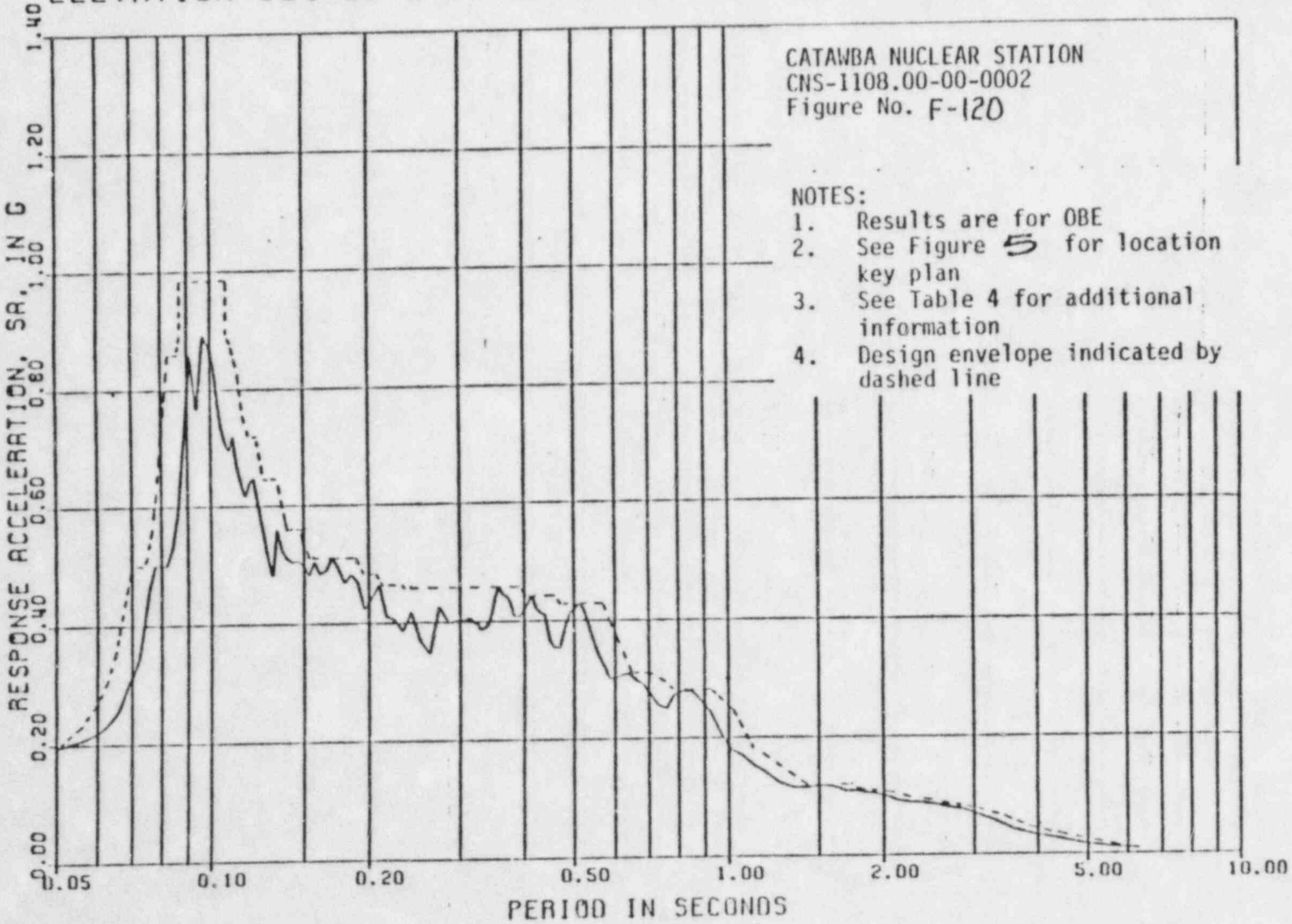
CATAWBA AUX BLDG NOR-SOU (X) EARTHQUAKE
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 594+00 LINE Y= -1.5



CATAWBA NUCLEAR STATION
CNS-1108.00-00-0002
Figure No. F-21

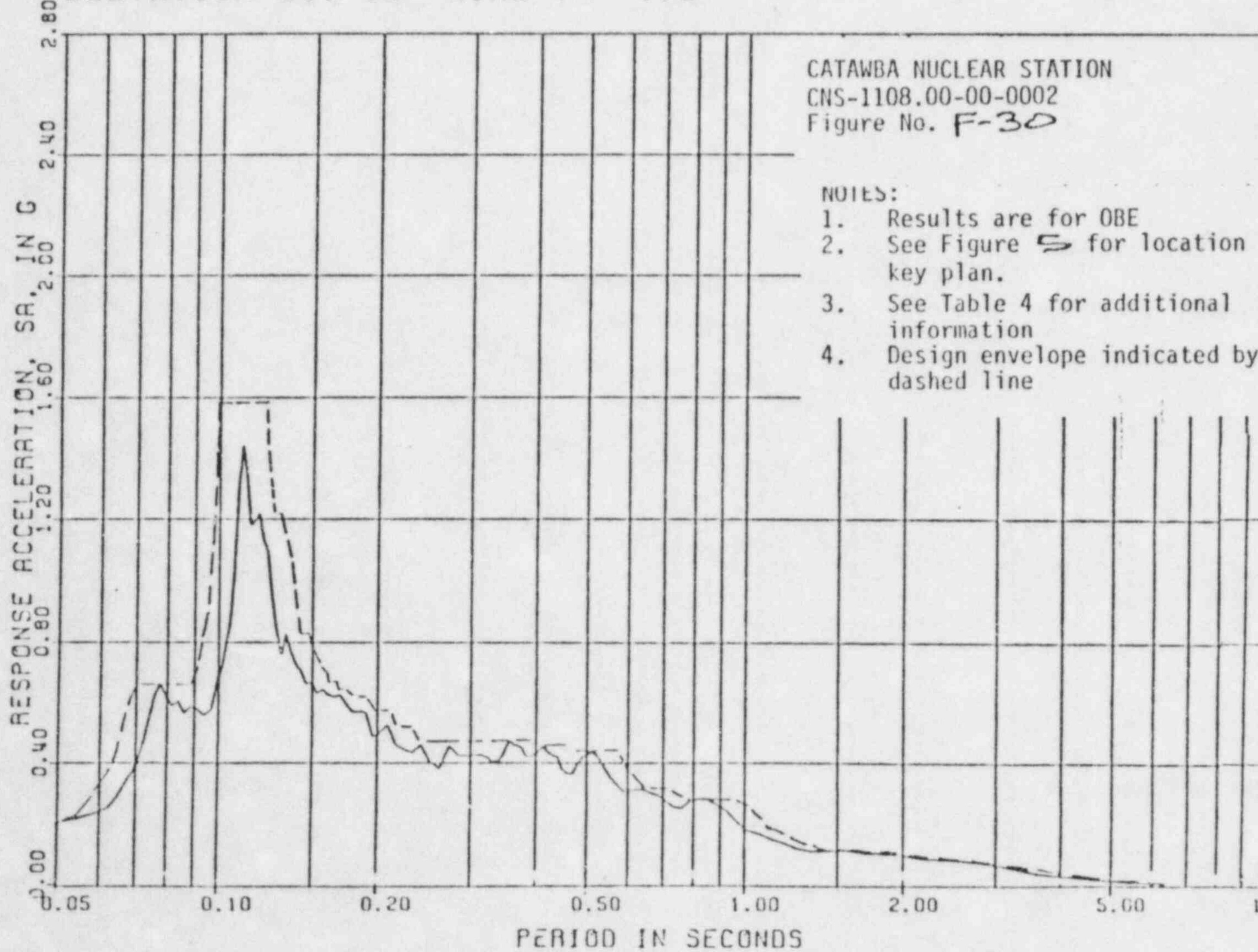
NOTES:
1. Results are for OBE
2. See Figure 5 for location key plan
3. See Table 4 for additional information
4. Design envelope indicated by dashed line

CATAWBA AUX BLDG EAS-WES (Y) EARTHQUAKE
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 594+00 CTR. OF STRUCT. RIGIDITY (0.092,164.082)



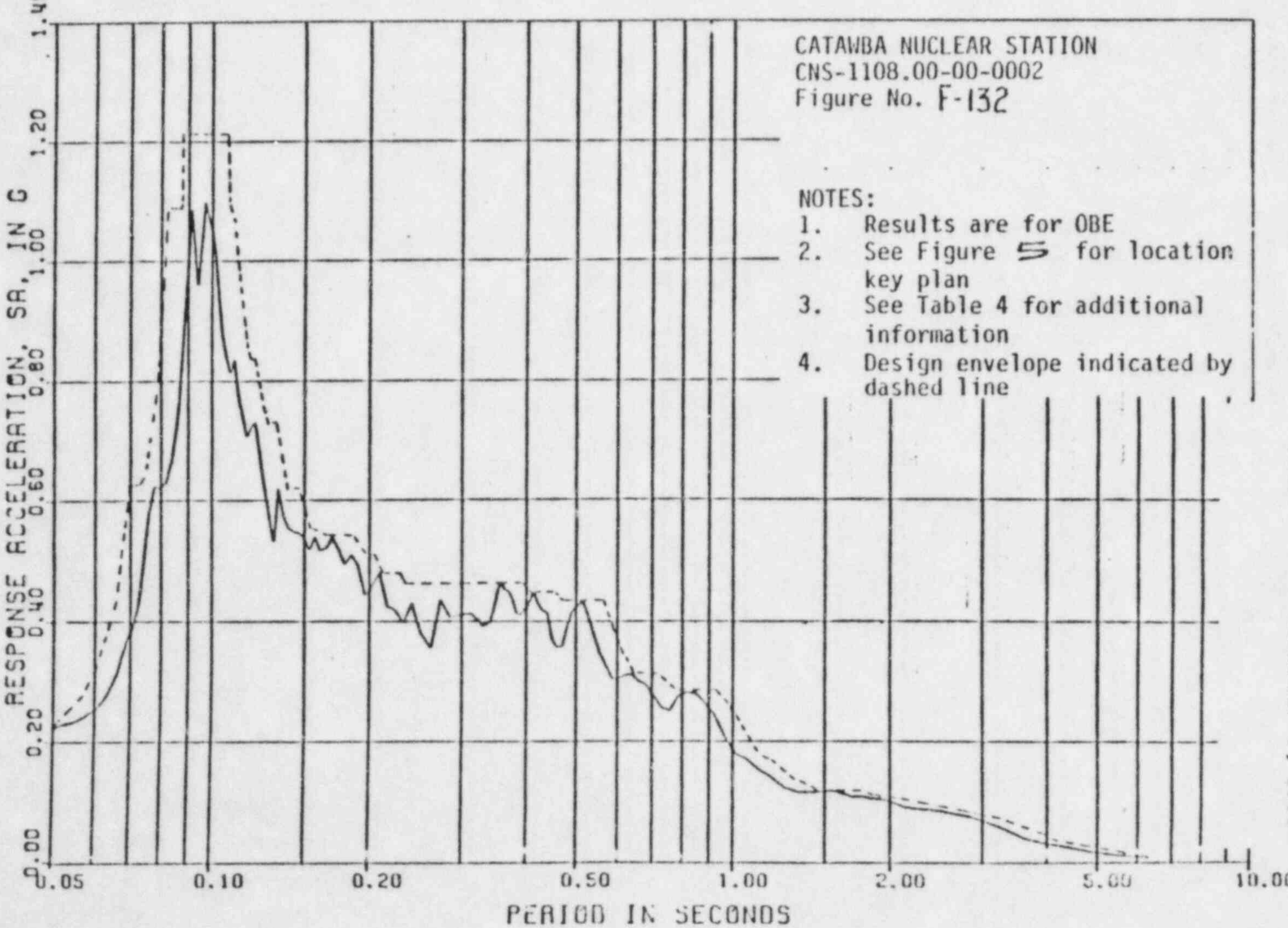
Revision 3: July 1, 1982
Date: December 5, 1980

CATAWBA AUXILIARY BLDG. NORTH-SOUTH (X)
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 611+00 LINE Y= -1.5



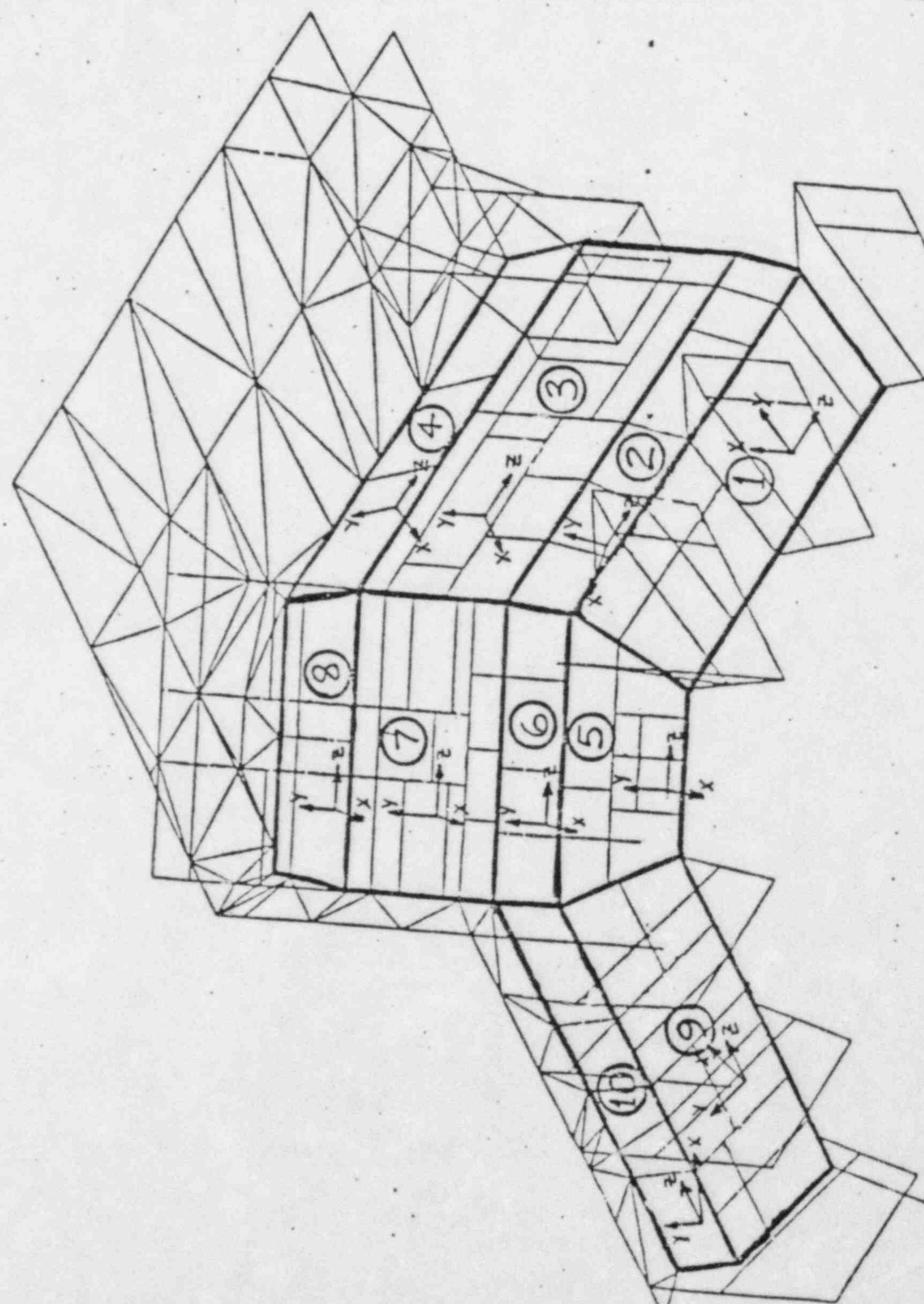
Revision 3: July 1, 1982
Date: December 5, 1980

CATAWBA AUXILIARY BLDG. EAST-WEST (Y) EA
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
ELEVATION 611+00 CTR. OF STRUCT. RIGIDITY (0.147,174.212)



Revision 3: July 1, 1982
Date: December 5, 1980

Page # 27 Calculation #
CNC-1381.05-00-0046
Prepared By DMC Date 10/25/83
Reviewed By [illegible] Date 10/25/83



GROUP A

NOTE: 1) X direction is always out-of-plane.
2) Z direction is ...

Fig B.1-1

Page # 28 Calculation # CNC-1381.05-00-0046
Prepared By [illegible] Date 12/25/83
Reviewed By [illegible] Date 12/25/83

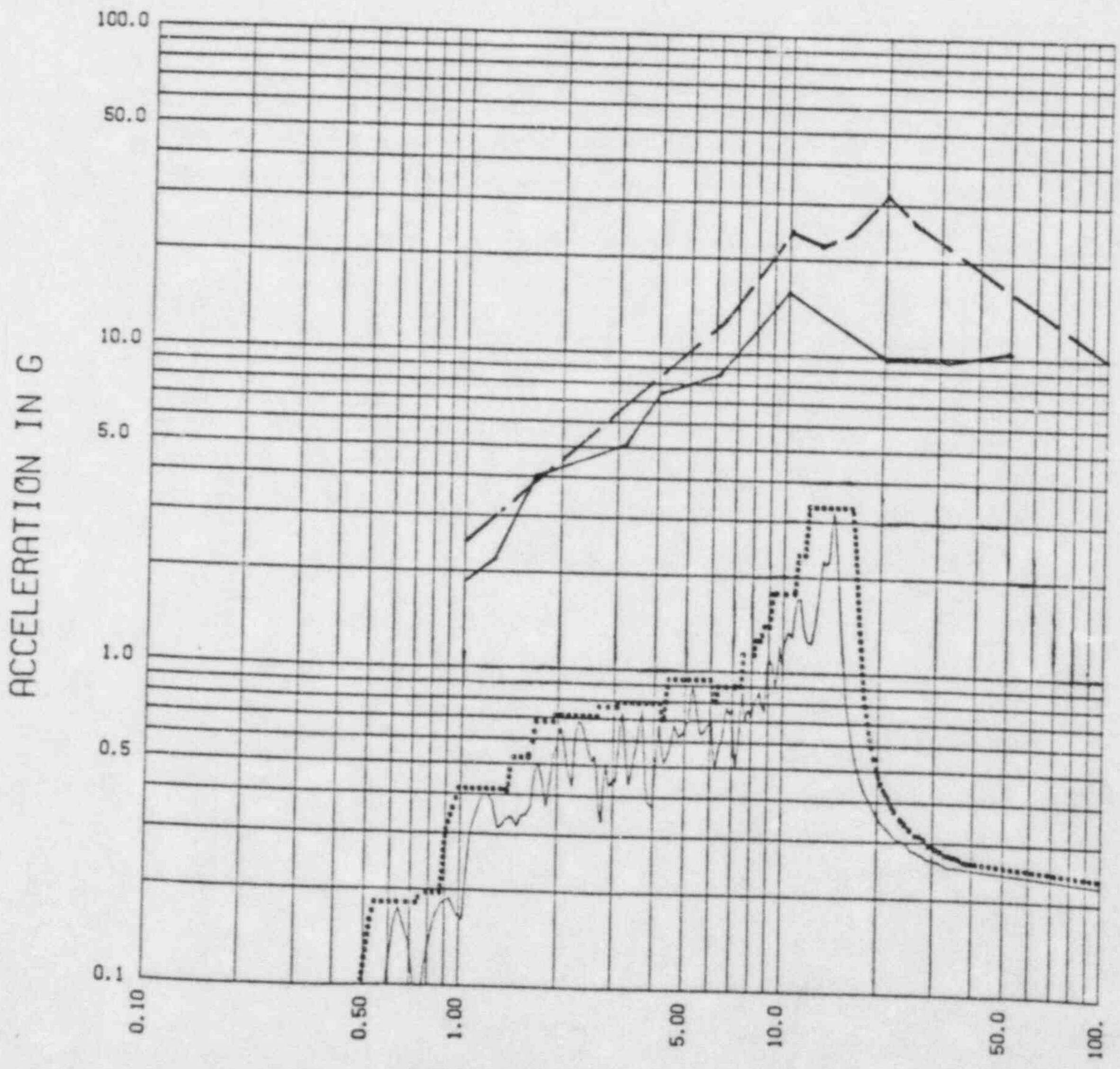
Fig B.1-2
MC I

CATAWBA NUCLEAR STATION

MAIN CONTROL BOARDS - GROUP A

SSE ACCELERATION X-DIRECTION : SECTION 1

ELEVATION 594+00 DAMPING= 0.01 REV. 1 7-83



— — CUTLER HAMMER/E30 PUSHBUTTON. CURVE BASED ON OM-1393-0009; WYLE TEST REPORT NO. 45477-1, pp. 39+43. 1% DAMPING.

—— CUTLER HAMMER/10250T SELECTOR SW. CURVE BASED ON OM-1393-0008; WYLE TEST REPORT NO. 42419-1, pp. 16+17. 1% DAMPING.

Page # 29	Calculation #
CNC-1381.05-00-0046	
Prepared By [signature]	Date [illegible]
Reviewed By [signature]	Date [illegible]

Fig B.1-4

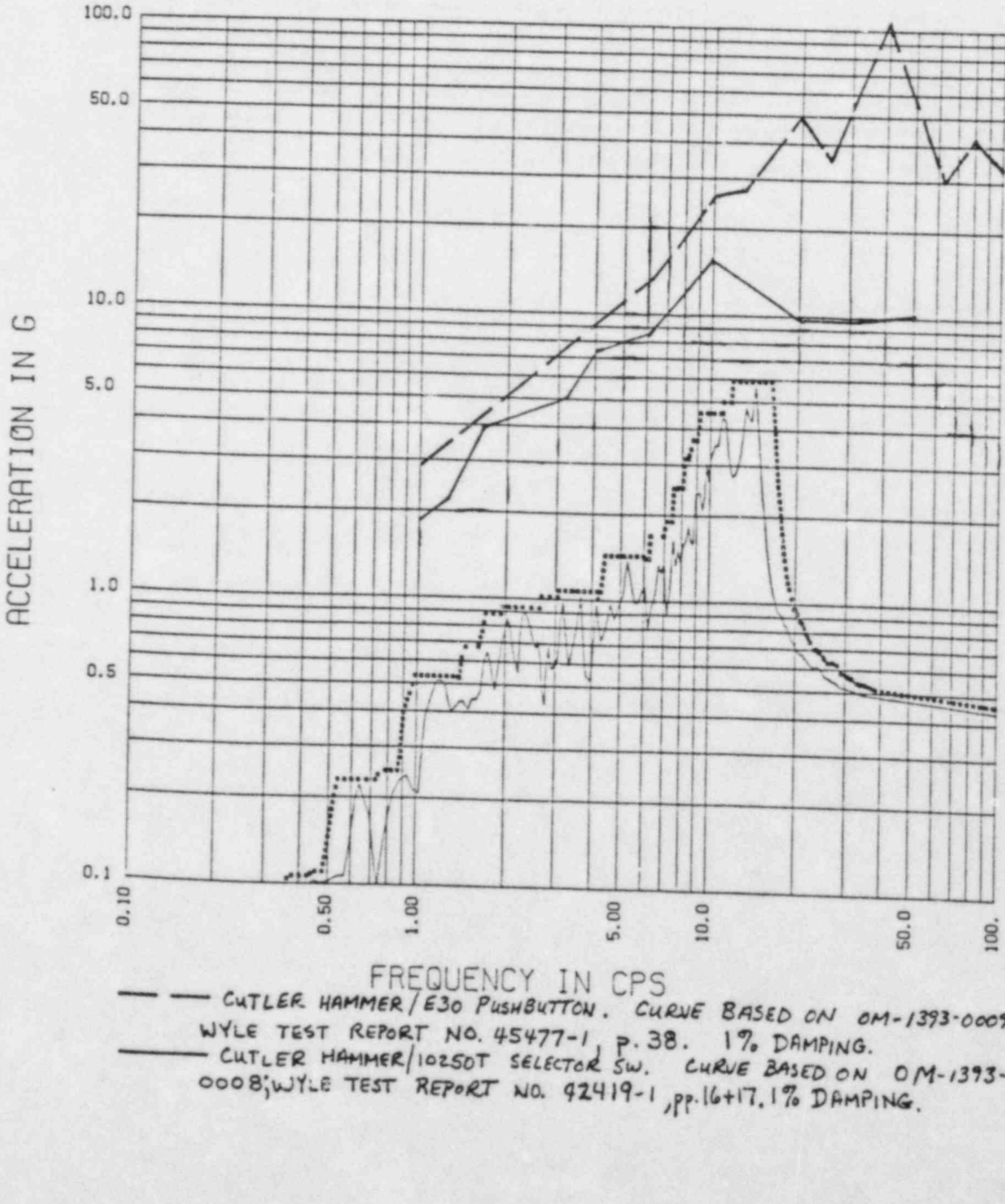
MC I

CATAWBA NUCLEAR STATION

MAIN CONTROL BOARDS - GROUP A

SSE ACCELERATION Y-DIRECTION : SECTION 1

ELEVATION 594+00 DAMPING= 0.01 REV. 1 7-83



— — CUTLER HAMMER/E30 PUSHBUTTON. CURVE BASED ON OM-1393-0009; WYLE TEST REPORT NO. 45477-1, p. 38. 1% DAMPING.

——— CUTLER HAMMER/10250T SELECTOR SW. CURVE BASED ON OM-1393-0008; WYLE TEST REPORT NO. 42419-1, pp. 16+17. 1% DAMPING.

Page # 30 Calculation # CNC-1381.05-00-0046

Prepared By [signature] Date [illegible]

Reviewed By [signature] Date 10/27/93

Fig B.1-6

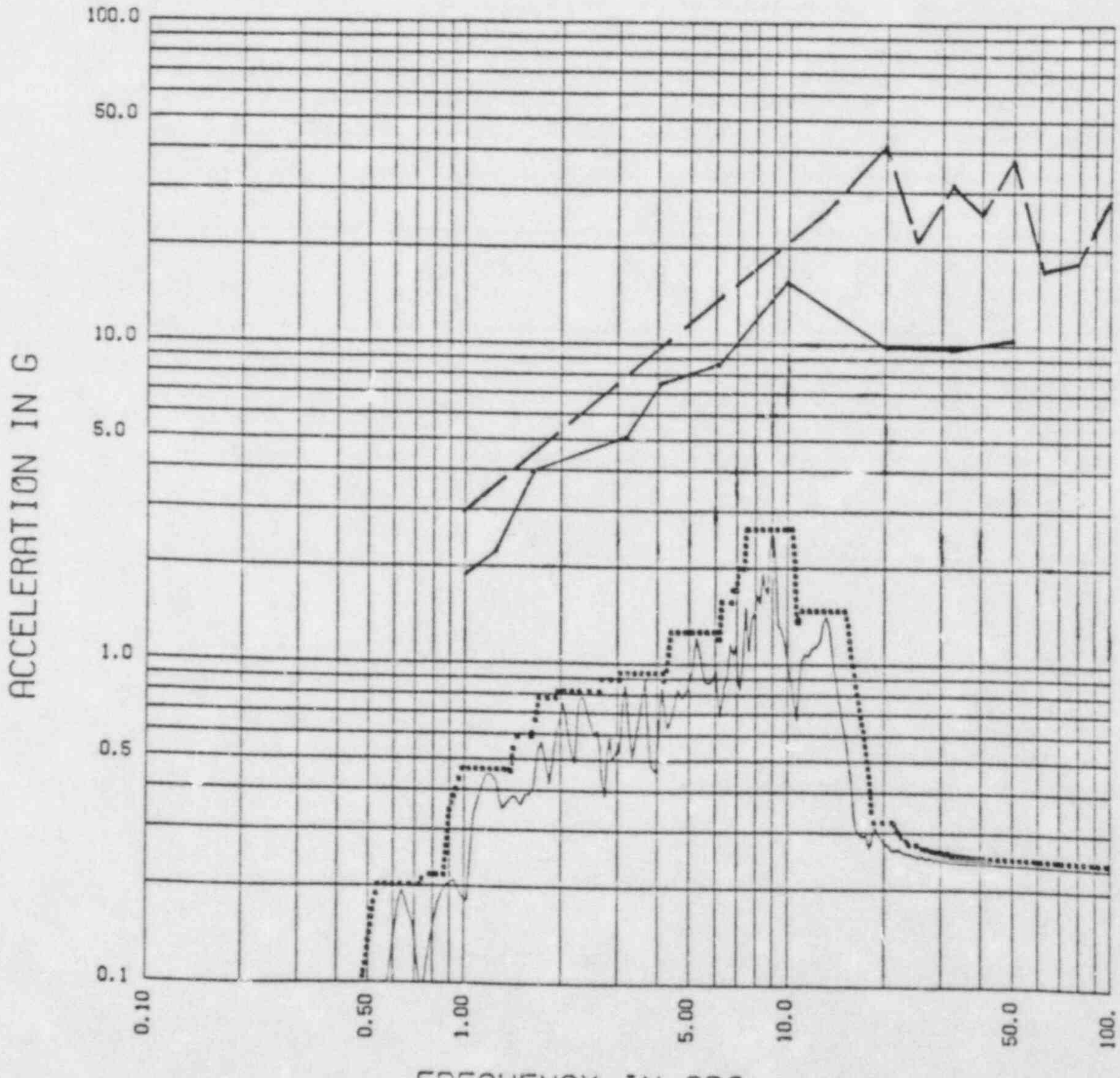
MC1

CATAWBA NUCLEAR STATION

MAIN CONTROL BOARDS - GROUP A

SSE ACCELERATION Z-DIRECTION : SECTION 1

ELEVATION 594+00 DAMPING= 0.01 REV. 1 7-83



— — CUTLER HAMMER/E30 PUSHBUTTON. CURVE BASED ON OM-1393-0009; WYLE TEST REPORT NO. 45477-1, p. 42. 1% DAMPING.

—— CUTLER HAMMER/10250T SELECTOR SW. CURVE BASED ON OM-1393-0008; WYLE TEST REPORT NO. 42419-1, pp. 16+17. 1% DAMPING.

SPECIFIC ITEM #17 MAIN CONTROL BOARDS

PART 1: Examine local plate areas for stress and acceleration levels.

STATUS: Analysis has been performed and is being added to calculation CNC-1381.05-00-0029

RESOLUTION SUMMARY: Analyses of a worst case plate (large unstiffened area and heavily loaded) showed that the local plate stresses were within allowables. Also frequency analyses showed that the natural frequency of the local plate was above 20.0 Hz indicating that the local plate would not modify the previously calculated response spectra.

PART 2: Provide favorable tabulated comparison of mode shapes between modal test and finite element analysis.

STATUS: The comparison has been tabulated and is being added to calculation CNC-1381.05-00-0029.

RESOLUTION SUMMARY: Copies of the mode shape comparisons are attached.

PART 3: Some analysis documents need to be revised.

STATUS: Revisions to the original analysis (CNC-1381.05-00-0029) are nearing completion. Revisions to the subsequent parametric study analysis (CNC-1381.05-00-0044) will begin shortly and should be completed by April 30, 1984.

RESOLUTION SUMMARY: The revisions being made are related to items discussed in parts 1 and 2 of this item.

PART 4: Conduct as-built weld survey to assure compliance with analysis.

STATUS: Weld survey in progress.

RESOLUTION SUMMARY: Any weld deficiencies noted during the as-built condition and the analysis will be in compliance.

SPECIFIC ITEM #17 MAIN CONTROL BOARDS

PART 5. Westinghouse WCAP-8687, Supp. 2-E15A presents the test results of two different seismic tests on Hagan Optimac Recorders - the Lot 1 test in which the recorders failed and the Lot 2 test in which the recorders had been modified to withstand the seismic test. A concern was raised as to whether or not the Hagan Optimac Recorders used on the Main Control Boards have received the seismic modifications as described in the WCAP-8687, Supp. 2-E15A, page 12.

STATUS: This item has been resolved.

RESOLUTION SUMMARY: In Westinghouse letter Catawba-3630, it is confirmed that all safety-related Hagan Optimac Recorders are built to the baseline design document which includes the seismic modifications described in WCAP-8687, Supp. 2-E15A, page 12. Therefore, all safety-related Hagan Optimac Recorders shipped to Catawba were seismically modified before the recorders left the factory.

DOCUMENT/ PAGE PULLED

ANO. 8404200271

NO. OF PAGES 1

REASON

☐ PAGE ILLEGIBLE

☐ HARD COPY FILED AT: PDR CF

OTHER ____________

☐ BETTER COPY REQUESTED ON __/__/__

☑ PAGE TOO LARGE TO FILM

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OTHER ____________

☐ FILMED ON APERTURE CARD NO 8404200271-07

SPECIFIC ITEM #18 DAMPER OPERATORS

PART 1: Test was conducted with 1/3 (11 ft-lb) of rated torque. Assure that torque needed to operate is less than this.

STATUS: Damper vendor has mailed information. Will receive by April 13, 1984.

RESOLUTION SUMMARY: Vendor is working to show that the required torque is less then the tested torque.

PART 2: Qualification of the mounting bracket was not included in AWV document no. 80343-301 (calculation) dated February 9, 1980.

STATUS: Vendor suspects a physical change in required bracing. A revised calculation and field modification instructions is anticipated.

RESOLUTION SUMMARY: Vendor is revising calculation 80343-301 and will issue field revision instructions by April 20, 1984.

PART 3: FSAR Table 3.10-1 does not contain proper report number for Rotory Actuator.

STATUS: Table will be revised during next update.

RESOLUTION SUMMARY: Revise table in accordance with attachment.

PART 4: SQRT form should be revised.

STATUS: SQRT form has been revised.

RESOLUTION SUMMARY: SQRT form has been revised as brought out in the audit interview.

PART 5: ITT General NH90 actuator report number 721.77.095 qualifies actuator in upright position. Verify that all actuators are so oriented.

STATUS: New ITTG report number 730.140 has been purchased.

RESOLUTION SUMMARY: New report qualifies actuator in horizontal as well as vertical positions.

Seismic and Dynamic Qualification Summary of Equipment

I. Plant Name: Catawba   TYPE:

1. Utility: Duke Power Co.   PWR: X

2. NSSS: Westinghouse   BWR:

3. A/E: N/A   Other

II. Component Name: Containment Return Air Isolation Damper Actuator

1. Scope: [ ] NSSS [X] BOP [ ] Other

2. Model Number: 11 NAZTI   Quantity: 4

3. Size or Range: N/A

4. Vendor: Rotork

5. If the component is a cabinet or panel, name and model Number of the devices included: N/A

6. Physical Description:

a. Appearance: Damper Actuator

b. Dimensions: 12"X20"X24"

c. Weight: 145 lb.

7. Location: Building: Reactor Bldg.

Elevation: 595'-8 1/2"

8. Field Mounting Conditions [ ] Bolt (No. 4 ,) Size 3/8")
[ ] Weld (Length ___)
[ ] ______

9. Mounting Orientation [e.g., on floor, cantilevered, suspended, etc.]

Damper Mounted to Floor

10. a. System is which located: VX

b. Functional Description: Isolate Upper & Lower Containment

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

[ ] Both [ ] Neither [X] Other LOCA

II. Pertinent Reference/Design Specifications for Qualification Requirements: CNS-1211.00-0005 Supplement No. 6. Attached is required seismic envelope.

a. Seismic Input

b. Hydrodynamic Load Input

c. Fatigue Considerations

d. Service Conditions

e. Qualified Life

III. Is Equipment Available for Inspection in the Plant:

[X] Yes [ ] No [ ] Partial or limited availability

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: CNM-1211.00-1076

(No., Title and Date): 43979-1 10-24-78

Company that Prepared Report: Wyle Laboratories

Company that Reviewed Report: Duke Power Company

Where Report is filed or available: Duke Power Company, Design Engineering

Applicable Codes And/Or Standards: IEEE 323-1974, 344-1975

V. Vibration Input:

1. Loads considered:
   a. [X] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Vibration from normal operation
   d. [ ] Combination of (a), (b), and (c)

2. Method of Combining RRS:

   [ ] Absolute Sum [ ] SRSS [ ] ____________ (other, specify)

3. Required Response Spectra** (attach the graphs): ____________

NOTE:
*If more than one report complete items IV thru VII for each report.
**If other than RRS is used, describe method.

4. Damping Corresponding to RRS: OBE 2% SSE 2%

5. Required Acceleration in Each Direct:

[ ] ZPA [ ] Other ________ (specify)

OBE S/S = 0.2G F/B = 0.2G V = 0.37G

SSE S/S = 0.375G F/B = 0.375G V = 0.694G

6. Were fatigue effects considered:

[ ] Yes [X] No

If yes, describe how they were treated in overall qualification program: ________

____

____

VI. <u>If Qualification by Test, then Complete</u>:

1. [ ] Single Frequency [X] Multi-Frequency [ ] random
[ ] sine beat
[ ] ________

2. [ ] Single Axis [X] Multi-Frequency
[ ] Independent Axis [ ] In-phase motions

3. Number of Qualifica

OBE 15 ________ Other ________ (specify)

4. Frequency Range: ________

5. Natural Frequencies ach ction (Side/Side, Front/Back, Vertical):

S/S = 30HZ F/B = 30HZ V = 10HZ

6. Method of Determining Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test

[ ] Yes (Attach TRS & RRS graphs)

[X] No

8. Maximum Input g Level Test:

OBE S/S = ______ F/B = ______ V = ______

SSE S/S = 25G F/B = 25G V = 20G

9. Laboratory Mounting:

A. [X] Bolt (No. 4 , Size 3/8")

[ ] Weld (Length __) [ ] ______

B. Orientation and Fixturing: Horizontal

10. Functional Operability verified:

[X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Electrical function is not compromised.

12. Other tests performed (such as aging or fragility test, including results):
Aged to 2.4×10^6 RADS

13. Failure Modes (If appropriate None)

14. Margins Available: [ ] Input Spectrum [ ] Fragility N/A

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ______ F/B = ______ V = ______

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam

[ ] Closed Form Solution [ ] Other ______

4. [ ] Computer Codes: ____________________

Frequency Range and No. of modes

[ ] Hand Calculations

5. Method of Combining Dynamic Responses from Seismic and Other Dynamic Loads:

[ ] Absolute Sum [ ] SRSS [ ] Other: __________ (specify)

6. Damping:

OBE ______ SSE ______ Basis for the damping used: __________

7. Support Considerations in the model: ____________________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

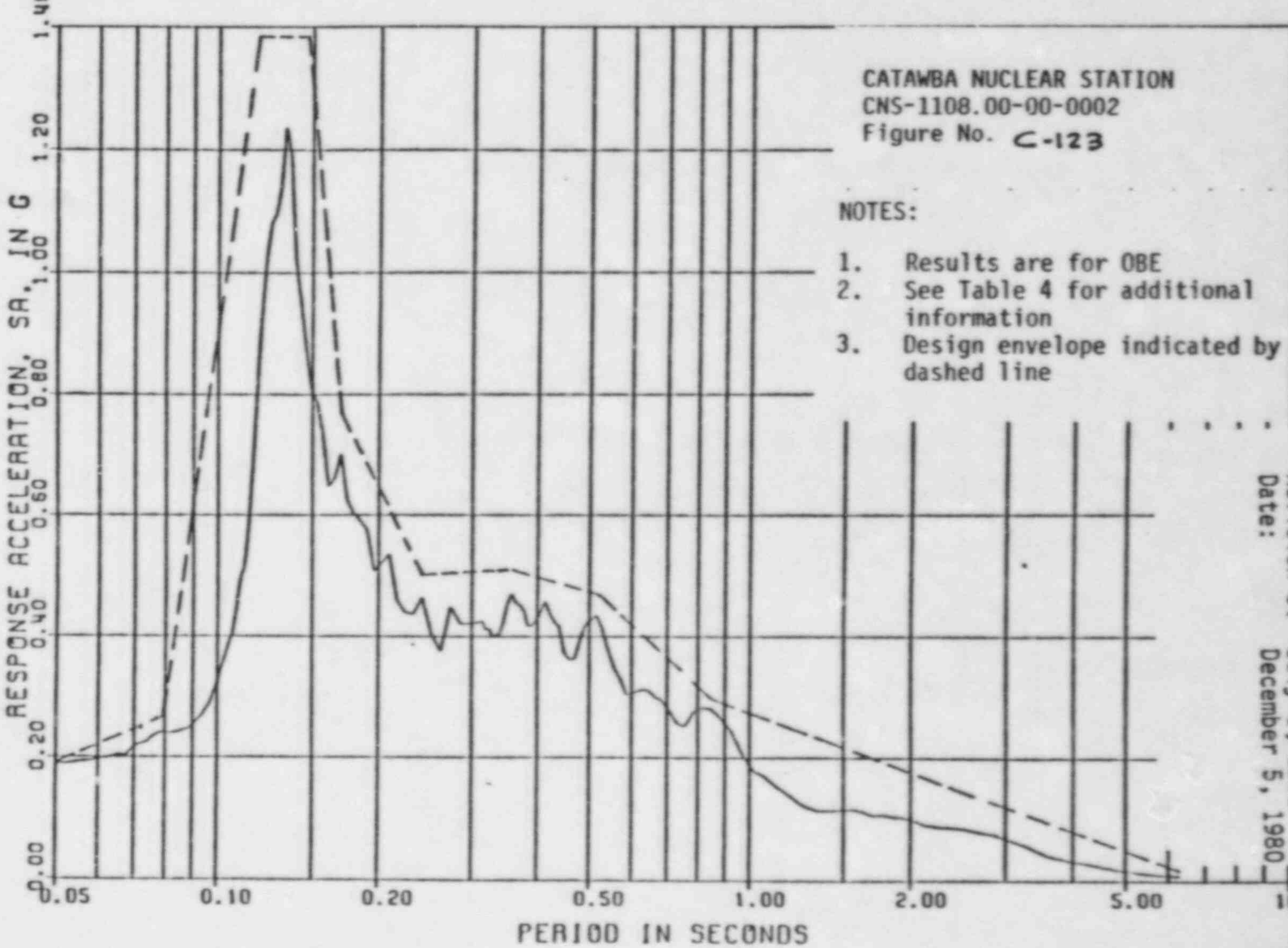
B.

Maximum Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

9. Failure Modes: ____________________

10. Margins Available: [ ] Input Spectrum [ ] Stress or Deflection

CATAWBA NUCLEAR STATION
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
REACTOR INTERIOR, E-W DIRECTION, EL. 599+6



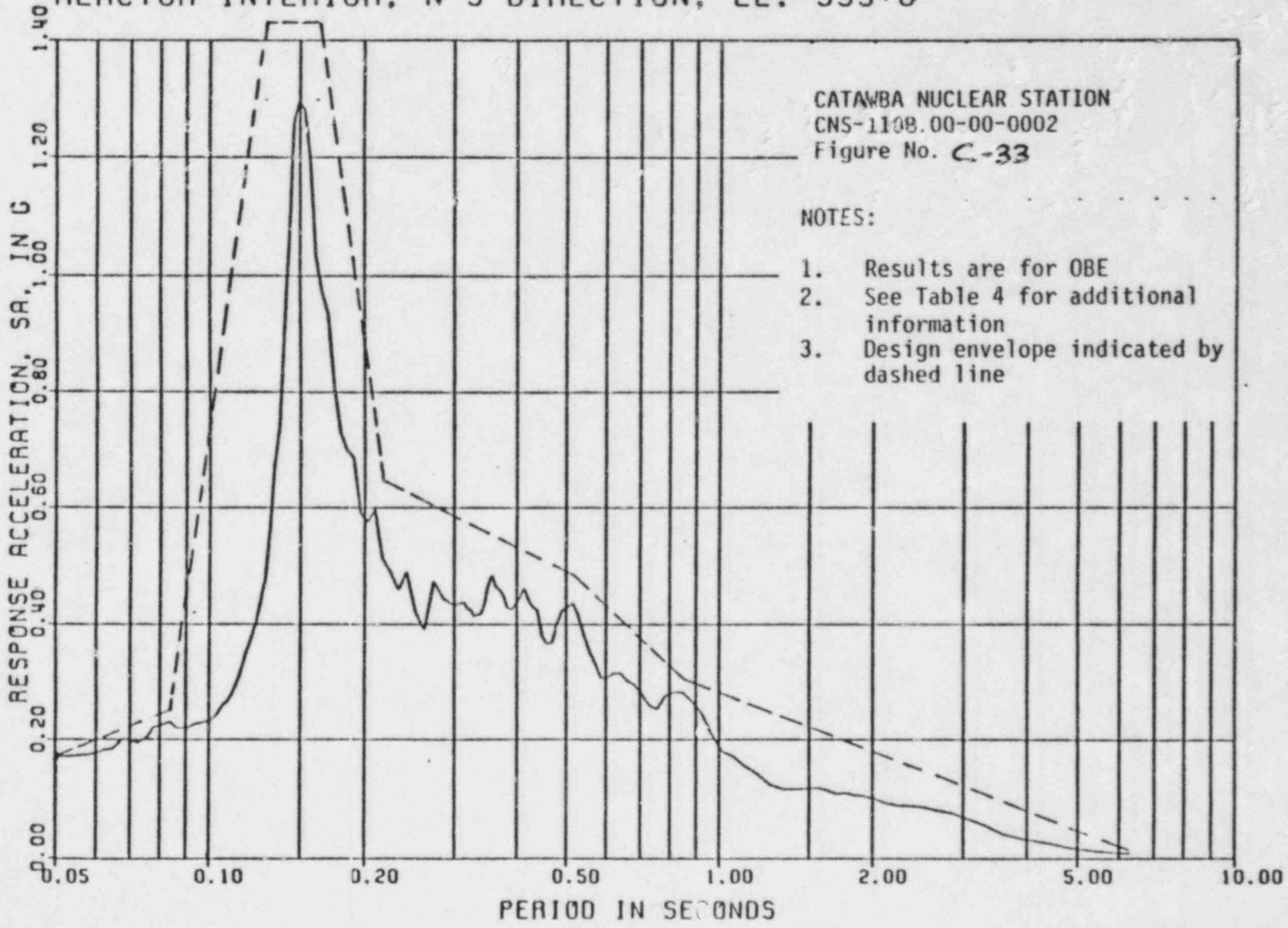
CATAWBA NUCLEAR STATION
CNS-1108.00-00-0002
Figure No. C-123

NOTES:

1. Results are for OBE
2. See Table 4 for additional information
3. Design envelope indicated by dashed line

Revision 3: July 1, 1982
Date: December 5, 1980

CATAWBA NUCLEAR STATION
RESPONSE ACCELERATION SPECTRA, DAMPING= 0.020
REACTOR INTERIOR, N-S DIRECTION, EL. 599+6

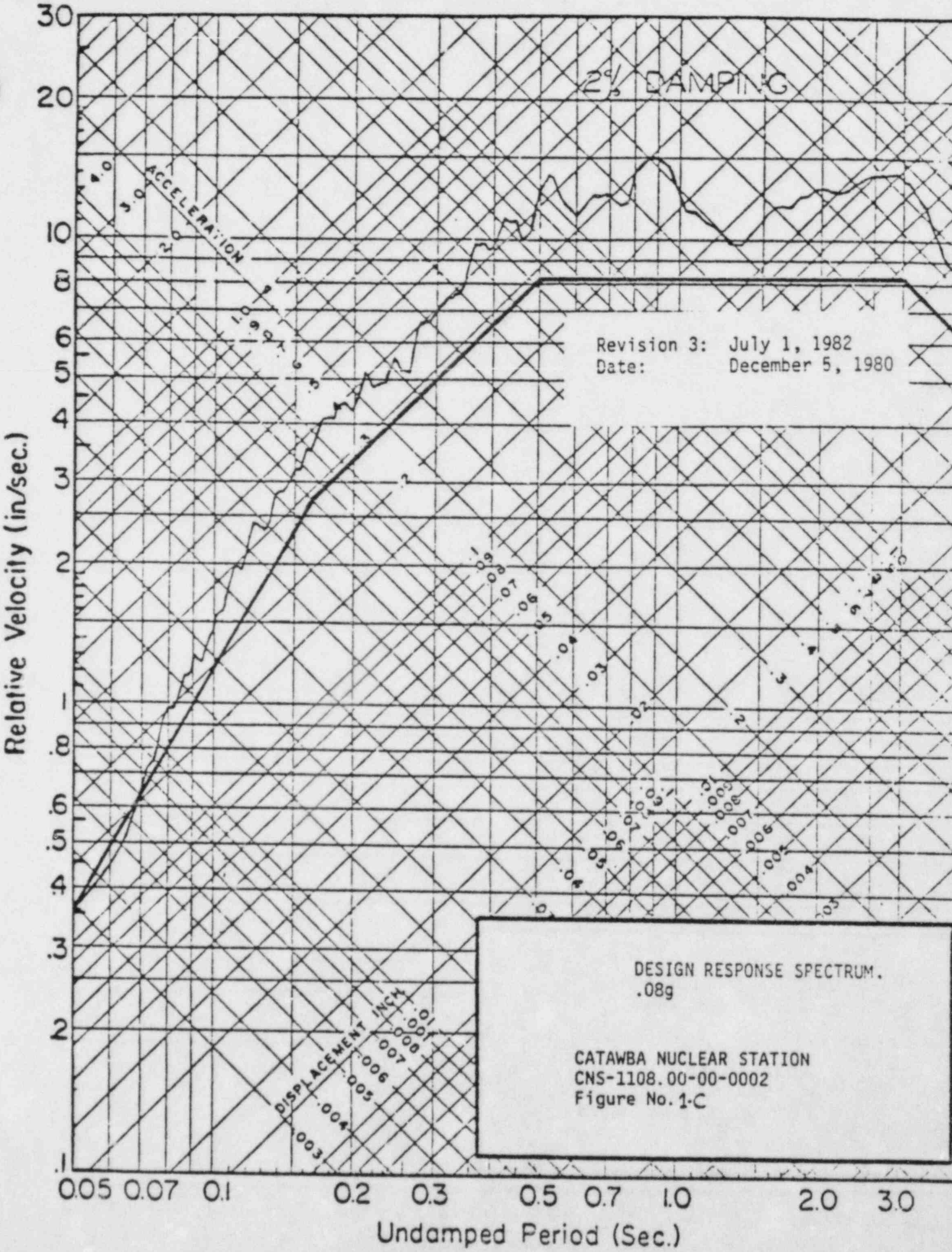


CATAWBA NUCLEAR STATION
CNS-1108.00-00-0002
Figure No. C-33

NOTES:

1. Results are for OBE
2. See Table 4 for additional information
3. Design envelope indicated by dashed line

Revision 3: July 1, 1982
Date: December 5, 1980



Revision 3: July 1, 1982
Date: December 5, 1980

DESIGN RESPONSE SPECTRUM.
.08g

CATAWBA NUCLEAR STATION
CNS-1108.00-00-0002
Figure No. 1-C

TABLE 3.10-1 (Page 16)

ELECTRICAL EQUIPMENT SEISMIC QUALIFICATION

EQUIPMENT CATEGORY & DESCRIPTION	EQUIPMENT VENDOR	MODEL	QUALIFICATION METHOD	QUALIFICATION REFERENCE
IV. Valve/Damper Operators				
1. Motor Operators (MSIV)	Atwood & Morrill		Test	A & M Test Report 201-39500 (CNM-1205.12-0009)
2. Motor Operators (FWIV)	Borg-Warner		Test	Borg-Warner Test Report 1736 (CNM-1205.12-8)
3. Motor Operators	Limitorque	SMB	Test	Limitorque-Report B0058 (CNM-1205 19-1)
4. Motor Operators	Rotork	NA1 NA2	Test	Rotork TR116 (11/73) (CNM-1205.19-6) Rotork TR404 (7/12/77) (CNM-1205.19-14) Rotork 20689 (12/1/70) (CNM-1205.19-22) Rotork TR4605 (3/2/72) (CNM-1205.19-23) Rotork N7/1 (5/15/70) (CNM-1205.19-21) Wyle ~~Rotork~~ 43979-1, Rev. A (12/19/78) (CNM-1205.19-11)
5. Motor Operators	ITT General Controls	NH90 Series	Test/Analysis	ADD Wyle Report No. 43979-1, Rev. A (CNM-1211.00-1076) AWV Document No. 80343-310 (CNM-1211.00-804) ITT Report 58072 dated 6/9/76 (CNM-1211.00-1132)