QUALIFICATION REPORT FQP-11AB-5

Group V Control Valves

for

ALVIN W. VOGTLE NUCLEAR PLANT
UNITS 1 & 2
GEORGIA POWER

IMPORTANT NOTE

THE REVISION LEVEL OF THIS DOCUMENT IS SHOWN AT THE TOP OF EACH PAGE OF THE DOCUMENT. PLEASE SPECIFY THIS REVISION LEVEL WHEN REFERRING TO THIS DOCUMENT.

THIS REVISION LEVEL WILL BE INCREASED WHEN ANY PAGE OF THE DOCUMENT IS REVISED. A SEPARATE REVISION HISTORY, DETAILING SPECIFIC CHANGES, WILL BE SUBMITTED WITH ANY DOCUMENT REVISION.

Control Valve Assemblies per FQP-11AB

Alvin W. Vogtle Nuclear Power Plant, Units 1 & 2
Georgia Power Company
Bechtel Power Corp. Purchase Order No.: PAV-206, PAV 2-34
Design Specification No.: X5AC03, Rev. 9, App. EA, Rev. 3, & App. QG, Rev. 0
Seismic Category/Class: Seismic Category I, Nuclear Class 3
Fisher Representative Order No.: 22B-X5AC03-N1P & 22B-X5AC03-N2P
Qualification Group: V
Environmental Designator: VIII-R-C83
Order Items: 155, 156, 165, 166
Serial Numbers: 8342938-41
Tag Numbers: 1 & 2-HV-12596 & 97
Bechtel Data Sheets: CX5DL-187 & 188

This is to certify that, to the best of my knowledge and belief, the qualification information listed in the Table of Contents (Page 3) or referenced in the following qualification summary is complete and accurate. The information meets the requirements and intent of the above design specification, as interpreted by the applicable Fisher Qualification Plan, FQP-11AB.

Jon Whitesell
Jon Whitesell
Qualification Analyst

I certify that I accept responsibility for the adequacy of this document, which was prepared by others, to the same degree that I would if I had prepared it, and that I am a duly Registered Professional Engineer under the laws of the State of Iowa.

John Dresser
John Dresser Reg. No: 7547
Registered Professional Engineer

REGISTERED PROFESSIONAL ENGINEER
JOHN C. DRESSER
7547
• IOWA •

Date: 1-16-85

Certified and Approved by:

Floyd D. Jury
Floyd D. Jury, Manager
Engineering Qualification & Analysis

N28-11/ 2

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4. Static Side load Test of the Vogtle Item 165 - 10" 9280 Butterfly Valve with Bettis N521C-SR80-12 Actuator, Fisher Lab Problem 1662, Report 72
5. Certificates of Compliance and Related Documentation - Bettis Actuators for Group V Valves
6. Arrhenius Rate Equation Calculation

Note: Report FQP-11A, a separate related volume entitled "Vogtle Environmental Qualification Report for Type 9200 Butterfly Control Valve Assembly" has been previously furnished under separate cover.

1.0 PURPOSE AND SCOPE

1.1 This Qualification Summary is submitted to verify qualification of the following Nuclear Code Class 3 active control valve assemblies for Seismic Category I service. Information presented and referenced in this report is in accordance with the specification listed above, as interpreted by Fisher Qualification Plan: FQP-11AB.

1.2 The valves covered by this report are designated active valves, Nuclear Safety Class 3, Nuclear Code Class 3, and Seismic Category I (Bechtel Project Class 313). The valves are located outside containment.

2.0 VALVE ASSEMBLY DESCRIPTION

The valves shown to be qualified by this report are 10" ANSI Class 150, Type 9280, butterfly valve assemblies. Actuators are **Bettis N521C-SR80-12 pneumatic actuators**. Specific production valves covered by this report are as follows:

Item No.	Unit 1 Serial No.	Unit 1 Tag No.	Item No.	Unit 2 Serial No.	Unit 2 Tag No.
155	8342938	1-HV-12596	165	8342940	2-HV-12596
156	8342939	1-HV-12597	166	8342941	2-HV-12597

3.0 REQUIREMENTS

The requirements for Group V valves are as follows:

3.1 Rigid Valve Requirement -- The lowest resonant frequency of these valves must be shown to be greater than or equal to 33 Hz (see FQP-11AB, Paragraph 2.3.2.).

3.2 Structural Integrity Requirements -- It must be shown that extended structure stress levels meet the acceptance criteria of Fisher Engineering Standard ES 117, Rev. F (Attachment 3, FQP-11AB), when the assemblies are loaded with a 4.5 g triaxial load (see FQP-11AB Paragraphs 2.2 and 3.3.1; also see Paragraph 3.5 for pressure-retaining part stress calculation procedure, per SAG 1034).

3.3 Environmental Requirements -- It must be shown that the environmental conditions in Appendices EA-15, EA-65, and EA-67 of Bechtel

Specificaton X5AC03, Rev. 9 for Environmental Designator VIII-R-C83, can be met by the subject valves without affecting the pressure retaining integrity of the valve assemblies or interfering with the safety-related function (see FQP-11AB, Para. 6.3).

3.4 Operability Requirements -- Capability of the subject "active" valves to perform the designated safety-related function must be shown in keeping with the FQP-11AB, Paragraph 5.0, requirements. The safety-related function of these Bettis actuator valve assemblies is to provide a "fail-closed" disc position upon loss of air pressure to the cylinder.

4.0 RESULTS

The ability of the subject valves to satisfy the requirements listed in Section 3 above is demonstrated in the following manner:

4.1 The lowest resonant frequency of the valve extended structure (actuator and mounting bracket) has been determined by impulsive excitation test and by analysis. The testing was done in the Fisher Laboratory as reported in Lab Problem 1667, Report 188A. The correlation analysis for the corresponding extended structure was done (2-6-84) according to Fisher Engineering Standard, ES 117, Rev. F (Attachment 3, FQP-11AB). ES 136, Rev. D is an algorithm verification of ES 117, Rev. F and is included as Attachment 4, FQP-11AB. The lowest resonant frequency for the extended structure as determined by test is 81.5 Hz in the X axis, and the calculated lowest resonant frequency is 81.3 Hz in the X axis. These values are within 0.3% (see Attachment 1).

The lowest calculated resonant frequency for the valve assembly is 77.7 Hz in the X axis. Even with the correlation factor (0.3%) taken into account, the lowest resonant of the the valve assembly is well above 33Hz as required. The resonant frequency test report and ES 117, Rev. F analyses are included as Attachments 1 and 2 to this final report.

4.2 The seismic analyses (done at 10.0 g) and certifications are included as Attachment 2 to this report. The analysis printouts provided are for a horizontal shaft orientation in a horizontal pipeline. This orientation has been determined to be the most highly stressed orientation possible (by comparison of maximum stresses for the other possible orientations). These analyses verify that this valve assembly is qualified for any orientation, with respect to seismic stresses, per Paragraph 4.1.1, Part 5 of the X5AC03 Specification. Supplementary stress calculations for pressure retaining valve parts are included as Attachment 3 to this report (see FQP-11AB, Paragraph 3.5). All stress levels are shown to be acceptable. Actuators are being qualified by Bettis in accordance with Section 2.6 of FQP-11AB.

4.3 The maximum environmental requirements (per Attachment EA-15, Rev. 3) for Normal/Abnormal conditions are as follows:

Temperature: 104/30°F
Pressure: Atmospheric
Radiation: $1X10^3$ Rads
Relative Humidity: 60%

These levels are within the conditions considered during valve design and can be met without exception. Valve design is in accordance with Section III of the ASME Boiler and Pressure Vessel Code and body pipeline connections mate with standard ANSI Class 150 flanges.

The DBA/Post-DBA temperature requirements illustrated on Figure 4 (EA-79) show a maximum temperature of 180°F for about 4 minutes, which can easily be met. The DBA/Post-DBA pressure requirements illustrated on Figure 6A (EA-81) show a maximum pressure of 3.5 psig for 14 seconds, which can also easily be met. The DBA/Post-DBA maximum radiation and relative humidity conditions are $1X10^3$ rads and 100%, respectively. Both of these requirements can be met without exception.

4.3.1 Similarity between the Vogtle production valves, covered in this report, and the environmental test valve discussed in FQP-11A, permits applying the elastomer test results to the valves of this Vogtle group. Attachment A-3 of FQP-11A discusses modifications and exceptions to the environmenta test program that adapt it to the Vogtle project.

4.3.2 The elastomer T-ring disc seal in these Vogtle valves is made of EPDM (ethylene propylene) material suitable for the design temperature of 200°F. EPDM T-ring seals are satisfactory without significant loss of function for radiation dosages up to 1×10^7 rads, but these seals should be replaced, along with other elastomeric parts, at intervals of four years or less.

4.3.3 The shaft packing used in these production valves consists of grafoil ribbon and filament rings. The packing is suitable for the design pressures and temperatures involved (100 psig, 200°F) and for the environmental conditions specified for Environmental Designator VIII-R-C83.

4.4 Margin allowances are addressed as follows:

4.4.1 Temperature - The maximum Normal/Abnormal external environmental temperature is 104°F, and the maximum internal temperature is 65°F. The valve internal design temperature is 200°F so margin is 96°F.

The maximum DBA/Post-DBA temperature is 180°F so the margin is at least 20°F, which exceeds the 15°F margin suggested in IEEE 323-1974.

4.4.2 Pressure -- The maximum Normal/Abnormal/DBA/Post-DBA external environmental pressure is 3.5 psig, and the maximum internal pressure (at shutoff) is 50 psig. These are well below the valve internal design pressure of 100 psig, providing a margin of at least 50 psi.

4.4.3 Frequency -- As shown in Paragraph 4.1 above, the margin provided regarding resonant frequency is at least 44.7 Hz above the required 33 Hz.

4.4.4 Vibration -- The level of seismic loading included in the static side load test was 10.0 g uniaxial (5.8 g triaxial equivalent), furnishing a margin of 1.3 g seismic excitation over the required 4.5 g triaxial.

4.5 Copies of the Certificates of Compliance for the ASCO solenoids and NAMCO limit switches are included in Attachment 5 of this report for reference.

4.6 Operability Results

4.6.1 Operability tests were performed before, during, and after each application of side load force to evaluate performance of the valve under similated seismic conditions, in accordance with the requirements of test procedure FTP-33, Rev. D (Attachment 11 to FQP-11AB).

4.6.2 Functional tests consisted of packing leakage tests, bi-directional seat leakage tests, stroking time tests, and verification of the safety-related function (fail-closed). Complete procedures followed during the operability tests are presented in Fisher Lab Problem 1662, Report 72 included as Attachment 4 of this report.

4.6.3 The side load applied at the center-of-gravity of the extended structure was the equivalent of a 10.0 g uniaxial load (2915 lbs) applied in the weakest direction. This load level corresponds to a 5.8 g triaxial load, which is more than 1.0 g above the required 4.5 g triaxial; therefore, the operability test qualifies the valve assembly for any orientation.

Average close-to-open stroking time was 3.2 seconds, and average open-to-close stroking time was 1.4 seconds. All closing times were under the required time of 5 seconds.

4.6.4 No packing leakage was noted during any of the functional testing. Packing leakage tests were run at 180 psig.

4.6.5 Seat Leakage was not detected in either flow direction during the functional tests. A 50 psig pressure drop was maintained during the seat leakage testing.

4.6.6 The test unit showed no structural damage after the tests and maintained the required "fail-safe" (fail-closed) position without deviation.

5.0 MAINTENANCE AND QUALIFIED LIFE

5.1 Qualified Life of these Vogtle project valves is limited by the elastomeric parts. To address this, Fisher has conducted an activation energy testing program as reported in Attachment A-7 of Report FQP-11A. That data covers common elastomeric materials, including those used for O-rings, T-ring seals, packing components, and gaskets for the valve-assemblies in this qualification group. These elastomeric parts, gaskets, and packing components are all identified as recommended spare parts on the valve-asssembly Bill-of-Material Drawings for the Group V Valves (48A8927 and 48A8928).

5.2 The lowest activation energy for any of the elastomeric materials was found to be 0.79 eV. Based on the results of a prior environmental test program, it is recommended that all elastomeric parts be replaced on a regular four-year cycle. This would ensure the valve a qualified life of at least 5 years at 126°F (see the calculation in Attachment A-8 of Report FQP-11A). This ensures a qualified life of 4 years normal service at 126°F plus a one year post-DBE life. The conditions are less severe than this for the Group V valve assemblies because the maximum Normal/Abnormal temperature is 104°F, and the maximum internal temperature is 65°F, providing substantial margin.

5.3 The normal-service qualified life for Fisher equipment can be renewed for another period by replacement of all elastomeric components listed in Paragraph 5.1 above, in accordance with the procedures provided in Fisher instruction manuals. Successive renewals of qualified life can be attained in increments up to the intended life of the plant or to 41 years, whichever is less.

5.3.1 Each time the valve-assembly is disassembled, new packing and gaskets should be used upon re-assembly.

5.3.2 Replacement of the elastomeric parts in the Bettis actuator should comply with the specified Bettis procedures and schedules furnished from Bettis.

5.4 Even though the specified orientation (shaft horizontal, pipeline horizontal) has been primarily considered in the qualification documentation provided in this report, there are no qualification restrictions for any orientation.

5.5 Additional calculations and further qualification rationale are provided in FQP-11A.

6.0 <u>STATEMENT OF QUALIFIED LIFE</u>

The qualification data presented herein for the Group V valves meet the requirements and intent of Bechtel Power Corp., Specification No. X5AC03, Rev. 9, including Appendices EA, Rev. 3, and QG, Rev. 0, as interpreted by Fisher Qualification Plan FQP-11AB.

John Dresser
John Dresser
Engineering Reviewer

Jon Whitesell
Jon Whitesell
Qualification Analyst

N28-11/ 10

ATTACHMENT 1

FQP-11AB-5

Resonant Frequency Test Report

Fisher Lab Problem 1667, Report 188A

Fisher Controls

FISHER

Laboratory Report

Project	78EC07
Problem	1667
Report	188 A
Page	1
Date	January 7, 1985

PRODUCTION
RESONANT FREQUENCY TEST
OF VOGTLE ITEM 165 - EXTENDED STRUCTURE

PROJECT NUMBER: 78EC07
PROJECT NAME: Vogtle
PROJECT ENGINEER: J. Dresser
TEST ENGINEER: J. Milliken
ITEM: 165 - Extended Structure
ORDER NUMBER: 022B-X5AC03-N2P
SERIAL NUMBER: 82-9022-1 (Actuator)
EM/FS NUMBER:
BILL OF MATERIALS DWG.: 48A8928 Rev. A
DIMENSIONED ASSEMBLY DWG.:

ACTUATOR TYPE: Bettis ACTUATOR SIZE: N521-SR80
ACTUATOR BRACKET: 48A0025

APPURTENANCES: Asco Solenoid, 67FR was removed to accomodate fixturing.

OTHER SPECIAL IDENTIFICATION:

PURPOSE: Model verification.

LOWEST CALCULATED RESONANT FREQUENCY OF TEST ITEM: 81.3 Hz/X-Axis

TEST PROCEDURE: Production testing per FTP-5

RESULTS: X-Axis - 81.5 Hz.
Y-Axis - 118.2 Hz.
Z-Axis - 82.5 Hz.

CONCLUSIONS AND RECOMMENDATIONS: The calculated lowest resonant frequency of 81.3 Hz (X-axis) is 0.3% lower than the measured resonant frequency of 81.5 Hz (X-axis). This is acceptable.

Jon Whitesell
Jon Whitesell
Qualification Analyst

Don Winnike
Don Winnike
Qualification Engineer

ATTACHMENT 2

FQP-11AB-5

ES 117 Analysis and Seismic Certification

a) Seismic Certification Letter for Group V Vogtle Valves dated February 6, 1984

b) Analysis Model Drawings for Group V Valves Extended Structure

c) Assembly Drawings 48A8927, Rev. A; 48A8928, Rev. A; 38A7939, Rev. A; and 38A7940, Rev. A

d) ES 117, Rev. F Computer Printouts for Group V Vogtle Valves dated February 6,1984

Fisher Controls International, Inc.
P.O. Box 11
Marshalltown, Iowa 50158
Phone 515/754-3011

FISHER

Fisher Controls

February 6, 1984

Seismic Certification for:
Representative Order: 22B-X5AC03-N1P, N2P
Customer Order: PAV-206, PAV-2-34
Georgia Power Company
Vogtle NuclearPlant - Units 1 & 2
Active Butterfly Valve Assemblies per FQP-11AB

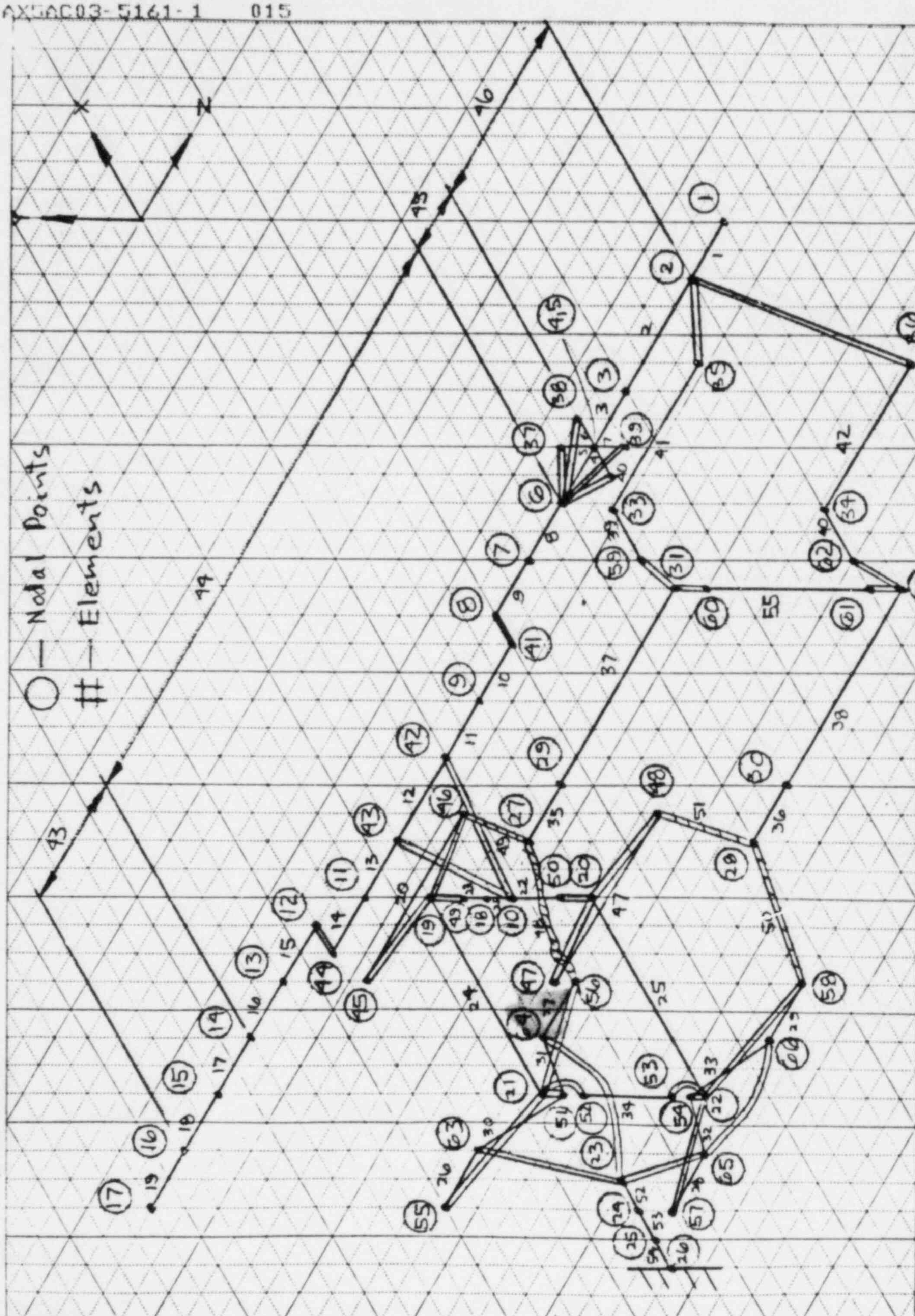
Item Number	Tag Number	Serial Number	Description
155	1-HV-12596	8342938	10" Type 9280 Valve Body
156	1-HV-12597	8342939	N521C-SR80-12 Bettis
165	2-HV-12596	8342940	Actuator
166	2-HV-12597	8342941	

Enclosed are the stresses and resonant frequency calculations for the above items. In accordance with Bechtel Specification X5AC03, Fisher Qualification Plan (FQP-11AB), and Paragraph VIII of Fisher Engineering Standard 117, the items are considered capable of maintaining their structural integrity when submitted to a triaxial load of 10.0 g's. Acceptable stress limits for materials are based on allowable stresses found in ASME Boiler and Pressure Vessel Code, Section III, for Code Class 3, per the Winter 75 Addenda. Active valve acceptance criteria are used as listed in Section VIII.A of ES-117.

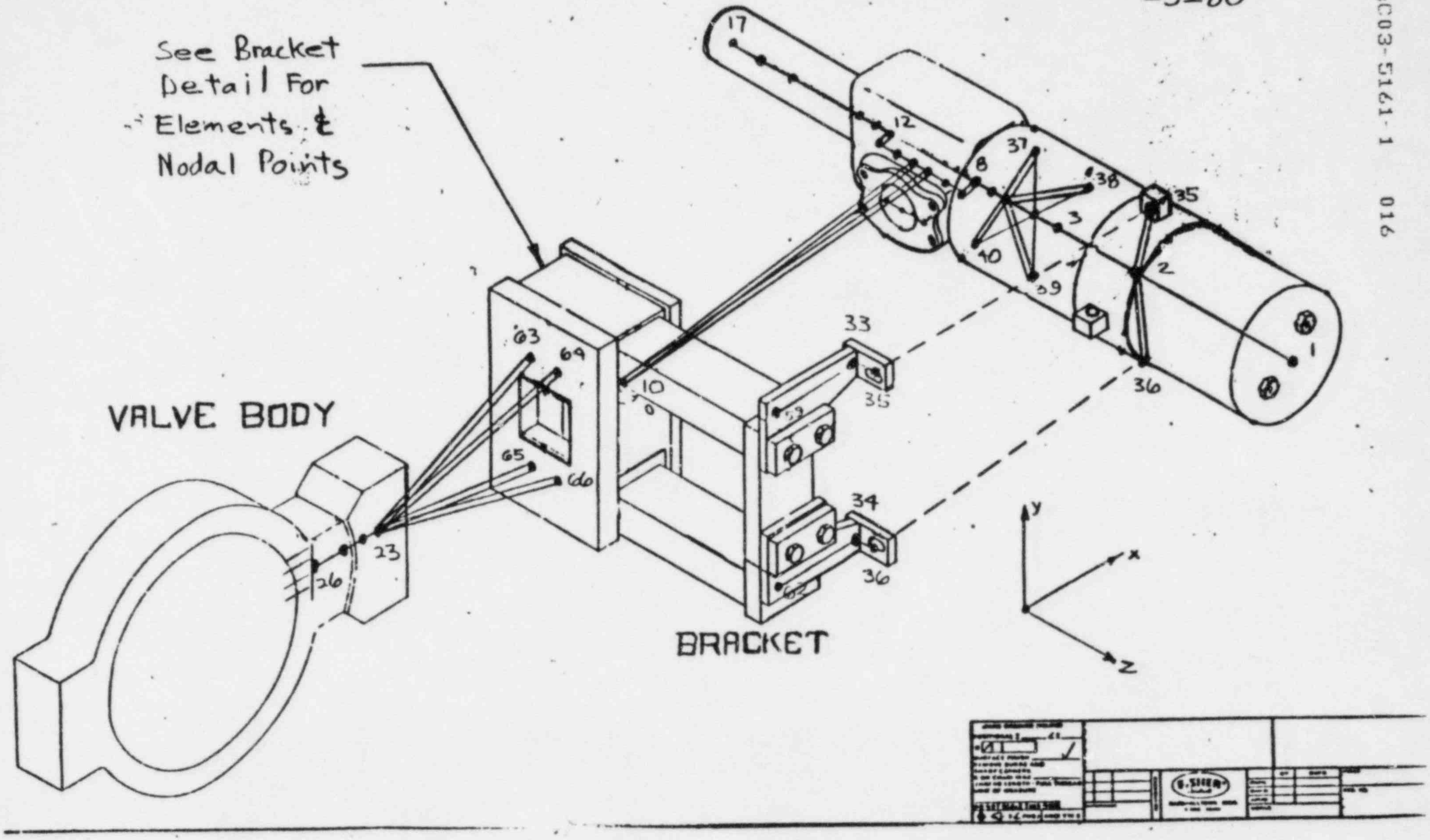
The second analysis is for correlation of tested resonant frequency. This analysis and test is for the extended structure only (actuator and mounting bracket). The same model is used as the first analysis with the exception that the bracket is now grounded (joint #23) instead of the body being grounded (joint #26). The resonant frequencies are well above the acceptable limit (33 Hz), and verified by test (see Attachment 1 of this report).

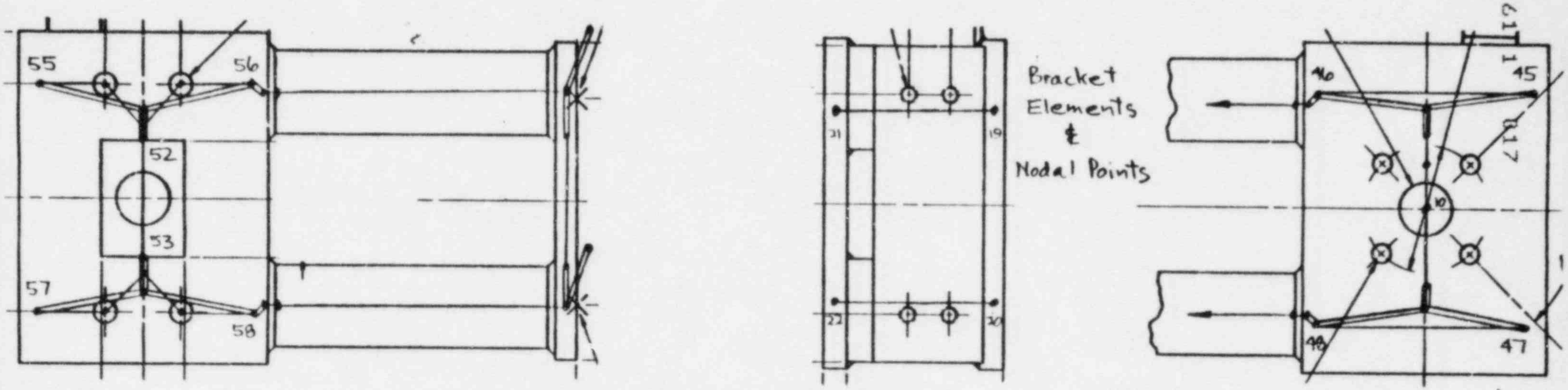
Jon Whitesell
Qualification Analyst

Don Winnike
Qualification Engineer


○ — Nodal Points
— Elements
X
Z

BETTIS N521C-SR80-12
-9280




Bracket Elements
&
Nodal Points
55
56
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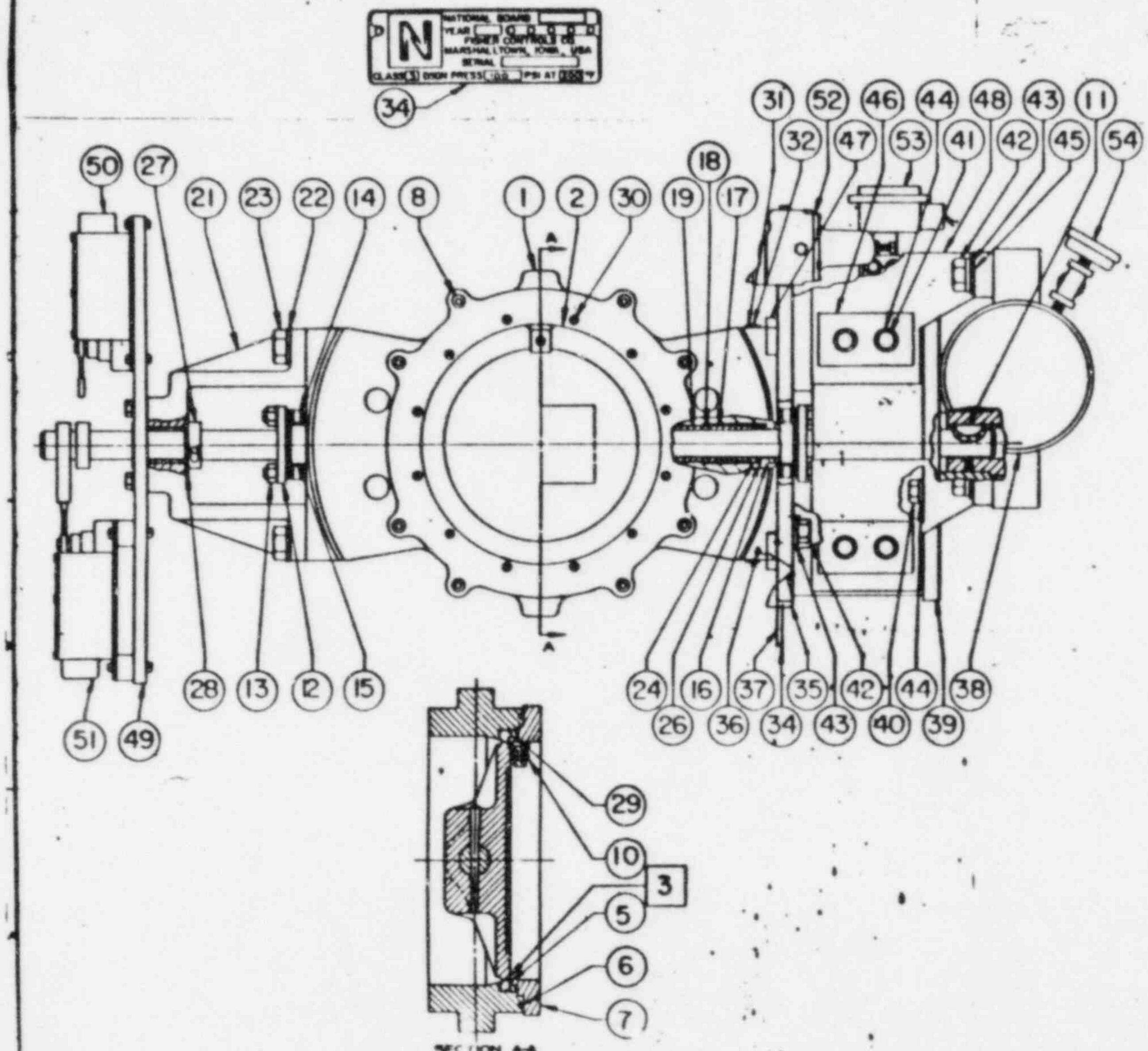


48A8927

FIND NO.	NO. REQD.	PART NUMBER	DESCRIPTION	MATERIAL SPECS
B 1	1	[illegible]	VALVE BODY	STEEL ASME SA-515-70
2	1	[illegible]	DISC & SHAFT ASSEMBLY	
F 3*	2	[illegible]	TAPER PIN	S17400 ASME SA-564, H1075 33-39RC
F 4	1	[illegible]	SHAFT	S17400 ASME SA-564, H1075 33-39RC
8	1	[illegible]	VALVE DISC	316 SST ASME SA-351-CF8M
[illegible]	1	[illegible]	SILICONE LUBRICANT	DOW CORNING COMPOUND 111
5*	1	[illegible]	T-RING	EPDM 70 DURO (CMS 06AC)
6*	1	[illegible]	O-RING	ETHYLENE/PROPYLENE
B 7	1	[illegible]	RETAINING RING ASSEMBLY	
	1	[illegible]	DISC STOP	S31600 ASME SA-479, FMS 20B20 BHN 149-195
	1	[illegible]	RETAINING RING	STEEL ASME SA-515-70
9	8	[illegible]	CAP SCREW	18-8 SST
10	1	[illegible]	SET SCREW	18-8 SST
F11*	1	[illegible]	WOODRUFF KEY	STEEL ALLOY [illegible]
12	2	[illegible]	PACKING FLANGE	STEEL, NON-WELD, FMS 20B13/ZN PL
13	4	[illegible]	HEX NUT	STEEL ASME SA-194-2H/ZN PL
14	4	[illegible]	STUD	STEEL ALLOY ASME SA-193-B7/ZN PL
15	2	[illegible]	PACKING FOLLOWER	S31600 ASME SA-479, FMS 20B20 BHN 149-195
16*	6	[illegible]	PACKING RING	GRAPHITE MOLDED RIBBON LOW CHLORIDE FMS 17B50
17	2	[illegible]	PACKING BOX RING	S31600 ASME SA-479, FMS 20B20 BHN 149-195
18	2	[illegible]	BUSHING RETAINER	18-8 SST FMS 20B16
19	3	[illegible]	BUSHING	BRONZE-GRAPHITE
21	1	[illegible]	BEARING BRACKET	STEEL ASME SA-216-WCB
22	4	[illegible]	LOCKWASHER	CARBON STEEL-PLATED
23	4	[illegible]	CAP SCREW	STEEL SAE GR 5/ZN PL
24*	4	[illegible]	PACKING RING	GRAPHITE FILAMENT YARN-FMS 17B26-17B16-LOW CHLORIDE
26*	8	[illegible]	PACKING WASHER	ZINC ASTM B69 TYPE 1
27	2	[illegible]	COLLAR	CARBON STEEL-PLATED
28	2	[illegible]	THRUST BUSHING	BRASS
29	1	[illegible]	COMPRESSION RING	STEEL/NON-WELD/FMS 20B13
30	12	[illegible]	SET SCREW	18-8 SST
31	2	[illegible]	FLOW ARROW	18-8 SST
32	4	[illegible]	DRIVE SCREW	18-8 SST
34	1	[illegible]	NUCLEAR NAMEPLATE	18-8 SST
35	1	[illegible]	CABLE ASSEMBLY	18-8 SST
36	1	[illegible]	DRIVE SCREW	18-8 SST
37	1	[illegible]	NAMEPLATE	18-8 SST
38	1	[illegible]	BETTIS ACTUATOR NS21C-SR80-12	ASSEMBLY
39	1	[illegible]	ACTUATOR BRACKET	STEEL/WELDABLE/FMS 20B14
40	4	[illegible]	CAP SCREW	STEEL SAE GR5/ZN PL
41	4	[illegible]	CAP SCREW	STEEL SAE GR5/ZN PL
42	6	[illegible]	CAP SCREW	STEEL SAE GR5/ZN PL
43	6	[illegible]	LOCK WASHER	CARBON STEEL-PLATED
44	8	[illegible]	LOCK WASHER	CARBON STEEL-PLATED
45	2	[illegible]	WASHER	CARBON STEEL
46	2	[illegible]	MOUNTING BLOCK	STEEL/NON-WELD/FMS 20B13
47	6	[illegible]	ANTI-ROTATION BLOCK	STEEL/WELDABLE/FMS 20B14
48	2	[illegible]	SUPPORT BRACKET	STEEL/WELDABLE/FMS 20B14
49	1	[illegible]	MOUNTING PLATE	STEEL/WELDABLE/FMS 20B14
50	1	[illegible]	NAMCO LIMIT SWITCH, EA180-31302	ASSEMBLY
51	1	[illegible]	NAMCO LIMIT SWITCH, EA180-32302	ASSEMBLY
52	1	TYPE 67AFR	FILTER REGULATOR	ASSEMBLY
53	1	[illegible]	ASCO SOLENOID [illegible]	ASSEMBLY
54	1	[illegible]	GAUGE	ASSEMBLY

* - RECOMMENDED SPARE PART
⊕ - APPLY LUBRICANT PER INSTRUCTION MANUAL
B - PRESSURE RETAINING PART
F - ESSENTIAL TO FUNCTION PART
· - COMMERCIAL QUALITY PART

NOTES

NOTE: THIS DRAWING IS FOR USE IN PART IDENTIFICATION ONLY.

CERTIFIED CORRECT | DATE 11-8-82 BY [signature]

VALVE PRESS/TEMP RATING ANSI B16.34-1977 CLASS 150

CUST: GEORGIA POWER COMPANY
PO NO PAV-206 VOGTLE UNIT 1
ORDER NO 228-K5AC03-NIP
TAG NO 1HV-12556, 1HV-12557
SOLENOID TAG NO. 1HY-12556, 1HY-12557
SERIAL NO 8342558-559

10" BODY
NS21C-SR80-12-S280
BETTIS ACTUATED
CONTROL VALVE

10-26-82 A FIRST DRAWN | DATE | REVISIONS

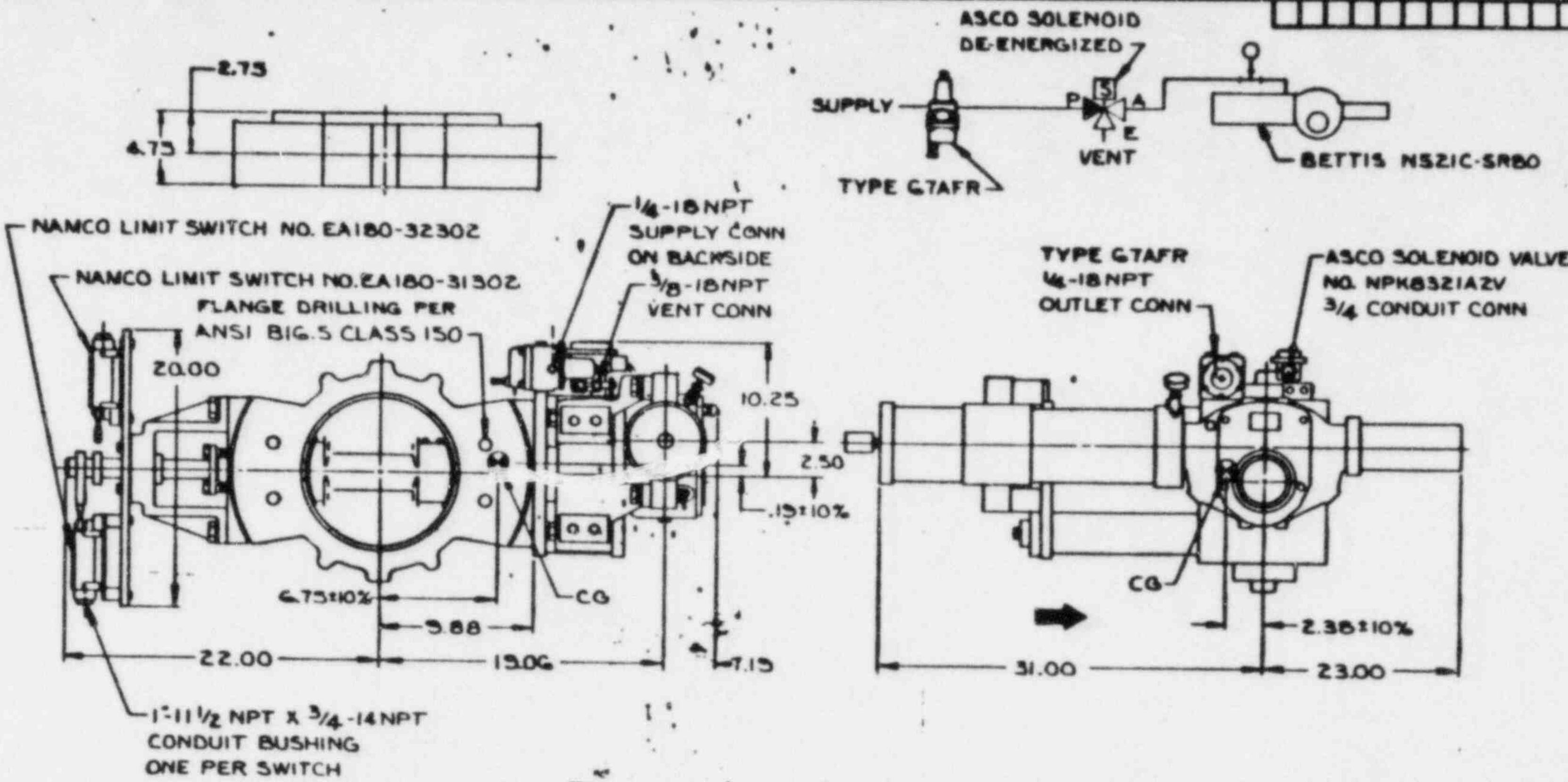
FISHER CONTROLS, MARSHALLTOWN, IOWA

SCALE NONE

ITEM 155, 156

48A8927 A

38A7939



ORIENTATION AND ACCESSORY MOUNTING VIEWS

ACCESSORIES WILL BE PIPED PER THE ABOVE INSTALLATION SCHEMATIC

DISC CHORDAL SWING Ø AT THE VALVE FACE IS 9.50

TOTAL VALVE WEIGHT: 515 LBS ±10%

UNLESS OTHERWISE SPECIFIED:
UNIT OF MEASURE: INCHES
ENVELOPE DIMENSIONS ARE ± .25

DIMENSIONS CERTIFIED CORRECT BY [signature] DATE 11-5-82	
VALVE PRESS./TEMP RATING: ANSI B16.34-1977 CLASS 150	
CUST: GEORGIA POWER COMPANY P.O. NO.: PAV-206 VOGTLE UNIT 1 ORDER NO.: 22B-X5AC03-N1P TAG NO: 1HV-12596, 1HV-12597 SOLENOID TAG NO.: 1HY-12596, 1HY-12597 SERIAL NO.: 8342938-939	10" BODY NS21C-SR80-12-9280 BETTIS ACTUATED CONTROL VALVE CW TO CLOSE VALVE SHAFT ROTATION

REVISIONS: DATE 10-26-82 A FIRST DRAWN

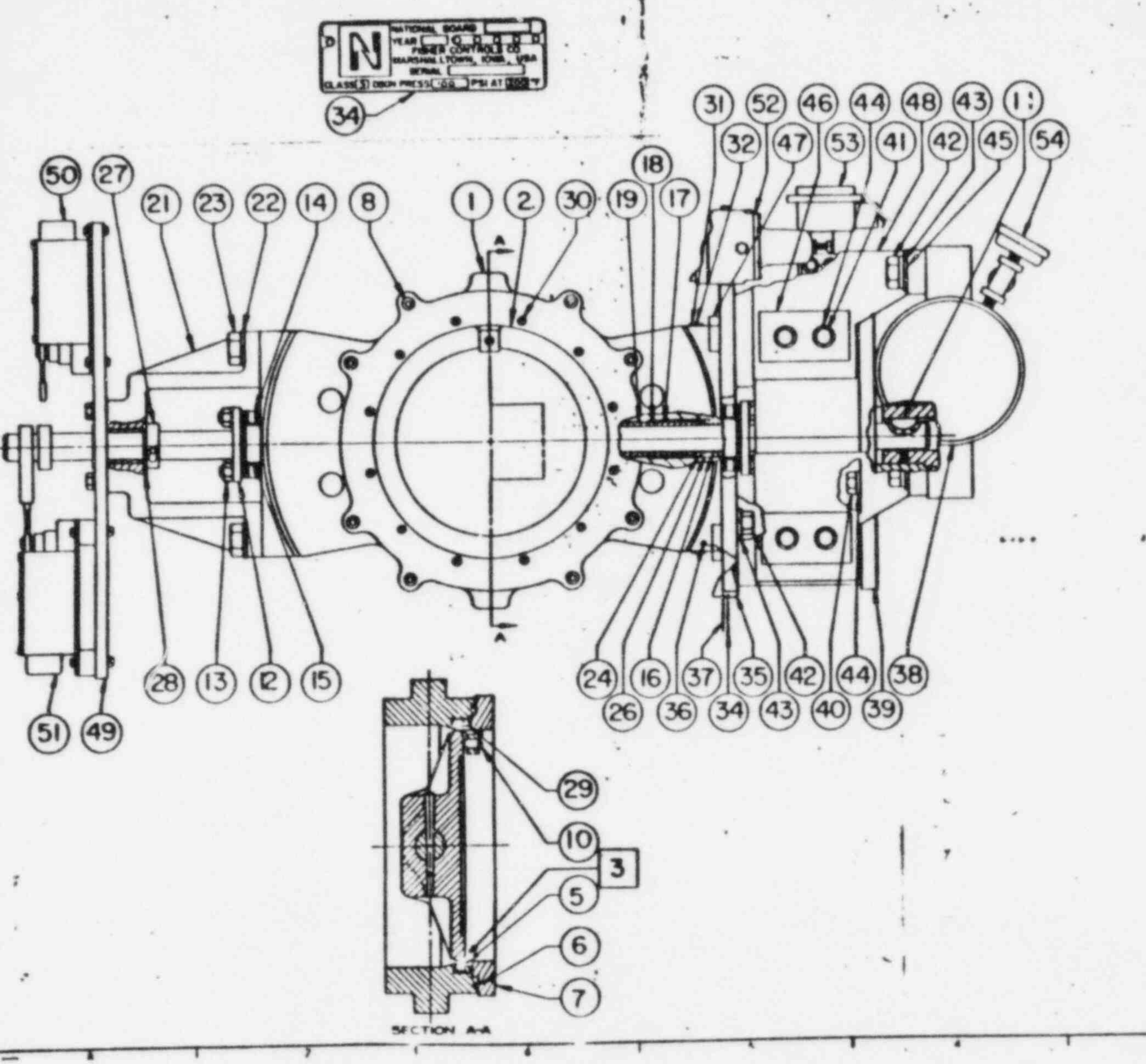
FISHER Controls, MARSHALLTOWN, IOWA

DRWN MHS 10-26-82; CHKD KAL 11-5-82; APVD CTC 11-11-82

ITEM 155, 156

DWG NO. 38A7939 REV A

48A8928



FIND NO	NO. REQD	PART NUMBER	DESCRIPTION	MATERIAL SPECS
1	1	[illegible]	VALVE BODY	STEEL ASME SA-515-70
2	1	[illegible]	DISC & SHAFT ASSEMBLY	
3	2	[illegible]	TAPER PIN	S17400 ASME SA-564, H1075 31-39RC
4	1	[illegible]	SHAFT	S17400 ASME SA-564, H1075 31-39RC
5	1	[illegible]	VALVE DISC	316 SST ASME SA-351-CF8M
[illegible]	1	[illegible]	SILICONE LUBRICANT	DOW CORNING COMPOUND 111
[illegible]	1	[illegible]	T-RING	EPDM 70 DURO (CPS 06AC)
[illegible]	1	[illegible]	O-RING	ETHYLENE/PROPYLENE
7	1	[illegible]	RETAINING RING ASSEMBLY	
	1	[illegible]	DISC STOP	S31600 ASME SA-479, FMS 20B20 BHN 165-195
	1	[illegible]	RETAINING RING	STEEL ASME SA-515-70
9	8	[illegible]	CAP SCREW	18-8 SST
10	1	[illegible]	SET SCREW	18-8 SST
11	1	[illegible]	WOODRUFF KEY	STEEL ALLOY ASTM [illegible]
12	2	[illegible]	PACKING FLANGE	STEEL, NON-WELD, FMS 20B13/20 PL
13	4	[illegible]	HEX NUT	STEEL ASME SA-194-2H/20 PL
14	4	[illegible]	STUD	STEEL ALLOY ASME SA-193-B7/20 PL
15	2	[illegible]	PACKING FOLLOWER	S31600 ASME SA-479, FMS 20B20 BHN 165-195
16	6	[illegible]	PACKING RING	GRAPHITE HOLDED RIBBON LOW CHLORIDE FMS 17B36
17	2	[illegible]	PACKING BOX RING	S31600 ASME SA-479, FMS 20B20 BHN 165-195
18	2	[illegible]	BUSHING RETAINER	18-8 SST FMS 20B15
19	3	[illegible]	BUSHING	[illegible]-GRAPHITE
21	1	[illegible]	BEARING BRACKET	STEEL ASME SA-216-WCB
22	4	[illegible]	LOCKWASHER	CARBON STEEL-PLATED
23	4	[illegible]	CAP SCREW	STEEL SAE GR 5/20 PL
24	4	[illegible]	PACKING RING	GRAPHITE FILAMENT YARN-FMS 17B[illegible] 17B16-LOW CHLORIDE
26	8	[illegible]	PACKING WASHER	ZINC ASTM B69 TYPE 1
27	2	[illegible]	COLLAR	CARBON STEEL-PLATED
28	2	[illegible]	THRUST BUSHING	BRASS
29	1	[illegible]	COMPRESSION RING	STEEL/NON-WELD/FMS 20B13
30	12	[illegible]	SET SCREW	18-8 SST
31	2	[illegible]	FLOW ARROW	18-8 SST
32	4	[illegible]	DRIVE SCREW	18-8 SST
34	1	[illegible]	NUCLEAR NAMEPLATE	18-8 SST
35	1	[illegible]	CABLE ASSEMBLY	18-8 SST
36	3	[illegible]	DRIVE SCREW	18-8 SST
37	1	[illegible]	NAMEPLATE	18-8 SST
38	1	[illegible]	BETTIS ACTUATOR NS21C-SR80-12	ASSEMBLY
39	1	[illegible]	ACTUATOR BRACKET	STEEL/WELDABLE/FMS 20B34
40	4	[illegible]	CAP SCREW	STEEL SAE GR5/20 PL
41	4	[illegible]	CAP SCREW	STEEL SAE GR5/20 PL
42	6	[illegible]	CAP SCREW	STEEL SAE GR5/20 PL
43	6	[illegible]	LOCK WASHER	CARBON STEEL-PLATED
44	8	[illegible]	LOCK WASHER	CARBON STEEL-PLATED
45	2	[illegible]	WASHER	CARBON STEEL
46	2	[illegible]	MOUNTING BLOCK	STEEL/NON-WELD/FMS 20B13
47	8	[illegible]	ANTI-ROTATION BLOCK	STEEL/WELDABLE/FMS 20B34
48	2	[illegible]	SUPPORT BRACKET	STEEL/WELDABLE/FMS 20B34
49	1	[illegible]	MOUNTING PLATE	STEEL/WELDABLE/FMS 20B34
50	1	[illegible]	NAMCO LIMIT SWITCH, EA180-31302	ASSEMBLY
51	1	[illegible]	NAMCO LIMIT SWITCH, EA180-32302	ASSEMBLY
52	1	TYPE 67AFR	FILTER REGULATOR	ASSEMBLY
53	1	[illegible]	ASCO SOLENOID NO. [illegible]	ASSEMBLY
54	1	[illegible]	GAUGE	ASSEMBLY

* - RECOMMENDED SPARE PART
@ - APPLY LUBRICANT PER INSTRUCTION MANUAL
B - PRESSURE RETAINING PART
F - ESSENTIAL TO FUNCTION PART
- COMMERCIAL QUALITY PART

NOTE: THIS DRAWING IS FOR USE IN PART IDENTIFICATION ONLY.

CERTIFIED CORRECT | DATE 11-8-88 BY [signature]

VALVE PRESS/TEMP RATING ANSI B16.34-1977 CLASS 150

CUST: GEORGIA POWER COMPANY
PO NO PAVE-34 VOGTLE UNIT 2
ORDER NO 22B-X5AC03-N2P
TAG NO 2HV-12556, 2HV-12557
SOLENOID TAG NO. 2HY-12556, 2HY-12557
SERIAL NO 8342540-8541

10" BODY
NS21C-SR80-12-S2R0
BETTIS ACTUATED
CONTROL VALVE

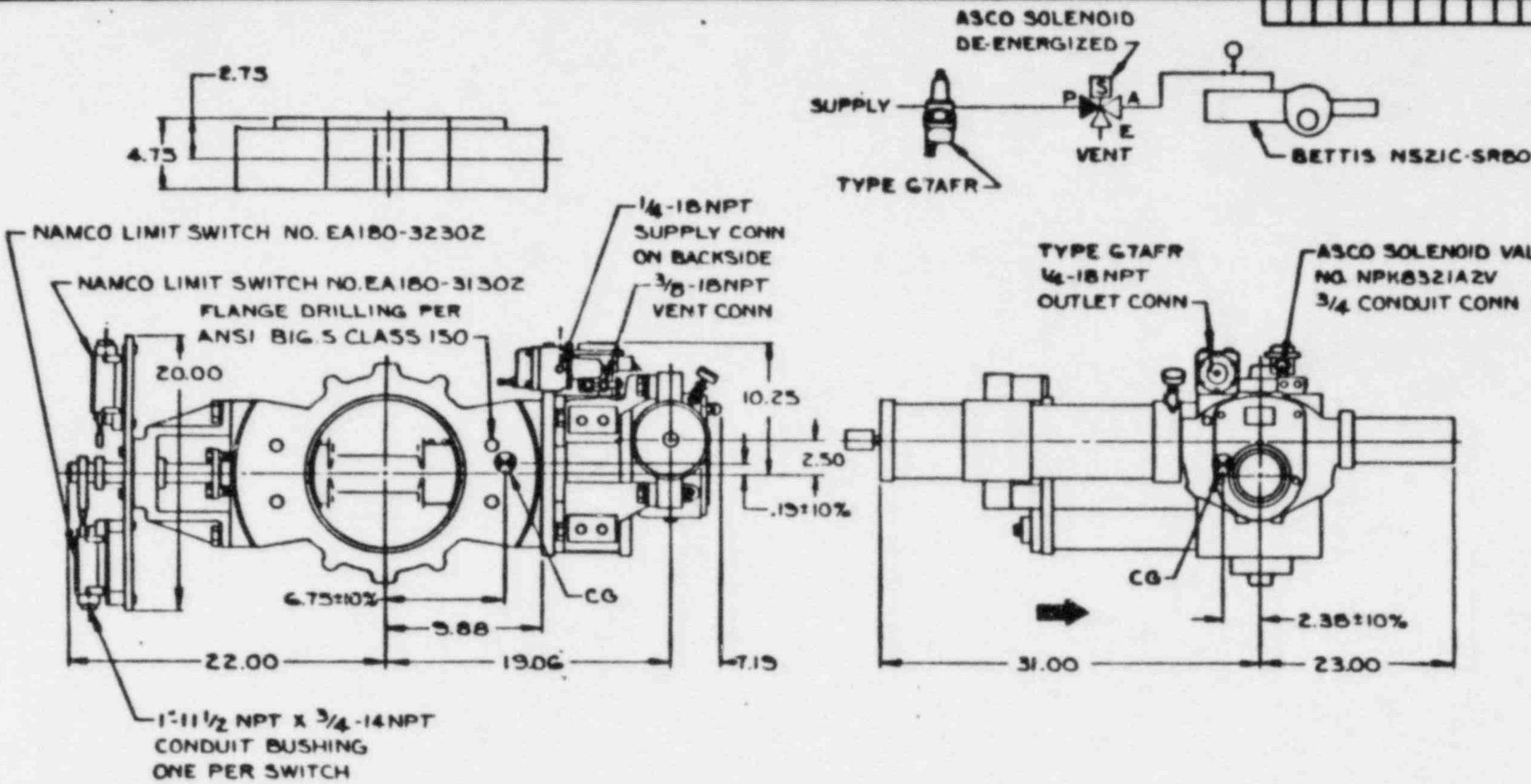
10-26-88 | A | FIRST DRAWN — DATE — REVISIONS

FISHER — MARSHALLTOWN, IOWA

SCALE: NONE

ITEM 165, 166

48A8928 A



ORIENTATION AND ACCESSORY MOUNTING VIEWS

ACCESSORIES WILL BE PIPED PER THE ABOVE INSTALLATION SCHEMATIC

DISC CHORDAL SWING Ø AT THE VALVE FACE IS 9.50

TOTAL VALVE WEIGHT: 515 LBS±10%

UNLESS OTHERWISE SPECIFIED
UNIT OF MEASURE INCHES
ENVELOPE DIMENSIONS ARE ± .25

DATE	REVISIONS
10-26-82	A FIRST DRAWN

DIMENSIONS CERTIFIED CORRECT BY [signature] DATE 11-5-82

VALVE PRESS/TEMP RATING ANSI B16.34-1977 CLASS 150

CUST. GEORGIA POWER COMPANY
P.O. NO. PAV2-34 VOGTLE UNIT 2
ORDER NO. 22B-X5AC03-N2P
TAG NO. 2HV-12596, 2HV-12597
SOLENOID TAG NO. 2HY-12596, 2HY-12597
SERIAL NO. 8342940-941

10" BODY
NS21C-SR80-12-9280
BETTIS ACTUATED
CONTROL VALVE
CW TO CLOSE VALVE SHAFT ROTATION

FISHER Controls

DWN MAS 10-26-82; CHKD KAL 11-5-82; APVD CTB 11-11-82

ITEM 165-166

DWG NO 38A7940 REV A

FISHER CONTROLS COMPANY

SEISMIC-4

SEISMIC ANALYSIS

OF

CONTROL VALVE ASSEMBLIES

(REV F)

** FISHER CONTROLS COMPANY **

GEORGIA POWER COMPANY
ASSEMBLY 48A8927, 48A8928
ORIENTATION 38A7939, 38A7940

REP ORDER 22B-X5AC03-N1P,N2P CODE CLASS 3
CUSTOMER ORDER PAV-206,PAV-2-34

SERIAL NO.	TAG NO.	ITEM NO.
8342938	1HV-12596	155
8342939	1HV-12597	156
8342940	2HV-12596	165
8342941	2HV-12597	166

** VALVE DESCRIPTION **

10 INCH N521-SR80-12-9280 CODE CLASS 3
BRACKET 48A0025 BETTIS SPRING RETURN PISTON ACTUATOR
ACCESSORIES : EA180 NAMCO LIMIT SWITCHES (2)
67FR PRESSURE REGULATOR
NPK8321A2V ASCO SOLENOID VALVE
1000 S ASHCROFT GAUGE

DESIGN CONDITIONS : 100 PSIG AT 200 DEG F
ACTUATOR TORQUE : 1471.0 IN-LB
REQUIRED FREQUENCY : 33 HERTZ 10.0 TRIAXIAL G LOADING

DATE OF THIS REPORT / FEBRUARY 6, 1984

C O N T R O L I N P U T D A T A

MANUAL INPUT GENERATION FOR VALVE ANALYSIS

SEISMIC STRESSES ARE SUPERIMPOSED BY SQUARE ROOT OF SUM OF SQUARES

STRESS ALLOWABLES ARE COMPARED TO MAXIMUM PRINCIPAL STRESS

MASS, STIFFNESS, LOAD AND STRESS MATRICES ARE NOT PRINTED

STATIC SEISMIC ANALYSIS TO BE PERFORMED

OPERATIONAL LOAD ANALYSIS TO BE PERFORMED

DYNAMIC MODAL ANALYSIS TO BE PERFORMED WITH EVALUATION

C R O S S - S E C T I O N D A T A

EL. NO.	CROSS-SECTION DESCRIPTION	PARAMETERS		
1	TUBE	A = 5.375 ,	T = .1650 ,	
2	TUBE	A = 5.375 ,	T = .1650 ,	
3	TUBE	A = 5.938 ,	T = .3600 ,	
4	TEE-SHAPED	A = 3.600 ,	T = .3000 ,	B = .9400 ,
		T1= .8750 ,	R1= .1250 ,	

5	TEE-SHAPED	A =	3.600 ,	T =	.3000 ,	B =	.9400 ,
		T1=	.8750 ,	R1=	.1250 ,		
6	TEE-SHAPED	A =	3.600 ,	T =	.3000 ,	B =	.9400 ,
		T1=	.8750 ,	R1=	.1250 ,		
7	TEE-SHAPED	A =	3.600 ,	T =	.3000 ,	B =	.9400 ,
		T1=	.2500 ,	R1=	.1250 ,		
8	RECTANG.BOX	A =	3.000 ,	T =	.5900 ,	B =	3.000 ,
		T1=	.5900 ,	R1=	.0 ,		
9	RECTANG.BOX	A =	4.000 ,	T =	.3750 ,	B =	5.500 ,
		T1=	.3750 ,	R1=	.0 ,		
10	RECTANG.BOX	A =	3.000 ,	T =	.5900 ,	B =	3.000 ,
		T1=	.5900 ,	R1=	.0 ,		
11	RECTANG.BOX	A =	8.000 ,	T =	.3750 ,	B =	4.500 ,
		T1=	.3750 ,	R1=	.0 ,		
12	RECTANG.BOX	A =	8.000 ,	T =	.3750 ,	B =	4.500 ,
		T1=	.3750 ,	R1=	.0 ,		
13	RECTANG.BOX	A =	8.000 ,	T =	.3750 ,	B =	4.500 ,
		T1=	.3750 ,	R1=	.0 ,		
14	RECTANG.BOX	A =	7.500 ,	T =	.3750 ,	B =	4.500 ,
		T1=	.3750 ,	R1=	.0 ,		
15	RECTANG.BOX	A =	4.000 ,	T =	.3750 ,	B =	5.500 ,
		T1=	.3750 ,	R1=	.0 ,		
16	RECTANG.BOX	A =	3.000 ,	T =	.5900 ,	B =	3.000 ,
		T1=	.5900 ,	R1=	.0 ,		
17	SOLID CIRCLE	A =	1.500 ,				
18	SOLID CIRCLE	A =	1.125 ,				
19	SOLID CIRCLE	A =	1.125 ,				
20	RECTANGULAR	A =	3.500 ,	T =	.8750 ,		
21	RECTANGULAR	A =	9.000 ,	T =	.8750 ,		
22	RECTANGULAR	A =	9.000 ,	T =	.8750 ,		
23	RECTANGULAR	A =	9.000 ,	T =	.8750 ,		
24	CHANNEL	A =	8.000 ,	T =	.4870 ,	B =	2.527 ,
		T1=	.3900 ,	R1=	.0 ,		
25	CHANNEL	A =	8.000 ,	T =	.4870 ,	B =	2.527 ,
		T1=	.3900 ,	R1=	.0 ,		
26	RECTANGULAR	A =	.8750 ,	T =	.9800 ,		
27	RECTANGULAR	A =	.8750 ,	T =	.9800 ,		
28	RECTANGULAR	A =	.8750 ,	T =	.9800 ,		
29	RECTANGULAR	A =	.8750 ,	T =	.9800 ,		
30	RECTANGULAR	A =	.8750 ,	T =	.9800 ,		
31	RECTANGULAR	A =	.8750 ,	T =	.9800 ,		
32	RECTANGULAR	A =	.8750 ,	T =	.9800 ,		
33	RECTANGULAR	A =	.8750 ,	T =	.9800 ,		
34	RECTANGULAR	A =	.8750 ,	T =	.9800 ,		
35	RECTANGULAR	A =	3.750 ,	T =	4.625 ,		
36	RECTANGULAR	A =	3.750 ,	T =	4.625 ,		
37	RECTANG.BOX	A =	3.000 ,	T =	.2500 ,	B =	3.000 ,
		T1=	.2500 ,	R1=	.1250 ,		
38	RECTANG.BOX	A =	3.000 ,	T =	.2500 ,	B =	3.000 ,
		T1=	.2500 ,	R1=	.1250 ,		
39	RECTANGULAR	A =	3.875 ,	T =	.7500 ,		
40	RECTANGULAR	A =	3.875 ,	T =	.7500 ,		
41	RECTANGULAR	A =	1.750 ,	T =	.7500 ,		
42	RECTANGULAR	A =	1.750 ,	T =	.7500 ,		
43	SOLID CIRCLE	A =	2.000 ,				
44	SOLID CIRCLE	A =	1.500 ,				
45	SOLID CIRCLE	A =	1.500 ,				
46	SOLID CIRCLE	A =	.7500 ,				
47	RECTANGULAR	A =	3.500 ,	T =	.8750 ,		
48	SOLID CIRCLE	A =	2.000 ,				
49	SOLID CIRCLE	A =	2.000 ,				
50	SOLID CIRCLE	A =	2.000 ,				
51	SOLID CIRCLE	A =	2.000 ,				
52	RECTANGULAR	A =	9.750 ,	T =	4.000 ,		
53	RECTANGULAR	A =	9.750 ,	T =	4.000 ,		
54	RECTANGULAR	A =	9.750 ,	T =	4.000 ,		

J O I N T   C O O R D I N A T E   D A T A

JOINT NO.	X	Y	Z
1	3.250000	2.500000	26.690002
2	3.250000	2.500000	20.690002
3	3.250000	2.500000	7.500000
4	3.250000	2.500000	6.500000
5	3.250000	2.500000	6.500000
6	3.250000	2.500000	5.560000
7	3.250000	2.500000	4.600000
8	3.250000	2.500000	3.000000
9	2.250000	2.500000	1.750000
10	-0.438000	0.0	0.0
11	2.250000	2.500000	-1.750000
12	3.250000	2.500000	-3.000000
13	3.250000	2.500000	-4.600000
14	3.250000	2.500000	-5.560000
15	3.250000	2.500000	-13.750000
16	3.250000	2.500000	-15.600000
17	3.250000	2.500000	-25.059000
18	-0.438000	0.875000	0.0
19	-0.438000	3.070000	0.0
20	-0.438000	-3.070000	0.0
21	5.938000	3.070000	0.0
22	-5.938000	-3.070000	0.0
23	-6.375000	0.0	0.0
24	-6.625000	0.0	0.0
25	-6.875000	0.0	0.0
26	-10.375000	0.0	0.0
27	-2.813000	3.875000	4.000000
28	-2.813000	-3.875000	4.000000
29	-2.813000	3.875000	4.500000
30	-2.813000	-3.875000	4.500000
31	-2.813000	3.875000	15.375000
32	-2.813000	-3.875000	15.375000
33	2.312000	5.625000	16.125000
34	2.312000	-2.250000	16.125000
35	2.312000	5.625000	20.690002
36	2.312000	-2.250000	20.690002
37	4.841000	4.091000	6.500000
38	4.841000	0.909000	6.500000
39	1.659000	0.909000	6.500000
40	1.659000	4.091000	6.500000
41	2.250000	2.500000	4.500000
42	2.250000	2.500000	1.593000
43	2.250000	2.500000	-1.593000
44	2.250000	2.500000	-4.500000
45	-0.438000	4.250000	-3.610000
46	-0.438000	4.250000	3.610000
47	-0.438000	-4.250000	-3.610000
48	-0.438000	-4.250000	3.610000

49	-0.438000	1.750000	0.0
50	-0.438000	-1.750000	0.0
51	-5.938000	2.987000	0.0
52	-5.938000	2.500000	0.0
53	-5.938000	-2.500000	0.0
54	-5.938000	-2.987000	0.0
55	-5.938000	4.125000	-3.610000
56	-5.938000	4.125000	3.610000
57	-5.938000	-4.125000	-3.610000
58	-5.938000	-4.125000	3.610000
59	-2.813000	5.625000	16.125000
60	-2.813000	2.375000	15.375000
61	-2.813000	-2.375000	15.375000
62	-2.813000	-2.250000	16.125000
63	-5.938000	4.125000	-1.375000
64	-5.938000	4.125000	1.375000
65	-5.938000	-4.125000	-1.375000
66	-5.938000	-4.125000	1.375000

BOUNDARY, SPRING & BOLT JOINT DATA

JOINT NO.	TYPE-MAT /FIXITY	PLANE-DIRECTION OR DESCRIPTION		SPRING & BOLT JOINT PARAMETERS
26	111111	BODY		
10	CIRC 4	A	-X +Y	N.T= 4.13 ,D/A= 0.5000, D= 4.5000
				YSH= 0.0 ,ZSH= 0.0 ,STD= 1.0000
				FG= 0.
23	PAD 4	B	+X -Y	N.T= 2.10 ,D/A= 0.7500, YE= 0.7500
				YO= 2.7500,YSH= 0.0 , S= 8.2500
				ZT= 0.7500, ZB= 0.0 ,ZSH= 0.0

CONCENTRATED MASS DATA

JOINT NO.	LUMPED MASS	FOR DIR.	SHIFT DISTANCE OR MOMENT OF INERTIA X	Y	Z
1	0.168219	XYZ	0.0	0.0	-12.500000
6	0.006470	XYZ	0.0	0.0	0.0
8	0.006470	XYZ	0.0	0.0	0.0
12	0.010352	XYZ	0.0	0.0	0.0

CONCENTRATED LOAD DATA

JOINT NO.	FORCES X	FORCES Y	FORCES Z	MOMENTS X	MOMENTS Y	MOMENTS Z
10	0.0	0.0	0.0	1471.0	0.0	0.0

E L E M E N T   I N P U T   D A T A

EL. NO.	JOINTS		LENGTH /RADIUS	ANGLE	AREA	MOMENTS OF INERTIA I-11	I-22	I-33	MATERIAL DESCRIPTION
1	1	2	6.000		2.7007	9.1726	18.3453	9.1726	STEEL
2	2	3	13.190		2.7007	9.1726	18.3453	9.1726	STEEL
3	3	4	1.000		6.3086	24.6379	49.2758	24.6379	DUCTILE IRON
4	40	4	2.250		1.6400	1.2021	0.1517	0.1087	DUCTILE IRON
5	37	4	2.250		1.6400	1.2021	0.1517	0.1087	DUCTILE IRON
6	38	4	2.250		1.6400	1.2021	0.1517	0.1087	DUCTILE IRON
7	39	4	2.250		1.2400	1.1672	0.0383	0.0443	DUCTILE IRON
8	6	7	0.960		5.6876	5.8357	8.3225	5.8357	DUCTILE IRON
9	7	8	1.600		6.5625	15.7451	29.5944	26.4326	DUCTILE IRON
10	9	41	2.750		5.6876	5.8357	8.3225	5.8357	DUCTILE IRON
11	9	42	0.157		8.8125	72.9131	63.1571	28.8896	DUCTILE IRON
12	42	43	3.186		8.8125	72.9131	63.1571	28.8896	DUCTILE IRON
13	43	11	0.157		8.8125	72.9131	63.1571	28.8896	DUCTILE IRON
14	11	44	2.750		8.4375	62.0947	57.5977	27.2900	DUCTILE IRON
15	12	13	1.600		6.5625	15.7451	29.5944	26.4326	DUCTILE IRON
16	13	14	0.960		5.6876	5.8357	8.3225	5.8357	DUCTILE IRON
17	14	15	8.190		1.7671	0.2485	0.4970	0.2485	STEEL
18	15	16	1.850		0.9940	0.0786	0.1573	0.0786	STEEL
19	16	17	9.459		0.9940	0.0786	0.1573	0.0786	STEEL
20	45	46	7.220		3.0625	0.1954	0.6585	3.1263	STEEL
21	10	18	0.875		7.8750	0.5024	1.8867	53.1563	STEEL
22	10	50	1.750		7.8750	0.5024	1.8867	53.1563	STEEL
23	18	49	0.875		7.8750	0.5024	1.8867	53.1563	STEEL
24	19	21	6.376		5.4872	43.8363	0.3685	2.4324	STEEL
25	20	22	5.500		5.4872	43.8363	0.3685	2.4324	STEEL
26	63	55	2.235		0.8575	0.0686	0.1023	0.0547	STEEL
27	64	56	2.235		0.8575	0.0686	0.1023	0.0547	STEEL
28	57	65	2.235		0.8575	0.0686	0.1023	0.0547	STEEL
29	58	66	2.235		0.8575	0.0686	0.1023	0.0547	STEEL
30	63	51	1.785		0.8575	0.0686	0.1023	0.0547	STEEL
31	64	51	1.785		0.8575	0.0686	0.1023	0.0547	STEEL
32	65	54	1.785		0.8575	0.0686	0.1023	0.0547	STEEL
33	66	54	1.785		0.8575	0.0686	0.1023	0.0547	STEEL
34	52	53	5.000		0.8575	0.0686	0.1023	0.0547	STEEL
35	27	29	0.500		17.3438	30.9161	41.2662	20.3247	STEEL
36	28	30	0.500		17.3438	30.9161	41.2662	20.3247	STEEL
37	29	31	10.875		2.7500	3.4948	5.2047	3.4948	STEEL
38	30	32	10.875		2.7500	3.4948	5.2047	3.4948	STEEL
39	33	59	5.125		2.9063	0.1362	0.4785	3.6366	STEEL
40	34	62	5.125		2.9063	0.1362	0.4785	3.6366	STEEL
41	33	35	4.565		1.3125	0.0615	0.1798	0.3350	STEEL
42	34	36	4.565		1.3125	0.0615	0.1798	0.3350	STEEL
43	14	16	10.040		3.1416	0.7854	1.5708	0.7854	STEEL
44	14	6	11.120		1.7671	0.2485	0.4970	0.2485	STEEL
45	5	6	0.940		1.7671	0.2485	0.4970	0.2485	STEEL
46	5	2	14.190		0.4418	0.0155	0.0311	0.0155	STEEL
47	47	48	7.220		3.0625	0.1954	0.6585	3.1263	STEEL
48	56	27	3.159		3.1416	0.7854	1.5708	0.7854	STIFF ELEMENT

49	46	27	2.436	3.1416	0.7854	1.5708	0.7854	STIFF ELEMENT
50	58	28	3.159	3.1416	0.7854	1.5708	0.7854	STIFF ELEMENT
51	48	28	2.436	3.1416	0.7854	1.5708	0.7854	STIFF ELEMENT
52	23	24	0.250	39.0	52.0	154.4	309.0	SA-515-70
53	24	25	0.250	39.0	52.0	154.4	309.0	SA-515-70
54	25	26	3.500	39.0	52.0	154.4	309.0	SA-515-70
	37	6		RIGID LINK				
	38	6		RIGID LINK				
	39	6		RIGID LINK				
	40	6		RIGID LINK				
	41	8		RIGID LINK				
	44	12		RIGID LINK				
	35	2		RIGID LINK				
	36	2		RIGID LINK				
	43	10		RIGID LINK				
	42	10		RIGID LINK				
	45	19		RIGID LINK				
	46	19		RIGID LINK				
	47	20		RIGID LINK				
	48	20		RIGID LINK				
	55	21		RIGID LINK				
	56	21		RIGID LINK				
	57	22		RIGID LINK				
	58	22		RIGID LINK				
	54	22		RIGID LINK				
	53	22		RIGID LINK				
	52	21		RIGID LINK				
	51	21		RIGID LINK				
	63	23		RIGID LINK				
	64	23		RIGID LINK				
	65	23		RIGID LINK				
	66	23		RIGID LINK				
	59	31		RIGID LINK				
	60	31		RIGID LINK				
	61	32		RIGID LINK				
	62	32		RIGID LINK				
	49	19		RIGID LINK				
	50	20		RIGID LINK				

S T A T I C   A N A L Y S I S

DEFORMATION RESPONSE TO 1 G GRAVITATIONAL LOAD IN VALVE SYSTEM X DIR.

JOINT NO.	. . . DEFLECTION . . . X	Y	Z	. . . ROTATION . . . X	Y	Z
1	0.001583	-0.000098	-0.000436	0.000003	0.000041	-0.000012
2	0.001269	-0.000082	-0.000436	0.000003	0.000054	-0.000012
3	0.000467	-0.000045	-0.000431	0.000003	0.000062	-0.000011
4	0.000404	-0.000042	-0.000431	0.000003	0.000062	-0.000011
5	0.000404	-0.000042	-0.000426	0.000000	0.000056	-0.000011
6	0.000351	-0.000042	-0.000426	0.000000	0.000056	-0.000011
7	0.000296	-0.000042	-0.000425	-0.000000	0.000055	-0.000011
8	0.000205	-0.000042	-0.000425	-0.000000	0.000054	-0.000011
9	0.000137	-0.000032	-0.000370	-0.000001	0.000050	-0.000010
10	0.000022	-0.000005	-0.000234	-0.000001	0.000050	-0.000010
11	-0.000039	-0.000034	-0.000370	-0.000001	0.000050	-0.000010
12	-0.000099	-0.000045	-0.000421	-0.000001	0.000050	-0.000010
13	-0.000176	-0.000046	-0.000421	-0.000001	0.000049	-0.000010
14	-0.000222	-0.000047	-0.000421	-0.000001	0.000048	-0.000010
15	-0.00054[illegible]	-0.000051	-0.000421	-0.000001	0.000035	-0.000010
16	-0.000604	-0.000052	-0.000421	-0.000001	0.000033	-0.000010
17	-0.000796	-0.000058	-0.000421	-0.000001	0.000016	-0.000010
18	0.000027	-0.000005	-0.000234	-0.000001	0.000046	-0.000003
19	0.000027	-0.000005	-0.000235	-0.000000	0.000041	-0.000000
20	0.000010	-0.000005	-0.000232	-0.000001	0.000040	-0.000001
21	0.000027	-0.000008	-0.000495	-0.000000	0.000041	-0.000001
22	0.000011	0.000000	-0.000010	-0.000001	0.000040	-0.000001
23	0.000001	-0.000000	-0.000008	0.000000	0.000004	-0.000000
24	0.000001	-0.000000	-0.000007	0.000000	0.000004	-0.000000
25	0.000001	-0.000000	-0.000006	0.000000	0.000004	-0.000000
26	0.0	0.0	0.0	0.0	0.0	0.0
27	0.000191	-0.000002	-0.000138	-0.000000	0.000041	-0.000000
28	0.000170	-0.000000	-0.000135	-0.000001	0.000040	-0.000001
29	0.000212	-0.000002	-0.000138	-0.000000	0.000042	-0.000001
30	0.000191	0.000000	-0.000135	-0.000001	0.000041	-0.000001
31	0.000834	-0.000011	-0.000135	0.000003	0.000060	-0.000010
32	0.000779	-0.000008	-0.000133	0.000002	0.000057	-0.000010
33	0.000899	-0.000064	-0.000379	0.000001	0.000064	-0.000010
34	0.000839	-0.000059	-0.000400	0.000003	0.000066	-0.000010
35	0.001305	-0.000071	-0.000377	0.000003	0.000054	-0.000012
36	0.001215	-0.000071	-0.000398	0.000003	0.000054	-0.000012
37	0.000421	-0.000060	-0.000514	0.000000	0.000056	-0.000011
38	0.000386	-0.000060	-0.000514	0.000000	0.000056	-0.000011
39	0.000386	-0.000025	-0.000337	0.000000	0.000056	-0.000011
40	0.000421	-0.000025	-0.000337	0.000000	0.000056	-0.000011
41	0.000287	-0.000031	-0.000371	-0.000000	0.000054	-0.000011
42	0.000128	-0.000032	-0.000370	-0.000001	0.000050	-0.000010
43	-0.000032	-0.000034	-0.000370	-0.000001	0.000050	-0.000010
44	-0.000173	-0.000036	-0.000371	-0.000001	0.000050	-0.000010
45	-0.000120	-0.000007	-0.000236	-0.000000	0.000041	-0.000000

46	0.000175	-0.000003	-0.000236	-0.000000	0.000041	-0.000000
47	-0.000137	-0.000007	-0.000231	-0.000001	0.000040	-0.000001
48	0.000154	-0.000003	-0.000231	-0.000001	0.000040	-0.000001
49	0.000027	-0.000005	-0.000234	-0.000000	0.000041	-0.000000
50	0.000012	-0.000005	-0.000232	-0.000001	0.000040	-0.000001
51	0.000026	-0.000001	-0.000009	-0.000000	0.000041	-0.000001
52	0.000026	-0.000001	-0.000009	-0.000000	0.000041	-0.000001
53	0.000012	0.000000	-0.000011	-0.000001	0.000040	-0.000001
54	0.000011	0.000000	-0.000011	-0.000001	0.000040	-0.000001
55	-0.000121	-0.000002	-0.000010	-0.000000	0.000041	-0.000001
56	0.000175	-0.000001	-0.000010	-0.000000	0.000041	-0.000001
57	-0.000134	-0.000002	-0.000010	-0.000001	0.000040	-0.000001
58	0.000154	0.000003	-0.000010	-0.000001	0.000040	-0.000001
59	0.000897	-0.000013	-0.000130	0.000003	0.000060	-0.000010
60	0.000819	-0.000011	-0.000139	0.000003	0.000060	-0.000010
61	0.000793	-0.000008	-0.000130	0.000002	0.000057	-0.000010
62	0.000837	-0.000010	-0.000130	0.000002	0.000057	-0.000010
63	-0.000004	-0.000000	-0.000010	0.000000	0.000004	-0.000000
64	0.000007	-0.000000	-0.000010	0.000000	0.000004	-0.000000
65	-0.000005	-0.000000	-0.000010	0.000000	0.000004	-0.000000
66	0.000006	-0.000000	-0.000010	0.000000	0.000004	-0.000000

DEFORMATION RESPONSE TO 1 G GRAVITATIONAL LOAD IN VALVE SYSTEM Y DIR.

JOINT NO.	. . .DEFLECTION . . . X	Y	Z	. . . ROTATION . . . X	Y	Z
1	-0.000133	0.001044	-0.000034	-0.000020	-0.000005	0.000008
2	-0.000103	0.000854	-0.000034	-0.000033	-0.000005	0.000008
3	-0.000041	0.000307	-0.000032	-0.000041	-0.000004	0.000011
4	-0.000037	0.000264	-0.000032	-0.000041	-0.000004	0.000011
5	-0.000037	0.000264	-0.000033	-0.000023	-0.000001	0.000012
6	-0.000036	0.000243	-0.000033	-0.000022	-0.000001	0.000012
7	-0.000034	0.000220	-0.000033	-0.000021	-0.000001	0.000013
8	-0.000032	0.000164	-0.000033	-0.000020	-0.000001	0.000013
9	-0.000032	0.000147	-0.000034	-0.000014	-0.000000	0.000012
10	0.000000	0.000089	0.000000	-0.000014	-0.000000	0.000012
11	-0.000030	0.000098	-0.000034	-0.000014	-0.000000	0.000013
12	-0.000030	0.000094	-0.000033	-0.000014	-0.000000	0.000013
13	-0.000029	0.000074	-0.000033	-0.000013	-0.000000	0.000013
14	-0.000029	0.000062	-0.000033	-0.000013	-0.000000	0.000013
15	-0.000025	0.000034	-0.000033	0.000001	-0.000000	0.000013
16	-0.000024	0.000038	-0.000033	0.000003	-0.000000	0.000013
17	-0.000020	0.000164	-0.000033	0.000019	-0.000000	0.000013
18	-0.000006	0.000089	-0.000011	-0.000014	0.000003	0.000008
19	-0.000030	0.000088	-0.000041	-0.000014	0.000007	0.000013
20	0.000030	0.000088	0.000042	-0.000014	-0.000007	0.000013
21	-0.000027	0.000177	-0.000078	-0.000014	0.000006	0.000014
22	0.000027	0.000012	0.000006	-0.000014	-0.000006	0.000014
23	-0.000000	0.000005	0.000000	-0.000003	-0.000000	0.000001
24	-0.000000	0.000005	0.000000	-0.000003	-0.000000	0.000001
25	-0.000000	0.000004	0.000000	-0.000003	-0.000000	0.000001
26	0.0	0.0	0.0	0.0	0.0	0.0
27	-0.000014	0.000112	-0.000037	-0.000014	0.000006	0.000014
28	0.000013	0.000113	0.000038	-0.000014	-0.000007	0.000014
29	-0.000011	0.000119	-0.000037	-0.000014	0.000006	0.000014
30	0.000010	0.000120	0.000038	-0.000015	-0.000006	0.000014
31	0.000004	0.000433	-0.000039	-0.000034	0.000001	0.000035
32	-0.000020	0.000435	0.000041	-0.000032	-0.000004	0.000031
33	-0.000057	0.000646	-0.000141	-0.000046	0.000001	0.000036
34	-0.000073	0.000632	0.000117	-0.000049	-0.000022	0.000034
35	-0.000128	0.000847	-0.000142	-0.000033	-0.000005	0.000008
36	-0.000066	0.000847	0.000120	-0.000033	-0.000005	0.000008
37	-0.000056	0.000282	-0.000066	-0.000022	-0.000001	0.000012
38	-0.000016	0.000282	0.000004	-0.000022	-0.000001	0.000012
39	-0.000018	0.000244	0.000000	-0.000022	-0.000001	0.000012
40	-0.000056	0.000244	-0.000070	-0.000022	-0.000001	0.000012
41	-0.000034	0.000202	-0.000034	-0.000020	-0.000001	0.000013
42	-0.000032	0.000145	-0.000034	-0.000014	-0.000000	0.000012
43	-0.000030	0.000100	-0.000034	-0.000014	-0.000000	0.000012
44	-0.000029	0.000061	-0.000034	-0.000014	-0.000000	0.000013
45	-0.000069	0.000038	-0.000058	-0.000014	0.000007	0.000013
46	-0.000022	0.000139	-0.000058	-0.000014	0.000007	0.000013
47	0.000070	0.000038	0.000059	-0.000014	-0.000007	0.000013
48	0.000021	0.000139	0.000059	-0.000014	-0.000007	0.000013

49	-0.000012	0.000068	-0.000023	-0.000014	0.000007	0.000013
50	0.000013	0.000088	0.000024	-0.000014	-0.000007	0.000013
51	-0.000026	0.000012	-0.000005	-0.000014	0.000006	0.000014
52	-0.000019	0.000012	0.000002	-0.000014	0.000006	0.000014
53	0.000019	0.000012	-0.000002	-0.000014	-0.000006	0.000014
54	0.000026	0.000012	0.000005	-0.000014	-0.000006	0.000014
55	-0.000064	-0.000040	-0.000021	-0.000014	0.000006	0.000014
56	-0.000020	0.000063	-0.000021	-0.000014	0.000006	0.000014
57	0.000064	-0.000040	0.000021	-0.000014	-0.000006	0.000014
58	0.000019	0.000064	0.000021	-0.000014	-0.000006	0.000014
59	-0.000056	0.000458	-0.000099	-0.000034	0.000001	0.000035
60	0.000056	0.000433	0.000013	-0.000034	0.000001	0.000035
61	-0.000067	0.000435	-0.000008	-0.000032	-0.000004	0.000031
62	-0.000074	0.000459	-0.000012	-0.000032	-0.000004	0.000031
63	-0.000004	0.000001	-0.000014	-0.000003	-0.000000	0.000001
64	-0.000004	0.000010	-0.000014	-0.000003	-0.000000	0.000001
65	0.000004	0.000001	0.000014	-0.000003	-0.000000	0.000001
66	0.000004	0.000010	0.000014	-0.000003	-0.000000	0.000001

DEFORMATION RESPONSE TO 1 G GRAVITATIONAL LOAD IN VALVE SYSTEM Z DIR.

JOINT	. . . DEFLECTION . . .			. . . ROTATION . . .		
NO.	X	Y	Z	X	Y	Z
1	-0.001434	-0.000096	0.000574	0.000003	-0.000051	0.000003
2	-0.001130	-0.000076	0.000569	0.000003	-0.000051	0.000003
3	-0.000466	-0.000033	0.000561	0.000003	-0.000051	0.000001
4	-0.000415	-0.000030	0.000560	0.000003	-0.000051	0.000001
5	-0.000415	-0.000030	0.000547	0.000005	-0.000063	0.000001
6	-0.000355	-0.000025	0.000546	0.000005	-0.000064	0.000001
7	-0.000294	-0.000021	0.000546	0.000005	-0.000064	0.000001
8	-0.000191	-0.000013	0.000545	0.000005	-0.000065	0.000000
9	-0.000112	-0.000008	0.000478	0.000005	-0.000065	-0.000000
10	0.000001	0.000001	0.000293	0.000005	-0.000065	-0.000000
11	0.000115	0.000008	0.000478	0.000005	-0.000065	-0.000000
12	0.000195	0.000014	0.000544	0.000005	-0.000065	-0.000000
13	0.000299	0.000021	0.000544	0.000005	-0.000065	-0.000000
14	0.000361	0.000026	0.000544	0.000005	-0.000065	-0.000000
15	0.000892	0.000063	0.000545	0.000005	-0.000065	-0.000000
16	0.001012	0.000072	0.000545	0.000005	-0.000065	-0.000000
17	0.001625	0.000115	0.000545	0.000005	-0.000065	-0.000000
18	0.000001	0.000001	0.000296	0.000004	-0.000056	-0.000000
19	0.000001	0.000001	0.000304	0.000004	-0.000051	-0.000000
20	0.000000	0.000001	0.000278	0.000005	-0.000047	-0.000000
21	-0.000000	0.000001	0.000627	0.000004	-0.000051	0.000000
22	-0.000001	0.000000	0.000020	0.000004	-0.000046	-0.000000
23	-0.000000	-0.000000	0.000016	0.000001	-0.000006	-0.000000
24	-0.000000	-0.000000	0.000014	0.000001	-0.000006	-0.000000
25	-0.000000	-0.000000	0.000013	0.000001	-0.000006	-0.000000
26	0.0	0.0	0.0	0.0	0.0	0.0
27	-0.000204	-0.000016	0.000166	0.000004	-0.000051	0.000000
28	-0.000187	-0.000017	0.000163	0.000004	-0.000047	-0.000000
29	-0.000229	-0.000018	0.000186	0.000004	-0.000051	0.000000
30	-0.000210	-0.000020	0.000163	0.000004	-0.000047	-0.000000
31	-0.000815	-0.000067	0.000187	0.000005	-0.000056	0.000001
32	-0.000769	-0.000071	0.000164	0.000005	-0.000054	0.000002
33	-0.000859	-0.000064	0.000531	0.000004	-0.000068	0.000001
34	-0.000813	-0.000064	0.000506	0.000004	-0.000071	0.000002
35	-0.001138	-0.000079	0.000531	0.000003	-0.000051	0.000003
36	-0.001118	-0.000079	0.000506	0.000003	-0.000051	0.000003
37	-0.000416	-0.000029	0.000655	0.000005	-0.000064	0.000001
38	-0.000414	-0.000029	0.000640	0.000005	-0.000064	0.000001
39	-0.000414	-0.000031	0.000437	0.000005	-0.000064	0.000001
40	-0.000416	-0.000031	0.000453	0.000005	-0.000064	0.000001
41	-0.000288	-0.000021	0.000480	0.000005	-0.000065	0.000000
42	-0.000101	-0.000007	0.000478	0.000005	-0.000065	-0.000000
43	0.000104	0.000008	0.000476	0.000005	-0.000065	-0.000000
44	0.000293	0.000021	0.000479	0.000005	-0.000065	-0.000000
45	0.000186	0.000016	0.000309	0.000004	-0.000051	-0.000000
46	-0.000184	-0.000014	0.000309	0.000004	-0.000051	-0.000000
47	0.000169	0.000018	0.000272	0.000005	-0.000047	-0.000000
48	-0.000169	-0.000016	0.000272	0.000005	-0.000047	-0.000000

49	0.000001	0.000001	0.000299	0.000004	-0.000051	-0.000000
50	0.000000	0.000001	0.000284	0.000005	-0.000047	-0.000000
51	-0.000000	-0.000000	0.000023	0.000004	-0.000051	0.000000
52	-0.000000	-0.000000	0.000021	0.000004	-0.000051	0.000000
53	-0.000001	0.000000	0.000023	0.000004	-0.000046	-0.000000
54	-0.000001	0.000000	0.000021	0.000004	-0.000046	-0.000000
55	0.000183	0.000014	0.000027	0.000004	-0.000051	0.000000
56	-0.000184	-0.000014	0.000027	0.000004	-0.000051	0.000000
57	0.000166	0.000016	0.000016	0.000004	-0.000046	-0.000000
58	-0.000169	-0.000015	0.000016	0.000004	-0.000046	-0.000000
59	-0.000859	-0.000071	0.000196	0.000005	-0.000056	0.000001
60	-0.000813	-0.000067	0.000180	0.000005	-0.000056	0.000001
61	-0.000772	-0.000071	0.000172	0.000005	-0.000054	0.000002
62	-0.000813	-0.000075	0.000172	0.000005	-0.000054	0.000002
63	0.000009	0.000001	0.000023	0.000001	-0.000006	-0.000000
64	-0.000009	-0.000001	0.000023	0.000001	-0.000006	-0.000000
65	0.000009	0.000001	0.000015	0.000001	-0.000006	-0.000000
66	-0.000009	-0.000001	0.000015	0.000001	-0.000006	-0.000000

DEFORMATION RESPONSE TO OPERATIONAL LOADS (NOT INCLUDING DEADWEIGHT)

JOINT NO.	. . .DEFLECTION . . . X	Y	Z	. . . ROTATION . . . X	Y	Z
1	-0.000012	-0.000383	0.000041	0.000013	-0.000000	0.000009
2	-0.000009	-0.000302	0.000041	0.000013	-0.000000	0.000009
3	-0.000004	-0.000115	0.000042	0.000015	-0.000000	0.000006
4	-0.000004	-0.000101	0.000042	0.000015	-0.000000	0.000005
5	-0.000004	-0.000101	0.000041	0.000017	0.000000	0.000005
6	-0.000004	-0.000085	0.000041	0.000017	0.000000	0.000005
7	-0.000004	-0.000069	0.000041	0.000017	0.000000	0.000004
8	-0.000004	-0.000041	0.000041	0.000017	0.000000	0.000004
9	-0.000004	-0.000023	0.000042	0.000017	0.000000	0.000002
10	0.000000	0.000002	-0.000001	0.000017	0.000000	0.000002
11	-0.000005	0.000037	0.000042	0.000017	0.000000	0.000002
12	-0.000005	0.000060	0.000041	0.000017	0.000000	0.000002
13	-0.000005	0.000087	0.000041	0.000017	0.000000	0.000002
14	-0.000005	0.000104	0.000041	0.000017	0.000000	0.000002
15	-0.000006	0.000245	0.000041	0.000017	0.000000	0.000002
16	-0.000006	0.000276	0.000041	0.000017	0.000000	0.000002
17	-0.000007	0.000439	0.000041	0.000017	0.000000	0.000002
18	-0.000001	0.000002	0.000013	0.000017	-0.000004	0.000000
19	-0.000000	0.000002	0.000046	0.000016	-0.000006	-0.000000
20	0.000000	0.000002	-0.000051	0.000016	0.000008	-0.000000
21	-0.000000	-0.000004	0.000099	0.000015	-0.000008	-0.000000
22	0.000000	-0.000000	-0.000006	0.000016	0.000006	-0.000000
23	0.000000	-0.000000	-0.000000	0.000004	0.000000	0.000000
24	0.000000	-0.000000	-0.000000	0.000003	0.000000	0.000000
25	0.000000	-0.000000	-0.000000	0.000003	0.000000	0.000000
26	0.0	0.0	0.0	0.0	0.0	0.0
27	-0.000031	-0.000063	0.000043	0.000016	-0.000008	-0.000000
28	0.000033	-0.000063	-0.000044	0.000016	0.000008	-0.000000
29	-0.000035	-0.000071	0.000043	0.000016	-0.000008	-0.000000
30	0.000037	-0.000071	-0.000044	0.000016	0.000008	-0.000000
31	-0.000082	-0.000239	0.000043	0.000015	-0.000003	-0.000001
32	0.000086	-0.000245	-0.000045	0.000016	0.000003	0.000002
33	-0.000082	-0.000252	0.000083	0.000013	0.000004	-0.000000
34	0.000084	-0.000246	-0.000023	0.000015	-0.000006	0.000002
35	-0.000037	-0.000311	0.000083	0.000013	-0.000006	0.000009
36	0.000033	-0.000311	-0.000023	0.000013	-0.000006	0.000009
37	-0.000011	-0.000093	0.000068	0.000017	0.000000	0.000005
38	0.000003	-0.000093	0.000015	0.000017	0.000000	0.000005
39	0.000003	-0.000108	0.000015	0.000017	0.000000	0.000005
40	-0.000011	-0.000108	0.000068	0.000017	0.000000	0.000005
41	-0.000004	-0.000071	0.000042	0.000017	0.000000	0.000004
42	-0.000004	-0.000021	0.000042	0.000017	0.000000	0.000002
43	-0.000005	0.000034	0.000042	0.000017	0.000000	0.000002
44	-0.000005	0.000064	0.000042	0.000017	0.000000	0.000002
45	0.000029	0.000061	0.000066	0.000016	-0.000008	-0.000000
46	-0.000028	-0.000058	0.000068	0.000016	-0.000008	-0.000000
47	-0.000030	0.000061	-0.000070	0.000016	0.000008	-0.000000
48	0.000030	-0.000058	-0.000070	0.000016	0.000008	-0.000000

49	-0.000001	0.000002	0.000027	0.000016	-0.000008	-0.000000
50	0.000001	0.000002	-0.000029	0.000016	0.000008	-0.000000
51	-0.000000	0.000000	0.000004	0.000015	-0.000008	-0.000000
52	-0.000001	0.000000	-0.000003	0.000015	-0.000008	-0.000000
53	0.000001	-0.000000	0.000003	0.000016	0.000008	-0.000000
54	0.000001	-0.000000	-0.000005	0.000016	0.000008	-0.000000
55	0.000028	0.000056	0.000022	0.000015	-0.000008	-0.000000
56	-0.000028	-0.000056	0.000022	0.000015	-0.000008	-0.000000
57	-0.000030	0.000056	-0.000022	0.000016	0.000008	-0.000000
58	0.000030	-0.000056	-0.000022	0.000016	0.000008	-0.000000
59	-0.000083	-0.000250	0.000071	0.000015	-0.000003	-0.000001
60	-0.000082	-0.000239	0.000020	0.000015	-0.000003	-0.000001
61	0.000083	-0.000245	-0.000021	0.000016	0.000003	0.000002
62	0.000085	-0.000257	-0.000019	0.000016	0.000003	0.000002
63	-0.000000	0.000005	0.000015	0.000004	0.000000	0.000000
64	0.000000	-0.000005	0.000015	0.000004	0.000000	0.000000
65	-0.000000	0.000005	-0.000015	0.000004	0.000000	0.000000
66	0.000000	-0.000005	-0.000015	0.000004	0.000000	0.000000

D Y N A M I C A N A L Y S I S

RESONANT FREQUENCY = **77.7 HERTZ** (IN X-DIRECTION OR Y-ROTATION)

* * * * NORMALIZED EIGENVECTOR * * * *

JOINT	. . .DEFLECTION . . .			. . . ROTATION . . .		
NO.	X	Y	Z	X	Y	Z
1	0.834622	-0.031058	-0.269605	0.001152	0.024665	-0.002511
2	0.663803	-0.023423	-0.268776	0.001288	0.028981	-0.002510
3	0.255962	-0.004479	-0.265982	0.001350	0.031607	-0.001796
4	0.224131	-0.003101	-0.265858	0.001340	0.031629	-0.001772
5	0.223920	-0.003161	-0.261726	-0.000418	0.033878	-0.001606
6	0.192084	-0.003569	-0.261607	-0.000453	0.033831	-0.001602
7	0.159307	-0.003989	-0.261454	-0.000509	0.033823	-0.001470
8	0.104580	-0.004770	-0.261226	-0.000534	0.033770	-0.001407
9	0.062460	-0.004183	-0.226989	-0.000742	0.032950	-0.000988
10	0.002290	-0.002831	-0.136577	-0.000743	0.032938	-0.000985
11	-0.052930	-0.006779	-0.226979	-0.000743	0.032954	-0.000985
12	-0.094769	-0.008708	-0.260325	-0.000746	0.033204	-0.000968
13	-0.148420	-0.009913	-0.260421	-0.000750	0.033397	-0.000990
14	-0.180760	-0.010643	-0.260487	-0.000759	0.033666	-0.000993
15	-0.465062	-0.017839	-0.260575	-0.000942	0.039055	-0.000994
16	-0.558256	-0.019612	-0.260591	-0.000969	0.039891	-0.000994
17	-1.000000	-0.030607	-0.260659	-0.001254	0.048962	-0.000995
18	0.002732	-0.002326	-0.136982	-0.000694	0.028428	-0.000405
19	0.003417	-0.002820	-0.138212	-0.000655	0.023906	-0.000363
20	0.000791	-0.002832	-0.133928	-0.000751	0.023159	-0.000469
21	0.003997	-0.005527	-0.288785	-0.000570	0.023730	-0.000452
22	0.001692	-0.000125	-0.006868	-0.000693	0.022906	-0.000424
23	0.000129	-0.000084	-0.005439	-0.000109	0.002498	-0.000033
24	0.000121	-0.000075	-0.004812	-0.000103	0.002351	-0.000031
25	0.000113	-0.000066	-0.004222	-0.000096	0.002203	-0.000029
26	0.0	0.0	0.0	0.0	0.0	0.0
27	0.099342	0.000761	-0.081923	-0.000615	0.023937	-0.000427
28	0.093043	0.001266	-0.078309	-0.000719	0.023154	-0.000460
29	0.111384	0.001068	-0.081917	-0.000611	0.024060	-0.000448
30	0.104687	0.001624	-0.078306	-0.000714	0.023270	-0.000480
31	0.437649	0.003327	-0.081115	0.000326	0.031415	-0.003982
32	0.420089	0.004404	-0.077661	0.000132	0.030671	-0.003655
33	0.469095	-0.017021	-0.238363	0.000689	0.037549	-0.003906
34	0.449988	-0.015511	-0.248192	0.001046	0.040153	-0.003853
35	0.671648	-0.021068	-0.237568	0.001288	0.028981	-0.002510
36	0.651880	-0.021068	-0.247712	0.001288	0.028981	-0.002510
37	0.226435	-0.005692	-0.316153	-0.000453	0.033831	-0.001602
38	0.221337	-0.005692	-0.314713	-0.000453	0.033831	-0.001602
39	0.221337	-0.000594	-0.207061	-0.000453	0.033831	-0.001602
40	0.226435	-0.000594	-0.208501	-0.000453	0.033831	-0.001602
41	0.155235	-0.002562	-0.227456	-0.000534	0.033770	-0.001407
42	0.057223	-0.004296	-0.226971	-0.000743	0.032938	-0.000985
43	-0.047718	-0.006662	-0.226971	-0.000743	0.032938	-0.000985

44	-0.144575	-0.008639	-0.227121	-0.000746	0.033204	-0.000986
45	-0.082432	-0.005185	-0.138985	-0.000655	0.023906	-0.000383
46	0.090171	-0.000455	-0.138985	-0.000655	0.023906	-0.000383
47	-0.083367	-0.005544	-0.133041	-0.000751	0.023159	-0.000469
48	0.083843	-0.000121	-0.133041	-0.000751	0.023159	-0.000469
49	0.002911	-0.002820	-0.137347	-0.000655	0.023906	-0.000383
50	0.001410	-0.002632	-0.134919	-0.000751	0.023159	-0.000469
51	0.003960	-0.000157	-0.006918	-0.000570	0.023730	-0.000452
52	0.003740	-0.000157	-0.006640	-0.000570	0.023730	-0.000452
53	0.001934	-0.000125	-0.007263	-0.000693	0.022906	-0.000424
54	0.001728	-0.000125	-0.006925	-0.000693	0.022906	-0.000424
55	-0.081192	-0.002214	-0.007566	-0.000570	0.023730	-0.000452
56	0.090140	0.001901	-0.007566	-0.000570	0.023730	-0.000452
57	-0.081446	-0.002626	-0.006137	-0.000693	0.022906	-0.000424
58	0.083936	0.002376	-0.006137	-0.000693	0.022906	-0.000424
59	0.468379	0.003083	-0.080544	0.000326	0.031415	-0.003982
60	0.431875	0.003327	-0.081604	0.000326	0.031415	-0.003982
61	0.425672	0.004404	-0.077663	0.000132	0.030671	-0.003855
62	0.449358	0.004305	-0.077647	0.000132	0.030671	-0.003855
63	-0.003170	-0.000246	-0.006982	-0.000109	0.002496	-0.000033
64	0.003699	0.000053	-0.006982	-0.000109	0.002498	-0.000033
65	-0.003441	-0.000246	-0.006080	-0.000109	0.002498	-0.000033
66	0.003426	0.000053	-0.006080	-0.000109	0.002498	-0.000033

S T A T I C   S E I S M I C   A N A L Y S I S

THE VALVE AXIS IS POSITIONED Y-UP

ACCELERATION OF GRAVITY, G = 386.400

DIRECTION OF SEISMIC ACCELERATION	NO. OF G'S	COMPONENTS OF UNIT ACCELERATION IN VALVE COORDINATE SYSTEM X-COMP.	Y-COMP.	Z-COMP.
HORIZONTAL(1)	10.000	0.0	0.0	-1.0000
HORIZONTAL(2)	10.000	1.0000	0.0	0.0
VERTICAL	10.000	0.0	-1.0000	0.0

REACTION RESPONSE TO STATIC SEISMIC LOAD IN HORIZ(1) DIRECTION

ELT. NO.	JNT. NO.	. .ELEMENT FORCES. . F1	F2	F3	. ELEMENT MOMENTS . M1	M2	M3
1	1	-0.	-650.	-0.	-0.	0.	-0.
	2	0.	695.	0.	0.	-0.	-0.
2	2	9.	-467.	-69.	332.	-215.	42.
	3	-9.	567.	69.	578.	215.	72.
3	3	9.	-563.	-70.	-578.	-215.	-72.
	4	-9.	580.	70.	648.	215.	81.
4	40	-343.	3.	35.	-82.	71.	-301.
	4	334.	-3.	-35.	4.	-71.	-461.
5	37	-48.	-33.	27.	-74.	53.	-160.
	4	39.	33.	-27.	13.	-53.	62.
6	38	-91.	-3.	-67.	32.	-76.	-181.
	4	82.	3.	67.	119.	76.	-14.
7	39	-135.	25.	-33.	-4.	-14.	-105.
	4	128.	-25.	33.	80.	14.	-192.
8	6	9.	-794.	-73.	-714.	-210.	-81.
	7	-9.	808.	73.	764.	210.	90.
9	7	9.	-809.	-72.	-763.	-210.	-90.
	8	-9.	836.	72.	699.	210.	105.
10	9	72.	-903.	-9.	117.	-201.	126.
	41	-72.	862.	9.	-91.	201.	73.
11	9	-73.	-879.	-9.	-116.	-201.	135.
	42	73.	882.	9.	118.	201.	-140.
12	42	0.	36.	-0.	0.	0.	0.
	43	-0.	36.	0.	0.	0.	-0.
13	43	-1.	453.	-1.	7.	6.	381.
	11	1.	-449.	1.	-7.	-6.	-382.
14	11	-1.	427.	-1.	1.	6.	364.
	44	1.	-367.	1.	2.	-6.	-366.
15	12	1.	328.	-1.	2.	5.	-1.
	13	-1.	-301.	1.	0.	-5.	2.
16	13	1.	303.	0.	0.	5.	-2.
	14	-1.	-289.	-0.	-0.	-5.	3.
17	14	-0.	56.	0.	-0.	0.	-0.
	15	0.	-16.	-0.	-0.	-0.	0.
18	15	0.	16.	0.	-0.	-0.	0.
	16	-0.	-11.	-0.	-0.	0.	0.
19	16	0.	26.	0.	-0.	-0.	0.
	17	-0.	-0.	-0.	-0.	0.	0.
20	45	0.	-31.	0.	-0.	0.	0.
	46	-0.	-31.	-0.	-0.	0.	0.
21	10	-863.	-16.	-13.	27.	-1684.	-4421.
	18	882.	16.	13.	-16.	1684.	3658.
22	10	-543.	-7.	58.	-33.	2242.	-736.
	50	582.	7.	-58.	-69.	-2242.	-248.
23	18	-885.	-16.	-13.	16.	-1685.	-3659.
	49	905.	16.	13.	-4.	1685.	2876.
24	19	-8.	372.	-125.	1349.	-178.	-14.
	21	8.	-372.	223.	-242.	178.	-35.

Complete Assembly

25	20	28.	-487.	-58.	-866.	-107.	66.
	22	-28.	487.	142.	1418.	107.	89.
26	63	1328.	516.	-105.	145.	0.	1811.
	55	-1328.	-511.	105.	89.	-0.	1156.
27	64	-1336.	-516.	-106.	146.	-0.	-1821.
	56	1336.	511.	106.	90.	0.	-1166.
28	57	-1184.	67.	-119.	101.	-0.	-1028.
	65	1184.	-72.	119.	164.	0.	-1617.
29	58	1213.	-67.	-117.	99.	0.	1061.
	66	-1213.	72.	117.	162.	-0.	1650.
30	63	604.	-117.	76.	-32.	-191.	223.
	51	-604.	114.	-73.	-101.	191.	854.
31	64	-617.	110.	78.	-33.	-190.	-234.
	51	617.	-106.	-75.	-103.	190.	-867.
32	65	526.	-503.	4.	35.	172.	185.
	54	-526.	500.	-6.	-44.	-172.	753.
33	66	-573.	493.	2.	37.	171.	-226.
	54	573.	-490.	-5.	-42.	-171.	-796.
34	52	-1.	5.	46.	-104.	11.	-3.
	53	1.	-5.	-34.	-97.	-11.	-2.
35	27	-23.	-169.	4.	71.	-68.	-548.
	29	23.	165.	-4.	-73.	68.	537.
36	28	-63.	-174.	4.	42.	-123.	-1035.
	30	63.	149.	-4.	-44.	123.	1003.
37	29	4.	-164.	23.	-536.	-68.	-73.
	31	-4.	81.	-23.	289.	68.	121.
38	30	4.	-149.	63.	-1003.	-123.	-44.
	32	-4.	65.	-63.	319.	123.	86.
39	33	-4.	23.	39.	-35.	17.	6.
	59	4.	-23.	-81.	-271.	-17.	-28.
40	34	-4.	63.	24.	44.	17.	2.
	62	4.	-63.	-65.	-272.	-17.	-22.
41	33	4.	-38.	15.	35.	-6.	17.
	35	-4.	22.	-15.	-106.	6.	3.
42	34	4.	-23.	55.	-44.	-1.	17.
	36	-4.	7.	-55.	-209.	1.	1.
43	14	-0.	104.	0.	-0.	-0.	-0.
	16	0.	-16.	-0.	-0.	0.	0.
44	14	1.	-123.	1.	0.	-5.	3.
	6	-1.	68.	-1.	-15.	5.	7.
45	5	-0.	-217.	-2.	-17.	-0.	2.
	6	0.	222.	2.	19.	0.	-2.
46	5	0.	-218.	-2.	17.	-0.	2.
	2	-0.	200.	2.	9.	0.	1.
47	47	0.	-31.	0.	-0.	0.	0.
	48	-0.	-31.	-0.	-0.	0.	0.
48	56	-40.	246.	1085.	-4726.	-1304.	-566.
	27	40.	-246.	-1085.	1299.	1304.	440.
49	46	-53.	496.	752.	-607.	-1063.	-291.
	27	53.	-496.	-752.	-1025.	1063.	162.
50	58	23.	449.	842.	-4671.	-1121.	269.
	28	-23.	-449.	-842.	2010.	1121.	-195.
51	48	107.	576.	498.	-543.	-1269.	683.
	28	-107.	-576.	-498.	-672.	1269.	-422.
52	23	-3.	98.	2212.	17806.	-3718.	-206.
	24	3.	-98.	-2239.	-18362.	3718.	205.

Complete Assembly

53	24	-3.	98.	2240.	18361.	-3718.	-206.
	25	3.	-98.	-2267.	-18924.	3718.	205.
54	25	-3.	98.	2268.	18925.	-3718.	-205.
	26	3.	-98.	-2650.	-27531.	3718.	195.

TYPE	JNT. NO.	FX	FY	FZ	MX	MY	MZ
		..... BOUNDARY OR JUNCTION REACTION					
BODY	26	-98.	3.	2650.	3718.	-27531.	-195.
A -X+Y	10	-71.	9.	-1406.	-3665.	3927.	-6.
B +X-Y	23	98.	-3.	-2212.	-3718.	17806.	206.

REACTION RESPONSE TO STATIC SEISMIC LOAD IN HORIZ(2) DIRECTION

ELT. NO.	JNT. NO.	. .ELEMENT FORCES. . F1	F2	F3	. ELEMENT MOMENTS . M1	M2	M3
1	1	0.	0.	650.	-8125.	0.	-0.
	2	-0.	-0.	-695.	4089.	0.	0.
2	2	-16.	-294.	204.	-3209.	-83.	-76.
	3	16.	294.	-304.	-139.	83.	-139.
3	3	-16.	-291.	303.	139.	-83.	139.
	4	16.	291.	-319.	-450.	83.	-156.
4	40	25.	83.	-44.	36.	-23.	-40.
	4	-25.	-77.	37.	55.	23.	95.
5	37	-123.	-91.	-63.	58.	-49.	-110.
	4	123.	84.	56.	76.	49.	-167.
6	38	-183.	-83.	36.	-49.	22.	-139.
	4	183.	77.	-29.	-25.	-22.	-273.
7	39	-12.	69.	33.	-45.	12.	-25.
	4	12.	-64.	-28.	-23.	-12.	-2.
8	6	-18.	-164.	427.	710.	-83.	166.
	7	18.	164.	-441.	-1126.	83.	-183.
9	7	-18.	-165.	441.	1127.	-83.	183.
	8	18.	165.	-468.	-1654.	83.	-211.
10	9	-534.	-165.	18.	-233.	-101.	-2693.
	41	493.	165.	-18.	185.	101.	1280.
11	9	534.	-144.	17.	233.	-100.	-2685.
	42	-537.	144.	-17.	-236.	100.	2769.
12	42	-36.	0.	-0.	0.	0.	-19.
	43	-36.	0.	0.	0.	0.	19.
13	43	-329.	223.	1.	1.	3.	-1711.
	11	326.	-223.	-1.	-1.	-3.	1659.
14	11	-326.	221.	1.	-2.	2.	-1677.
	44	265.	-221.	-1.	-0.	-2.	865.
15	12	-1.	223.	-225.	1484.	3.	-1.
	13	1.	-223.	198.	-1146.	-3.	-0.
16	13	-1.	226.	-198.	1146.	2.	0.
	14	1.	-226.	184.	-963.	-2.	-1.
17	14	-0.	-0.	-50.	276.	0.	-0.
	15	0.	0.	10.	-30.	-0.	0.
18	15	0.	0.	-10.	30.	-0.	0.
	16	-0.	-0.	5.	-17.	0.	0.
19	16	0.	0.	-26.	124.	0.	0.
	17	-0.	-0.	-0.	-0.	0.	0.
20	45	-0.	0.	31.	-37.	0.	-0.
	46	0.	0.	31.	37.	0.	0.
21	10	-181.	267.	950.	-1715.	-1180.	-916.
	18	181.	-267.	-969.	875.	1180.	756.
22	10	-206.	250.	11.	-787.	1262.	-196.
	50	206.	-250.	26.	802.	-1262.	-164.
23	18	-182.	267.	970.	-875.	-1181.	-760.
	49	182.	-267.	-989.	18.	1181.	600.
24	19	5.	-42.	-11.	[illegible]	-9.	47.
	21	-5.	140.	11.	38.	9.	-15.

Complete Assembly

25	20	-13.	-328.	-32.	-650.	-32.	-60.
	22	13.	244.	32.	826.	32.	-11.
26	63	794.	-4.	-21.	25.	2.	1160.
	55	-799.	4.	21.	21.	-2.	620.
27	64	-1410.	4.	5.	-3.	-2.	-1845.
	56	1405.	-4.	-5.	-7.	2.	-1301.
28	57	-957.	-19.	-12.	7.	5.	-804.
	65	952.	19.	12.	20.	-5.	-1330.
29	58	1190.	19.	-37.	35.	-5.	1068.
	66	-1195.	-19.	37.	46.	5.	1598.
30	63	-0.	116.	16.	-12.	-160.	-258.
	51	-4.	-116.	-16.	-17.	160.	262.
31	64	-1010.	51.	-15.	16.	-156.	-637.
	51	1006.	-51.	15.	11.	156.	-1163.
32	65	282.	10.	-10.	17.	149.	-7.
	54	-286.	-10.	10.	1.	-149.	514.
33	66	-702.	153.	20.	-10.	158.	-376.
	54	698.	-153.	-20.	-26.	-158.	-673.
34	52	9.	-93.	7.	-15.	2.	34.
	53	-21.	93.	-7.	-19.	-2.	40.
35	27	-460.	234.	-18.	-183.	-533.	-4206.
	29	435.	-234.	18.	191.	533.	3962.
36	28	-366.	151.	1.	-266.	-465.	-3563.
	30	362.	-151.	-1.	265.	466.	3376.
37	29	-18.	235.	436.	-3961.	-533.	191.
	31	18.	-235.	-352.	-302.	533.	-364.
38	30	1.	152.	362.	-3375.	-466.	265.
	32	-1.	-152.	-279.	-110.	466.	-254.
39	33	18.	311.	-235.	637.	-13.	8.
	59	-18.	-352.	235.	566.	13.	63.
40	34	-1.	236.	-152.	463.	5.	9.
	62	1.	-278.	152.	318.	-5.	-14.
41	33	-18.	235.	303.	-637.	-8.	-13.
	35	18.	-235.	-286.	-707.	8.	-65.
42	34	1.	153.	229.	-462.	-9.	5.
	36	-1.	-153.	-212.	-546.	9.	-0.
43	14	-0.	0.	-110.	766.	-0.	-0.
	16	0.	-0.	22.	-106.	0.	0.
44	14	-1.	-221.	24.	-81.	-2.	-1.
	6	1.	221.	31.	120.	2.	-9.
45	5	-0.	-93.	10.	32.	-0.	4.
	6	0.	93.	-15.	-43.	0.	-4.
46	5	0.	-94.	10.	-32.	-0.	4.
	2	-0.	94.	7.	8.	0.	2.
47	47	0.	0.	31.	-37.	0.	-0.
	48	-0.	0.	31.	37.	0.	0.
48	56	137.	1485.	140.	-2043.	-1166.	-510.
	27	-137.	-1465.	-140.	1601.	1166.	942.
49	46	-427.	970.	5.	-2235.	-1869.	-2147.
	27	427.	-970.	-5.	2223.	1889.	1108.
50	58	-163.	959.	144.	-3163.	788.	519.
	28	163.	-859.	-144.	2727.	-785.	-1035.
51	48	308.	459.	107.	-901.	615.	1164.
	28	-308.	-459.	-107.	700.	-616.	-414.
52	23	-4.	2291.	8.	14463.	115.	3671.
	24	4.	-2318.	-8.	-14484.	-115.	-3672.

53	24	-4.	2318.	8.	14484.	115.	3672.
	25	4.	-2345.	-8.	-14486.	-115.	-3673.
54	25	-4.	2346.	8.	14486.	115.	3673.
	26	4.	-2728.	-8.	-14515.	-115.	-3668.

TYPE	JNT. NO.	. . . . . BOUNDARY OR JUNCTION REACTION . . . . . FX	FY	FZ	MX	MY	MZ
BODY	26	-2728.	4.	8.	-115.	-14515.	3688.
A -X+Y	10	940.	-16.	-387.	-720.	2442.	-2501.
B +X-Y	23	2291.	-4.	-8.	115.	14483.	-3671.

REACTION RESPONSE TO STATIC SEISMIC LOAD IN VERTICAL DIRECTION

ELT. NO.	JNT. NO.	. .ELEMENT FORCES. . F1	F2	F3	. ELEMENT MOMENTS . M1	M2	M3
1	1	-650.	-0.	-0.	-0.	0.	-8125.
	2	695.	0.	0.	0.	0.	4089.
2	2	-312.	83.	15.	93.	507.	-3963.
	3	411.	-83.	-15.	-289.	-507.	-804.
3	3	-411.	82.	15.	289.	507.	804.
	4	427.	-82.	-15.	-304.	-507.	-1223.
4	40	250.	82.	128.	-41.	96.	110.
	4	-250.	-75.	-122.	-240.	-96.	452.
5	37	184.	77.	-77.	165.	-114.	79.
	4	-184.	-70.	70.	-19.	114.	335.
6	38	-278.	-82.	-53.	158.	-84.	-142.
	4	278.	75.	46.	-46.	84.	-483.
7	39	-73.	-58.	97.	-10.	32.	-30.
	4	73.	53.	-92.	-203.	-32.	-135.
8	6	-541.	93.	17.	306.	503.	1565.
	7	556.	-93.	-17.	-323.	-503.	-2091.
9	7	-556.	93.	17.	323.	503.	2091.
	8	583.	-93.	-17.	-350.	-503.	-3002.
10	9	-17.	93.	649.	-3818.	-105.	-276.
	41	17.	-93.	-608.	2090.	105.	231.
11	9	17.	91.	649.	3817.	-104.	-278.
	42	-17.	-91.	-652.	-3920.	104.	281.
12	42	0.	0.	-36.	19.	0.	0.
	43	-0.	0.	-36.	-19.	0.	-0.
13	43	2.	7.	-325.	1945.	262.	9.
	11	-2.	-7.	322.	-1895.	-262.	-9.
14	11	2.	6.	-321.	1895.	258.	9.
	44	-2.	-6.	261.	-1094.	-258.	-4.
15	12	221.	6.	2.	-0.	-3.	1486.
	13	-194.	-6.	-2.	-2.	3.	-1154.
16	13	194.	6.	2.	2.	-3.	1154.
	14	-180.	-6.	-2.	-4.	3.	-975.
17	14	50.	0.	-0.	0.	0.	276.
	15	-10.	-0.	0.	0.	-0.	-30.
18	15	10.	-0.	-0.	0.	-0.	30.
	16	-5.	0.	0.	0.	0.	-17.
19	16	26.	-0.	-0.	0.	-0.	124.
	17	0.	0.	0.	0.	0.	0.
20	45	31.	0.	-0.	0.	0.	37.
	46	31.	0.	0.	-0.	0.	-37.
21	10	649.	477.	1929.	-1613.	-883.	1675.
	18	-649.	-496.	-1929.	-75.	883.	-1107.
22	10	-561.	-573.	1914.	-1615.	-799.	-1040.
	50	561.	611.	-1914.	-1734.	799.	58.
23	18	649.	500.	1929.	75.	-883.	1107.
	49	-649.	-519.	-1929.	-1763.	883.	-539.
24	19	81.	-709.	245.	-1912.	255.	224.
	21	16.	709.	-245.	352.	-255.	-16.

25	20	8.	-892.	-73.	-1288.	-79.	174.
	22	-92.	892.	73.	1691.	79.	103.
26	63	-631.	-810.	285.	-420.	69.	-749.
	55	631.	810.	-290.	-223.	-69.	-660.
27	64	-271.	810.	461.	-613.	-69.	-258.
	56	271.	-810.	-456.	-412.	69.	-347.
28	57	-630.	821.	290.	-221.	68.	-659.
	65	630.	-821.	-285.	-421.	-68.	-750.
29	58	-263.	-821.	470.	-426.	-68.	-339.
	66	263.	821.	-475.	-630.	68.	-249.
30	63	-685.	-13.	-33.	-94.	-41.	-493.
	51	685.	15.	36.	156.	41.	-729.
31	64	-520.	1146.	-250.	98.	92.	-431.
	51	520.	-1143.	247.	345.	-92.	-497.
32	65	682.	-19.	-27.	-102.	-39.	491.
	54	-682.	16.	30.	152.	39.	727.
33	66	514.	-1205.	-261.	105.	92.	428.
	54	-514.	1203.	257.	357.	-92.	490.
34	52	-44.	31.	-133.	333.	-29.	-111.
	53	44.	-19.	133.	334.	29.	-110.
35	27	-134.	128.	334.	-3592.	-1153.	-1295.
	29	134.	-128.	-309.	3431.	1153.	1229.
36	28	148.	-215.	388.	-3737.	-972.	1102.
	30	-148.	215.	-364.	3549.	972.	-1026.
37	29	309.	128.	134.	-1229.	-1154.	3431.
	31	-226.	-128.	-134.	-226.	1154.	-521.
38	30	364.	-214.	-148.	1028.	-972.	3549.
	32	-280.	214.	148.	561.	972.	-44.
39	33	-184.	134.	-128.	326.	128.	-131.
	59	226.	-134.	128.	326.	-128.	-920.
40	34	-239.	-148.	214.	-403.	182.	-118.
	62	281.	148.	-214.	-692.	-182.	-1213.
41	33	184.	128.	133.	-328.	131.	128.
	35	-167.	-128.	-133.	-280.	-131.	673.
42	34	238.	-214.	-149.	408.	118.	182.
	36	-222.	214.	149.	271.	-118.	869.
43	14	110.	-0.	-0.	0.	0.	768.
	16	-22.	0.	0.	0.	-0.	-105.
44	14	19.	-6.	-2.	4.	3.	69.
	6	36.	6.	2.	16.	-3.	-159.
45	5	-12.	4.	0.	4.	1.	51.
	6	17.	-4.	-0.	-4.	-1.	-64.
46	5	13.	4.	0.	-4.	1.	51.
	2	5.	-4.	-0.	-2.	-1.	2.
47	47	31.	0.	0.	-0.	0.	37.
	48	31.	0.	-0.	0.	0.	-37.
48	56	888.	1488.	-361.	2807.	978.	550.
	27	-888.	-1488.	361.	-1665.	-978.	2254.
49	46	-828.	1014.	-595.	-996.	-3986.	-4976.
	27	828.	-1014.	595.	2448.	3986.	2957.
50	58	958.	-1319.	555.	-3707.	525.	701.
	28	-958.	1319.	-555.	1953.	-525.	2326.
51	48	-800.	-796.	645.	840.	-4576.	-4639.
	28	800.	796.	-645.	-2412.	4576.	2690.
52	23	-2217.	15.	3.	25.	14313.	17576.
	24	2244.	-15.	-3.	-26.	-14313.	-18133.

53	24	-2244.	15.	3.	26.	14313.	18133.
	25	2272.	-15.	-3.	-26.	-14313.	-18697.
54	25	-2272.	15.	3.	26.	14314.	18701.
	26	2654.	-15.	-3.	-36.	-14314.	-27322.

TYPE	JNT. NO.	. . . . . BOUNDARY OR JUNCTION REACTION . . . . . FX	FY	FZ	MX	MY	MZ
BODY	26	-15.	2654.	3.	-14314.	-36.	27322.
A -X+Y	10	15.	-1050.	87.	2715.	84.	-3228.
B +X-Y	23	15.	-2217.	-3.	14313.	25.	-17576.

REACTION RESPONSE TO OPERATIONAL LOADS (INCLUDING DEADWEIGHT)

ELT. NO.	JNT. NO.	. .ELEMENT FORCES. . F1	F2	F3	. ELEMENT MOMENTS . M1	M2	M3
1	1	-65.	-0.	-0.	-0.	0.	-812.
	2	70.	0.	0.	0.	0.	409.
2	2	-32.	7.	1.	6.	107.	-427.
	3	42.	-7.	-1.	-25.	-107.	-65.
3	3	-42.	7.	1.	25.	107.	65.
	4	44.	-7.	-1.	-27.	-107.	-108.
4	40	22.	9.	16.	2.	9.	10.
	4	-22.	-8.	-15.	-37.	-9.	40.
5	37	16.	9.	-3.	23.	-10.	7.
	4	-16.	-8.	2.	-17.	10.	30.
6	38	-25.	-9.	-1.	21.	-7.	-13.
	4	25.	8.	0.	-19.	7.	-43.
7	39	-6.	-7.	13.	5.	3.	-3.
	4	6.	6.	-13.	-34.	-3.	-12.
8	6	-55.	8.	2.	27.	106.	143.
	7	57.	-8.	-2.	-28.	-106.	-197.
9	7	-57.	8.	2.	28.	106.	197.
	8	59.	-8.	-2.	-31.	-106.	-290.
10	9	-2.	8.	66.	-373.	44.	-25.
	41	2.	-8.	-62.	197.	-44.	20.
11	9	1.	8.	66.	371.	44.	-24.
	42	-1.	-8.	-66.	-382.	-44.	25.
12	42	0.	0.	-4.	2.	0.	0.
	43	-0.	0.	-4.	-2.	0.	-0.
13	43	0.	1.	-33.	194.	25.	1.
	11	-0.	-1.	32.	-189.	-25.	-1.
14	11	0.	1.	-32.	190.	24.	1.
	44	-0.	-1.	26.	-110.	-24.	-0.
15	12	22.	1.	0.	-0.	-2.	149.
	13	-19.	-1.	-0.	-0.	2.	-116.
16	13	19.	1.	0.	0.	-2.	116.
	14	-18.	-1.	-0.	-0.	2.	-98.
17	14	5.	0.	-0.	0.	0.	28.
	15	-1.	-0.	0.	0.	-0.	-3.
18	15	1.	-0.	-0.	0.	-0.	3.
	16	-0.	0.	0.	0.	0.	-2.
19	16	3.	-0.	-0.	0.	-0.	12.
	17	0.	0.	0.	0.	0.	-0.
20	45	3.	0.	0.	-0.	0.	4.
	46	3.	0.	0.	-0.	0.	-4.
21	10	133.	47.	184.	-134.	-169.	907.
	18	-133.	-49.	-184.	-27.	169.	-791.
22	10	-125.	-59.	183.	-136.	-162.	-625.
	50	125.	63.	-183.	-184.	162.	607.
23	18	133.	50.	184.	27.	-189.	791.
	49	-133.	-52.	-184.	-188.	189.	-674.
24	19	14.	-74.	17.	-179.	17.	39.
	21	-4.	74.	-17.	72.	-17.	17.

25	20	-7.	-89.	3.	-159.	4.	-5.
	22	-1.	89.	-3.	141.	-4.	-12.
26	63	-87.	-167.	70.	-99.	7.	-107.
	55	87.	167.	-70.	-57.	-7.	-87.
27	64	-4.	167.	87.	-118.	-7.	6.
	56	4.	-167.	-87.	-76.	7.	-14.
28	57	-87.	169.	70.	-57.	7.	-87.
	65	87.	-169.	-70.	-99.	-7.	-108.
29	58	-2.	-169.	89.	-78.	-7.	-12.
	66	2.	169.	-89.	-121.	7.	9.
30	63	-79.	-69.	-19.	-9.	-1.	-53.
	51	79.	69.	19.	43.	1.	-88.
31	64	-41.	182.	-40.	10.	13.	-39.
	51	41.	-181.	40.	62.	-13.	-34.
32	65	79.	65.	-18.	-10.	-1.	53.
	54	-79.	-66.	18.	43.	1.	88.
33	66	40.	-189.	-42.	10.	13.	38.
	54	-40.	189.	41.	63.	-13.	33.
34	52	-5.	4.	-28.	70.	-7.	-12.
	53	5.	-3.	28.	70.	7.	-12.
35	27	-21.	17.	32.	-344.	-117.	-221.
	29	21.	-17.	-29.	329.	117.	210.
36	28	23.	-25.	39.	-374.	-64.	204.
	30	-23.	25.	-37.	355.	64.	-193.
37	29	29.	17.	21.	-210.	-117.	329.
	31	-21.	-17.	-21.	-22.	117.	-56.
38	30	37.	-25.	-23.	193.	-64.	354.
	32	-29.	25.	23.	53.	64.	2.
39	33	-17.	21.	-17.	50.	10.	-17.
	59	21.	-21.	17.	35.	-10.	-79.
40	34	-24.	-23.	25.	-57.	17.	-15.
	62	29.	23.	-25.	-70.	-17.	-121.
41	33	17.	17.	21.	-50.	17.	10.
	35	-15.	-17.	-21.	-48.	-17.	62.
42	34	24.	-25.	-23.	57.	15.	17.
	36	-23.	25.	23.	47.	-15.	90.
43	14	11.	-0.	-0.	0.	0.	77.
	16	-2.	0.	0.	0.	-0.	-11.
44	14	2.	-1.	-0.	0.	2.	7.
	6	4.	1.	0.	1.	-2.	-16.
45	5	-1.	0.	0.	0.	0.	5.
	6	2.	-0.	-0.	-0.	-0.	-6.
46	5	1.	0.	0.	-0.	0.	5.
	2	1.	-0.	-0.	-0.	-0.	0.
47	47	3.	0.	0.	0.	0.	4.
	48	3.	0.	0.	0.	0.	-4.
48	56	92.	155.	-116.	453.	509.	158.
	27	-92.	-155.	116.	-86.	-509.	133.
49	46	-85.	77.	-132.	-34.	30.	-535.
	27	85.	-77.	132.	356.	-30.	329.
50	58	105.	-141.	139.	-529.	441.	142.
	28	-105.	141.	-139.	92.	-441.	191.
51	48	-66.	-55.	142.	-23.	-72.	-538.
	28	86.	55.	-142.	-323.	72.	328.
52	23	-222.	3.	1.	10.	2910.	1752.
	24	225.	-3.	-1.	-10.	-2910.	-1808.

53	24	-225.	3.	1.	10.	2910.	1807.
	25	228.	-3.	-1.	-10.	-2910.	-1864.
54	25	-226.	3.	1.	10.	2910.	1864.
	26	266.	-3.	-1.	-13.	-2910.	-2726.

TYPE	JNT. NO.	FX	FY	FZ	MX	MY	MZ
		. . . . . BOUNDARY OR JUNCTION REACTION					
BODY	26	-3.	266.	1.	-2910.	-13.	2728.
A -X+Y	10	1.	-106.	8.	1732.	7.	-270.
B +X-Y	23	3.	-222.	-1.	2910.	10.	-1752.

DEFORMATION RESPONSE TO STATIC SEISMIC LOAD IN HORIZ(1) DIRECTION

JOINT NO.	. . . DEFLECTION . . . X	Y	Z	. . . ROTATION . . . X	Y	Z
1	0.014344	0.000956	-0.005739	-0.000032	0.000508	-0.000025
2	0.011296	0.000764	-0.005689	-0.000032	0.000508	-0.000025
3	0.004662	0.000333	-0.005605	-0.000031	0.000514	-0.000012
4	0.004150	0.000302	-0.005601	-0.000031	0.000515	-0.000012
5	0.004147	0.000300	-0.005466	-0.000049	0.000634	-0.000006
6	0.003550	0.000254	-0.005462	-0.000049	0.000637	-0.000008
7	0.002939	0.000207	-0.005456	-0.000048	0.000642	-0.000006
8	0.001915	0.000130	-0.005447	-0.000048	0.000646	-0.000005
9	0.001115	0.000076	-0.004783	-0.000046	0.000646	0.000002
10	-0.000009	-0.000010	-0.002931	-0.000046	0.000646	0.000002
11	-0.001146	-0.000084	-0.004783	-0.000046	0.000646	0.000002
12	-0.001953	-0.000139	-0.005436	-0.000046	0.000646	0.000002
13	-0.002990	-0.000213	-0.005440	-0.000046	0.000646	0.000002
14	-0.003612	-0.000257	-0.005442	-0.000046	0.000648	0.000002
15	-0.008918	-0.000632	-0.005447	-0.000046	0.000648	0.000002
16	-0.010117	-0.000716	-0.005448	-0.000046	0.000648	0.000002
17	-0.016245	-0.001150	-0.005452	-0.000046	0.000646	0.000002
18	-0.000011	-0.000010	-0.002960	-0.000044	0.000579	0.000001
19	-0.000011	-0.000010	-0.003042	-0.000042	0.000513	0.000000
20	-0.000004	-0.000010	-0.002776	-0.000046	0.000468	0.000000
21	0.000003	-0.000006	-0.006267	-0.000039	0.000508	-0.000001
22	0.000012	-0.000000	-0.000204	-0.000043	0.000464	0.000001
23	0.000000	0.000000	-0.000162	-0.000009	0.000063	0.000000
24	0.000000	0.000000	-0.000145	-0.000008	0.000059	0.000000
25	0.000000	0.000000	-0.000129	-0.000008	0.000056	0.000000
26	0.0	0.0	0.0	0.0	0.0	0.0
27	0.002036	0.000157	-0.001858	-0.000041	0.000513	-0.000000
28	0.001869	0.000174	-0.001627	-0.000045	0.000468	0.000000
29	0.002295	0.000177	-0.001858	-0.000041	0.000513	-0.000000
30	0.002103	0.000196	-0.001627	-0.000045	0.000469	0.000000
31	0.008148	0.000668	-0.001874	-0.000051	0.000556	-0.000012
32	0.007689	0.000712	-0.001641	-0.000051	0.000537	-0.000022
33	0.008568	0.000639	-0.005309	-0.000035	0.000682	-0.000013
34	0.008131	0.000638	-0.005059	-0.000036	0.000713	-0.000022
35	0.011375	0.000788	-0.005313	-0.000032	0.000508	-0.000025
36	0.011176	0.000788	-0.005061	-0.000032	0.000508	-0.000025
37	0.004162	0.000287	-0.006552	-0.000049	0.000637	-0.000008
38	0.004136	0.000287	-0.006397	-0.000049	0.000637	-0.000008
39	0.004136	0.000313	-0.004371	-0.000049	0.000637	-0.000008
40	0.004162	0.000313	-0.004527	-0.000049	0.000637	-0.000008
41	0.002883	0.000207	-0.004802	-0.000048	0.000646	-0.000005
42	0.001015	0.000069	-0.004782	-0.000046	0.000646	0.000002
43	-0.001044	-0.000077	-0.004782	-0.000046	0.000646	0.000002
44	-0.002925	-0.000210	-0.004788	-0.000046	0.000646	0.000002
45	-0.001862	-0.000161	-0.003092	-0.000042	0.000513	0.000000
46	0.001838	0.000141	-0.003092	-0.000042	0.000513	0.000000
47	-0.001695	-0.000176	-0.002722	-0.000046	0.000468	0.000000
48	0.001686	0.000157	-0.002722	-0.000046	0.000468	0.000000

Complete Assembly

49	-0.000011	-0.000010	-0.002967	-0.000042	0.000513	0.000000
50	-0.000004	-0.000010	-0.002837	-0.000046	0.000466	0.000000
51	0.000003	0.000001	-0.000226	-0.000039	0.000508	-0.000001
52	0.000003	0.000001	-0.000207	-0.000039	0.000508	-0.000001
53	0.000011	-0.000000	-0.000228	-0.000043	0.000464	0.000001
54	0.000012	-0.000000	-0.000207	-0.000043	0.000464	0.000001
55	-0.001632	-0.000141	-0.000271	-0.000039	0.000508	-0.000001
56	0.001839	0.000142	-0.000271	-0.000039	0.000508	-0.000001
57	-0.001661	-0.000155	-0.000158	-0.000043	0.000464	0.000001
58	0.001687	0.000155	-0.000158	-0.000043	0.000464	0.000001
59	0.008587	0.000706	-0.001963	-0.000051	0.000556	-0.000012
60	0.008130	0.000668	-0.001798	-0.000051	0.000556	-0.000012
61	0.007722	0.000712	-0.001718	-0.000051	0.000537	-0.000022
62	0.008126	0.000751	-0.001725	-0.000051	0.000537	-0.000022
63	-0.000086	-0.000012	-0.000226	-0.000009	0.000063	0.000000
64	0.000086	0.000012	-0.000226	-0.000009	0.000063	0.000000
65	-0.000085	-0.000012	-0.000152	-0.000009	0.000063	0.000000
66	0.000087	0.000012	-0.000152	-0.000009	0.000063	0.000000

DEFORMATION RESPONSE TO STATIC SEISMIC LOAD IN HORIZ(2) DIRECTION

JOINT NO.	. . .DEFLECTION . . . X	Y	Z	. . . ROTATION . . . X	Y	Z
1	0.015831	-0.000983	-0.004357	0.000027	0.000406	-0.000115
2	0.012695	-0.000821	-0.004357	0.000027	0.000540	-0.000115
3	0.004669	-0.000450	-0.004309	0.000026	0.000618	-0.000110
4	0.004041	-0.000424	-0.004307	0.000025	0.000618	-0.000110
5	0.004037	-0.000424	-0.004257	0.000001	0.000562	-0.000109
6	0.003510	-0.000424	-0.004255	0.000000	0.000557	-0.000109
7	0.002962	-0.000423	-0.004254	-0.000001	0.000551	-0.000108
8	0.002051	-0.000424	-0.004252	-0.000001	0.000544	-0.000107
9	0.001367	-0.000322	-0.003705	-0.000006	0.000504	-0.000104
10	0.000222	-0.000052	-0.002339	-0.000006	0.000503	-0.000104
11	-0.000395	-0.000341	-0.003705	-0.000006	0.000502	-0.000104
12	-0.000986	-0.000452	-0.004205	-0.000006	0.000497	-0.000104
13	-0.001760	-0.000461	-0.004207	-0.000006	0.000491	-0.000104
14	-0.002221	-0.000467	-0.004209	-0.000006	0.000484	-0.000104
15	-0.005421	-0.000513	-0.004209	-0.000006	0.000346	-0.000104
16	-0.006042	-0.000523	-0.004209	-0.000006	0.000328	-0.000104
17	-0.007958	-0.000576	-0.004209	-0.000006	0.000162	-0.000104
18	0.000266	-0.000051	-0.002342	-0.000005	0.000456	-0.000029
19	0.000269	-0.000050	-0.002350	-0.000005	0.000409	-0.000003
20	0.000103	-0.000054	-0.002317	-0.000006	0.000403	-0.000013
21	0.000265	-0.000080	-0.004955	-0.000002	0.000409	-0.000006
22	0.000113	0.000005	-0.000105	-0.000007	0.000400	-0.000011
23	0.000009	-0.000003	-0.000081	0.000000	0.000040	-0.000002
24	0.000009	-0.000003	-0.000071	0.000000	0.000036	-0.000002
25	0.000008	-0.000003	-0.000062	0.000000	0.000035	-0.000002
26	0.0	0.0	0.0	0.0	0.0	0.0
27	0.001906	-0.000022	-0.001379	-0.000003	0.000412	-0.000005
28	0.001704	-0.000003	-0.001355	-0.000006	0.000404	-0.000012
29	0.002116	-0.000020	-0.001379	-0.000003	0.000415	-0.000005
30	0.001906	0.000000	-0.001355	-0.000006	0.000407	-0.000012
31	0.008343	-0.000113	-0.001348	0.000026	0.000596	-0.000101
32	0.007790	-0.000085	-0.001335	0.000021	0.000568	-0.000095
33	0.008987	-0.000639	-0.003794	0.000015	0.000642	-0.000099
34	0.008387	-0.000592	-0.003997	0.000026	0.000658	-0.000096
35	0.013054	-0.000713	-0.003766	0.000027	0.000540	-0.000115
36	0.012146	-0.000713	-0.003979	0.000027	0.000540	-0.000115
37	0.004207	-0.000597	-0.005141	0.000000	0.000557	-0.000109
38	0.003860	-0.000597	-0.005142	0.000000	0.000557	-0.000109
39	0.003860	-0.000251	-0.003370	0.000000	0.000557	-0.000109
40	0.004207	-0.000251	-0.003368	0.000000	0.000557	-0.000109
41	0.002867	-0.000315	-0.003708	-0.000001	0.000544	-0.000107
42	0.001284	-0.000323	-0.003705	-0.000006	0.000503	-0.000104
43	-0.000318	-0.000341	-0.003705	-0.000006	0.000503	-0.000104
44	-0.001732	-0.000357	-0.003708	-0.000006	0.000497	-0.000104
45	-0.001205	-0.000067	-0.002356	-0.000005	0.000409	-0.000003
46	0.001750	-0.000033	-0.002356	-0.000005	0.000409	-0.000003
47	-0.001365	-0.000074	-0.002310	-0.000006	0.000403	-0.000013
48	0.001542	-0.000033	-0.002310	-0.000006	0.000403	-0.000013

49	0.000265	-0.000050	-0.002344	-0.000005	0.000409	-0.000003
50	0.000120	-0.000054	-0.002324	-0.000006	0.000403	-0.000013
51	0.000265	-0.000013	-0.000094	-0.000002	0.000409	-0.000006
52	0.000262	-0.000013	-0.000094	-0.000002	0.000409	-0.000006
53	0.000119	0.000005	-0.000109	-0.000007	0.000400	-0.000011
54	0.000114	0.000005	-0.000105	-0.000007	0.000400	-0.000011
55	-0.001206	-0.000021	-0.000097	-0.000002	0.000409	-0.000006
56	0.001749	-0.000006	-0.000097	-0.000002	0.000409	-0.000006
57	-0.001341	-0.000020	-0.000096	-0.000007	0.000400	-0.000011
58	0.001544	0.000029	-0.000098	-0.000007	0.000400	-0.000011
59	0.008967	-0.000133	-0.001302	0.000026	0.000598	-0.000101
60	0.008192	-0.000113	-0.001368	0.000026	0.000598	-0.000101
61	0.007934	-0.000085	-0.001303	0.000021	0.000568	-0.000095
62	0.008371	-0.000101	-0.001300	0.000021	0.000566	-0.000095
63	-0.000039	-0.000004	-0.000097	0.000000	0.000040	-0.000002
64	0.000072	-0.000005	-0.000097	0.000000	0.000040	-0.000002
65	-0.000053	-0.000004	-0.000099	0.000000	0.000040	-0.000002
66	0.000058	-0.000005	-0.000099	0.000000	0.000040	-0.000002

DEFORMATION RESPONSE TO STATIC SEISMIC LOAD IN VERTICAL DIRECTION

JOINT NO.	. . . DEFLECTION . . . X	Y	Z	. . . ROTATION . . . X	Y	Z
1	0.001333	-0.010438	0.000336	0.000199	0.000050	-0.000079
2	0.001033	-0.008543	0.000336	0.000333	0.000050	-0.000079
3	0.000409	-0.003067	0.000322	0.000414	0.000041	-0.000111
4	0.000368	-0.002640	0.000322	0.000412	0.000040	-0.000112
5	0.000368	-0.002638	0.000331	0.000229	0.000014	-0.000120
6	0.000355	-0.002426	0.000331	0.000222	0.000013	-0.000120
7	0.000343	-0.002199	0.000330	0.000208	0.000011	-0.000126
8	0.000325	-0.001844	0.000329	0.000202	0.000010	-0.000128
9	0.000318	-0.001472	0.000337	0.000141	0.000004	-0.000125
10	-0.000002	-0.000866	-0.000004	0.000141	0.000004	-0.000125
11	0.000302	-0.000976	0.000337	0.000141	0.000004	-0.000125
12	0.000297	-0.000944	0.000332	0.000136	0.000004	-0.000126
13	0.000290	-0.000736	0.000332	0.000135	0.000004	-0.000126
14	0.000285	-0.000617	0.000332	0.000127	0.000004	-0.000126
15	0.000249	-0.000336	0.000332	-0.000011	0.000004	-0.000126
16	0.000241	-0.000377	0.000332	-0.000026	0.000004	-0.000126
17	0.000200	-0.001835	0.000332	-0.000194	0.000004	-0.000126
18	0.000058	-0.000866	0.000112	0.000140	-0.000031	-0.000080
19	0.000299	-0.000864	0.000411	0.000140	-0.000066	-0.000134
20	-0.000301	-0.000863	-0.000423	0.000140	0.000068	-0.000132
21	0.000272	-0.001773	0.000777	0.000142	-0.000060	-0.000140
22	-0.000271	-0.000121	-0.000061	0.000144	0.000062	-0.000137
23	0.000000	-0.000050	-0.000000	0.000034	0.000000	-0.000010
24	0.000000	-0.000046	-0.000000	0.000032	0.000000	-0.000010
25	0.000000	-0.000042	-0.000000	0.000030	0.000000	-0.000009
26	0.0	0.0	0.0	0.0	0.0	0.0
27	0.000143	-0.001120	0.000370	0.000143	-0.000063	-0.000138
28	-0.000135	-0.001127	-0.000377	0.000144	0.000065	-0.000136
29	0.000112	-0.001193	0.000370	0.000145	-0.000062	-0.000139
30	-0.000103	-0.001200	-0.000377	0.000146	0.000064	-0.000137
31	-0.000036	-0.004328	0.000387	0.000342	-0.000010	-0.000346
32	0.000203	-0.004348	-0.000405	0.000325	0.000041	-0.000311
33	0.000567	-0.006459	0.001408	0.000459	-0.000009	-0.000363
34	0.000731	-0.006323	-0.001173	0.000492	0.000219	-0.000336
35	0.001261	-0.008468	0.001423	0.000333	0.000050	-0.000079
36	0.000655	-0.008468	-0.001196	0.000333	0.000050	-0.000079
37	0.000559	-0.002825	0.000662	0.000222	0.000013	-0.000120
38	0.000177	-0.002825	-0.000043	0.000222	0.000013	-0.000120
39	0.000177	-0.002443	-0.000000	0.000222	0.000013	-0.000120
40	0.000559	-0.002443	0.000705	0.000222	0.000013	-0.000120
41	0.000339	-0.002016	0.000339	0.000202	0.000010	-0.000128
42	0.000317	-0.001448	0.000337	0.000141	0.000004	-0.000125
43	0.000303	-0.000999	0.000337	0.000141	0.000004	-0.000125
44	0.000290	-0.000611	0.000337	0.000136	0.000004	-0.000126
45	0.000694	-0.000379	0.000577	0.000140	-0.000066	-0.000134
46	0.000220	-0.001389	0.000577	0.000140	-0.000066	-0.000134
47	-0.000701	-0.000376	-0.000569	0.000140	0.000066	-0.000132
48	-0.000212	-0.001390	-0.000569	0.000140	0.000068	-0.000132

49	0.000123	-0.000884	0.000227	0.000140	-0.000066	-0.000134
50	-0.000127	-0.000863	-0.000238	0.000140	0.000068	-0.000132
51	0.000260	-0.000116	0.000050	0.000142	-0.000060	-0.000140
52	0.000192	-0.000116	-0.000019	0.000142	-0.000060	-0.000140
53	-0.000192	-0.000121	0.000021	0.000144	0.000062	-0.000137
54	-0.000259	-0.000121	-0.000049	0.000144	0.000062	-0.000137
55	0.000636	0.000397	0.000212	0.000142	-0.000060	-0.000140
56	0.000202	-0.000629	0.000212	0.000142	-0.000060	-0.000140
57	-0.000638	0.000399	-0.000213	0.000144	0.000062	-0.000137
58	-0.000194	-0.000641	-0.000213	0.000144	0.000062	-0.000137
59	0.000559	-0.004584	0.000985	0.000342	-0.000010	-0.000346
60	-0.000557	-0.004328	-0.000126	0.000342	-0.000010	-0.000346
61	0.000670	-0.004348	0.000082	0.000325	0.000041	-0.000311
62	0.000740	-0.004591	0.000123	0.000325	0.000041	-0.000311
63	0.000043	-0.000007	0.000141	0.000034	0.000000	-0.000010
64	0.000043	-0.000102	0.000141	0.000034	0.000000	-0.000010
65	-0.000043	-0.000007	-0.000142	0.000034	0.000000	-0.000010
66	-0.000043	-0.000102	-0.000142	0.000034	0.000000	-0.000010

Complete Assembly

DEFORMATION RESPONSE TO OPERATIONAL LOADS (INCLUDING DEAD*WEIGHT)

JOINT NO.	. . . DEFLECTION . . . X	Y	Z	. . . ROTATION . . . X	Y	Z
1	0.000122	-0.001427	0.000075	0.000033	0.000005	0.000001
2	0.000094	-0.001156	0.000075	0.000047	0.000005	0.000001
3	0.000036	-0.000422	0.000074	0.000056	0.000004	-0.000006
4	0.000033	-0.000365	0.000074	0.000056	0.000004	-0.000006
5	0.000033	-0.000364	0.000075	0.000040	0.000001	-0.000007
6	0.000031	-0.000327	0.000075	0.000039	0.000001	-0.000007
7	0.000030	-0.000288	0.000075	0.000038	0.000001	-0.000009
8	0.000028	-0.000226	0.000074	0.000037	0.000001	-0.000009
9	0.000027	-0.000171	0.000075	0.000031	0.000001	-0.000011
10	-0.000000	-0.000067	-0.000001	0.000031	0.000001	-0.000011
11	0.000025	-0.000061	0.000075	0.000031	0.000001	-0.000011
12	0.000025	-0.000034	0.000075	0.000031	0.000001	-0.000011
13	0.000024	0.000014	0.000075	0.000031	0.000001	-0.000011
14	0.000023	0.000042	0.000075	0.000030	0.000001	-0.000011
15	0.000019	0.000211	0.000075	0.000016	0.000001	-0.000011
16	0.000018	0.000239	0.000075	0.000014	0.000001	-0.000011
17	0.000013	0.000255	0.000075	-0.000002	0.000001	-0.000011
18	0.000025	-0.000087	0.000024	0.000031	-0.000007	-0.000006
19	0.000030	-0.000087	0.000090	0.000030	-0.000014	-0.000014
20	-0.000030	-0.000087	-0.000093	0.000031	0.000015	-0.000013
21	0.000027	-0.000161	0.000176	0.000030	-0.000014	-0.000014
22	-0.000027	-0.000012	-0.000012	0.000030	0.000014	-0.000014
23	0.000000	-0.000005	-0.000000	0.000007	0.000000	-0.000001
24	0.000000	-0.000005	-0.000000	0.000007	0.000000	-0.000001
25	0.000000	-0.000004	-0.000000	0.000006	0.000000	-0.000001
26	0.0	0.0	0.0	0.0	0.0	0.0
27	-0.000017	-0.000175	0.000080	0.000030	-0.000014	-0.000014
28	0.000020	-0.000176	-0.000082	0.000030	0.000015	-0.000014
29	-0.000024	-0.000190	0.000080	0.000030	-0.000014	-0.000014
30	0.000027	-0.000191	-0.000082	0.000031	0.000015	-0.000014
31	-0.000085	-0.000672	0.000082	0.000050	-0.000004	-0.000035
32	0.000106	-0.000680	-0.000085	0.000046	0.000007	-0.000029
33	-0.000026	-0.000898	0.000223	0.000059	0.000003	-0.000037
34	0.000158	-0.000878	-0.000140	0.000064	0.000016	-0.000031
35	0.000091	-0.001157	0.000225	0.000047	0.000005	0.000001
36	0.000099	-0.001157	-0.000143	0.000047	0.000005	0.000001
37	0.000044	-0.000376	0.000134	0.000039	0.000001	-0.000007
38	0.000021	-0.000376	0.000010	0.000039	0.000001	-0.000007
39	0.000021	-0.000352	0.000015	0.000039	0.000001	-0.000007
40	0.000044	-0.000352	0.000139	0.000039	0.000001	-0.000007
41	0.000030	-0.000272	0.000075	0.000037	0.000001	-0.000009
42	0.000027	-0.000166	0.000075	0.000031	0.000001	-0.000011
43	0.000026	-0.000066	0.000075	0.000031	0.000001	-0.000011
44	0.000024	0.000023	0.000075	0.000031	0.000001	-0.000011
45	0.000098	0.000023	0.000126	0.000030	-0.000014	-0.000014
46	-0.000006	-0.000196	0.000126	0.000030	-0.000014	-0.000014
47	-0.000100	0.000024	-0.000129	0.000031	0.000015	-0.000013
48	0.000009	-0.000197	-0.000129	0.000031	0.000015	-0.000013

49	0.000012	-0.000087	0.000049	0.000030	-0.000014	-0.000014
50	-0.000012	-0.000087	-0.000053	0.000031	0.000015	-0.000013
51	0.000026	-0.000012	0.000009	0.000030	-0.000014	-0.000014
52	0.000019	-0.000012	-0.000005	0.000030	-0.000014	-0.000014
53	-0.000019	-0.000012	0.000005	0.000030	0.000014	-0.000014
54	-0.000025	-0.000012	-0.000009	0.000030	0.000014	-0.000014
55	0.000092	0.000095	0.000043	0.000030	-0.000014	-0.000014
56	-0.000008	-0.000119	0.000043	0.000030	-0.000014	-0.000014
57	-0.000093	0.000096	-0.000044	0.000030	0.000014	-0.000014
58	0.000010	-0.000120	-0.000044	0.000030	0.000014	-0.000014
59	-0.000027	-0.000709	0.000169	0.000050	-0.000004	-0.000035
60	-0.000138	-0.000672	0.000008	0.000050	-0.000004	-0.000035
61	0.000150	-0.000680	-0.000013	0.000048	0.000007	-0.000029
62	0.000159	-0.000716	-0.000007	0.000048	0.000007	-0.000029
63	0.000004	0.000004	0.000029	0.000007	0.000000	-0.000001
64	0.000004	-0.000015	0.000029	0.000007	0.000000	-0.000001
65	-0.000004	0.000004	-0.000029	0.000007	0.000000	-0.000001
66	-0.000004	-0.000015	-0.000029	0.000007	0.000000	-0.000001

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	. . . DEFLECTION . . .			. . . ROTATION . . .		
NO.	X	Y	Z	X	Y	Z
1	0.021526	-0.011955	0.007286	0.000237	0.000657	0.000143
2	0.017118	-0.009773	0.007249	0.000382	0.000747	0.000143
3	0.006647	-0.003539	0.007151	0.000472	0.000809	-0.000162
4	0.005837	-0.003056	0.007147	0.000470	0.000809	-0.000163
5	0.005832	-0.003053	0.007010	0.000274	0.000849	-0.000169
6	0.005036	-0.002803	0.007006	0.000266	0.000847	-0.000170
7	0.004217	-0.002537	0.007001	0.000252	0.000847	-0.000174
8	0.002853	-0.002122	0.006993	0.000245	0.000845	-0.000177
9	0.001620	-0.001680	0.006135	0.000180	0.000620	-0.000173
10	-0.000223	-0.000976	-0.003751	0.000160	0.000819	-0.000173
11	0.001275	-0.001100	0.006134	0.000180	0.000819	-0.000173
12	0.002233	-0.001091	0.006955	0.000177	0.000817	-0.000174
13	0.003505	0.000908	0.006960	0.000173	0.000814	-0.000174
14	0.004273	0.000857	0.006962	0.000165	0.000809	-0.000174
15	0.010458	0.001092	0.006967	0.000063	0.000735	-0.000174
16	0.011804	0.001202	0.006967	0.000068	0.000727	-0.000174
17	0.018103	0.002496	0.006971	-0.000202	0.000666	-0.000174
18	0.000278	-0.000974	0.003800	0.000178	-0.000745	-0.000093
19	0.000432	-0.000972	0.003956	0.000177	-0.000674	-0.000147
20	-0.000347	-0.000972	-0.003734	0.000176	0.000636	-0.000146
21	0.000407	-0.001956	0.008203	0.000177	-0.000669	-0.000154
22	-0.000320	-0.000133	-0.000249	0.000180	0.000630	-0.000152
23	0.000009	-0.000055	-0.000181	0.000042	0.000074	-0.000012
24	0.000009	-0.000051	-0.000161	0.000040	0.000070	-0.000011
25	0.000008	-0.000046	-0.000143	0.000037	0.000066	-0.000010
26	0.0	0.0	0.0	0.0	0.0	0.0
27	-0.002813	-0.001307	0.002423	0.000179	-0.000675	-0.000153
28	0.002552	-0.001316	-0.002232	0.000182	0.000636	-0.000151
29	-0.003148	-0.001397	0.002423	0.000181	-0.000677	-0.000154
30	0.002868	-0.001408	-0.002232	0.000184	0.000639	-0.000152
31	-0.011747	-0.005052	0.002423	0.000396	-0.000821	-0.000395
32	0.011054	-0.005086	-0.002239	0.000378	0.000790	-0.000355
33	-0.012469	-0.007420	0.006899	0.000520	0.000940	-0.000413
34	0.011862	-0.007261	-0.006693	0.000557	0.001011	-0.000382
35	0.017453	-0.009692	0.006691	0.000382	0.000747	0.000143
36	0.016619	-0.009692	-0.006691	0.000382	0.000747	0.000143
37	0.005988	-0.003277	0.008489	0.000266	0.000847	-0.000170
38	0.005681	-0.003277	0.008218	0.000266	0.000847	-0.000170
39	0.005681	-0.002828	0.005534	0.000266	0.000847	-0.000170
40	0.005988	-0.002828	0.005825	0.000266	0.000847	-0.000170
41	0.004110	-0.002325	0.006152	0.000245	0.000845	-0.000177
42	0.001694	-0.001651	0.006134	0.000180	0.000819	-0.000173
43	0.001159	-0.001124	0.006134	0.000180	0.000819	-0.000173
44	0.003435	0.000761	0.006141	0.000177	0.000817	-0.000174

45	0.002422	0.000440	0.004055	0.000177	-0.000674	-0.000147
46	-0.002554	-0.001593	0.004055	0.000177	-0.000674	-0.000147
47	-0.002386	0.000445	-0.003748	0.000176	0.000636	-0.000146
48	0.002304	-0.001596	-0.003748	0.000176	0.000636	-0.000146
49	0.000304	-0.000972	0.003853	0.000177	-0.000674	-0.000147
50	-0.000186	-0.000972	-0.003728	0.000176	0.000636	-0.000146
51	0.000397	-0.000129	0.000259	0.000177	-0.000669	-0.000154
52	0.000344	-0.000129	-0.000233	0.000177	-0.000669	-0.000154
53	-0.000245	-0.000133	0.000259	0.000180	0.000630	-0.000152
54	-0.000309	-0.000133	-0.000247	0.000180	0.000630	-0.000152
55	0.002376	0.000517	0.000400	0.000177	-0.000669	-0.000154
56	-0.002554	-0.000764	0.000400	0.000177	-0.000669	-0.000154
57	-0.002321	0.000524	-0.000327	0.000180	0.000630	-0.000152
58	0.002306	-0.000780	-0.000327	0.000180	0.000630	-0.000152
59	-0.012455	-0.005349	0.002722	0.000396	-0.000821	-0.000395
60	-0.011693	-0.005052	0.002282	0.000396	-0.000821	-0.000395
61	0.011241	-0.005086	-0.002171	0.000378	0.000790	-0.000355
62	0.011650	-0.005369	-0.002170	0.000378	0.000790	-0.000355
63	0.000108	0.000019	0.000312	0.000042	0.000074	-0.000012
64	0.000124	-0.000118	0.000312	0.000042	0.000074	-0.000012
65	-0.000114	0.000019	-0.000260	0.000042	0.000074	-0.000012
66	-0.000117	-0.000118	-0.000260	0.000042	0.000074	-0.000012

BEAM STRESS FOR COMBINED STATIC AND OPERATIONAL LOADS

ELM NO.	JNT NO.	SPT NO.	C1 / K	C2 / FAC1	C3 / FAC3/2	STRESS/10(3) SMAX	SAL	MATERIAL DESCRIPTION	SMAX /SAL
20	45	3	-1.75	0.0	-0.44	0.1	27.0	STEEL	0.00
			0.0	1.00	1.00				
21	10	5	0.0	0.0	0.44	3.0	27.0	STEEL	0.11
			0.87	1.50	1.00				
22	50	5	0.0	0.0	0.44	2.8	27.0	STEEL	0.10
			0.87	1.50	1.00				
23	49	6	0.0	0.0	-0.44	2.6	27.0	STEEL	0.10
			0.67	1.50	1.00				
24	19	11	-0.35	0.0	-4.00	0.6	27.0	STEEL	0.03
			0.52	4.13	1.00				
25	22	11	-0.35	0.0	-4.00	0.6	27.0	STEEL	0.02
			0.52	4.13	1.00				
26	63	4	0.44	0.0	-0.49	23.1	27.0	STEEL	0.86
			0.0	1.00	1.00				
27	64	1	0.44	0.0	0.49	23.5	27.0	STEEL	0.87
			0.0	1.00	1.00				
28	65	4	0.44	0.0	-0.49	20.7	27.0	STEEL	0.77
			0.0	1.00	1.00				
29	66	2	-0.44	0.0	0.49	22.0	27.0	STEEL	0.81
			0.0	1.00	1.00				
30	51	3	-0.44	0.0	-0.49	11.7	27.0	STEEL	0.43
			0.0	1.00	1.00				
31	51	1	0.44	0.0	0.49	14.9	27.0	STEEL	0.55
			0.0	1.00	1.00				
32	54	4	0.44	0.0	-0.49	11.3	27.0	STEEL	0.42
			0.0	1.00	1.00				
33	54	4	0.44	0.0	-0.49	14.0	27.0	STEEL	0.52
			0.0	1.00	1.00				
34	52	3	-0.44	0.0	-0.49	4.0	27.0	STEEL	0.15
			0.0	1.00	1.00				
35	27	2	-1.88	0.0	2.31	0.6	27.0	STEEL	0.02
			0.0	1.00	1.00				
36	28	3	-1.88	0.0	-2.31	0.6	27.0	STEEL	0.02
			0.0	1.00	1.00				
37	29	1	1.50	0.0	1.50	3.0	27.0	STEEL	0.11
			0.0	1.00	1.00				
38	30	4	-1.50	0.0	1.50	2.8	27.0	STEEL	0.10
			0.0	1.00	1.00				
39	59	1	1.94	0.0	0.38	2.5	27.0	STEEL	0.09
			0.0	1.00	1.00				
40	62	2	-1.94	0.0	0.38	3.1	27.0	STEEL	0.12
			0.0	1.00	1.00				
41	35	3	-0.88	0.0	-0.38	6.1	27.0	STEEL	0.23
			0.0	1.00	1.00				
42	36	4	0.88	0.0	-0.38	6.0	27.0	STEEL	0.22
			0.0	1.00	1.00				
47	47	3	-1.75	0.0	-0.44	0.1	27.0	STEEL	0.00
			0.0	1.00	1.00				

52	24	6	0.0	0.0	-2.00	1.2	26.3	SA-515-70	0.04
			3.70	1.50	1.00				
53	25	6	0.0	0.0	-2.00	1.2	26.3	SA-515-70	0.05
			3.70	1.50	1.00				
54	26	6	0.0	0.0	-2.00	1.4	26.3	SA-515-70	0.06
			3.70	1.50	1.00				

BOLTED JOINT STRESS FOR COMBINED STATIC AND OPERATIONAL LOADS
(N=NUMBER OF BOLTS, AREA=AREA PER BOLT)

BOLT JNT	JOINT LOC.	DESCRIPTION, TYPE	N	AREA	BOLT NO.	STRESS/10(3) SMAX	SAL	MATERIAL DESCRIPTION	SMAX /SAL	NOTE
10	A	CIRC	4	0.13	4	15.1	82.8	SAE GR 5	0.18	
23	B	PAD	4	0.31	4	13.1	82.8	SAE GR 5	0.16	

THIS EQUIPMENT IS ACCEPTABLE FOR THE SPECIFIED SEISMIC DISTURBANCE

THIS REPORT HAS BEEN PREPARED BY /

BARRY L GAARDER
SENIOR DRAFTSMAN

FISHER CONTROLS COMPANY

VERSION 04/22/82

** FISHER CONTROLS COMPANY **

GEORGIA POWER COMPANY

ASSEMBLY 48A8927, 48A8928
ORIENTATION 38A7939, 38A7940

REP ORDER 228-X5AC03-N1P,N2P CODE CLASS 3
CUSTOMER ORDER PAV-206,PAV-2-34

SERIAL NO.	TAG NO.	ITEM NO.
8342938	1HV-12596	155
8342939	1HV-12597	156
8342940	2HV-12596	165
8342941	2HV-12597	166

** VALVE DESCRIPTION **

10 INCH N521-SR80-12-9280 CODE CLASS 3
BRACKET 48A0025 BETTIS SPRING RETURN PISTON ACTUATOR
ACCESSORIES : EA180 NAMCO LIMIT SWITCHES (2)
67FR PRESSURE REGULATOR
NPK8321A2V ASCO SOLENOID VALVE
1000 S ASHCROFT GAUGE

DESIGN CONDITIONS : 100 PSIG AT 200 DEG F
ACTUATOR TORQUE : 1471.0 IN-LB
REQUIRED FREQUENCY : 33 HERTZ 10.0 TRIAXIAL G LOADING
DYNAMIC ANALYSIS, ACTUATOR ONLY

DATE OF THIS REPORT / FEBRUARY 6, 1984

C O N T R O L   I N P U T   D A T A

MANUAL INPUT GENERATION FOR VALVE ANALYSIS

SEISMIC STRESSES ARE SUPERIMPOSED BY SQUARE ROOT OF SUM OF SQUARES

STRESS ALLOWABLES ARE COMPARED TO MAXIMUM PRINCIPAL STRESS

MASS, STIFFNESS, LOAD AND STRESS MATRICES ARE NOT PRINTED

DYNAMIC MODAL ANALYSIS TO BE PERFORMED WITH EVALUATION

C R O S S - S E C T I O N   D A T A

EL. NO.	CROSS-SECTION DESCRIPTION	PARAMETERS		
1	TUBE	A = 5.375 ,	T = .1650 ,	
2	TUBE	A = 5.375 ,	T = .1650 ,	
3	TUBE	A = 5.938 ,	T = .3600 ,	
4	TEE-SHAPED	A = 3.600 ,	T = .3000 ,	B = .9400 ,
		T1= .8750 ,	R1= .1250 ,	
5	TEE-SHAPED	A = 3.600 ,	T = .3000 ,	B = .9400 ,
		T1= .8750 ,	R1= .1250 ,	
6	TEE-SHAPED	A = 3.600 ,	T = .3000 ,	B = .9400 ,
		T1= .8750 ,	R1= .1250 ,	
7	TEE-SHAPED	A = 3.600 ,	T = .3000 ,	B = .9400 ,
		T1= .2500 ,	R1= .1250 ,	

8	RECTANG.BOX	A =	3.000	T =	.5900	B =	3.000
		T1=	.5900	R1=	.0		
9	RECTANG.BOX	A =	4.000	T =	.3750	B =	5.500
		T1=	.3750	R1=	.0		
10	RECTANG.BOX	A =	3.000	T =	.5900	B =	3.000
		T1=	.5900	R1=	.0		
11	RECTANG.BOX	A =	8.000	T =	.3750	B =	4.500
		T1=	.3750	R1=	.0		
12	RECTANG.BOX	A =	8.000	T =	.3750	B =	4.500
		T1=	.3750	R1=	.0		
13	RECTANG.BOX	A =	8.000	T =	.3750	B =	4.500
		T1=	.3750	R1=	.0		
14	RECTANG.BOX	A =	7.500	T =	.3750	B =	4.500
		T1=	.3750	R1=	.0		
15	RECTANG.BOX	A =	4.000	T =	.3750	B =	5.500
		T1=	.3750	R1=	.0		
16	RECTANG.BOX	A =	3.000	T =	.5900	B =	3.000
		T1=	.5900	R1=	.0		
17	SOLID CIRCLE	A =	1.500				
18	SOLID CIRCLE	A =	1.125				
19	SOLID CIRCLE	A =	1.125				
20	RECTANGULAR	A =	3.500	T =	.8750		
21	RECTANGULAR	A =	9.000	T =	.8750		
22	RECTANGULAR	A =	9.000	T =	.8750		
23	RECTANGULAR	A =	9.000	T =	.8750		
24	CHANNEL	A =	8.000	T =	.4870	B =	2.527
		T1=	.3900	R1=	.0		
25	CHANNEL	A =	8.000	T =	.4870	B =	2.527
		T1=	.3900	R1=	.0		
26	RECTANGULAR	A =	.8750	T =	.9800		
27	RECTANGULAR	A =	.8750	T =	.9800		
28	RECTANGULAR	A =	.8750	T =	.9800		
29	RECTANGULAR	A =	.8750	T =	.9800		
30	RECTANGULAR	A =	.8750	T =	.9800		
31	RECTANGULAR	A =	.8750	T =	.9800		
32	RECTANGULAR	A =	.8750	T =	.9800		
33	RECTANGULAR	A =	.8750	T =	.9800		
34	RECTANGULAR	A =	.8750	T =	.9800		
35	RECTANGULAR	A =	3.750	T =	4.625		
36	RECTANGULAR	A =	3.750	T =	4.625		
37	RECTANG.BOX	A =	3.000	T =	.2500	B =	3.000
		T1=	.2500	R1=	.1250		
38	RECTANG.BOX	A =	3.000	T =	.2500	B =	3.000
		T1=	.2500	R1=	.1250		
39	RECTANGULAR	A =	3.875	T =	.7500		
40	RECTANGULAR	A =	3.875	T =	.7500		
41	RECTANGULAR	A =	1.750	T =	.7500		
42	RECTANGULAR	A =	1.750	T =	.7500		
43	SOLID CIRCLE	A =	2.000				
44	SOLID CIRCLE	A =	1.500				
45	SOLID CIRCLE	A =	1.500				
46	SOLID CIRCLE	A =	.7500				
47	RECTANGULAR	A =	3.500	T =	.8750		
48	SOLID CIRCLE	A =	2.000				
49	SOLID CIRCLE	A =	2.000				
50	SOLID CIRCLE	A =	2.000				
51	SOLID CIRCLE	A =	2.000				
52	RECTANGULAR	A =	9.750	T =	4.000		
53	RECTANGULAR	A =	9.750	T =	4.000		
54	RECTANGULAR	A =	9.750	T =	4.000		

J O I N T C O O R D I N A T E D A T A

JOINT NO.	X	Y	Z
1	3.250000	2.500000	26.690002
2	3.250000	2.500000	20.690002
3	3.250000	2.500000	7.500000
4	3.250000	2.500000	6.500000
5	3.250000	2.500000	6.500000
6	3.250000	2.500000	5.560000
7	3.250000	2.500000	4.600000
8	3.250000	2.500000	3.000000
9	2.250000	2.500000	1.750000
10	-0.438000	0.0	0.0
11	2.250000	2.500000	-1.750000
12	3.250000	2.500000	-3.000000
13	3.250000	2.500000	-4.600000
14	3.250000	2.500000	-5.560000
15	3.250000	2.500000	-13.750000
16	3.250000	2.500000	-15.600000
17	3.250000	2.500000	-25.059000
18	-0.438000	0.875000	0.0
19	-0.438000	3.070000	0.0
20	-0.438000	-3.070000	0.0
21	5.938000	3.070000	0.0
22	-5.938000	-3.070000	0.0
23	-6.375000	0.0	0.0
24	-6.625000	0.0	0.0
25	-6.875000	0.0	0.0
26	-10.375000	0.0	0.0
27	-2.813000	3.875000	4.000000
28	-2.813000	-3.875000	4.000000
29	-2.813000	3.875000	4.500000
30	-2.813000	-3.875000	4.500000
31	-2.813000	3.875000	15.375000
32	-2.813000	-3.875000	15.375000
33	2.312000	5.625000	16.125000
34	2.312000	-2.250000	16.125000
35	2.312000	5.625000	20.690002
36	2.312000	-2.250000	20.690002
37	4.841000	4.091000	6.500000
38	4.841000	0.909000	6.500000
39	1.659000	0.909000	6.500000
40	1.659000	4.091000	6.500000
41	2.250000	2.500000	4.500000
42	2.250000	2.500000	1.593000
43	2.250000	2.500000	-1.593000
44	2.250000	2.500000	-4.500000
45	-0.438000	4.250000	-3.610000
46	-0.438000	4.250000	3.610000
47	-0.438000	-4.250000	-3.610000
48	-0.438000	-4.250000	3.610000

49	-0.438000	1.750000	0.0
50	-0.438000	-1.750000	0.0
51	-5.938000	2.987000	0.0
52	-5.938000	2.500000	0.0
53	-5.938000	-2.500000	0.0
54	-5.938000	-2.987000	0.0
55	-5.938000	4.125000	-3.610000
56	-5.938000	4.125000	3.610000
57	-5.938000	-4.125000	-3.610000
58	-5.938000	-4.125000	3.610000
59	-2.813000	5.625000	16.125000
60	-2.813000	2.375000	15.375000
61	-2.813000	-2.375000	15.375000
62	-2.813000	-2.250000	16.125000
63	-5.938000	4.125000	-1.375000
64	-5.938000	4.125000	1.375000
65	-5.938000	-4.125000	-1.375000
66	-5.938000	-4.125000	1.375000

B O U N D A R Y , S P R I N G & B O L T J O I N T D A T A

JOINT NO.	TYPE-MAT /FIXITY	PLANE-DIRECTION OR DESCRIPTION		SPRING & BOLT JOINT PARAMETERS
23	111111	BODY		
10	CIRC 4	A	-X +Y	N.T= 4.13 ,D/A= 0.5000, D= 4.5000 YSH= 0.0 ,ZSH= 0.0 ,STD= 1.0000 FG= 0.
23	PAD 4	B	+X -Y	N.T= 2.10 ,D/A= 0.7500, YE= 0.7500 YO= 2.7500,YSH= 0.0 , S= 8.2500 ZT= 0.7500, ZE= 0.0 ,ZSH= 0.0

C O N C E N T R A T E D M A S S D A T A

JOINT NO.	LUMPED MASS	FOR DIR.	SHIFT DISTANCE OR MOMENT OF INERTIA X	Y	Z
1	0.168219	XYZ	0.0	0.0	-12.500000
6	0.006470	XYZ	0.0	0.0	0.0
8	0.006470	XYZ	0.0	0.0	0.0
12	0.010352	XYZ	0.0	0.0	0.0

C O N C E N T R A T E D L O A D D A T A

JOINT NO.	. . . . FORCES. . . . X	Y	Z	. . . .MOMENTS. . . . X	Y	Z
10	0.0	0.0	0.0	1471.0	0.0	0.0

ELEMENT INPUT DATA

EL. NO.	JOINTS		LENGTH /RADIUS	ANGLE	AREA	MOMENTS OF INERTIA I-11	I-22	I-33	MATERIAL DESCRIPTION
1	1	2	6.000		2.7007	9.1726	18.3453	9.1726	STEEL
2	2	3	13.190		2.7007	9.1726	18.3453	9.1726	STEEL
3	3	4	1.000		6.3086	24.6379	49.2758	24.6379	DUCTILE IRON
4	40	4	2.250		1.6400	1.2021	0.1517	0.1087	DUCTILE IRON
5	37	4	2.250		1.6400	1.2021	0.1517	0.1087	DUCTILE IRON
6	38	4	2.250		1.6400	1.2021	0.1517	0.1087	DUCTILE IRON
7	39	4	2.250		1.2400	1.1672	0.0383	0.0443	DUCTILE IRON
8	6	7	0.960		5.6876	5.8357	8.3225	5.8357	DUCTILE IRON
9	7	8	1.600		6.5625	15.7451	29.5944	26.4326	DUCTILE IRON
10	9	41	2.750		5.6876	5.8357	8.3225	5.8357	DUCTILE IRON
11	9	42	0.157		8.8125	72.9131	63.1571	28.8896	DUCTILE IRON
12	42	43	3.186		8.8125	72.9131	63.1571	28.8896	DUCTILE IRON
13	43	11	0.157		8.8125	72.9131	63.1571	28.8896	DUCTILE IRON
14	11	44	2.750		8.4375	62.0947	57.5977	27.2900	DUCTILE IRON
15	12	13	1.600		6.5625	15.7451	29.5944	26.4326	DUCTILE IRON
16	13	14	0.960		5.6876	5.8357	8.3225	5.8357	DUCTILE IRON
17	14	15	8.190		1.7671	0.2485	0.4970	0.2485	STEEL
18	15	16	1.850		0.9940	0.0786	0.1573	0.0786	STEEL
19	16	17	9.459		0.9940	0.0786	0.1573	0.0786	STEEL
20	45	46	7.220		3.0625	0.1954	0.6585	3.1263	STEEL
21	10	18	0.875		7.8750	0.5024	1.8867	53.1563	STEEL
22	10	50	1.750		7.8750	0.5024	1.8867	53.1563	STEEL
23	18	49	0.875		7.8750	0.5024	1.8867	53.1563	STEEL
24	19	21	6.376		5.4872	43.8363	0.3685	2.4324	STEEL
25	20	22	5.500		5.4872	43.8363	0.3685	2.4324	STEEL
26	63	55	2.235		0.8575	0.0686	0.1023	0.0547	STEEL
27	64	56	2.235		0.8575	0.0686	0.1023	0.0547	STEEL
28	57	65	2.235		0.8575	0.0686	0.1023	0.0547	STEEL
29	58	66	2.235		0.8575	0.0686	0.1023	0.0547	STEEL
30	63	51	1.785		0.8575	0.0686	0.1023	0.0547	STEEL
31	64	51	1.785		0.8575	0.0686	0.1023	0.0547	STEEL
32	65	54	1.785		0.8575	0.0686	0.1023	0.0547	STEEL
33	66	54	1.785		0.8575	0.0686	0.1023	0.0547	STEEL
34	52	53	5.000		0.8575	0.0685	0.1023	0.0547	STEEL
35	27	29	0.500		17.3438	30.9161	41.2662	20.3247	STEEL
36	28	30	0.500		17.3438	30.9161	41.2662	20.3247	STEEL
37	29	31	10.875		2.7500	3.4948	5.2047	3.4948	STEEL
38	30	32	10.875		2.7500	3.4948	5.2047	3.4948	STEEL
39	33	59	5.125		2.9063	0.1362	0.4785	3.6366	STEEL
40	34	62	5.125		2.9063	0.1362	0.4785	3.6366	STEEL
41	33	35	4.565		1.3125	0.0615	0.1798	0.3350	STEEL
42	34	36	4.565		1.3125	0.0615	0.1798	0.3350	STEEL
43	14	16	10.040		3.1416	0.7854	1.5708	0.7854	STEEL
44	14	6	11.120		1.7671	0.2485	0.4970	0.2485	STEEL
45	5	6	0.940		1.7671	0.2485	0.4970	0.2485	STEEL
46	5	2	14.190		0.4418	0.0155	0.0311	0.0155	STEEL
47	47	48	7.220		3.0625	0.1954	0.6585	3.1263	STEEL
48	56	27	3.159		3.1416	0.7854	1.5708	0.7854	STIFF ELEMENT

49	46	27	2.436	3.1416	0.7854	1.5708	0.7854	STIFF ELEMENT
50	58	28	3.159	3.1416	0.7854	1.5708	0.7854	STIFF ELEMENT
51	48	28	2.436	3.1416	0.7854	1.5708	0.7854	STIFF ELEMENT
52	23	24	0.250	39.0	52.0	154.4	309.0	SA-515-70
53	24	25	0.250	39.0	52.0	154.4	309.0	SA-515-70
54	25	26	3.500	39.0	52.0	154.4	309.0	SA-515-70
	37	6		RIGID LINK				
	38	6		RIGID LINK				
	39	6		RIGID LINK				
	40	6		RIGID LINK				
	41	8		RIGID LINK				
	44	12		RIGID LINK				
	35	2		RIGID LINK				
	36	2		RIGID LINK				
	43	10		RIGID LINK				
	42	10		RIGID LINK				
	45	19		RIGID LINK				
	46	19		RIGID LINK				
	47	20		RIGID LINK				
	48	20		RIGID LINK				
	55	21		RIGID LINK				
	56	21		RIGID LINK				
	57	22		RIGID LINK				
	58	22		RIGID LINK				
	54	22		RIGID LINK				
	53	22		RIGID LINK				
	52	21		RIGID LINK				
	51	21		RIGID LINK				
	63	23		RIGID LINK				
	64	23		RIGID LINK				
	65	23		RIGID LINK				
	66	23		RIGID LINK				
	59	31		RIGID LINK				
	60	31		RIGID LINK				
	61	32		RIGID LINK				
	62	32		RIGID LINK				
	49	19		RIGID LINK				
	50	20		RIGID LINK				

D Y N A M I C A N A L Y S I S

RESONANT FREQUENCY = **81.3 HERTZ** (IN X-DIRECTION OR Y-ROTATION)

*** * * * NORMALIZED EIGENVECTOR * * * ***

JOINT	. . . DEFLECTION . . .			. . . ROTATION . . .		
NO.	X	Y	Z	X	Y	Z
1	-0.816283	0.040290	0.254039	-0.001443	-0.023426	0.002688
2	-0.650872	0.030564	0.253166	-0.001644	-0.028127	0.002687
3	-0.251951	0.006362	0.250245	-0.001740	-0.030980	0.001932
4	-0.220725	0.004587	0.250114	-0.001727	-0.031003	0.001906
5	-0.220496	0.004651	0.245759	0.000235	-0.033341	0.001731
6	-0.189168	0.004866	0.245633	0.000274	-0.033289	0.001727
7	-0.156885	0.005132	0.245470	0.000341	-0.033275	0.001567
8	-0.102979	0.005636	0.245232	0.000370	-0.033214	0.001521
9	-0.061553	0.004752	0.211525	0.000618	-0.032326	0.001071
10	-0.002266	0.002962	0.123104	0.000619	-0.032312	0.001067
11	0.051657	0.006915	0.211515	0.000619	-0.032329	0.001067
12	0.092765	0.008772	0.244265	0.000622	-0.032598	0.001070
13	0.145490	0.009779	0.244363	0.000626	-0.032808	0.001072
14	0.177308	0.010390	0.2[illegible]429	0.000635	-0.033099	0.001076
15	0.479422	0.016583	0.244521	0.000820	-0.038959	0.001077
16	0.552524	0.018130	0.244534	0.000847	-0.039870	0.001077
17	1.000000	0.028172	0.244603	0.001132	-0.049779	0.001078
18	-0.002735	0.002956	0.123395	0.000569	-0.027478	0.000429
19	-0.003465	0.002949	0.124342	0.000528	-0.022634	0.000414
20	-0.000659	0.002963	0.120605	0.000629	-0.021904	0.000507
21	-0.004072	0.005883	0.266714	0.000438	-0.022449	0.000489
22	-0.001628	0.000040	0.000679	0.000568	-0.021632	0.000461
23	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.000000	0.0	0.0	0.0	-0.000000
25	0.0	0.000000	0.0	0.0	0.0	-0.000000
26	0.0	0.000000	0.0	0.0	0.0	-0.000000
27	-0.094326	-0.000203	0.070970	0.000485	-0.022667	0.000462
28	-0.087658	-0.000736	0.068267	0.000595	-0.021897	0.000499
29	-0.105738	-0.000445	0.070963	0.000480	-0.022799	0.000485
30	-0.098878	-0.001031	0.068264	0.000589	-0.022021	0.000520
31	-0.423346	-0.000275	0.070078	-0.000619	-0.030695	0.004369
32	-0.404846	-0.001424	0.067785	-0.000400	-0.029921	0.004220
33	-0.454788	0.022299	0.222529	-0.001056	-0.037299	0.004295
34	-0.434818	0.020621	0.235119	-0.001452	-0.040185	0.004228
35	-0.659269	0.028044	0.221665	-0.001644	-0.028127	0.002687
36	-0.638109	0.028044	0.234611	-0.001644	-0.028127	0.002687
37	-0.223208	0.007378	0.299033	0.000274	-0.033289	0.001727
38	-0.217712	0.007378	0.298160	0.000274	-0.033289	0.001727
39	-0.217712	0.001882	0.192233	0.000274	-0.033289	0.001727
40	-0.223208	0.001882	0.193106	0.000274	-0.033289	0.001727
41	-0.152801	0.003559	0.212017	0.000370	-0.033214	0.001521
42	-0.056407	0.004845	0.211507	0.000619	-0.032312	0.001067
43	0.046539	0.006817	0.211507	0.000619	-0.032312	0.001067

44	0.141663	0.008635	0.211666	0.000622	-0.032598	0.001070
45	0.077755	0.004855	0.124965	0.000528	-0.022634	0.000414
46	-0.085663	0.001042	0.124965	0.000528	-0.022634	0.000414
47	0.079012	0.005232	0.120064	0.000629	-0.021904	0.000507
48	-0.079133	0.000693	0.120064	0.000629	-0.021904	0.000507
49	-0.002918	0.002949	0.123644	0.000528	-0.022634	0.000414
50	-0.001328	0.002963	0.121635	0.000629	-0.021904	0.000507
51	-0.004031	0.000075	0.000069	0.000438	-0.022449	0.000489
52	-0.003793	0.000075	-0.000144	0.000438	-0.022449	0.000489
53	-0.001891	0.000040	0.001003	0.000568	-0.021632	0.000461
54	-0.001666	0.000040	0.000727	0.000566	-0.021632	0.000461
55	0.076454	0.001657	0.000568	0.000438	-0.022449	0.000489
56	-0.085629	-0.001507	0.000568	0.000438	-0.022449	0.000489
57	0.076950	0.002091	0.000080	0.000568	-0.021632	0.000461
58	-0.079234	-0.002012	0.000080	0.000568	-0.021632	0.000461
59	-0.454014	0.000190	0.068994	-0.000619	-0.030695	0.004369
60	-0.416792	-0.000275	0.071007	-0.000619	-0.030695	0.004369
61	-0.411176	-0.001424	0.067165	-0.000400	-0.029921	0.004220
62	-0.434144	-0.001124	0.067135	-0.000400	-0.029921	0.004220
63	0.0	0.0	0.0	0.0	0.0	0.0
64	0.0	0.0	0.0	0.0	0.0	0.0
65	0.0	0.0	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0	0.0	0.0

THIS REPORT HAS BEEN PREPARED BY /

BARRY L GAARDER
SENIOR DRAFTSMAN

FISHER CONTROLS COMPANY

VERSION 04/22/82

ATTACHMENT 3

FQP-11AB-5

Pressure Retaining Parts Stress Calculations
for 10-inch Type 9280 Valves

Vogtle Group V

NA-134

Fisher Controls MARSHALLTOWN, IOWA	BUTTERFLY VALVE TYPE 9280	NO. SAG 1034	
	Calculation Procedure for Pressure Retaining Parts	BY BLG	8-23-8
		RBE	10.27.83
		PAGE 1	OF 15
		REV	

Following are stress calculations to determine:

1. Valve body hoop and bending stress NA-134, Page 1, Rev. A
2. Retaining ring hoop stress
3. Shaft torsional, bending, and shear stress
4. Disc bending stress

These calculations are for a Type 9280 Butterfly Valve constructed of the following materials:

1. Body SA-515-70
2. Disc SA-351-CF8M
3. Retaining ring SA-515-70
4. Shaft SA-564 H1075

Reference:

Order No. 22B-X5AC03-N1P, N2P

P.O. PAY-206, PAY-2-34

Item No. 155, 156, 165, 166

Category Seismic Category I

Type 10" N521C-SR80-12-9280

Valve Tag No's.	Serial No's.
1HV-12596	8342938
1HV-12597	8342939
2HV-12596	8342940
2HV-12597	8342941

FISHER Controls MARSHALLTOWN, IOWA	BUTTERFLY VALVE TYPE 9280	NO. SAG 1034	
	Calculation Procedure for Pressure Retaining Parts	BY BLG	8-23-8
		RBE	10.27.8
		PAGE 2	OF 15
		REV	

NA-134, Page 2, Rev. A

Design Conditions:

1. Service Pressure 100 PSIG
2. Pressure Drop 50 PSI
3. Service Temperature 200 °F
4. Actuator Torque 3320 In-Lb (Based on 200% of the output torque rating at 80-90 psi operating pressure)

Allowable Design Stresses for Materials of Construction:

1. Body 26250 PSI
2. Disc 24750 PSI
3. Retaining Ring 26250 PSI
4. Shaft 54300 PSI (Torsion)
   27150 PSI (Shear)

Order of Calculations:

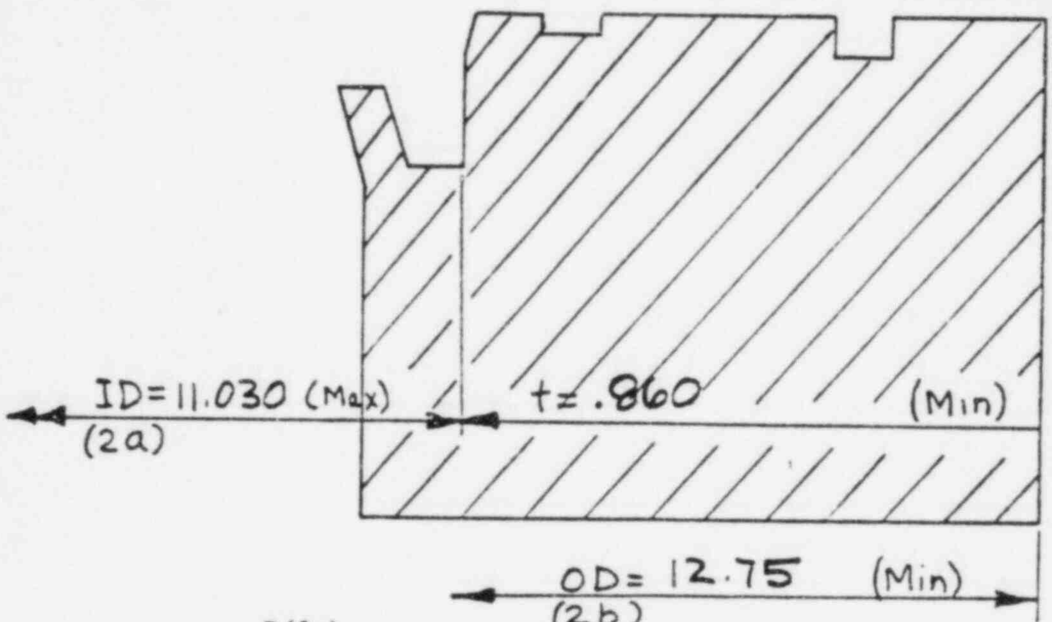
1. Body hoop and bending stress
2. Retaining ring hoop stress
3. Shaft torsional, bending, and shear stress
4. Disc bending stress

Following the calculations is a summary of allowable stresses vs. calculated stresses.

5. Code Case 1635-1

1. Body Hoop & Bending Stress

NA-134, Page 3, Rev. A



$\sigma_h = \frac{P(2a)}{2t}$ for thin cylinder

$= \frac{P(b^2 + a^2)}{(b^2 - a^2)}$ for thick cylinder

$$= \frac{100(6.375^2 + 5.515^2)}{6.375^2 - 5.515^2}$$

$= 695$ psi

Where

P = Internal pressure (PSIG) = 100
2a = Inside diameter (In)
2b = Outside diameter (In)
t = Wall thickness (In)
σ_h = Hoop stress in Body (PSI)

Sr = -P

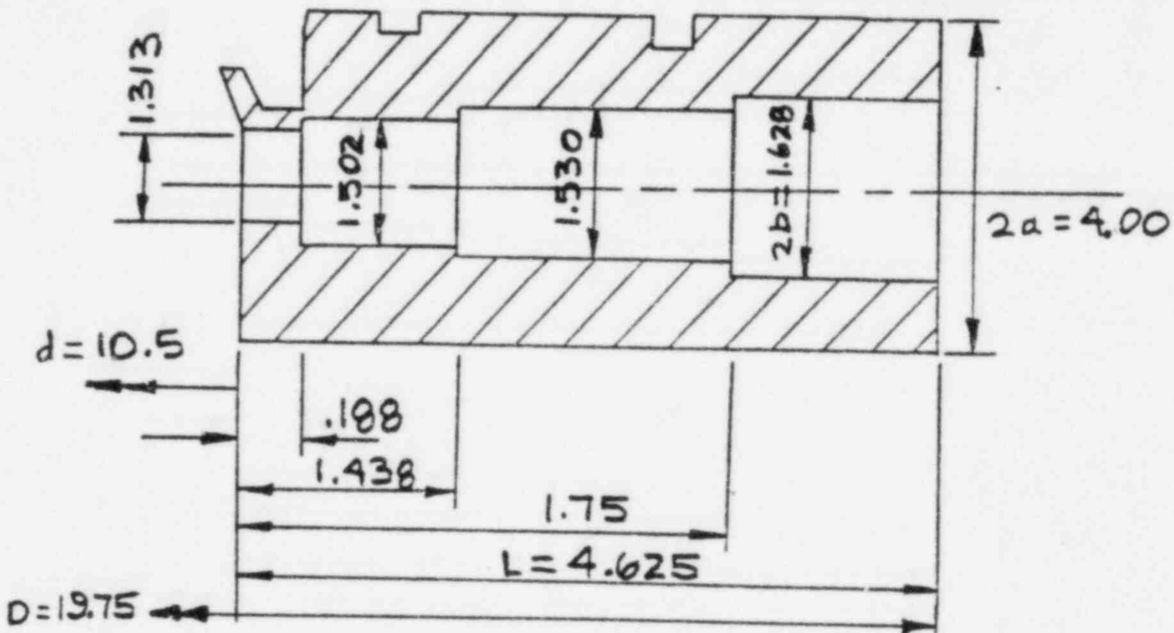
= -100 PSI

NOTE: The body is considered to be a *thick* walled cylinder since b/t < 10.

FISHER Controls MARSHALLTOWN, IOWA	BUTTERFLY VALVE TYPE 9280 Calculations Procedure for Pressure Retaining Parts	NO. SAG 1034	C
		BY BLG	8-23-83
		RBE	10.27.8
		PAGE 4	OF 15
		REV	

Hoop Stress at Shaft Hole

NA-134, Page 4, Rev. A



$$\sigma = P \frac{d^2(1-2\lambda) + D^2(1+\lambda)}{D^2 - d^2} \quad *$$

$$= 100\left(\frac{10.5^2[1-2(.3)] + 19.75^2(1+.3)}{19.75^2 - 10.5^2}\right)$$

$$= 197 \text{ psi}$$

Where

P = Internal Pressure (PSIG)

d = Inside Diameter (In)

D = Outside Diameter (In)

λ = Poissons Ratio (0.3 for Steel)

σ = Maximum Unit Stress (PSI)

*Clavarinos formula for thick walled cylinder d/(2t) < 10), King, R. C. and Crocker, "Piping Handbook", Pages 3-13. Fifth Edition, McGraw-Hill, New York, 1967.

To conservatively allow for shaft hole, unit stress for solid block (L by 2a) should be multipled by the ratio of the face to face dimension (2a) over that value minus the packing hole diameter.

$$\sigma_s = \sigma \left(\frac{2a}{2a - 2b}\right) = 197\left(\frac{4.00}{4.00 - 1.628}\right) = 332 \text{ psi}$$

$$\sigma_h = P\,\frac{a^2 + b^2}{a^2 - b^2}$$

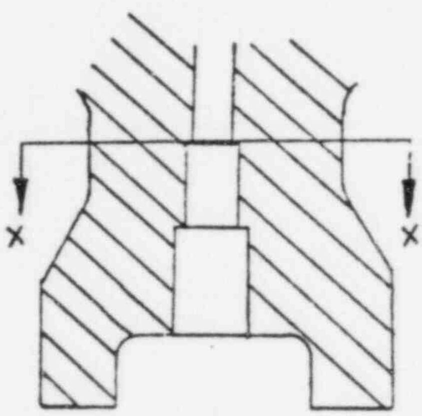
(This expression includes a ratio of the cross-sectional areas available to carry the hoop stress load.)

$$= 100\left(\frac{2^2 + .814^2}{2^2 - .814^2}\right)$$

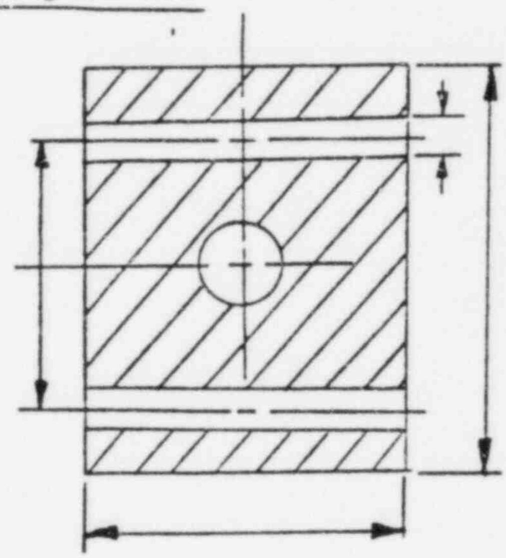
$$= 140 \text{ psi}$$

Where:
a = Outside Radius of Shaft Hole (In)
b = Inside Radius of Shaft Hole (In)(Largest)
σ_h = Hoop Stress of Shaft Hole (PSI)

Body bending stress at weakest supporting section:



Bending Moment



Section X-X

Bending Moment

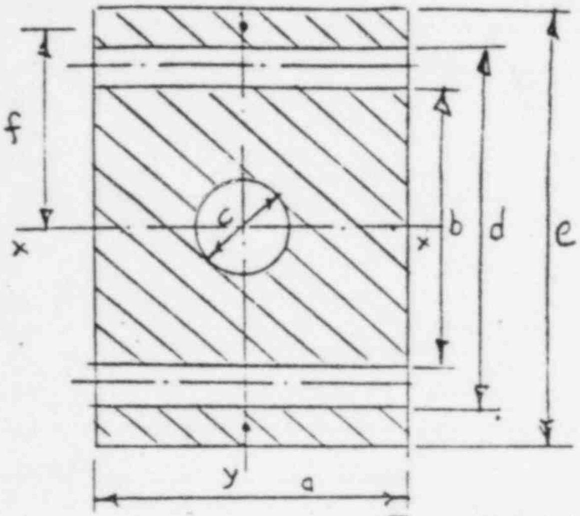
$M = W\,(G_{Load} + 1)\,D$

Where

G_{Load} = Seismic Acceleration in g's
W = Weight of Extended Structure (Lb)
D = Distance to Extended Structure C.G. (In

$= 110\,(4.5 + 1)\,12.33$

$= 7460$ In-Lb



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a = 4.00

b = 2.688

c = 1.628

d = 4.688

e = 8.6

$f = \frac{d + e}{4} = \frac{4.688 + 8.6}{4} = 3.322$

$$I_{xx} = \frac{ab^3}{12} - \frac{\pi(c)^4}{64} + 2\left[\frac{a(\frac{e-d}{2})^3}{12} + (\frac{e-d}{2})(a)(f)^2\right]$$

$$= \frac{4.00(2.688)^3}{12} - \frac{\pi(1.628)^4}{64} + 2\left[\frac{4.00(\frac{8.6-4.688}{2})^3}{12} + (\frac{8.6-4.688}{2})(4.00)3.322^2\right]$$

$$= 183.80 \text{ In}^4$$

$$\text{Bending Stress } (\sigma_{xx}) = \frac{M(e/2)}{I_{xx}}$$

(Based upon 4.5 G Load)

$$= \frac{7460(\frac{8.6}{2})}{183.80}$$

$$\sigma_{xx} = 175 \text{ PSI}$$

Assume weight of extended structure acts 90° from previous calculation:

$$I_{yy} = \frac{(b)(a)^3}{12} - \frac{\pi(c)^4}{64} + 2\left[\frac{(\frac{e-d}{2})(a)^3}{12}\right]$$

$$= \frac{2.688(4.00)^3}{12} - \frac{\pi(1.628)^4}{64} + 2\left[\frac{(\frac{8.6-4.688}{2})(4.00)^3}{12}\right]$$

$$= 34.86 \text{ in}^4$$

Bending Stress (based on a 4.5 G load)

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$$\sigma_{yy} = \frac{M(a/2)}{I_{yy}}$$

$$= \frac{7460\left(\frac{4.00}{2}\right)}{34.86}$$

$$= 428 \text{ PSI}$$

Consider an accident condition with bending about the xx and yy axes simultaneously:

$$\sigma = \sigma_{xx} + \sigma_{yy}$$

$$= 175 + 428$$

$$= 603 \text{ PSI}$$

This value is conservative because it includes the 1G load (weight) of the actuator and bracket in the yy axis However, the stress is significantly below the allowable stress of 26250 PSI.

Torsional Shear Stress

Conservatively omitting the load carrying capacity of material on outside of bolt holes and modeling shaft hole as a rectangle.

$$\tau_1 = \frac{4T}{(a^2 - c^2)(b + c)}$$

$$= \frac{4(3320)}{(4.00^2 - 1.628^2)(2.688 + 1.628)}$$

$$= 231 \text{ psi}$$

$$\tau_2 = \frac{4T}{(b^2 - c^2)(a + c)} = \frac{4(3320)}{(2.688^2 - 1.628^2)(4.00 + 1.628)}$$

$$= 516 \text{ PSI}$$

2. Retaining Ring Hoop Stress

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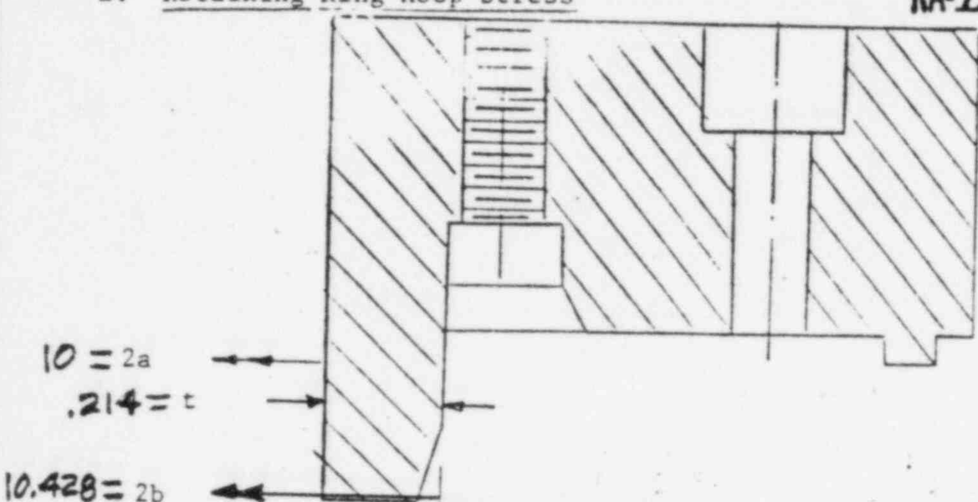

Hoop Stress $(S_t) = \frac{P(2a)}{2t}$ for thin ring

$$= \frac{a^2 P}{b^2 - a^2}\left(1 + \frac{b^2}{\rho^2}\right) \text{ for thick ring}$$

S_{tmax} at $\rho = a$

$$= \frac{100(10)}{2(.214)}$$

$$= 2337 \text{ PSI}$$

P = Internal Pressure

2a = Inside Diameter

t = Min. Wall Thickness

2b = Outside Diameter

Note: The ring is considered to be a thin walled cylinder since $a/t > 10$.

MC7621

3. Shaft Torsional, Bending, & Shear Stresses

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Maximum Torsional Shear Stress (Ss) = $\frac{T(d/2)}{J}$

$J = \frac{\pi d^4}{32}$

$J = \frac{\pi (1.25)^4}{32}$

$J = .24 \text{ In}^4$

Where

T = Torque

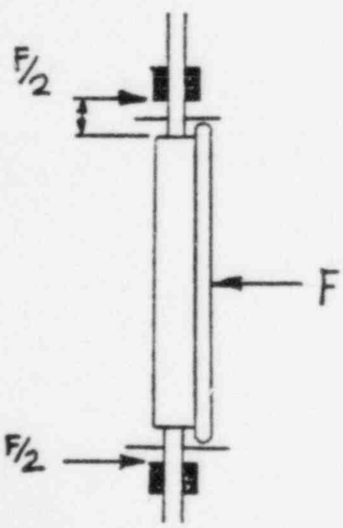
d = Shaft Diameter = 1.25

J = Polar moment of inertia

$S_s = \frac{T(d/2)}{J}$

$S_s = \frac{3320\left(\frac{1.25}{2}\right)}{.24}$

$S_s = 8646$ PSI



Bending Stress (σ_B) = $\frac{M(d/2)}{I}$

Force (F) = ΔP.A

$I = \frac{\pi d^4}{64}$

Moment (M) = (F/2)L

Where A is area of disc = 78.5

Where d is dia. of shaft = 1.25

Where L is the distance from outer edge of bushing to edge of disc = .75

$I = \frac{\pi (1.25)^4}{64} = .1198$

$F = 100(78.50) = 7850$

$M = \left(\frac{7850}{2}\right).75 = 2944$

$\sigma_B = (\sigma_x) = \frac{2944\left(\frac{1.25}{2}\right)}{.1198} = 15359$ psi

Max. Shear Stress at neutral axis due to shear load:

$$\tau_{max} = 1.38 \frac{2F}{\pi d^2} \quad \text{from experimental results}$$

$$= 1.38 \frac{(2)7850}{\pi\, 1.25^2}$$

$$= 4414 \text{ PSI}$$

Combine max. torsional shear and max. shear stresses:

$$\tau_{comb} = S_s + \tau_{max}$$

$$= 8646 + 4414$$

$$= 13060 \text{ PSI}$$

Combine max. torsional shear and bending stress using maximum shear stress theory of failure:

$$\sigma_x = \sigma_B = 15359 \text{ PSI}$$

$$\sigma_y = 0 \text{ PSI}$$

$$\tau_{xy} = S_s = 8646 \text{ PSI}$$

Principal stresses

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

$$= \frac{15359+0}{2} + \sqrt{\left(\frac{15359-0}{2}\right)^2 + 8646^2}$$

$$\sigma_1 = 19244 \text{ PSI}$$

$$\sigma_2 = \frac{\sigma_x + \sigma_y}{2} - \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + (\tau_{xy})^2}$$

$$= \frac{15359+0}{2} - \sqrt{\left(\frac{15359-0}{2}\right)^2 + 8646^2}$$

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$$\sigma_2 = -3885 \text{ PSI}$$

Then

$$\tau_{max} = \frac{\sigma_1 - \sigma_2}{2}$$

$$\tau_{max} = \frac{19244-(-3885)}{2}$$

$$\tau_{max} = 11565 \text{ PSI}$$

The factor of safety by the maximum shear stress theory is:

$$N = \frac{S_{yt}}{2\tau_{max}}$$

Where N = Factor of safety

S_{yt} = Maximum code allowable stress

$$= \frac{54375}{2(11565)}$$

$$N = 2.36$$

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		RBE 10-27-8
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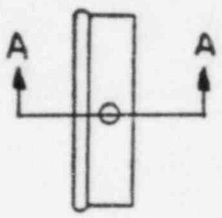
4. Disc Bending Stress

(A) Bending stress (σ) = $\frac{M(h_1/2)}{I}$ @ Sect AA

Bending Moment (M) = $0.083(\Delta P)(D^3)$*

$$I = \frac{Dh^3}{12} = \frac{D[h_1^3 - h_2^3]}{12}$$

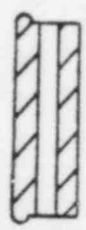


Where h_1 = Total width = 2.688

h_2 = Diameter of hole = 1.25

D = Diameter of disc = 10

ΔP = Pressure drop = 100



Section A-A

$M = .083(100)10^3 = 8300$

$I = 10\left(\frac{2.688^3 - 1.25^3}{12}\right) = 14.557$

$\sigma = \frac{8300\left(\frac{2.688}{2}\right)}{14.557} = 767$ psi

(B) Bending stress (σ_B) = $\frac{M(h_1/2)}{I}$ @ Sect BB

Bending moment (M) = $0.3927\ D^2\ \Delta P\ [L_0 + 0.2878D]$*

$$I = \frac{Dh_1^3}{12} - \frac{\pi h_2^4}{64}$$

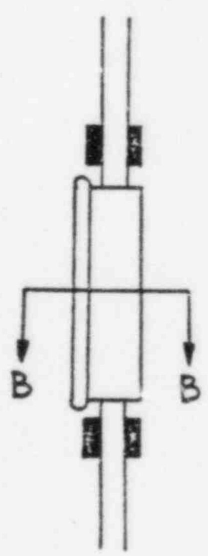
Where

h_1 = Total width

h_2 = Diameter of hole

D = Diameter of disc

L_0 = Distance from center of the bushing to the edge of disc = 1.375



$M = .3927(10.0)^2\ 100\ [1.375 + .2878(10)]$

$= 16702$

$I = \frac{10(2.688)^3}{12} - \frac{\pi(1.25)^4}{64}$

$= 16.065$

* See Appendix 1 for derivation.

Section
BB

$$\sigma_B = \frac{16702\left(\frac{2.688}{2}\right)}{16.065}$$

$$= 1398\,psi$$

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SUMMARY OF STRESSES

COMPONENT	MATERIAL SPECIFICATION	STRESS CALCULATION	ALLOWABLE (DESIGN) STRESS (PSI)	CALCULATED (ACTUAL) STRESS (PSI)
BODY	SA-515-70	HOOP	26250	695
		HOOP @ SHAFT	26250	140
		BENDING	26250	603
RETAINING RING	SA-515-70	HOOP	26250	2337
SHAFT	SA-564 H1075	TORSIONAL SHEAR	27150	8646
		BENDING	54300	15359
		SHEAR	27150	13060
		MAX SHEAR BY FAILURE THEORY	27150	11565
DISC	SA-351-CF8M	BENDING @ SHAFT	24750	767
		BENDING PERPEN SHAFT	24750	1398

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FISHER Controls®
MARSHALLTOWN, IOWA

BUTTERFLY VALVE TYPE 9280

Calculation Procedure
for
Pressure Retaining Parts

NO. SAC 1034
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5. ASME CODE CASE 1635-1

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Section Modulus of Piping:

Pipe Size 10" Schedule 40

O.D. = 10.75

I.D. = 10.02

$$Z_p = \frac{\pi(d_o^4 - d_i^4)}{32\, d_o}$$

$$= \frac{\pi(10.75^4 - 10.02^4)}{32\,(10.75)}$$

$$= 29.90 \text{ In}^3$$

Sectional Modulus of Valve Body:

O.D. = 12.75

I.D. = 11.030

$$Z_v = \frac{\pi(d_o^4 - d_i^4)}{32\, d_o}$$

$$= \frac{\pi(12.75^4 - 11.030^4)}{32(12.75)}$$

$$= 89.52$$

$$\text{Ratio} = \frac{Z_v}{Z_p} = \frac{89.52}{29.90} = 2.994$$

Allowable Stress for SA-106 GRB Piping = 15000 PSI

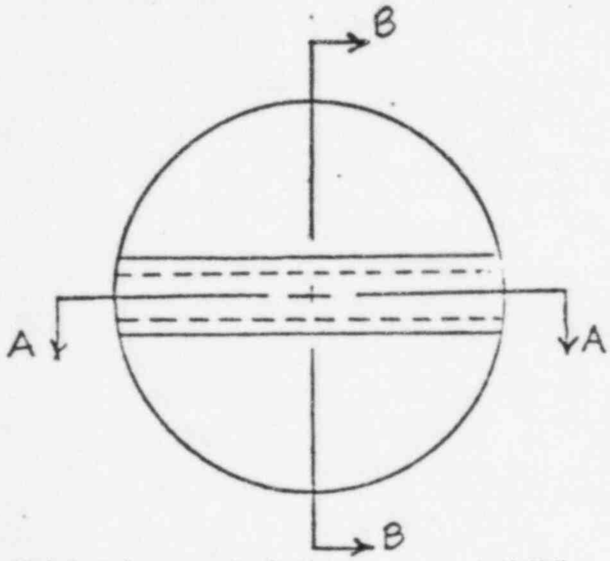
Allowable Stress for SA-515-70 Body = 26250 PSI

Based upon this information, this valve meets the conditions set forth in Code Case 1635-1.

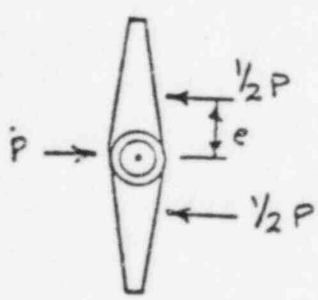
APPENDIX A

EQUATION DERIVATION

Derivation of disc bending moment equations



Section "AA"



$$\Sigma M_{AA} = \tfrac{1}{2} P_e$$

Where: P = Load on Disc = (ΔPA)

e = Distance to Centroid

$= .2122D = \frac{2D}{3\pi}$

$$\Sigma M_{AA} = \tfrac{1}{2}\,\Delta P\,\frac{\pi D^2}{4}\,(.2122D)$$

$$= .083\,\Delta P D^3$$

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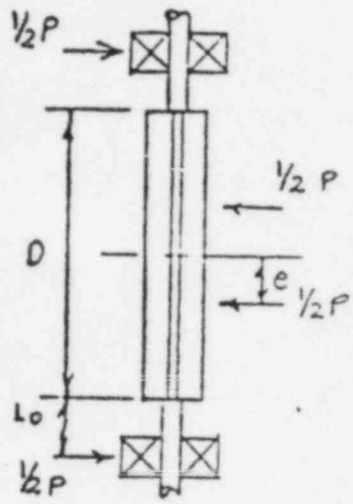
SECTION "BB"



$$\Sigma M_{BB} = \tfrac{1}{2}P\left(\tfrac{1}{2}D + L_o\right) - \tfrac{1}{2}P(e)$$

WHERE: P = Load on disc = (ΔPA)

D = Disc Diameter

e = Distance to Centroid

L_o = Hub to Bushing Length

$$M_{BB} = \tfrac{1}{2}\,\tfrac{\pi}{4}\,D^2\,\Delta P\left(\tfrac{1}{2}D + L_o\right) - \tfrac{1}{2}\,\tfrac{\pi}{4}\,D^2\,\Delta P\,(.2122D)$$

$$= \frac{\pi}{8}\,D^2\,\Delta P\,(L_o + .2878\,D)$$

$$= .3927\,D^2\,\Delta P\,(L_o + .2878\,D)$$

Calculations prepared by Barry L. Goauder

Title Senior Draftsman

Calculations checked by Richard Eberhart

Title SENIOR ENGINEER

ATTACHMENT 4

FQP-11AB-5

Static Side Load Test of Vogtle Item 165

10" Type 9280 Butterfly Valve with
Bettis N521C-SR80-12 Actuator

Fisher Lab Problem 1662, Report 72

Laboratory Report

FISHER

STATIC SIDELOAD TEST OF A 10" 9280 BFV WITH A BETTIS TYPE N521C-SR80-12 ACTUATOR, VOGTLE TEST ITEM 165

ABSTRACT

A static sideload test was performed on a 10" Type 9280 BFV with Bettis N521C-SR80-12 actuator. This valve was a production valve intended for service in the Vogtle Nuclear Power Plant (Rep. Order No. 22B-X5AC03-N2P; Item No. 165; S/N 8342940; Project No. 78EC07). A sideload force equivalent to 10g acceleration was applied near the center-of-gravity of the extended structure of the valve assembly. This load was applied along the axis of least rigidity as determined by an earlier resonant frequency test (Problem 1667, Report 188). The static sideload was intended to conservatively simulate dynamic loads encountered in a seismic event as specified by Bechtel (A&E for the Vogtle Project). Operability tests were performed before, during and after application of the sideload as a means of evaluating performance of the valve assembly during a simulated seismic event. Testing was performed according to FTP-33, Rev. D and the results of the tests successfully satisfied all criteria required by this procedure and the associated requirements in the Test Valve Data Sheet.

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INTRODUCTION

The test of Item 165, Vogtle Project, was requested by the Nuclear Qualification Group via the test request letter included in this report. The purpose of this report is to evaluate the operability of the valve assembly when subjected to a sideload of the magnitude specified in the Test Valve Data Sheet included in this report. The test valve was in a fully operational mode with the valve body in a pressurized test fixture. A baseline series of functional tests were performed prior to the application of the sideload. The sideload was then applied in increments of 50%, 75% and 100%. At 100% sideload functional tests were then again conducted and recorded. The sideload was then incrementally removed in reverse sequence. At zero sideload a final series of functional tests was performed. Every functional test consisted of a packing leakage test, a bidirectional seat leakage test, limit switch trip point test, and a series of stroking time tests which included verification of the "lock-in-last-position" or "fail-safe" mode. Deflection measurements of the extended structure were made during the incremental application and incremental release of the sideload. This series of before, during and after tests provided a method of comparing normal operation under no sideload to operation during sideload. This test also allowed a comparison of before and after performance to see the detrimental effects, if any, caused by the sideload. Structural yield, binding of internal components, and loss of pressure retaining ability would be revealed, if present, by this test. A full evaluation of the valve assembly is presented in the Conclusion to this report.

TEST PROCEDURE

The detailed test procedure is presented in FTP-33, Rev. D. A brief summary of the test procedure, aided by Sketches 1 & 2, is presented in this section.

The pre-functional and post-functional tests consisted of the same procedure. The packing leakage test was performed first at a pressure of 180 psi with tap water as the test fluid. The valve disc was open during this test. The test pressure was held for 5 minutes and all gasketing and packing was checked for leaks.

Next a bidirectional seat leakage was performed with tap water. First the inlet was pressurized to 50 psig with the valve disc closed and the outlet at atmospheric pressure. The test fixture was previously filled with water to evacuate all air pockets. The vertical fittings shown in Sketch 1 were used to observe any leakage to atmosphere. After a period of 10 minutes at these conditions a 2 minute period followed for measurement of seat leakage. This test was then repeated with the outlet at 50 psig and the inlet at atmospheric pressure.

Finally, a stroking time test was conducted. The actuation signal (0-125 VDC) and direct stem movement were recorded on adjacent channels of a strip chart recorder. An RVDT was used to record the true stem position.

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The following sequence of operational cycles were recorded on the strip chart recorder*:

Cycle 1; CLOSE TO OPEN
OPEN TO CLOSE

Cycle 2; CLOSE TO OPEN
OPEN TO CLOSE

Cycle 3; CLOSE TO OPEN
OPEN TO CLOSE

Cycle 4; CLOSE TO OPEN
OPEN TO CLOSE

Each half cycle stroking time was recorded to make sure that the required stroking time (Test Valve Data Sheet) was never exceeded. Average stroking times were computed for each half cycle (CL→OP and OP→CL).

Stroking time constants (time required to travel from the closed or open position to 63.2% of full travel in the direction opposite of the starting position) were also determined so that changes in stroking speed could be evaluated throughout the testing.

*Closed is the fail-safe position for the test valve.

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The overall testing sequence was as follows: Pre-Functional→Sideload→Post-Functional. In the previously described functional tests, packing leakage, bidirectional seat leakage and operational cycles were done for each of the three portions of the test, however, the sideload portion had the following additional test steps for measurement of deflection due to the sideload application:

1) Measurement of deflections with disc closed at 50%, 75% and 100% of the sideload.

2) Functionals as previously described.

3) Measurement of deflection with the disc at Fail-Safe position for 100%, 75%, 50% and 0% of the sideload.

During application and release of the sideload the valve body was not pressurized.

The magnitude of the sideload force equivalent to 10g at the center-of-gravity of the extended structure was determined as 2915 lb. (100% sideload). The distance from the matchline (actuator/valve body interface) to the center-of-gravity was 6.63 inches as given in the Test Valve Data Sheet. The actual point of application of the sideload was 6.63 inches from the matchline representing a moment arm of 6.63 inches. Since the X axis of the actuator was in the vertical direction and the sideload was applied in the vertical direction, the sideload magnitude was determined by S=RW+W from FTP-33 where S was the sideload force at the c.g., R was the resultant g load, and W was the weight of the extended structure.

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$$S = RW + W$$

$$S = [(10g)(265\ lb) + (265\ lb) = 2915\ lb$$

The values for R and W are given in the Test Valve Data Sheet.

RESULTS

The results of all tests described in the previous section are presented in Tables 1, 2 and 3. Table 1 gives the results of the Pre-Functional Tests. Table 2 gives the results of the Sideload Tests. Table 3 gives the results of the Post-Functional Tests.

At no time during any of the tests did any packing or seat leakage occur. All stroking times were less than the required 5 seconds. The average close-to-open stroking time was 3.2 seconds. The average open-to-close stroking time was 1.40 seconds. All stroking time constants deviations were well within the +20% criteria. No yielding or any other structural damage was observed. Ideally, the dial indicator readings should have been returned to zero inches after release of the sideload. However, due to all the bolted and gasketed joints in the test fixture this requirement was not met. Gage 5 located at the bottom (see Table 3) registered .0002 deflection which indicates that the whole fixture moved slightly thus affecting the other gage readings. When fail-safe operation was required, it was maintained without deviation during all operational cycle testing and during the incremental release of the sideload. The maximum limit switch deviation was less than 1°.

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TABLE 1
SIDELOAD TEST RESULTS

PRE-FUNCTIONAL TEST RESULTS

1) PACKING LEAKAGE @ 180 psi: CRITERIA No Leakage TEST No Leakage

2) BIDIRECTIONAL SEAT LEAKAGE @ 50 ΔPSI: CRITERIA No Leakage

DIRECTION OF FLOW TEST No Leakage
REVERSE FLOW TEST No Leakage

3) STROKING TIMES & STROKING TIME CONSTANTS: CRITERIA S.T. <5 Sec; S.T.C. Change <20%

			STROKING TIME	STROKING TIME CONSTANT
A) CYCLE 1,	ΔP= 50	CL→FAIL	3.2	1.75 **
	P= 50	OP→CL	1.4	0.95 **
B) CYCLE 2,	ΔP= 50	CL→OP	3.15	1.75
	P= 50	OP→CL	1.4	0.95
C) CYCLE 3,	ΔP= 50	CL→OP	3.2	1.75
	P= 50	OP→CL	1.4	0.95
D) CYCLE 4,	ΔP= 50	CL→OP	3.2	1.75
	P= 50	OP→CL	1.4	0.95
E) AVG TIME	ΔP= 50	CL→OP	3.19	1.75
	P= 50	OP→CL	1.4	0.95

F) MAXIMUM STROKING TIME CONSTANT CHANGE 0 %OF INITIAL VALUE**

* TEST FLUID Water
**INITIAL VALUE

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TABLE 2
SIDELOAD TEST RESULTS

SIDELOAD TEST RESULTS (1-3 @ 100% SIDELOAD ONLY)*

1) PACKING LEAKAGE @ 180 psi: CRITERIA No Leakage TEST No Leakage

2) BIDIRECTIONAL SEAT LEAKAGE @ 50 ΔPSI: CRITERIA No Leakage

DIRECTION OF FLOW TEST No Leakage
REVERSE FLOW TEST No Leakage

3) STROKING TIMES & STROKING TIME CONSTANTS: CRITERIA S.T. <5 Sec; S.T.C. Change <20%

			STROKING TIME	STROKING TIME CONSTANT
A) CYCLE 1,	ΔP= 50	CL→FAIL	3.2	1.75
	P= 50	OP→CL	1.4	0.95
B) CYCLE 2,	ΔP= 50	CL→OP	3.2	1.75
	P= 50	OP→CL	1.4	0.95
C) CYCLE 3,	ΔP= 50	CL→OP	3.2	1.70
	P= 50	OP→CL	1.4	0.95
D) CYCLE 4,	ΔP= 50	CL→OP	3.2	1.75
	P= 50	OP→CL	1.4	0.95
E) AVG TIME	ΔP= 50	CL→OP	3.2	1.74
	P= 50	OP→CL	1.4	0.95

F) MAXIMUM STROKING TIME CONSTANT CHANGE -2.9 % OF INITIAL VALUE**

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TABLE 2 (CONTINUED)

4) DEFLECTION MEASUREMENTS: CRITERIA No Structural Damage
TEST No Damage

% Side Load	Force	Gage 1	Gage 2	Gage 3	Gage 4	Gage 5	Disc
0	265	0	0	0	0	0	CLOSED
50	1458	.003	.001	.002	.008	0	CLOSED
75	2186	.0005	.0018	.0032	.014	0	CLOSED
100	2915	.0073	.0035	.0049	.019	.0005	CLOSED
75	2186	.006	.003	.004	.016	.0002	FAIL-SAFE
50	1458	.004	.0019	.0025	.011	.0002	FAIL-SAFE
0	265	.0005	.001	.001	.003	.0002	FAIL-SAFE

DIAL INDICATOR LOCATIONS #1(-14-5/8); #2(+2-5/8); #3(6-5//8"); #4(27-1/4); #5(on Limit Switch Plate);[Ref. Shaft Axis]

5) FAIL-SAFE OPERATION DURING DECREASING SIDELOAD Maintained Fail-safe Position without Measureable Deviation

*Test Fluid Water
**See Table I for Initial Stroking Time Constants

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TABLE 3
SIDELOAD TEST RESULTS

POST-FUNCTIONAL TEST RESULTS*

1) PACKING LEAKAGE @ 180 psi: CRITERIA No Leakage TEST No Leakage

2) BIDIRECTIONAL SEAT LEAKAGE @ 50 ΔPSI: CRITERIA No Leakage

DIRECTION OF FLOW TEST No Leakage
REVERSE FLOW TEST No Leakage

3) STROKING TIMES & STROKING TIME CONSTANTS: CRITERIA S.T. <5 Sec.; S.T.C. Change <20%

				STROKING TIME	CONSTANT
A) CYCLE 1,	ΔP=	50	CL→OP	3.2	1.75
	P=	50	OP→CL	1.4	0.95
B) CYCLE 2,	ΔP=	50	CL→OP	3.2	1.75
	P=	50	OP→CL	1.4	0.90
C) CYCLE 3,	ΔP=	50	CL→OP	3.2	1.75
	P=	50	OP→CL	1.35	0.90
D) CYCLE 4,	ΔP=	50	CL→OP	3.2	1.75
	P=	50	OP→CL	1.4	0.90
E) AVG. TIME	ΔP=	50	CL→OP	3.2	1.75
	P=	50	OP→CL	1.39	0.91

F) MAXIMUM STROKING TIME CONSTANT CHANGE -5.3 % OF INITIAL VALUE**

*TEST FLUID Water
**SEE TABLE I FOR INITIAL STROKING TIME CONSTANTS

Fisher Controls

FISHER

Laboratory Report

Problem	1662
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Date	12-5-84

CONCLUSION

All applicable criteria given in FTP-33 and in the Test Valve Data Sheet have been successfully met without exception by Vogtle Item 165.

J.B. Milliken

J.B. Milliken
Evaluation & Analysis Department

R.W. Roe

R.W. Roe
Evaluation & Analysis Department

REP28/8

INSTRUMENTATION EQUIPMENT SHEET

DATE 11-14-83 PROBLEM NO. 1662 REPORT NO. 72 TEST AREA Seismic

TECHNICIAN Bob Roe TEST ENGINEER Jon Milliken TEST DESCRIPTION Static Sideload

NO.	INSTRUMENT	MANUFACTURER	MODEL NO.	SERIAL NO.	FISHER CONTROL NO.	USEABLE RANGE	ACCURACY	CALIBRATION ON	CALIBRATION DUE
1	Power Supply	Instant Instruments	LD5.2	None	None	+5V			
2	" "	" "	LD15.2	"	"	±15V			
3	RVDT		600-000	C-7	"				
4	Oscillograph	Gould	22005	01103	7514-2			7-84	1-85
5	DC Preamp	"	13-4615-00	01568	7521-6			7-84	1-85
6	" "	"	13-4615-10	09217	7521-8			9-84	3-85
7	" "	"	13-4615-10	09214	7521-4			9-84	3-85
8	Bridge Amp	"	13-4615-30	00827	7522-4			9-84	3-85
9	Power Supply	Hewlett Packard	6443B	None	2049-1	0-125 V		8-84	8-85
10	Force Gage	Dillon	X-CT	9412	9405-1	+5000 Lb		9-17-84	9-85
11	3/4" Turnbuckle	None	None	None	None				
12	I-Beam	None	None	None	None				
13	Bell Flanges	Ladish	"	"	"				
14	Bookend Pair	Fabricated	"	"	"				
15	Pressure Tank		"	"	"				
16	Pressure Gage	Marsh	2358	"	9609-2	0-300 psi	±1% F.S.	2-83	2-84
17	Pressure Gage	"	"	"	9608-2	0-160 psi	±1% F.S.	2-83	2-84
18	Dial Indicator	Starrett	25-3041	None	9902-6	0-2.25	±0.001	1-84	1-85

CALIBRATION GUIDELINES PER FTP-26 CHECKED BY Jon Milliken

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PROBLEM NO. 1662

REPORT NO. 72

INSTRUMENTATION EQUIPMENT SHEET

DATE 11-14-83 PROBLEM NO. 1662 REPORT NO. 72 TEST AREA Seismic

TECHNICIAN Bob Roe TEST ENGINEER Jon Milliken TEST DESCRIPTION Static Sideload

NO.	INSTRUMENT	MANUFACTURER	MODEL NO.	SERIAL NO.	FISHER CONTROL NO.	USEABLE RANGE	ACCURACY	CALIBRATION	
								ON	DUE
19	Dial Indicator	Starrett	25-3041	None	9902-4	0-3"	±0.001	1-84	1-85
20	" "	"	"	"	9902-5	0-3"	"	"	"
21	" "	"	"	"	9902-2	0-3"	"	"	"
22	" "	"	25-441	"	9901-2	0-1"	"	"	"
23	Pressure Transducer	C.E.C.	4-326-00	10932	-	0-100 psi	Calibrated to Press. Gage #9806-2, Equip. Item#L& (±1% F.S.)		
24	Box Beam	Fabricated	None	None	None				
25	Pressure Gage	Marsh	2358	"	9609-1	0-300 psi	±1% F.S.		

CALIBRATION GUIDELINES PER FTP-26 CHECKED BY Jon Milliken

9510-AX5AC03-5161-1 PAGE NO. 14

PROBLEM NO. 1662

REPORT NO. 72

TEST VALVE DATA SHEET

Item No. 165 S/N 8342940 Assembly Drwg. 48A8928

Order No. 22B-X5AC03-N2P Installation Drwg. 38A7940

Valve Body:	Actuator:	Appurtenances:
10" Type 9280 (Wafer Type)	Bettis N521C-SR80-12 (per 18A0028)	Namco EA 180-31302/32302 ASCO NPK8321A2V Fisher 67AFR Regulator

ANSI B16.34 Body Class	Class 150
Rated Pressure at 100°F	285 Psig
Nominal Valve Stroke	90°
Valve Closure Time	5 Seconds
Nominal Actuator Supply	80 Psig
Allowable Seat Leakage	0
Seat Leak Test Pressure	50 Psid/1 Min.
Service Condition Pressure	3.00 Inches W.C.
Service Pressure Drop	0.25 Inches W.C.
Valve Safety Related Function	Spring to Close
Measured Extended Structure Weight	265 Pounds
Measured Extended Structure C.G. (From Shaft Axis)	6.63 Inches
Extended Structure Uniaxial G-load	10.0 g
Calculated Lowest Natural Frequency/Axis	77.7 Hz/X
P_B (Shaft Packing)	180 Psig
P_L (Seat Leak)	50 Psid
P_S (Body Pressure for Stroking Tests)	50 Psid
Test Fluid	Water

N11-13/ 1

NEAL RINEHART 15
7-23-82

FISHER

Memorandum

JB 7-23-82

To: Tom Buresh

From: Cynthia Alexander

Date: July 23, 1982

cc: Floyd Jury

Subject: Natural Frequency and Static Sideload Testing ; VOGTLE JON MILLIKEN

Reference: Vogtle 78EC07 PCO-1 (LWS 7-2-82 LIST)

PCO-1

Tom,

Since the time I submitted my request for lab work for the Vogtle project, several valves have been released from customer hold. A current list of required testing is attached. Please forward this list to the test engineer.

Thank you.

Cynthia Alexander

Cynthia Alexander

CA/ew

9510-AX5AC03-5161-1 108

Fisher Controls

FISHER

Laboratory Report

Problem	1662
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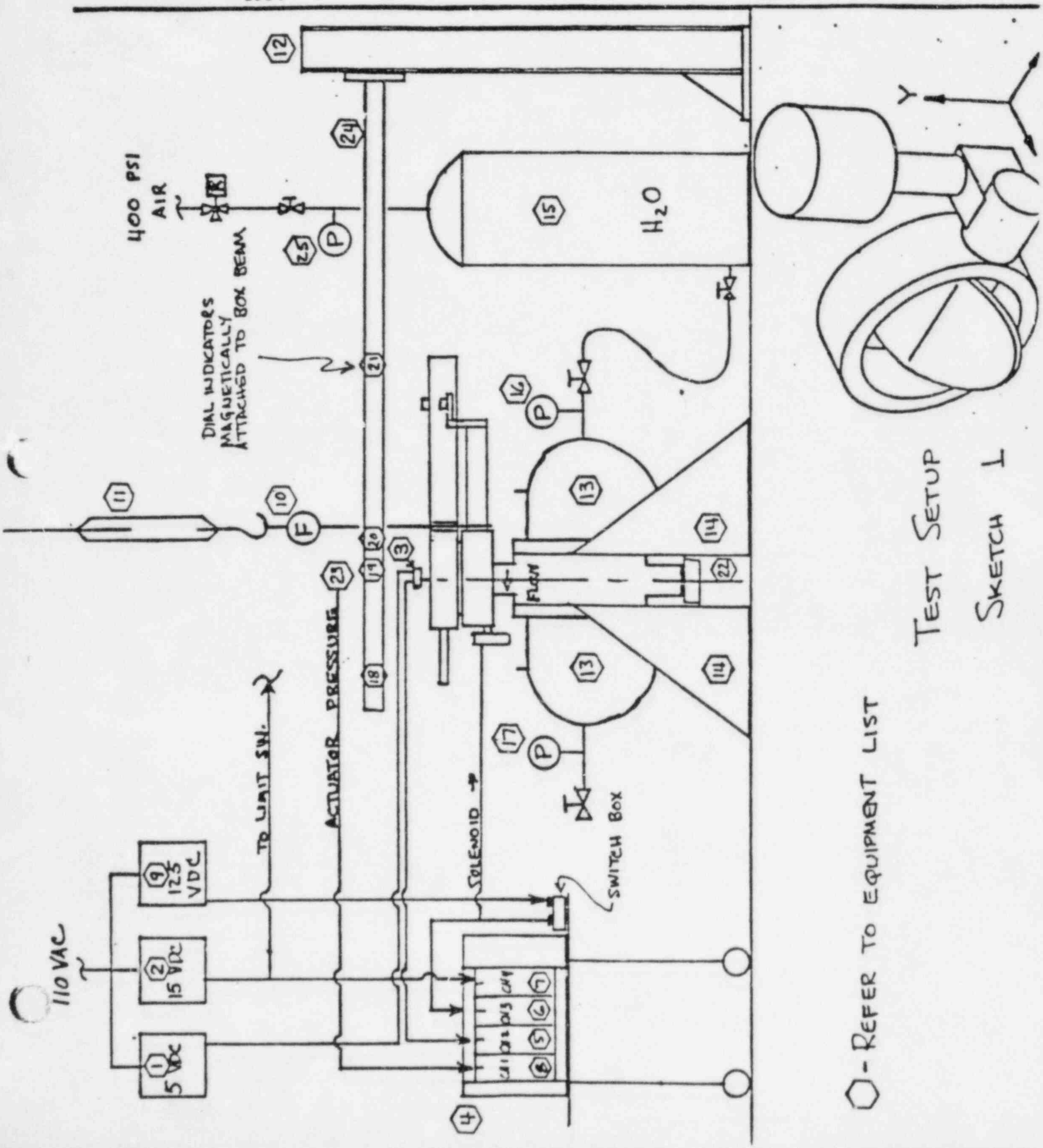

Fisher Controls

FISHER

Laboratory Report

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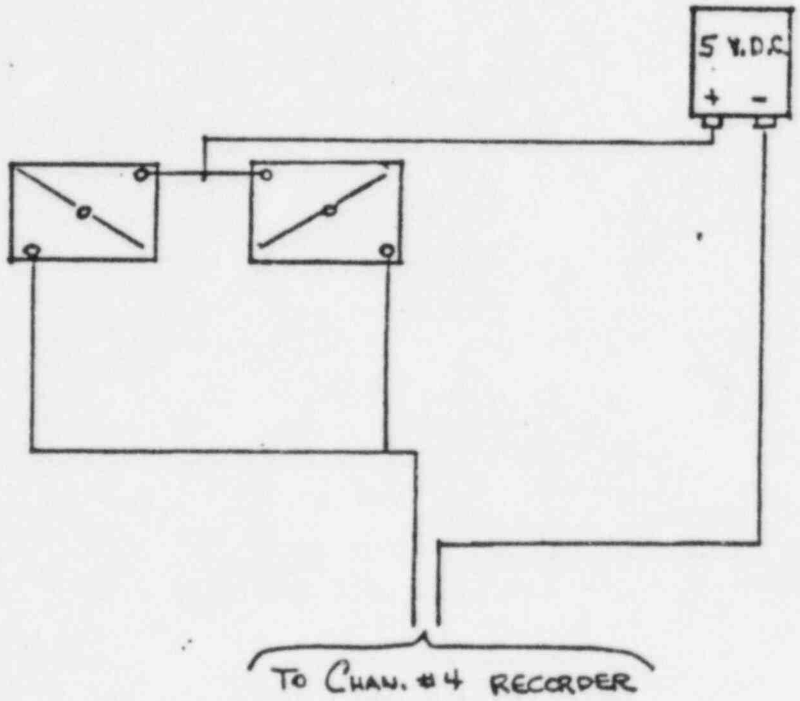
LIMIT SWITCH WIRING SCHEMATIC



SKETCH 2

Photo 1

Overall Test Setup A

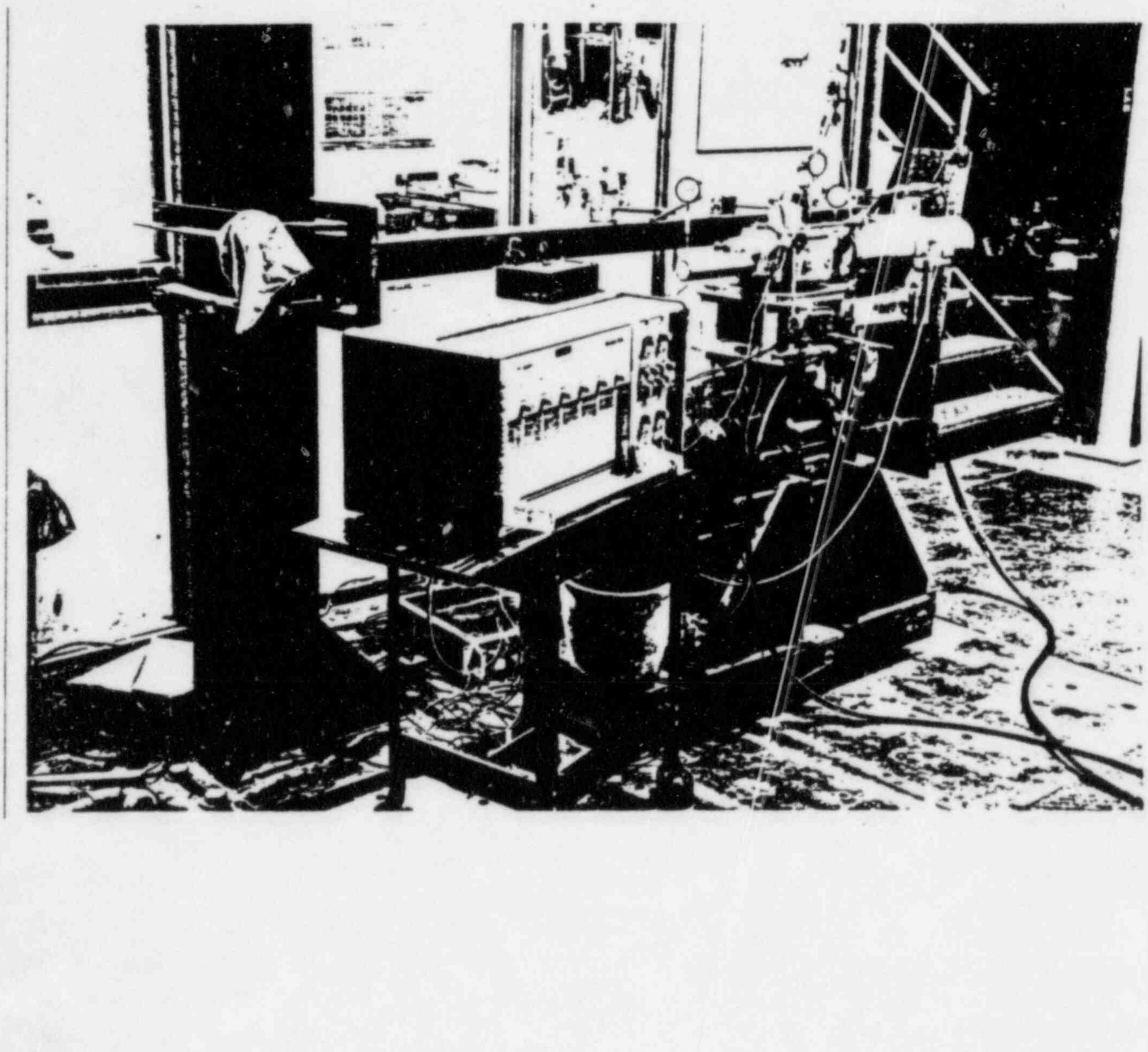


Photo 2

Overall Test Setup B

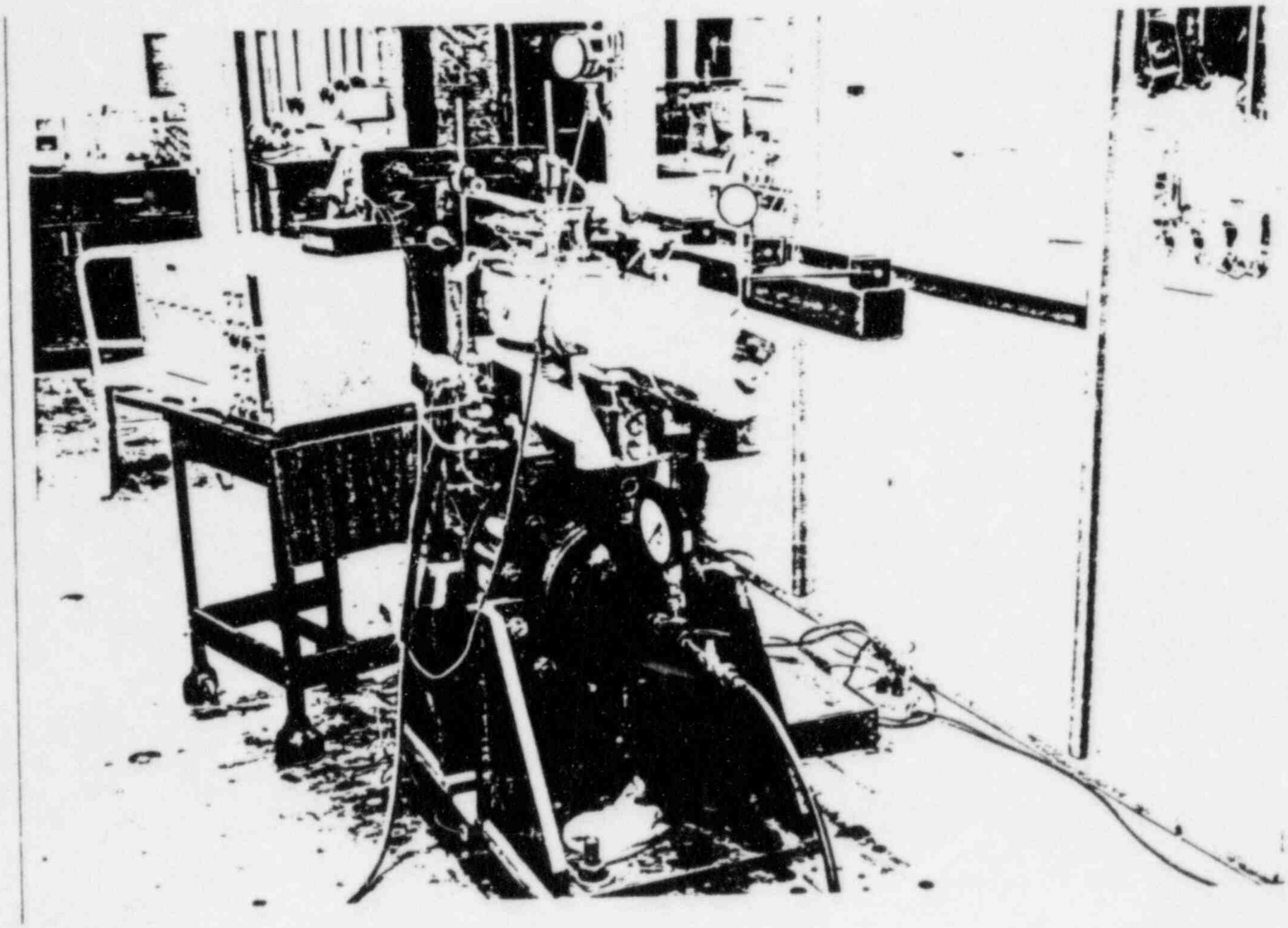


Photo 3

Dial Indicators and Sideload Locations

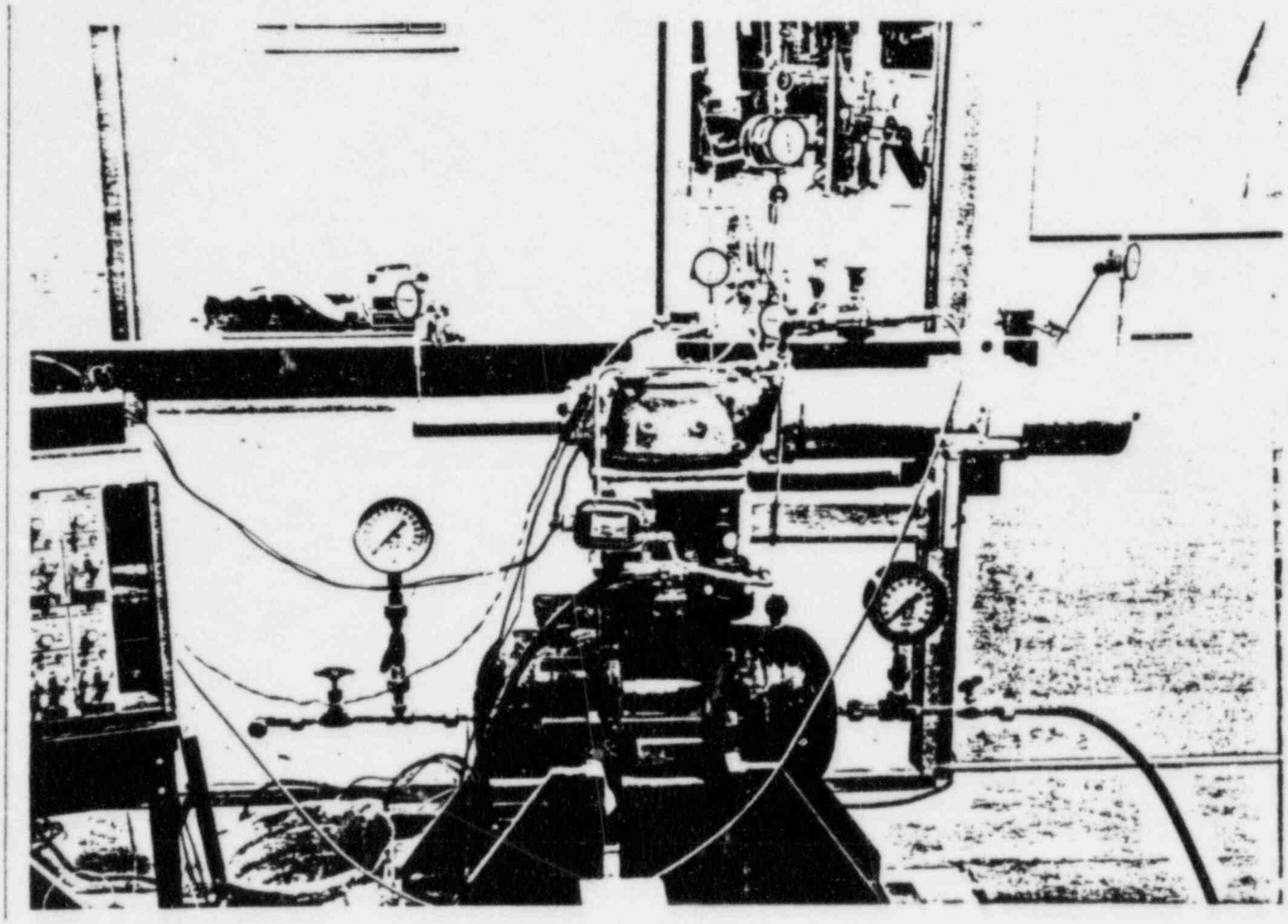
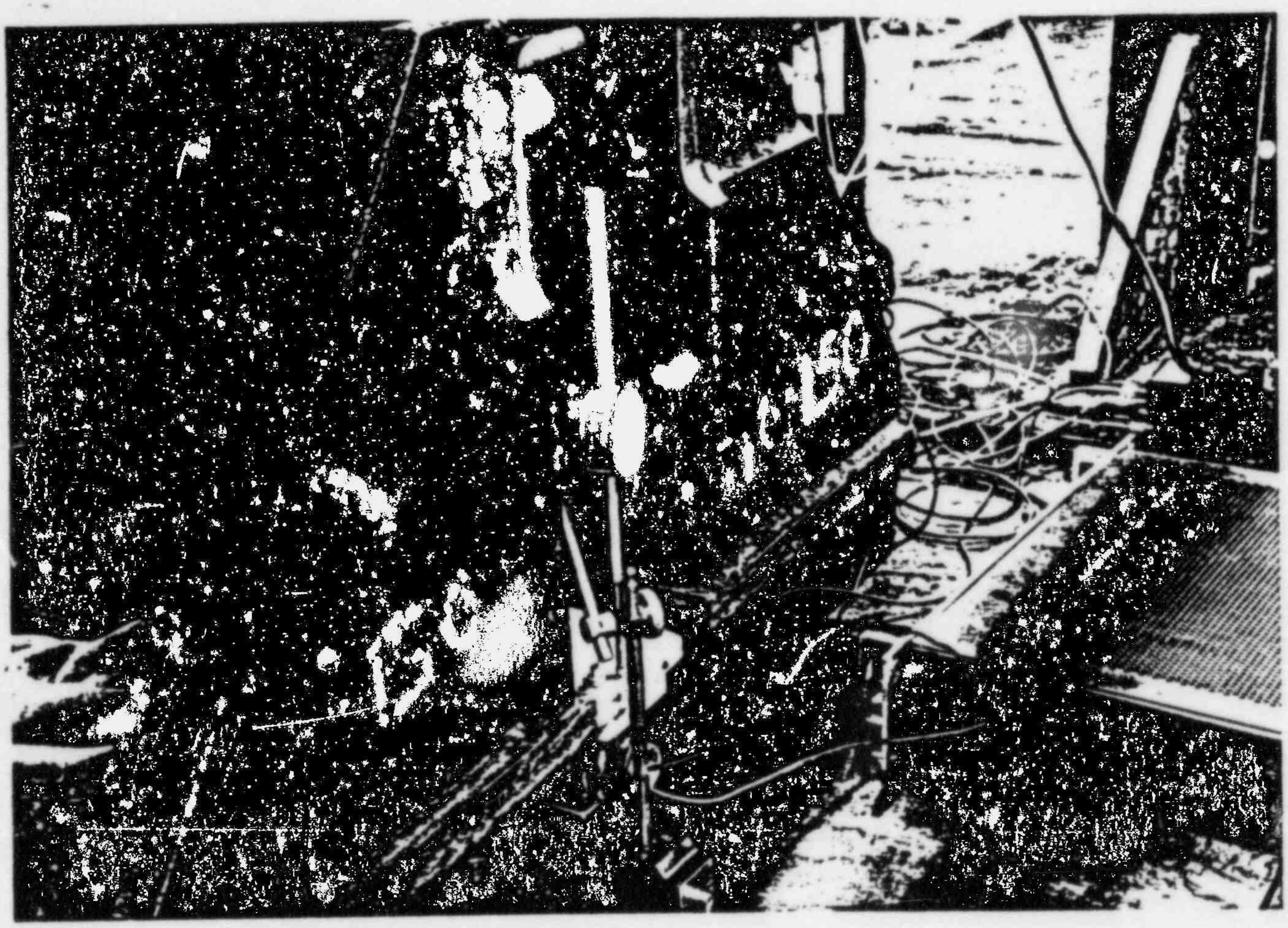


Photo 4

Dial Indicator Locations on Limit Switch Plate



ATTACHMENT 5

FQP-11AB-5

Certificates of Compliance and Related Documentation

Bettis Actuators for Group V Valves

9510-AX5AC03-5161-1 115

S/N 8342938

FISHER Controls

ASSEMBLY TEST REPORT

VALVE SERIAL NO: 8342938	SIZE AND TYPE: 10" 9280 Bettis	CUSTOMER ORDER NO: PAV-206	R NO: 791126 2	DRAWING NO: 38A 7939	REV: A
	CODE: ASME Boiler & Pressure Vessel Code		TAG NO: 1HV-12596	REP ORDER NO: 022B-XSA C02-NIP	ITEM NO: 155
	SECT. III 19 74 EDITION, Winter 19 75 ADDENDA		STAMP: ☒ YES ☐ NO CLASS 3	NCR NO S	
ATR: 791126 2 1	REV: 1	ISSUED BY: FJH	DATE: 2/5/82	REVISED BY: FJH	DATE: 4/29/82

CONTROLLED PARTS VERIFICATION

PART	✓	PIECE S/N	HEAT NO.	PART	✓	PIECE S/N	HEAT NO.	PART	✓
BODY	✓	SA0215-1	8x150-4A-1	Retaining Ring	✓	SA0210-1	90447-2 3 EC 203-7		
BONNET				Disc	✓	SA0214-1	85200-2		
VALVE PLUG				Disc Stop	✓	SA0209-1	75854-1		
STUDS									
NUTS									

PARTS VERIFIED BY: D Rimzan (Quality Assurance) Date: 1-4-83 ______ Authorized Inspector ______ Date

SPECIAL PROCESSING, TESTING AND RESULTS

HOLD/WIT PTS CUST INSP	HOLD PTS AUTH INSP	DESCRIPTION	✓	PROCEDURE	REV	AMENDMENT	REV	TEST PRESSURE	TIME (MIN)	ALLOW LEAKAGE	FINAL RESULTS	ASSEMBLER	FISHER INSP
[signature] HOLD ANI		HYDROSTATIC TEST	✓	FMP 2X14	1	Am-6	2	450	15	0	—	Not Required	D Rimzan 4-6-83
[signature]	4/7 Bechtel	SEAT LEAK TEST	✓	FMP 2X16	3	Am-8	1	50	1	0	0-LEAK	DePoe 4-2-83	[signature] 4/4/83
		DISC HYDRO											
		DIAPH TO CASE LEAK TEST											
[signature]	4/4 Bechtel	OPERATIONAL TEST	✓	FMP 2C6-2		Am-21	0	SIGNAL:	TIME OPEN		TIME CLOSE 3 sec	DMcLeming	[signature] 4/4/83
		HYSTERESIS TEST						MAX. ERROR:					
		Complete Form EC 3780	✓									N/A	
[signature]	Bechtel	CLEANING PRIOR TO ASSEMBLY	✓	APR III. A								4-7-83 DePoe	
[signature]	[signature]	PAINTING	✓	APR IV. B								Boston	[signature]
		FINAL CLEANING											
[signature]	Bechtel	SEAL ENDS	✓	APR V. B.								McCann	4-15-83
[signature] HOLD ANI	[signature]	FINAL INSPECTION											[signature] 4/20/83
		STAMP 4-19-83	✓									McCann	4-19-83
[signature]	Bechtel	PACKAGING	✓	APR V. C.								Patton	5-17-83

NOTE: Notify Customer Service for customer hold points. Notify authorized inspector for authorized inspector hold points.

F Pervy — APPROVED QUALITY ASSURANCE — 2-5-82 DATE — Kent Corking — REVIEWED AUTHORIZED INSPECTOR — APR 4 1983 DATE

Form 31318

S/N 8342938

Namco Controls
An Acme-Cleveland Company
1300 Burris Road (P.O. Box 730)
Newton, NC 28658

QUALITY CONTROL PROCEDURE

CERTIFICATION OF COMPLIANCE

Fisher Controls Company
205 South Center Street
Marshalltown, Iowa 50158
Attn: Q. C. Documentation Dept.

PURCHASE ORDER NUMBER S 181170 ITEM NUMBER 000

CUSTOMER PART NUMBER 15A4157X022

NAMCO PART NUMBER EA180-31302 B/M REV. K QTY. 6

LOT NUMBER 31119 DATE CODE 4682

NAME LIMIT SWITCH

NAMCO SHIPPER NUMBER E-40380 DATE SHIPPED 11/19/82

NAMCO CONTROLS CERTIFIES THAT SWITCHES FURNISHED HAVE BEEN MANUFACTURED, INSPECTED, TESTED, AND FOUND TO MEET APPLICABLE B/M AND DRAWING SPECIFICATIONS. NAMCO QUALITY ASSURANCE MANUAL, REV. "F", INCORPORATES 10CFR50(B) AND ANSI 45.2 AS APPLICABLE.
NAMCO FURTHER CERTIFIES THAT THESE SWITCHES WERE MANUFACTURED TO THE SAME SPECIFICATIONS AS SWITCH MODEL EA180-11302, REV. H, WHICH WAS QUALIFIED TO IEEE STANDARDS 323 (1974), 344 (1975), AND 382 (1972), PER REPORT NO. QTR-105.

11/19/82
DATE

Frank J. [signature]
QUALITY CONTROL MANAGER

9510-AX5AC03-5161-1 117

s/n 8342939

ASSEMBLY TEST REPORT

FISHER Controls

VALVE SERIAL NO: 8342939	SIZE AND TYPE: 10" NS216-SR80-12-928	CUSTOMER ORDER NO: PAV-206	PR NO: 791126 2	DRAWING NO: 38A7939	REV: A	ATR: 791126 2 1 — REV: 1
	CODE: ASME BOILER & PRESSURE VESSEL CODE		TAG NO: 1HV-12597	REP ORDER NO: 22B-X5AC03-NIP	ITEM NO: 156	ISSUED BY: FJH — DATE: 2/5/82
	SECT. III 19 74 EDITION, WINTER 19 75 ADDENDA		STAMP: [X] YES [ ] NO — CLASS: 3	NCR NO S:		REVISED BY: FJH — DATE: 4/29/82

CONTROLLED PARTS VERIFICATION

PART	✓	PIECE S/N	HEAT NO.	PART	✓	PIECE S/N	HEAT NO.	PART	✓	
BODY	✓	SA6015-1	B4150-4A-4	RETAINING RING	✓	SA6010-1	9094[redacted]5-4	Solenoid	✓	818138-1
BONNET				Disc	✓	PD5661-1	D4016-4 MATE 3.52 & CE			
VALVE PLUG				Disc Stop	✓	75854-1				
STUDS				Switch	✓	683164-1				
NUTS				Switch	✓	683165-1	2082K 29067			

PARTS VERIFIED BY: D. Cuyjar (Quality Assurance) — Date: 1-31-83 — Authorized Inspector: [signature] — Date:

SPECIAL PROCESSING, TESTING AND RESULTS

HOLD/WIT PTS CUST. INSP	HOLD PTS AUTH. INSP	DESCRIPTION	✓	PROCEDURE	REV	AMENDMENT	REV	TEST PRESSURE	TIME (MIN)	ALLOW LEAKAGE	FINAL RESULTS	ASSEMBLER	FISHER INSP.	
D. Jenkins Bechtel	HOLD ANI 1-13	HYDROSTATIC TEST	✓	FMP 2X14	1	AM-6	2	450	15	0	0-leak		Thatcher	2/10/83
D. Jenkins	Bechtel	SEAT LEAK TEST	✓	FMP 2X16	3	AM-8	1	50	1	0	0-leak		Thatcher	2/24/83
		DISC HYDRO												
		DIAPH TO CASE LEAK TEST												
D. Jenkins 3/25/83 Bechtel		OPERATIONAL TEST	✓	FMP 2C6.2	0	AM-21	0	SIGNAL:	TIME OPEN		TIME 1.9 SEC CLOSE OK	Edwards	Thatcher	2/25/83
		HYSTERESIS TEST						MAX. ERROR:						
		COMPLETE FORM FC 3720	✓											
Bechtel		CLEANING PRIOR TO ASSEMBLY	✓	APR III. A								0-21-83		
3/28 Bechtel		PAINTING	✓	APR IV B							OK	M. Boston	3-28-83	
		FINAL CLEANING												
Bechtel		SEAL ENDS	✓	APR V. D.								3-23-83 McCase		
Bechtel		FINAL INSPECTION	✓										Thatcher	3/23/83
	HOLD ANI	STAMP 3-23-83	✓								OK	3-23-83		
Bechtel		PACKAGING		APR V.C.										

NOTE: Notify Customer Service for customer hold points. Notify authorized inspector for authorized inspector hold points.

APPROVED QUALITY ASSURANCE: F. Perez — DATE: 2-5-82 — REVIEWED AUTHORIZED INSPECTOR: [signature] — DATE: 1-19-83

Form 31318 — Printed in U.S.A.

Namco Controls
An Acme-Cleveland Company
149 Cucumber Street
Jefferson, Ohio 44047

S/N 8342939

QUALITY CONTROL PROCEDURE

CERTIFICATION OF COMPLIANCE

Fisher Controls Intl., Inc.
Center St. Plant
Marshalltown, IA 50158

PURCHASE ORDER NUMBER S-180627 ITEM NUMBER 000

CUSTOMER PART NUMBER 15A5650X392

NAMCO PART NUMBER EA180-32302 B/M REV. K QTY. 2

LOT NUMBER 29067 DATE CODE 2082

NAME LIMIT SWITCH

NAMCO SHIPPER NUMBER E-35073-00 DATE SHIPPED 5/11/82

NAMCO CONTROLS CERTIFIES THAT SWITCHES FURNISHED HAVE BEEN MANUFACTURED, INSPECTED, TESTED, AND FOUND TO MEET APPLICABLE B/M AND DRAWING SPECIFICATIONS. NAMCO QUALITY ASSURANCE MANUAL, REV. "C", INCORPORATES 10CFR50(B) AND ANSI 45.2 AS APPLICABLE.
NAMCO FURTHER CERTIFIES THAT THESE SWITCHES WERE MANUFACTURED TO THE SAME SPECIFICATIONS AS SWITCH MODEL EA180-11302, REV. H, WHICH WAS QUALIFIED TO IEEE STANDARDS 323 (1974), 344 (1975), AND 382 (1972), PER REPORT NO. QTR-105.

THESE SWITCHES HAVE: Style 2 MOUNTING
CCW ROTATION
10 DEGREE TRIP

5-11-82
DATE

R E L[illegible]
QUALITY CONTROL MANAGER

8510 AX5AC03-5161-1 119

S/N 8342939

Namco Controls
An Acme-Cleveland Company
149 Cucumber Street
J[illegible]erson, Ohio 44047

QUALITY CONTROL PROCEDURE

CERTIFICATION OF COMPLIANCE

Fisher Controls Intl. Inc.
Center St. Plant
Marshalltown, Iowa 50158

PURCHASE ORDER NUMBER S-180698 ITEM NUMBER 000

CU[illegible]OMER PART NUMBER 15A4157X022

NA[illegible]O PART NUMBER EA180-31302 B/M REV. H QTY. 2

LOT NUMBER 28094 DATE CODE 0882

NAME LIMIT SWITCH

NAMCO SHIPPER NUMBER E-35072-00 DATE SHIPPED 5/7/82

NAMCO CONTROLS CERTIFIES THAT SWITCHES FURNISHED HAVE BEEN MANUFACTURED, INSPECTED, TESTED, AND FOUND TO MEET APPLICABLE B/M AND DRAWING SPECIFICATIONS. NAMCO QUALITY ASSURANCE MANUAL, REV. "C", INCORPORATES 10CFR50(B) AND ANSI 45.2 AS APPLICABLE.
NAMCO FURTHER CERTIFIES THAT THESE SWITCHES WERE MANUFACTURED TO THE SAME SPECIFICATIONS AS SWITCH MODEL EA180-11302, REV. H, WHICH WAS QUALIFIED TO IEEE STANDARDS 323 (1974), 344 (1975), AND 382 (1972), PER REPORT NO. QTR-105.

THESE SWITCHES HAVE:

Style 2 MOUNTING
CW ROTATION
10 DEGREE TRIP

5-7-82
DATE

R.E. Ferris
QUALITY CONTROL MANAGER

S/N 8342939

9510-AX5AC03-5161-1 120

Automatic Switch Co.

Manufacturers of DEPENDABLE CONTROL Since 1888

ASCO

HAM PARK, NEW JERSEY 07932 · N.J.·201 966-2000 / N.Y.·(212) 344-3765

CERTIFICATE OF COMPLIANCE

Customer Name FISHER CONTROLS INTERNATIONAL, INC.

Customer P.O. No. S181203

Consignee

Consignee P.O. No.

ASCO Shop Order No. 98168K

ASCO Part No. NP K 8321A-2-V Quantity 3

Voltage 125/DC Eng. Job No.

This is to certify that the subject valve(s) meet the performance requirements of IEEE-323-1974, IEEE-344-1975, and IEEE-382-1972, **as substantiated by testing valves of generically equal design** in accordance with ASCO Qualification Specification AQS-21678, Revision "B", dated February 15, 1978. The following test levels were included in this qualification test program:

I. Aging Simulation Phases:

A. Thermal Aging Simulation - **268°F for 12 days**. These aging parameters were determined by Arrhenius calculations to simulate a minimum of 10 years in a 140°F continuous ambient. Refer to Figure 1 for additional information regarding service periods for elastomeric components and solenoid coils.

B. Radiation Aging Simulation - 50 megarads of gamma radiation at a rate not exceeding 1 megarad per hour to simulate expected non-accident radiation exposure.

C. Wear Aging Simulation - 40,000 operations at maximum operating pressure differential and nominal voltage.

D. Vibration Aging Simulation - 1 million cycles, distributed equally among the three orthogonal axes, between 50 and 100 Hz, at an input acceleration level of 0.75g. The valves were cycled once every 15 minutes during the test. The valves were attached to the shaker table by rigid test fixtures using the standard valve mounting provisions with the solenoids vertical and upright. Flexible hoses were used on all ports; therefore, the set-up did not affect the rigidity or mass of the valves being tested.

E. Seismic Aging (OBE) Simulation - The valves were mounted to the shaker table as described for the vibration aging simulation and were exposed to two sinusoidal sweeps from 1 to 33 to 1 Hz, with a peak acceleration level of 3g within machine limits, in each of three orthogonal axes at a rate of 1 octave per minute. One sweep in each axis was conducted with the valves energized and the other with the valves de-energized. These sinusoidal sweeps are considered to provide the equivalent dynamic effect of 5 OBE's.

Form No VE 2926R4

ASCO SHOP ORDER NO. 1 1?98168K S/N 8342939

II. Design Basis Event (DBE) Phases:

A. Seismic DBE (SSE) Simulation - The valves were mounted to the shaker table as described for the vibration aging simulation and were exposed to single frequency sinusoidal tests at ⅓ octave frequency interval dwell points from 1-40 Hz. At each test frequency, the peak input acceleration was increased and the g-levels were recorded at which the cylinder port pressure (zero when de-energized and full inlet pressure when energized for a normally closed valve, opposite for a normally open valve) differed from the nominal by 0%, 5% and 10% of inlet pressure (up to 10g maximum). The valves are considered to function properly up to a 10% change in cylinder port pressure. This level was selected as being sufficiently low to prevent spurious shifting of the customer's main valve or other equipment. Motion was applied at the same frequency and acceleration limits in each of the three orthogonal axes separately. Based on this testing and/or additional testing conducted by ASCO (after consideration of margin as suggested in IEEE-323-1974), the following acceptable maximum acceleration levels have been determined:

13.5g

B. Radiation DBE Simulation - 150 megarads* of gamma radiation at a rate not exceeding 1 megarad per hour to simulate (after consideration of margin as suggested in IEEE-323-1974) at least 136 megarads of accident radiation exposure.

C. Environmental DBE (LOCA/HELB) Simulation - The valves were installed in a pressure vessel and subjected to a 30-day exposure of steam and chemical spray following the suggestions of IEEE-382-1972 (chemical spray per Table 1(b) and test chamber temperature profile per Figure 1 and Table 2). The valves had been pressurized to maximum operating pressure and continuously energized for 4 hours prior to the first transient (to produce coil saturation). They were de-energized when the temperature of the first transient reached 250°F, to show satisfactory shifting for demonstration of safety function. The valves were kept pressurized and were cycled during the 30-day exposure, as suggested in IEEE-382-1972, to demonstrate their ability to operate on demand during the LOCA or HELB.

Test report AQS-21678/TR, Rev. A, is on file at Automatic Switch Company in Florham Park, New Jersey, and is available for customer perusal.

*Based on the results of testing conducted subsequent to this program, ASCO has determined that use of the subject valves incorporating Viton elastomers should be limited to those applications where no shifting of position will be required following exposure to total gamma radiation doses in excess of 20 megarads. However, the subject valves are capable of maintaining a safety position after exposure to doses up to 200 megarads.

Dated DECEMBER 17, 1982 Authorized Signature

QUALITY CONTROL MANAGER

NOTE: IN ORDER TO MAINTAIN QUALIFICATION, CATALOG NP-1 VALVES SHOULD BE REBUILT USING THE APPROPRIATE SPARE PARTS WHENEVER INDICATED BY THE PERIODIC INSPECTION OF VALVE COMPONENTS OR WHENEVER ANY OF THE FOLLOWING LEVELS, SIMULATED DURING QUALIFICATION TESTING, ARE REACHED:

1. WEAR AGING – 40,000 CYCLES
2. RADIATION AGING – 5 X 10^7 RAD
3. THERMAL AGING – THE MAXIMUM SERVICE PERIOD INDICATED FOR THE APPLICABLE SERVICE AMBIENT TEMPERATURE.

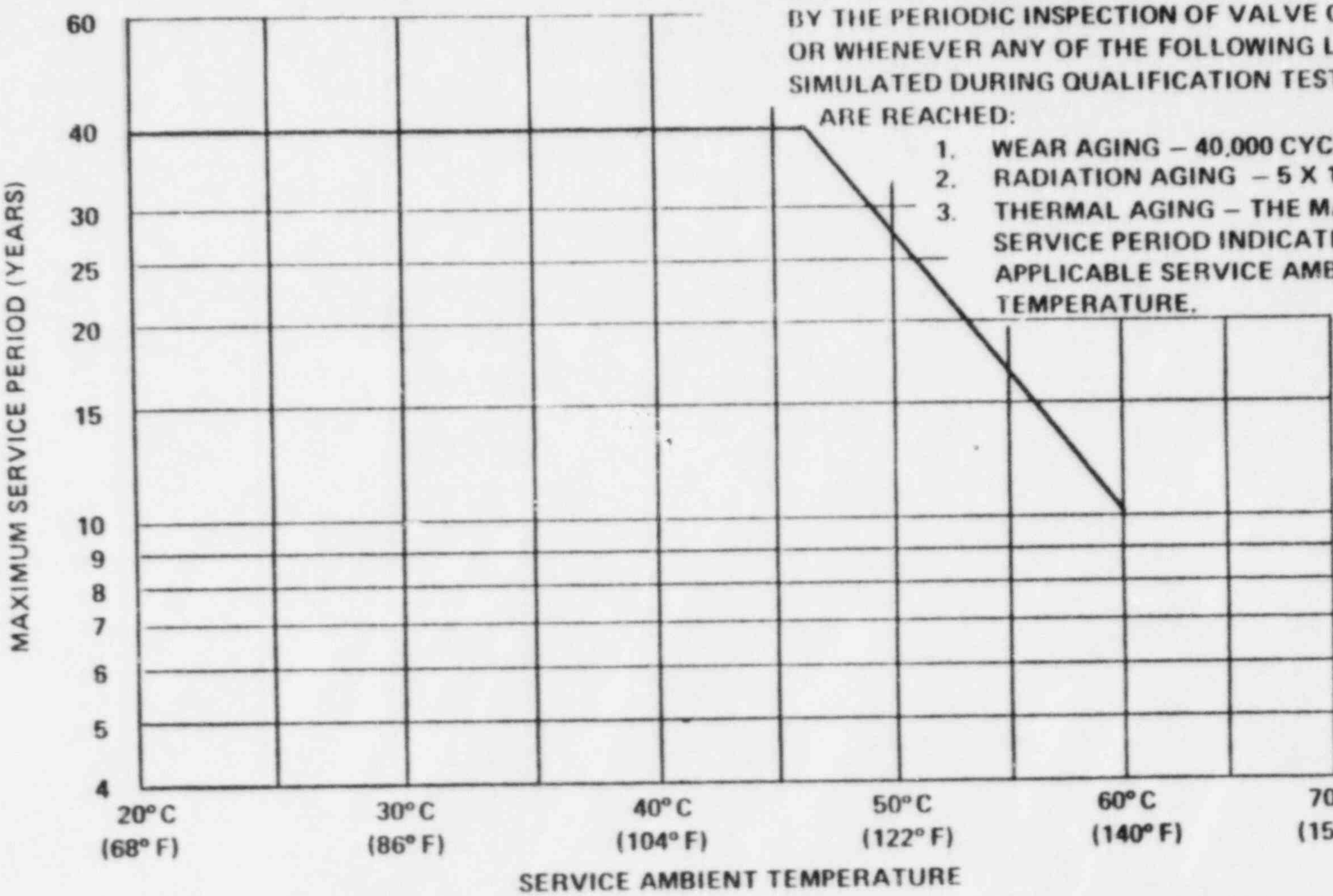


FIGURE 1

MAXIMUM SERVICE PERIODS FOR ELASTOMERIC COMPONENTS AND SOLENOID COILS IN ASCO CATALOG NP-1 VALVES

S/N 8342939

9510 AX5...

G·H BETTIS

A Galveston-Houston Company

7031 Grand Blvd.
P.O. Box 14689
Houston, Texas 77021
(713) 748-1143 Telex 76-2713

August 2, 1982

Fisher Control
P. O. Box 190
Marshalltown, Iowa 50158

Attention: Ms. Judy Evans
Subject: Certification of Compliance for the Fisher Control Purchase Order 180752; G.H. Bettis Sales Order 78-1741-OE

Ms. Evans:

This letter is to certify that the equipment furnished on line number 01A our sales order, item 000 your purchase order, reference RMA#2089, were refurbished in accordance with written G.H. Bettis Engineering Specifications and Standards.

Units Shipped:

Qty.	Model	Serial Number
2	N521C-SR-80-12	78-1741-3 & 5

Cordially,
G.H. Bettis Company

Anthony T. Locascio
Quality Assurance Manager

ATL:jw
cc: File

FISHER Controls

ASSEMBLY TEST REPORT

VALVE SERIAL NO	SIZE AND TYPE	CUSTOMER ORDER NO.	APR NO.	TAG NO.	DRAWING NO.	REP. ORDER NO.	REV.	ITEM NO	ATR	REV	ISSUED BY	DATE	REVISED BY	DATE
8342940	10" 9280	PAV-2-34	79P126-2	2HV-12596	38A7940	0228-X5AC03-N2P	A	0165	79P126-2-1	1	EH	2/5/82	FdH	4/28/82

CODE: ASME BOILER & PRESSURE VESSEL CODE SECT. III 19 74 EDITION, WINTER 19 75 ADDENDA

STAMP: [X] YES [ ] NO CLASS: 3 NCR NO.'S:

CONTROLLED PARTS VERIFICATION

PART	✓	PIECE S/N	HEAT NO.	PART	✓	PIECE S/N	HEAT NO.	PART	✓
BODY	✓	SA0273-1	B4150-4A-2	RETAINING RING	✓	SA0268-1	94947-23-36205-2		
BONNET				DISC	✓	SA0272-1	B5200-3		
VALVE PLUG				DISC STOP	✓	SA0267-1	MATL SIZE & GR. 75834-1		
STUDS				Solenoid	✓	—	—		
NUTS				Bettis Actuator		—	82-9022-1		

PARTS VERIFIED BY ______ Quality Assurance ______ Date ______ Authorized Inspector ______ Date

SPECIAL PROCESSING, TESTING AND RESULTS

✓	HOLD/WIT PTS CUST. INSP	HOLD PTS AUTH. INSP	DESCRIPTION	✓	PROCEDURE	REV	AMENDMENT	REV	TEST PRESSURE	TIME (MIN)	ALLOW LEAKAGE	FINAL RESULTS	ASSEMBLER	FISHER INSP.
	[signature] 10/1	[signature]	HYDROSTATIC TEST	✓	FMP 2X14	1	Am-6	2	N/A	[signature]		10-1-84		
			SEAT LEAK TEST	✓	FMP 2X16	3	Am-8	1	50	1	0	0 LEAK	Edward	[signature] 10/8/84
			DISC HYDRO											
			DIAPH TO CASE LEAK TEST											
	[signature] 10/8	[signature]	OPERATIONAL TEST	✓	FMP 2C6-2		AM-21	0	SIGNAL:	TIME OPEN		TIME CLOSE ✓	T. [signature]	[signature] 10 8 84
			HYSTERESIS TEST						MAX. ERROR:					
			complete item EC 3290	✓										
	[signature] 10/8	[signature]	CLEANING PRIOR TO ASSEMBLY	✓	APR III. A								Edward	10-8-84
			PAINTING	✓	APR IV. B									
			FINAL CLEANING											
	[signature]	[signature]	SEAL ENDS	✓	APR V. B.								Edward	11-29-84
	[signature]	12-6-84	FINAL INSPECTION	✓										[signature] 12/6/84
	HOLD ANI		STAMP	✓									[signature]	12-6-84
	[signature] 12/19	[signature]	PACKAGING	✓	APR V. c								[signature]	12-19-84

NOTE: Notify Customer Service for customer ... points. Notify authorized inspector ... authorized inspector hold points.

F. Perez APPROVED QUALITY ASSURANCE 5-82 DATE Kent Cockering [signature] REVIEWED AUTHORIZED INSPECTOR OCT 24 1984 Date

S/N 8342940

S/N 8342940

9510-AX5AC03-5161-1 125

Automatic Switch Co.

Manufacturers of DEPENDABLE CONTROL Since 1888

ASCO

FLORHAM PARK, NEW JERSEY 07932 · N.J.-(201) 966-2000 / N.Y.-(212) 344-3785

CERTIFICATE OF COMPLIANCE

Date April 23, 1982

Customer Fisher Controls Intern'l Inc.

Customer P.O. No. S180605

Consignee

Consignee P.O. No.

ASCO Shop Order No. 58150K

ASCO Part No. HT8321A7 Quantity 2

This is to certify that we have supplied the above item ordered and it was manufactured in accordance with ASCO Quality Control procedures, specifications and drawings on file which also include manufacturing free from mercury contamination.

Authorized Signature
B. J. Sampson
Valve Sales Department

bjs/tm
cc: ASCO-Chicago

Form V.Sls. 2725

S/N 8342940

Automatic Switch Co.

Manufacturers of DEPENDABLE CONTROL Since 1888

FLORHAM PARK, NEW JERSEY 07932 · N.J. 201 966-2000 N.Y. 212 344-3765

CERTIFICATE OF COMPLIANCE

Customer Name FISHER CONTROLS INTERNATIONAL, INC.

Customer P.O. No. S181203

Consignee

Consignee P.O. No.

ASCO Shop Order No. 98168K

ASCO Part No. NP K 8321A-2-V Quantity 3

Voltage 125/DC Eng. Job No.

This is to certify that the subject valve(s) meet the performance requirements of IEEE-323-1974, IEEE-344-1975, and IEEE-382-1972, as substantiated by testing valves of generically equal design in accordance with ASCO Qualification Specification AQS-21678, Revision "B", dated February 15, 1978. The following test levels were included in this qualification test program:

Aging Simulation Phases:

A. Thermal Aging Simulation - 266 F for 12 days. These aging parameters were determined by Arrhenius calculations to simulate a minimum of 40 years in a 140 F continuous ambient. Refer to Figure 1 for additional information regarding service periods for elastomeric components and solenoid coils.

B. Radiation Aging Simulation - 50 megarads of gamma radiation at a rate not exceeding 1 megarad per hour to simulate expected non-accident radiation exposure.

C. Wear Aging Simulation - 40,000 operations at maximum operating pressure differential and nominal voltage.

D. Vibration Aging Simulation - 1 million cycles, distributed equally among the three orthogonal axes, between 50 and 100 Hz, at an input acceleration level of 0.75g. The valves were cycled once every 15 minutes during the test. The valves were attached to the shaker table by rigid test fixtures using the standard valve mounting provisions with the solenoids vertical and upright. Flexible hoses were used on all ports; therefore, the set-up did not affect the rigidity or mass of the valves being tested.

E. Seismic Aging (OBE) Simulation - The valves were mounted to the shaker table as described for the vibration aging simulation and were exposed to two sinusoidal sweeps from 1 to 33 to 1 Hz, with a peak acceleration level of 3g within machine limits, in each of three orthogonal axes at a rate of 1 octave per minute. One sweep in each axis was conducted with the valves energized and the other with the valves de-energized. These sinusoidal sweeps are considered to provide the equivalent dynamic effect of 5 OBE's.

Form No VE 2926R4

9510-AX5AC03-5161-1 127

ASCO SHOP ORDER NO. 98168K

S/N 8342940

I. Design Basis Event (DBE) Phases:

A. Seismic DBE (SSE) Simulation - The valves were mounted to the shaker table as described for the vibration aging simulation and were exposed to single frequency sinusoidal tests at ⅓ octave frequency interval dwell points from 1-40 Hz. At each test frequency, the peak input acceleration was increased and the g-levels were recorded at which the cylinder port pressure (zero when de-energized and full inlet pressure when energized for a normally closed valve, opposite for a normally open valve) differed from the nominal by 0%, 5% and 10% of inlet pressure (up to 10g maximum). The valves are considered to function properly up to a 10% change in cylinder port pressure. This level was selected as being sufficiently low to prevent spurious shifting of the customer's main valve or other equipment. Motion was applied at the same frequency and acceleration limits in each of the three orthogonal axes separately. Based on this testing and/or additional testing conducted by ASCO (after consideration of margin as suggested in IEEE-323-1974), the following acceptable maximum acceleration levels have been determined:

13.5g

B. Radiation DBE Simulation - 150 megarads* of gamma radiation at a rate not exceeding 1 megarad per hour to simulate (after consideration of margin as suggested in IEEE-323-1974) at least 136 megarads of accident radiation exposure.

C. Environmental DBE (LOCA/HELB) Simulation - The valves were installed in a pressure vessel and subjected to a 30-day exposure of steam and chemical spray following the suggestions of IEEE-382-1972 (chemical spray per Table 1(b) and test chamber temperature profile per Figure 1 and Table 2). The valves had been pressurized to maximum operating pressure and continuously energized for 4 hours prior to the first transient (to produce coil saturation). They were de-energized when the temperature of the first transient reached 280°F, to show satisfactory shifting for demonstration of safety function. The valves were kept pressurized and were cycled during the 30-day exposure, as suggested in IEEE-382-1972, to demonstrate their ability to operate on demand during the LOCA or HELB.

Test report AQS-21678/TR, Rev. A, is on file at Automatic Switch Company in Florham Park, New Jersey, and is available for customer perusal.

*Based on the results of testing conducted subsequent to this program, ASCO has determined that use of the subject valves incorporating Viton elastomers should be limited to those applications where no shifting of position will be required following exposure to total gamma radiation doses in excess of 20 megarads. However, the subject valves are capable of maintaining a safety position after exposure to doses up to 200 megarads.

Dated DECEMBER 17, 1982 Authorized Signature

QUALITY CONTROL MANAGER

Form VS-2026 E1

NOTE: IN ORDER TO MAINTAIN QUALIFICATION, CATALOG NP-1 VALVES SHOULD BE REBUILT USING THE APPROPRIATE SPARE PARTS WHENEVER INDICATED BY THE PERIODIC INSPECTION OF VALVE COMPONENTS OR WHENEVER ANY OF THE FOLLOWING LEVELS, SIMULATED DURING QUALIFICATION TESTING, ARE REACHED:

1. WEAR AGING – 40,000 CYCLES
2. RADIATION AGING – 5 X 10[7] RAD
3. THERMAL AGING – THE MAXIMUM SERVICE PERIOD INDICATED FOR THE APPLICABLE SERVICE AMBIENT TEMPERATURE.

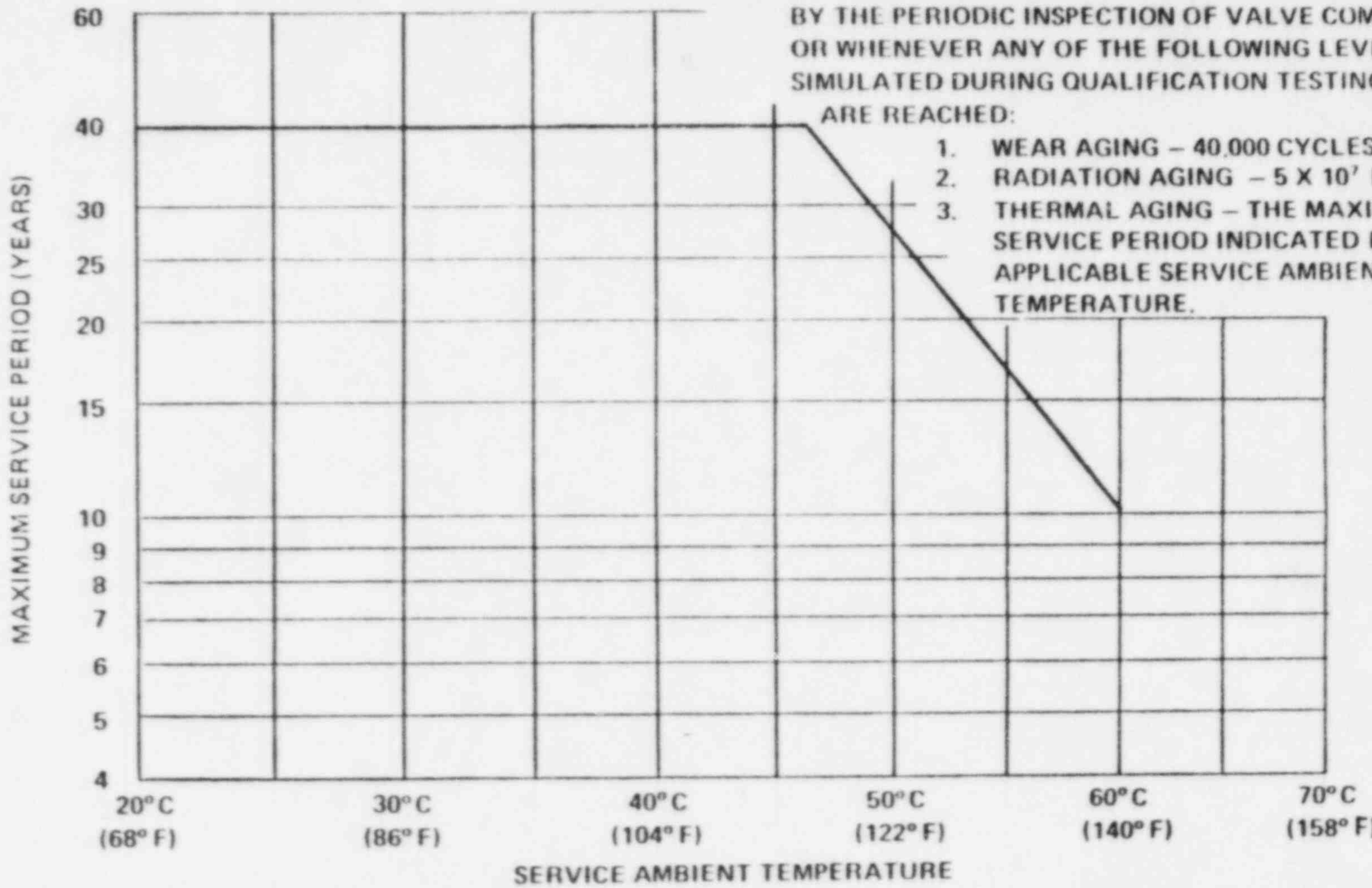


FIGURE 1

MAXIMUM SERVICE PERIODS FOR ELASTOMERIC COMPONENTS AND SOLENOID COILS IN ASCO CATALOG NP-1 VALVES

S/N 8342940

S/N 8342941

FISHER Controls — ASSEMBLY TEST REPORT

VALVE SERIAL NO	8342941
SIZE AND TYPE	10" N52IC-SRBD-17
CUSTOMER ORDER NO	PAV-2-34
CODE	ASME Boiler & Pressure Vessel Code
SECT	III — 19 74 EDITION, WINTER 19 75 ADDENDA
PR NO	791121 2
TAG NO	2HV-12597
STAMP	[X] YES [ ] NO
CLASS	3
DRAWING NO	48A 8928
REP ORDER NO	22B-X5AC03-N2P
NCR NO S	
REV	A
ITEM NO	166
ATR	791121 2 1
ATR REV	1
ISSUED BY / DATE	FJH 2/5/82
REVISED BY / DATE	FJH 4/29/82

CONTROLLED PARTS VERIFICATION

PART	√	PIECE S/N	HEAT NO.	PART	√	PIECE S/N	HEAT NO.	PART	√	
BODY	X	SAQ302-1	B4150-4A-3	Retaining Ring	X	SA0297-1	90987-23-36205-3	Solenoid	X	818137-1
BONNET				Disc	X	PQ5660-1	P4016-5			
VALVE PLUG				Disc Stop	X	SA0296-1	75854-1			
STUDS				Switch	X	683997-1	2082K29047			
NUTS				Switch	X	683996-1	—			

PARTS VERIFIED BY: D. [signature] (Quality Assurance) — Date: 3-2-83 — [signature] (Authorized Inspector) — Date:

SPECIAL PROCESSING, TESTING AND RESULTS

HOLD/WIT PTS CUST. INSP	HOLD PTS AUTH. INSP	DESCRIPTION	√	PROCEDURE	REV	AMENDMENT	REV	TEST PRESSURE	TIME (MIN)	ALLOW LEAKAGE	FINAL RESULTS	ASSEMBLER	FISHER INSP
[signature]	HOLD ANI 3-15-83	HYDROSTATIC TEST	√	FMP 2X14	1	Am-6	2	450	15	0	Leak	McCane 3-15-83	B. [signature] 3/15/83
[signature]	[initials] Bechtel	SEAT LEAK TEST	√	FMP 2X16	3	Am-8	1	50	1	0	0 Leak	[signature] 3-21-83	[signature] 3/21/83
		DISC HYDRO											
		DIAPH TO CASE LEAK TEST											
D. [signature]	[signature]	OPERATIONAL TEST	√	FMP 2C6-2	4	Am-21	0	SIGNAL:	TIME OPEN		TIME CLOSE	Rainsberger 4-1-83	[signature] 4-1-83
		HYSTERESIS TEST						MAX. ERROR					
		[illegible] FC 3750	√										
D. [signature] 3/9	[initials] Bechtel	CLEANING PRIOR TO ASSEMBLY	√	APR III A								3-19-83 [signature]	
[signature]	[signature]	PAINTING	√	APR IV B								Borton	[signature]
		FINAL CLEANING											
D. [signature]	[initials] Bechtel	SEAL ENDS	√	APR V B								McCane	4-15-83
[signature]	[signature]	FINAL INSPECTION	√										[signature] 4/21/83
	HOLD ANI 4-19-83	[illegible]	√									McCane	4-19-83
[signature]	[signature]	PACKAGING	√	APR 7 C								[signature]	4-17-83

NOTE: Notify Customer Service for customer hold points. Notify authorized inspector for authorized inspector hold points.

[signature] — APPROVED QUALITY ASSURANCE — DATE: 2-5-82 — [signature] 4-19-83 — REVIEWED AUTHORIZED INSPECTOR — DATE: [signature]

S/N 8342941

9510 AX50C03-5161 1 130

Namco Controls
An Acme-Cleveland Company
149 Cucumber Street
Jefferson, Ohio 44047

QUALITY CONTROL PROCEDURE

CERTIFICATION OF COMPLIANCE

Fisher Controls Intl. Inc.

Center St. Plant

Marshalltown, Iowa 50158

PURCHASE ORDER NUMBER S-180698 ITEM NUMBER 000

CUSTOMER PART NUMBER 15A4157X022

NAMCO PART NUMBER EA180-31302 B/M REV. H QTY. 2

LOT NUMBER 28094 DATE CODE 0882

NAME LIMIT SWITCH

NAMCO SHIPPER NUMBER E-35072-00 DATE SHIPPED 5/7/82

NAMCO CONTROLS CERTIFIES THAT SWITCHES FURNISHED HAVE BEEN MANUFACTURED, INSPECTED, TESTED, AND FOUND TO MEET APPLICABLE B/M AND DRAWING SPECIFICATIONS. NAMCO QUALITY ASSURANCE MANUAL, REV. "C", INCORPORATES 10CFR50(B) AND ANSI 45.2 AS APPLICABLE.
NAMCO FURTHER CERTIFIES THAT THESE SWITCHES WERE MANUFACTURED TO THE SAME SPECIFICATIONS AS SWITCH MODEL EA180-11302, REV. H, WHICH WAS QUALIFIED TO IEEE STANDARDS 323 (1974), 344 (1975), AND 382 (1972), PER REPORT NO. QTR-105.

THESE SWITCHES HAVE: Style 2 MOUNTING

CW ROTATION

10 DEGREE TRIP

5-7-82
DATE

R E Ferris
QUALITY CONTROL MANAGER

S/N 8342941

Namco Controls P318 AKSHC03-5161-1 131
An Acme-Cleveland Company
149 Cucumber Street
Jefferson, Ohio 44047

QUALITY CONTROL PROCEDURE

CERTIFICATION OF COMPLIANCE

Fisher Controls Intl., Inc.

Center St. Plant

Marshalltown, IA 50158

PURCHASE ORDER NUMBER S-180627 ITEM NUMBER 000

CUSTOMER PART NUMBER 15A5650X392

NAMCO PART NUMBER EA180-32302 B/M REV. K QTY. 2

LOT NUMBER 29067 DATE CODE 2082

NAME LIMIT SWITCH

NAMCO SHIPPER NUMBER E-35073-00 DATE SHIPPED 5/11/82

NAMCO CONTROLS CERTIFIES THAT SWITCHES FURNISHED HAVE BEEN MANUFACTURED, INSPECTED, TESTED, AND FOUND TO MEET APPLICABLE B/M AND DRAWING SPECIFICATIONS. NAMCO QUALITY ASSURANCE MANUAL, REV. "C", INCORPORATES 10CFR50(B) AND ANSI 45.2 AS APPLICABLE.
NAMCO FURTHER CERTIFIES THAT THESE SWITCHES WERE MANUFACTURED TO THE SAME SPECIFICATIONS AS SWITCH MODEL EA180-11302, REV. H, WHICH WAS QUALIFIED TO IEEE STANDARDS 323 (1974), 344 (1975), AND 382 (1972), PER REPORT NO. QTR-105.

THESE SWITCHES HAVE: Style 2 MOUNTING

CCW ROTATION

10 DEGREE TRIP

5-11-82
DATE

R E Lessin
QUALITY CONTROL MANAGER

S/N 8342941

9510 AX5AC03-5161-1 132

Automatic Switch Co.

Manufacturers of DEPENDABLE CONTROL Since 1888

FLORHAM PARK, NEW JERSEY 07932 · N.J. (201) 966-2000 N.Y. (212) 344-3765

CERTIFICATE OF COMPLIANCE

Customer Name FISHER CONTROLS INTERNATIONAL, INC.

Customer P.O. No. S181203

Consignee

Consignee P.O. No.

ASCO Shop Order No. 98168K

ASCO Part No. NP K 8321A-2-V Quantity 3

Voltage 125/DC Eng. Job No.

This is to certify that the subject valve(s) meet the performance requirements of IEEE-323-1974, IEEE-344-1975, and IEEE-382-1972, as substantiated by testing valves of generically equal design in accordance with ASCO Qualification Specification AQS-21678, Revision "B", dated February 15, 1978. The following test levels were included in this qualification test program:

I. Aging Simulation Phases:

A. Thermal Aging Simulation - 268°F for 12 days. These aging parameters were determined by Arrhenius calculations to simulate a minimum of 10 years in a 140°F continuous ambient. Refer to Figure 1 for additional information regarding service periods for elastomeric components and solenoid coils.

B. Radiation Aging Simulation - 50 megarads of gamma radiation at a rate not exceeding 1 megarad per hour to simulate expected non-accident radiation exposure.

C. Wear Aging Simulation - 40,000 operations at maximum operating pressure differential and nominal voltage.

D. Vibration Aging Simulation - 1 million cycles, distributed equally among the three orthogonal axes, between 50 and 100 Hz, at an input acceleration level of 0.75g. The valves were cycled once every 15 minutes during the test. The valves were attached to the shaker table by rigid test fixtures using the standard valve mounting provisions with the solenoids vertical and upright. Flexible hoses were used on all ports; therefore, the set-up did not affect the rigidity or mass of the valves being tested.

E. Seismic Aging (OBE) Simulation - The valves were mounted to the shaker table as described for the vibration aging simulation and were exposed to two sinusoidal sweeps from 1 to 33 to 1 Hz, with a peak acceleration level of 3g within machine limits, in each of three orthogonal axes at a rate of 1 octave per minute. One sweep in each axis was conducted with the valves energized and the other with the valves de-energized. These sinusoidal sweeps are considered to provide the equivalent dynamic effect of 5 OBE's.

Form No VE 2926R4

SS10 AX56C03 E1/1 1
ASCO SHOP ORDER NO. 1398168K

S/N 834294/

II. Design Basis Event (DBE) Phases:

A. Seismic DBE (SSE) Simulation - The valves were mounted to the shaker table as described for the vibration aging simulation and were exposed to single frequency sinusoidal tests at ½ octave frequency interval dwell points from 1-40 Hz. At each test frequency, the peak input acceleration was increased and the g-levels were recorded at which the cylinder port pressure (zero when de-energized and full inlet pressure when energized for a normally closed valve, opposite for a normally open valve) differed from the nominal by 0%, 5% and 10% of inlet pressure (up to 10g maximum). The valves are considered to function properly up to a 10% change in cylinder port pressure. This level was selected as being sufficiently low to prevent spurious shifting of the customer's main valve or other equipment. Motion was applied at the same frequency and acceleration limits in each of the three orthogonal axes separately. Based on this testing and/or additional testing conducted by ASCO (after consideration of margin as suggested in IEEE-323-1974), the following acceptable maximum acceleration levels have been determined:

13.5g

B. Radiation DBE Simulation - 150 megarads* of gamma radiation at a rate not exceeding 1 megarad per hour to simulate (after consideration of margin as suggested in IEEE-323-1974) at least 136 megarads of accident radiation exposure.

C. Environmental DBE (LOCA/HELB) Simulation - The valves were installed in a pressure vessel and subjected to a 30-day exposure of steam and chemical spray following the suggestions of IEEE-382-1972 (chemical spray per Table 1(b) and test chamber temperature profile per Figure 1 and Table 2). The valves had been pressurized to maximum operating pressure and continuously energized for 4 hours prior to the first transient (to produce coil saturation). They were de-energized when the temperature of the first transient reached 280°F, to show satisfactory shifting for demonstration of safety function. The valves were kept pressurized and were cycled during the 30-day exposure, as suggested in IEEE-382-1972, to demonstrate their ability to operate on demand during the LOCA or HELB.

Test report AQS-21678/TR, Rev. A, is on file at Automatic Switch Company in Florham Park, New Jersey, and is available for customer perusal.

*Based on the results of testing conducted subsequent to this program, ASCO has determined that use of the subject valves incorporating Viton elastomers should be limited to those applications where no shifting of position will be required following exposure to total gamma radiation doses in excess of 20 megarads. However, the subject valves are capable of maintaining a safety position after exposure to doses up to 200 megarads.

Dated DECEMBER 17, 1982 Authorized Signature

QUALITY CONTROL MANAGER

Form VE 2026 R4

NOTE: IN ORDER TO MAINTAIN QUALIFICATION, CATALOG NP-1 VALVES SHOULD BE REBUILT USING THE APPROPRIATE SPARE PARTS WHENEVER INDICATED BY THE PERIODIC INSPECTION OF VALVE COMPONENTS OR WHENEVER ANY OF THE FOLLOWING LEVELS, SIMULATED DURING QUALIFICATION TESTING, ARE REACHED:

1. WEAR AGING – 40,000 CYCLES
2. RADIATION AGING – 5 X 10⁷ RAD
3. THERMAL AGING – THE MAXIMUM SERVICE PERIOD INDICATED FOR THE APPLICABLE SERVICE AMBIENT TEMPERATURE.

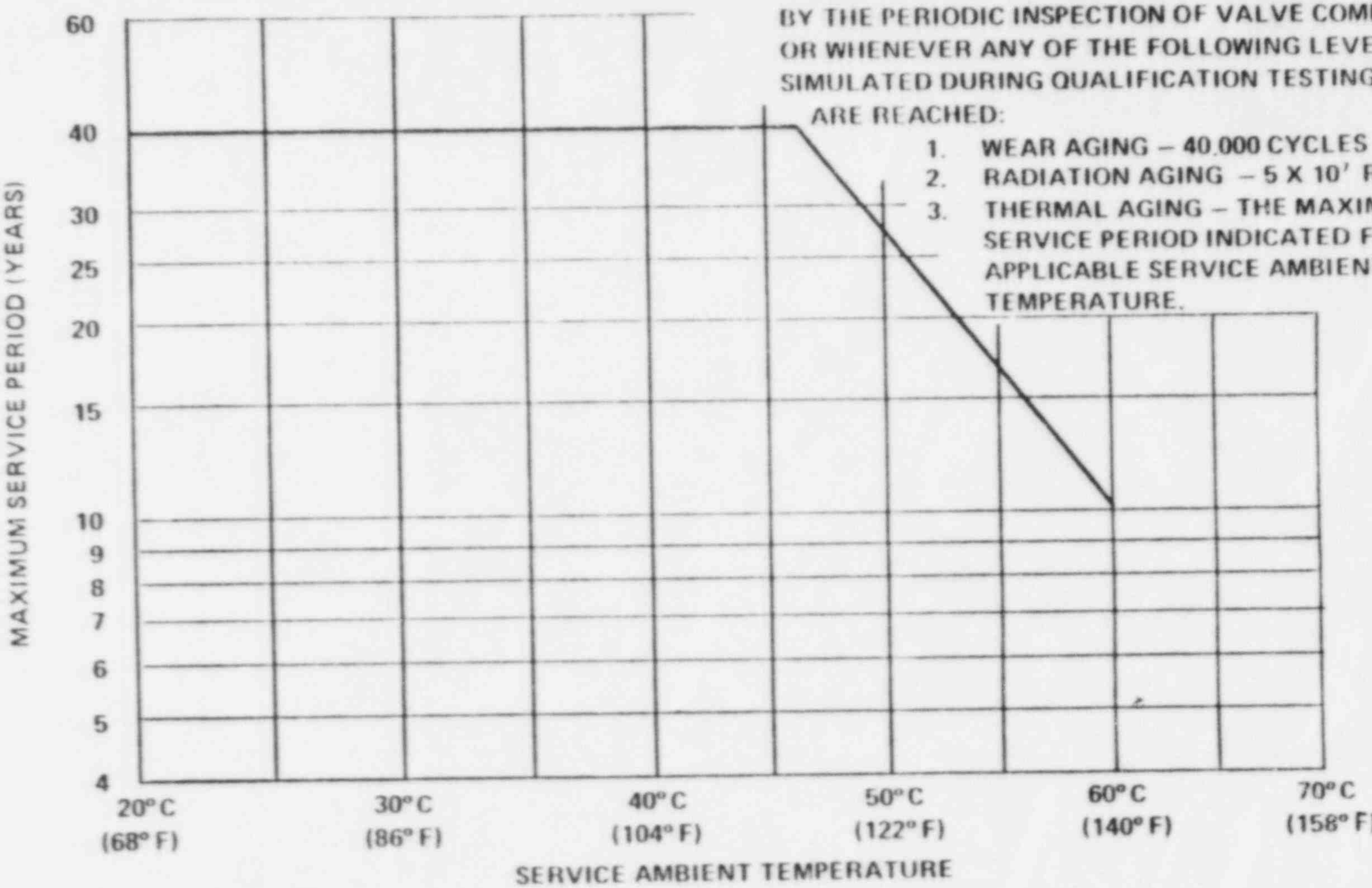


FIGURE 1

MAXIMUM SERVICE PERIODS FOR ELASTOMERIC COMPONENTS AND SOLENOID COILS IN ASCO CATALOG NP-1 VALVES

S/N 8342941

9510-AX5...

GH BETTIS

A Galveston-Houston Company

7031 Grand Blvd
P.O. Box 14689
Houston, Texas 77021
(713) 748-1140   Telex 76-2713

August 2, 1982

Fisher Control
P. O. Box 190
Marshalltown, Iowa 50158

Attention: Ms. Judy Evans
Subject: Certification of Compliance for the Fisher Control Purchase Order 180752; G.H. Bettis Sales Order 78-1741-OE

Ms. Evans:

This letter is to certify that the equipment furnished on line number 01A our sales order, item 000 your purchase order, reference RMA#2089, were refurbished in accordance with written G.H. Bettis Engineering Specifications and Standards.

Units Shipped:

Qty.	Model	Serial Number
2	N521C-SR-80-12	78-1741-3 & 5

Cordially,
G.H. Bettis Company

Anthony T. Locascio

Anthony T. Locascio
Quality Assurance Manager

ATL:jw
cc: File

ATTACHMENT 6

FQP-11AB-5

Arrhenius Rate Equation Calculation

Arrhenius Rate Equation Calculations

The Arrhenius rate equation as referenced in IEEE 382 can be expressed as follows:

$$\frac{t_1}{t_2} = e^{\frac{\phi}{K}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)}$$

where:

t_1 = service life

t_2 = test duration

T_1 = service temperature

T_2 = test temperature

ϕ = activation energy

K = Boltzman's constant = 0.8617×10^{-4} eV/K

Values determined by the aging segment of the Wyle Test Report No. 45088-1, Fisher Lab Problem 1685-3, Report 11, and Bechtel Specification X5AC03, Appendix EA, result in the following numbers:

t_2 = 28.5 days

T_1 = 126 ^{o}F = 325 K

T_2 = 227.8 ^{o}F = 382 K

ϕ = 0.79 eV

hence:

$$t_1 = (t_2)\, e^{\frac{\phi}{K}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)}$$

$$t_1 = (28.5 \text{ days})\, e^{\frac{(0.79)\text{eV}}{(0.8617 \times 10^{-4})\text{eV/K}}\left(\frac{1}{(325)\text{K}} - \frac{1}{(382)\text{K}}\right)}$$

t_1 = 1918 days = 5 years 93 days

9510-AX5AC03-5161-2 138

FISHER

Certification of Applicabilty

Alvin W. Vogtle Nuclear Power Plant, Units 1 & 2
Georgia Power Company
Bechtel Power Corp. Purchase Order No.: PAV-206, PAV 2-34
Seismic Category/Class: Seismic Category I, Nuclear Class 3
Fisher Representative Order No.: 22B-X5AC03-N1P & 22B-X5AC03-N2P
Qualification Group: V
Environmental Designator: VIII-R-C83
Order Items: 155, 156, 165, 166
Serial Numbers: 8342938-41
Tag Numbers: 1 & 2-HV-12596 & 97
Bechtel Data Sheets: CX5DL-187 & 188

This is to certify that, to the best of my knowledge and belief, the previously submitted Fisher Qualification Report (FQP-11AB-5, Rev. A) which was provided per Rev. 9 of Design Specification No. X5AC03, App. EA, Rev. 3, & App. QG, Rev. 0 (as interpreted by Fisher Qualification Plan FQP-11AB) is also applicable to Rev. 11 of the same X5AC03 Specification and Appendices.

Jon Whitesell
Jon Whitesell
Qualification Analyst

I certify that I accept responsibility for the adequacy of this document, which was prepared by others, to the same degree that I would if I had prepared it, and that I am a duly Registered Professional Engineer under the laws of the State of Iowa.

John Dresser
John Dresser Reg. No: 7547
Registered Professional Engineer

Date: 4-24-85

REGISTERED PROFESSIONAL ENGINEER
JOHN C. DRESSER
7547
IOWA

Approved by:

Floyd D. Jury
Floyd D. Jury, Manager
Engineering Qualification & Analysis

PROPRIETARY