FQP-11A, Rev. C
May 14, 1985

FISHER ENVIRONMENTAL QUALIFICATION REPORT
Type 9200 Butterfly Control Valve Assembly
Alvin W. Vogtle Nuclear Plant
Georgia Power Co.
Bechtel Power Corp. X5AC03 Series

9510-AX5AC03-5068-4 002

Fisher Controls **Document Cover Sheet**

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Vogtle Environmental Qualification Report for Type 9200 Butterfly Control Valve Assembly

FISHER

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1.0 Scope

This report summarizes the procedures used and test results obtained in the course of Fisher's Environmental Qualification Test on a Bettis-actuated Type 9200 butterfly valve assembly. The test program was originally conducted to satisfy the requirements of another qualification project. The program is now presented, with modifications as noted, for qualification of the Seismic Category I butterfly valves for the Vogtle project. The original controlling documents, FQP-19 and FQP-23, are provided as addenda to Attachment A-1. Discussion of anomalies noted during the environmental test is presented in Attachment A-2. Modifications and exceptions to the test procedures that pertain to the Vogtle project are provided in Attachment A-3. The program verifies qualification of the valve tested for a normal service life in a nuclear power plant environment and verifies the capability of the valve to subsequently survive a Design Basis Accident (DBA) and perform its safety-related function. Re-instatement of qualified life in successive increments, to a maximum of 41 years total, is also discussed. Therefore, this document furnishes suitable evidence of equipment adequacy under environmental conditions required for the Vogtle project. In conjunction with any of the individual Vogtle valve group reports, this volume furnishes complete qualification information in keeping with Specification X5AC03, Rev. 11, including Appendix EA, Rev. 3 and Appendix QG, Rev. 0, as interpreted by FQP-11AB and FQP-11C.

1.1 Extent of Environmental Test

In accordance with FQP-19, radiation exposure, artificial aging, seismic vibration, and exposure to a design basis accident environment were used to verify qualification of a 20" Type 9200 butterfly valve with an elastomeric EPDM T-ring seal and a Bettis Model T420B-SR2 Rotary pneumatic actuator. Activation energy testing of elastomeric materials is also included to determine qualified life for the T-ring seal and other elastomeric components.

1.2 Extension of Test Results

Test results can be extended to other Type 9200 valves, since the test valve was of typical construction design and material. Other sizes of Type 9200 valves can be qualified since all components required in performance of safety-related functions utilize the same materials and design principles as the test valve. Although various models of Bettis' actuators could well be qualified by results of this environmental test program (since all components of the Bettis actuator required to perform the safety-related function utilize the same design principles and material as the tested unit), this report does not purport to qualify the Bettis actuator. Qualification documentation for the Bettis Actuators is being provided by the supplier (G.H. Bettis, Waller, Texas).

2.0 Selection of Test Valve Components

Test valve components were selected as being representative of both the 9200 Series valve bodies and the Bettis actuator line. It was Fisher's intention to test the largest body and actuator sizes possible, inasmuch as the largest valves on the previous project were subject to the most stringent environmental specification requirements. Consequently, the T420B-SR2-12 Bettis actuator was combined with a 20" Type 9200 butterfly valve body, since this was the largest actuator/body combination that could be accommodated in the Wyle Lab environmental test chamber. (Both major components had been qualified seismically in earlier tests.) The vibratory sequences in this series of tests were conducted specifically to provide seismic aging to the test valve.

3.0 Acceptance Criteria

FQP-19 provides a listing of acceptance criteria for the various environmental test valve components. These include leakage criteria for the valve and specific actuator. As required by the Qualification Plan, any malfunctions are to be reported for evaluation. The Wyle Environmental Test Report No. 45088-1 (Attachment A-1) provides this notification by means of a series of designated "anomalies" that are further discussed in Attachments A-2. However, it must be noted that the "anomalies" primarily indicate deviation from test procedure or facility limitation, rather than equipment shortcoming. None of the "anomalies" listed was found to prevent satisfactory performance of the valve's safety-related function.

4.0 Conduct of the Environmental Test

The test was conducted in accordance with FQP-19 and included readjustment of the elastomer T-ring seal following the high temperature accelerated aging process. This adjustment was performed to compensate for the unrealistic compression-set tendencies of the elastomer T-ring material resulting from the accelerated aging temperature, which would not have resulted from a real-time, 5-year aging period at 120°F. (Field service information has confirmed that Type 9200 valves regularly provide satisfactory shut-off capability and exhibit no excessive compression-set tendencies after 5 years of real-time, normal-service operation.) So the planned adjustment served to ensure that the test valve was very comparable to production units aged at normal operating temperatures.

Following the post-aging re-adjustment of the T-ring seal, the valve assembly was exposed to radiation equivalent to putting the valve assembly in its end-of-life condition. This radiation ($1x10^7$ rads equivalent air dose) was followed by the Design Basis Accident simulation, which included seismic aging, a 30-day steam and chemical exposure profile, and an additional radiation exposure bringing the accumulated exposure to $1x10^8$ rads. Supplementary irradiation was provided, as certified by Isomedix in the Attachment A-5 letter to bring the total dosage accumulated to 2×10^8 rads, satisfying the Vogtle requirements. A summary of the high radiation level tests and results is presented in Fisher Laboratory Test Report 8, Problem 1685-3 which is provided as Attachment A-9 to this report (FQP-11A).

5.0 Summarization of Environmental Test Results

The original environmental testing program was based on Fisher Qualification Plan FQP-19 and is fully documented in Wyle Test Report No. 45088-1, furnished as Attachment A-1 of this volume. (The Wyle Report includes a copy of FQP-19, designated as Addendum I.) Results of various portions of the test program are summarized below.

5.1 Normal Load Functional Tests - The test valve was subjected to a series of baseline and normal load functional tests at elevated temperature. No seat leakage was noted during the 75 psid gaseous nitrogen (GN_2) testing or during 150 psid water testing. Sections II, III, and IV of Report 45088-1 (Attachment A-1) document the procedures and results of these tests.

5.2 Thermal Aging Simulation - The test valve was cycled 1000 times during the 28 1/2-day heat aging process and leak-checked at 228°F four times during the period. No leakage was detected during any of the four required leak checks at high temperature with 75 psi pressure drop. A subsequent 75 psid functional test at ambient temperature also produced no leakage. Complete procedures and results appear in Sections V and VI of Wyle Test Report No. 45088-1 (Attachment A-1).

5.3 Radiation Exposure - No visual evidence of damage or degradation of the unit resulted from exposure to 1.0×10^7 Rads equivalent air dose radiation. Post-radiation functional tests initially indicated very minor leakage past the piston of the Bettis' actuator, but the leakage ceased after operating the valve several times. No leakage was observed past the valve disc during the 15-minute test period. Sections VII and VIII of Report 45088-1 (Attachment A-1)report the complete test procedures and results. Supplementary radiation exposure , as documented in Attachments A-5 and A-9 provides evidence that total exposure of the test valve assembly reached 2×10^8 rads. Note that catastrophic failure of the T-ring did not occur even at the highest radiation level (200 Mrad). The main effect of the environmental test sequence was increased leakage after return to ambient (70°F) temperatures.

5.4 Seismic Aging Simulation - The test valve operated smoothly throughout the sine-beat seismic tests.

5.4.1 Some minor difficulties were encountered, as shown in the designated "Notice of Anomaly" sheets included in Wyle Test report No. 45088-1 (Attachment A-1 of this volume), but, as previously mentioned, most refer to deviations from test procedure or to facility limitations, rather than to equipment shortcomings. Further discussion of these "anomalies" is presented in Attachment A-2. See Attachment A-10 for clarification of NOA #4 in NA-29 (Attachment A-2). C

5.4.2 Electrical monitoring, stroking time tests, and seat leakage tests all showed favorable results before, during, and after the seismic tests.

5.4.3 Post-seismic functional tests produced no difficulties that have bearing on the Vogtle project. (See Section IX of Wyle Test Report No. 45088-1.) Valve stroking time was shown to be consistently in the range of 20 seconds and there was zero leakage with 75 psid across the valve disc for 15 minutes.

5.5 DBA Load Test

5.5.1 The test valve met all the specified criteria, including satisfactory performance of the safety-related function by closing and staying closed. The Wyle test facility was unable to meet the rapid change of temperature specified, but the slower temperature ramp achieved actually was a more severe test than that specified. The valve performed satisfactorily throughout, with no leakage past the valve disc. DBA Load test procedures and results are discussed in Section XI of Wyle Report 45088-1 (Atachment A-1).

5.5.2 Additional thermal transients and seat leakage tests were performed as discussed in Section XII of the Wyle report. The tests were necessitated because of Wyle Laboratories' inability to accomplish the intended 381°F temperature transient during the DBA load test sequence. No leakage was detected at 10, 20 and 30 psid, but leakage increased from one bubble per minute at 40 psid to 1167 cc/minute with a 75 psi differential pressure across the valve disc. This leakage is well below the allowable test procedure leak rate of 1472 cc/minutes for the initial functional tests at 75 psid.

5.5.3 Specifically to satisfy the requirements of the Vogtle project, further thermal transients and seat leakage tests were performed as documented in Wyle Test Report No. 45390-1, Attachment A-4. The test valve was pre-heated to 200°F for 11 hours, moved to a 400°F oven for 15 minutes, stabilized at 125°F for one hour, and then leak checked with 2.5 psig air for 15 minutes. Zero leakage was noted. Oven temperature was lowered to 100°F and maintained for one hour prior to another leakage test. Again, no leakage was noted.

5.6 Activation Energy Testing

The thermal aging of elastomeric parts was based on a conventional aging relationship (10°C rule; FQP-19 page 4) for the original test program. Activation energy testing has been added to the test program for the Vogtle project. The results from this testing permit a more accurate prediction of qualified life. The purpose, procedure, results and conclusion of this testing are recorded in Attachment A-7.

5.6.1 The results from activation energy testing show that the lowest activation energy for any elastomeric material used in the Vogtle butterfly valves is 0.79 eV (See Attachment A-7). The relationship between activation energy and thermal aging is explained in IEEE 382-1980; Appendix C, "Rationale for Normal Service Thermal Aging.

5.6.2 The aging simulation done for this environmental qualification program (227.8°F for 28.5 days) can be shown to be equivalent to 5 years, 30 days at 126°F, based on an activation energy of 0.79 eV. Calculations are provided in Attachment A-8. The environmental testing supports a four year life at a continuous environmental or internal temperature of 131°F. The calculation for this is also provided in Attachment A-8. If the temperature is greater than 131°F, the maximum life will be stated in the final report.

5.7 Qualified Life Determination

Page 4 of FQP-19 provides a general discussion of the rationale used in Fisher's selection of the accelerated aging techniques employed in the environmental test program. The maximum time period for which the following equipment shall be qualified is the same as that described in Paragraph 5.6.2:

5.7.1 Fisher Type 9200 style valve bodies with elastomeric T-ring seals (This qualification also utilizes cycle aging information presented in the Continental Mechanical Aging Test Report No. 92-395, Attachment A-6 of this report.)

5.7.2 Bettis spring-return pneumatic piston actuators of similar design and materials. [This qualification presumes acceptance by Vogtle of the qualification documentation furnished by the actuator manufacturer (G.H. Bettis).]

5.7.3 Model EA180-31302 and EA180-32302 NAMCO limit switches. (This qualification presumes acceptance by Vogtle of the qualification documentation furnished by the limit switch manufacturer.)

5.7.4 Model NPK8316A74E and Model NPK8321A2V ASCO solenoid valves. (This qualification presumes acceptance by Vogtle of the qualification documentation furnished by the solenoid manufacturer.)

5.8 Extension of Qualified Life of the Vogtle Butterfly Valves

5.8.1 Qualified life is primarily a function of elastomer longevity under the rigors of thermal and mechanical aging, seismic vibration, irradiation, and chemical profile exposure. Seismic Category I butterfly valves installed in the Vogtle nuclear plant are designed for a 41-year service life. This design life (or installed life) is in compliance with the project specifications. Qualified life can be reinstated in increments (as explained in Paragraph 5.6.2) up to a 41-year maximum, contingent upon regular performance of required maintenance operations.

5.8.2 Regular maintenance must include replacement of all elastomeric parts, i.e., T-ring seals, O-rings, packing components, and gaskets, if qualified life of the unit is to be extended for another period.

5.8.3 The requirement for replacement of elastomers at periodic intervals is based on use of the Arrhenius rate equation with activation energy values for the elastomers as determined by test. Fisher research data, Lab Problem 1685-3, Report 11, "Determination of Activation Energies for Nuclear Service Elastomeric Materials" is included as Attachment A-7 to this report.

5.8.4 All maintenance should be performed in accordance with instruction manuals provided by Fisher or by the appurtenance manufacturer.

6.0 Conclusions Based on the Environmental Test Program

6.1 The environmental test sequence completed in accordance with the FQP-19 test plan is documented in Wyle Test Report 45088-1. It was demonstrated that the valve assembly would perform satisfactorily for the intended period between maintenance cycles.

6.1.1 Stroking times were found to be slightly shorter at the conclusion of the DBA simulation than at the beginning of the program, indicating no detriment to valve operability due to increased friction. (See Section XI Results.)

6.1.2 Post-DBA leak-test showed no leakage at low pressure differentials and less leakage at the 75 psid level than that allowed for the initial functional tests. (See Section XII Results.)

6.2 General condition of the valve and its successful operation at the conclusion of FQP-19 DBA simulation and supplemental tests demonstrate successful completion of the test program and verify its ability to perform its safety-related closure function as required. (See Section XIII of Wyle Report 45088-1, Report 45390-1, and Fisher Report 8, Problem 1685-3.)

7.0 Report Summary

Information presented in this report is accurate and was compiled as a result of the test programs and calculations described or referenced herein.

Prepared by:

Jon Whitesell

Jon Whitesell
Qualification Analyst

Date: May 14, 1985

Reviewed by:

John C. Dresser

John C. Dresser
Qualification Specialist

Approved by:

Floyd Jury

Floyd D. Jury, Manager
Engineering Qualification and Analysis

Attachment A-1

to

Vogtle Qualification Report, FQP-11A

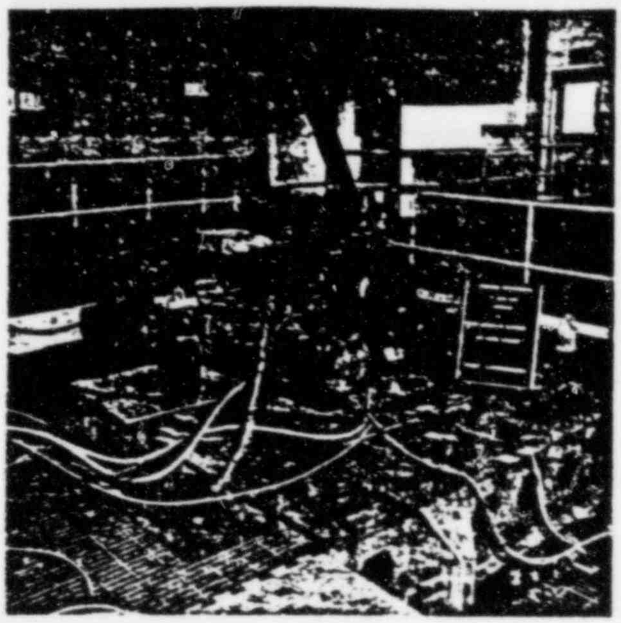
Wyle Environmental Test Report No. 45088-1
Dated November 21, 1980

(Includes FQP-19 as Addendum I
and FQP-23 as Addendum II)

NEQ

Nuclear Environmental Qualification

Test Report



REPORT NO. 45088-1

WYLE JOB NO. 45088

CUSTOMER P. O. NO. H-217770

PAGE i OF 450 PAGE REPORT

DATE November 21, 1980

SPECIFICATION (S) See References in Paragraph 5.0

1.0 CUSTOMER Fisher Controls Company

ADDRESS Post Office Box 190, 205 South Center Street, Marshalltown, Iowa 50158

2.0 TEST SPECIMEN Type 9200, 20" Butterfly Valve with a G. H. Bettis Actuator

3.0 MANUFACTURER Fisher Controls Company

4.0 SUMMARY

One (1) 20-inch, Type 9200, Butterfly Valve with a G. H. Bettis Actuator, hereinafter called the test item, was subjected to a Qualification Test Program as specified in Reference 5.1 and in accordance with References 5.2 and 5.3, to meet the intent of References 5.4, 5.5 and 5.6. The test item is used as a containment isolation valve and is Class IE, safety-related. Paragraph 6.0 contains a description of the test item.

The Qualification Program was performed to confirm the adequacy of design of the test item to perform its required function in Nuclear Power Generating Stations under normal and abnormal conditions as specified.

STATE OF ALABAMA } ss.
COUNTY OF MADISON }

CA Professional Eng.
Reg. No. 2635

James F. Gleason, being duly sworn, deposes and says: The information contained in this report is the result of complete and carefully conducted tests and is to the best of his knowledge true and correct in all respects.

Seal

SUBSCRIBED and sworn to before me this 25th day of November, 19 80

Virginia L. Dent

Notary Public in and for the State of Alabama at large

My Commission expires June 13, 19 83

PREPARED BY Earl Campbell
E. Campbell

APPROVED BY Herschel Jordan
H. D. Jordan

WYLE Q. A. M. J. Kimbrell
M. J. Kimbrell

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP
HUNTSVILLE, ALABAMA

4.0 SUMMARY (Continued)

The test item complied with all specified requirements, although ten (10) anomalies were noted. The test sequence, test item compliance with requirements, and Notices of Anomaly (NOA's) are discussed briefly below in tabular form and in detail in the appropriate sections of this report.

TEST PROGRAM ANOMALIES

REPORT SECTION	TYPE TEST	REQUIREMENTS	COMPLIED WITH REQUIREMENTS	NOA NO.	REMARKS
I	Pretest Inspection	Visual Inspection	Yes	-	N/A
II	Baseline Functional	Operate and Leak-Check	Yes	-	N/A
III	Normal Load Test	Operate at 120°F, 120°F and 170°F. Leak-Check.	Yes	-	Replaced "T" Ring
IV	Post-Normal Load Functional	Operate and Leak-Check	Yes	-	N/A
V	Aging Simulation	Ten alternate high temp. and humidity cycles, leak checks, and 1000 full strokes	Yes	1	Chamber temp. out-of-tolerance for approximately 30 minutes.
VI	Post-Aging Functional	Operate and Leak-Check	Yes	2	Cracked flexible conduit. Lubricant leak. Intermittent limit switch operation. No electrical measurements were made. Seat leakage of 4102 in.^{3}/min of GN_2. Adjusted "T"-Ring.
VII	Radiation	1.0×10^7 Rads gamma air equivalent.	Yes	-	N/A
VIII	Post-Radiation Functional	Operate and Leak-Check	Yes	3	Shipping damage to 1/4" tube. Leakage past the actuator piston of approximately 314 cc/sec.

4.0 SUMMARY (Continued)

TEST PROGRAM ANOMALIES (Continued)

IX	Seismic	FQP-23, Rev. 9.	Yes	4	Intermittent limit switch. Loose bolts between actuator mounting bracket and valve body. Test terminated.
X	Post-Seismic Functional	Operate and Leak-Check	Yes	5	Loose wire in junction box and loose condulet.
				6	Hairline crack in the junction box.
XI	Accident (DBE) Simulation	Valve must close and stay closed. 381°F max temp and 30 days test leak check continuously.	Yes	7	First temp. transient took 13 min and 37 sec.
				8	Test was aborted due to excessive steam leakage.
				9	Second temp. transient of 381°F was not accomplished; high temp was 365°F. The test chamber temp was out-of-tolerance on the high temp. side for approximately 2 hours.
				10	The test chamber temp. was out-of-tolerance for approximately 4 hours, 30 min, on the low temp. side. Add 9 hours, 30 min, to overall test time.
XII	Thermal Transient (LOCA Addendum)	381°F for 2 min, leak-check.	Yes	-	N/A
XIII	Post-LOCA Functional	Operate and Leak-Check.	No	-	Information only.

4.0 SUMMARY (Continued)

This final test report contains the following sections. The Qualification Program was performed in the sequence indicated by Section Numbers I through XIII.

Section I	Pretest Inspection
Section II	Baseline Functional Test
Section III	Normal Load Conditions Test
Section IV	Post-Normal Load Functional Tests
Section V	Aging Simulation
Section VI	Post-Aging Simulation Functional Tests
Section VII	Radiation Exposure
Section VIII	Post-Radiation Functional Tests
Section IX	Seismic Simulation
Section X	Post-Seismic Functional Tests
Section XI	LOCA (DBE) Simulation
Section XII	Thermal Transient Test (Addendum to LOCA)
Section XIII	Post-LOCA Functional Tests

Addendum I - Fisher Document FQP-19, Revision F

Addendum II - Fisher Document FQP-23, Revision 9

5.0 REFERENCES

5.1 Fisher Controls Company Purchase Order Number H-217770

5.2 Fisher Document FQP-19, Revision F

5.3 Fisher Document FQP-23, Revision 9

5.4 IEEE 382-1972, Trial-Use Guide for Type Test of Class 1 Electric Valve Operators for Nuclear Power Generating Stations.

5.5 IEEE 323-1974, "IEEE Standard for Qualifying Class IE Equipment for Nuclear Power Generating Stations".

5.6 IEEE 344-1975, "Seismic Qualification of Class IE Equipment for Nuclear Power Generating Stations".

6.0 TEST ITEM DESCRIPTION

The test item is used as a containment isolation valve and is classified IE, safety-related. The following tabulation shows the test item, actuator and appurtenances that were subjected to the Qualification Program.

20", Type 9200, Fisher Controls Company
Butterfly Control Valve

Bettis T-420B-SR2-12 Pneumatic Actuator

ASCO NP8320A185V 3-Way Solenoid Valve

Namco EA18031302 and EA18032302 Limit Switches

Fisher P595 Filter with Brass Element

Fisher 95H Regulator

Texsteam 35R Pressure Relief Valve

Hoffman Junction Box w/G.E. #EB-25 Terminal Strips

Versa VSP-3501-155H Pneumatic 3-Way Valve

7.0 QUALITY ASSURANCE

All test equipment and instrumentation used in the performance of this test program were calibrated in accordance with Wyle Laboratories' Quality Assurance Policies and Procedures Manual, which conforms to the applicable portions of ANSI N-45.2, 10 CFR 50, Appendix B, and Military Specification MIL-C-45662A. Standards used in performing all calibrations are traceable to the National Bureau of Standards.

SECTION I

PRETEST INSPECTION

1.0 REQUIREMENTS

A visual inspection shall be performed to assure that the test item is not damaged due to shipping or handling since manufacture.

2.0 PROCEDURES

The test item was visually inspected upon receipt at Wyle Laboratories. A photograph was made showing the as-received condition of the test item.

3.0 RESULTS

The test item was subjected to the operations required by Paragraph 1.0 and as described in Paragraph 2.0. There was no visual evidence of damage due to shipping or handling since the test item was manufactured.

A photograph showing the as-received condition of the test item is presented in Appendix I.

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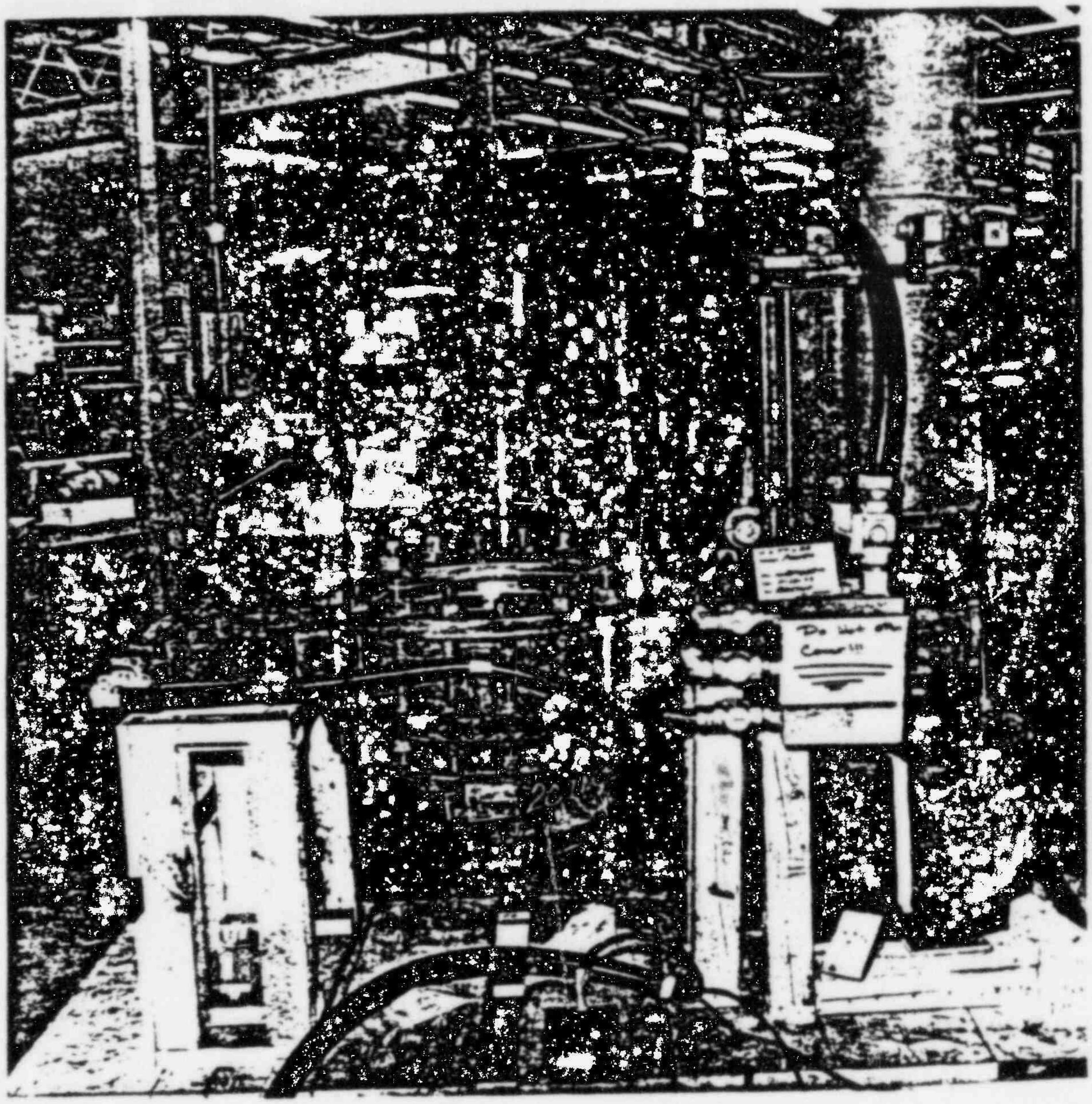
APPENDIX I

PHOTOGRAPH



PHOTOGRAPH I-1

AS-RECEIVED CONDITION

SECTION II

BASELINE FUNCTIONAL TESTS

1.0 REQUIREMENTS

Functional tests shall be performed to ensure that all components perform without malfunction prior to any condition simulation. Baseline measurements shall be taken on various parameters as noted below:

A regulated gas supply shall be connected to the solenoid valve of the test valve assembly. Nominal flow, as received from the gas supply when the solenoid valve is actuated, shall be used. The functional tests shall be performed with a voltage to the electrical appurtenances of 90 VDC, 125 VDC, and 140 VDC.

The functional test parameters to be measured shall be as follow:

Time duration of the operating stroke: Opening and closing times shall be recorded. (A cycle is defined as going from the full-closed to the full-open and back to the full-closed position.)

Seat leakage at 75 psid shall be recorded (reference Addendum I, Page 39, Table 5 of this report).

Pressure of regulated gas supply to solenoid valve shall be 70 psig.

Regulator inlet and outlet pressures shall be recorded.

The type of gas being used shall be recorded.

The voltages to the solenoid shall be recorded.

The voltages to the limit switches shall be recorded.

The functionability of indicator lights and proper indication of "closed" and "open" shall be recorded.

2.0 PROCEDURES

The test item was wired electrically to a variable D.C. power supply to operate the solenoid and limit switches. The GN_2 source was plumbed to the test specimen regulator. The test item was operated at 90 VDC, 125 VDC and 140 VDC, from closed to full-open to closed at each voltage. The regulated GN_2 pressure to the regulator and to the solenoid was visually monitored. The GN_2 pressure was 140 psig to the regulator and 70 psig to the solenoid.

2.0 PROCEDURES (Continued)

The test item's operating time at each voltage was measured by monitoring the electrical signals to the solenoid and limit switches on an oscillograph. The functionability of the lamps on the test item control box was visually monitored and recorded.

Additionally, the solenoid coil resistance was measured and recorded. The contact resistances of the limit switches were measured and recorded.

3.0 RESULTS

The test item was subjected to the tests required by Paragraph 1.0. The tests were conducted as outlined in Paragraph 2.0 above. The test item complied with all requirements without exception. There was no seat leakage observed at 75 psid. The lights on the control box were functional, indicating open or closed as required.

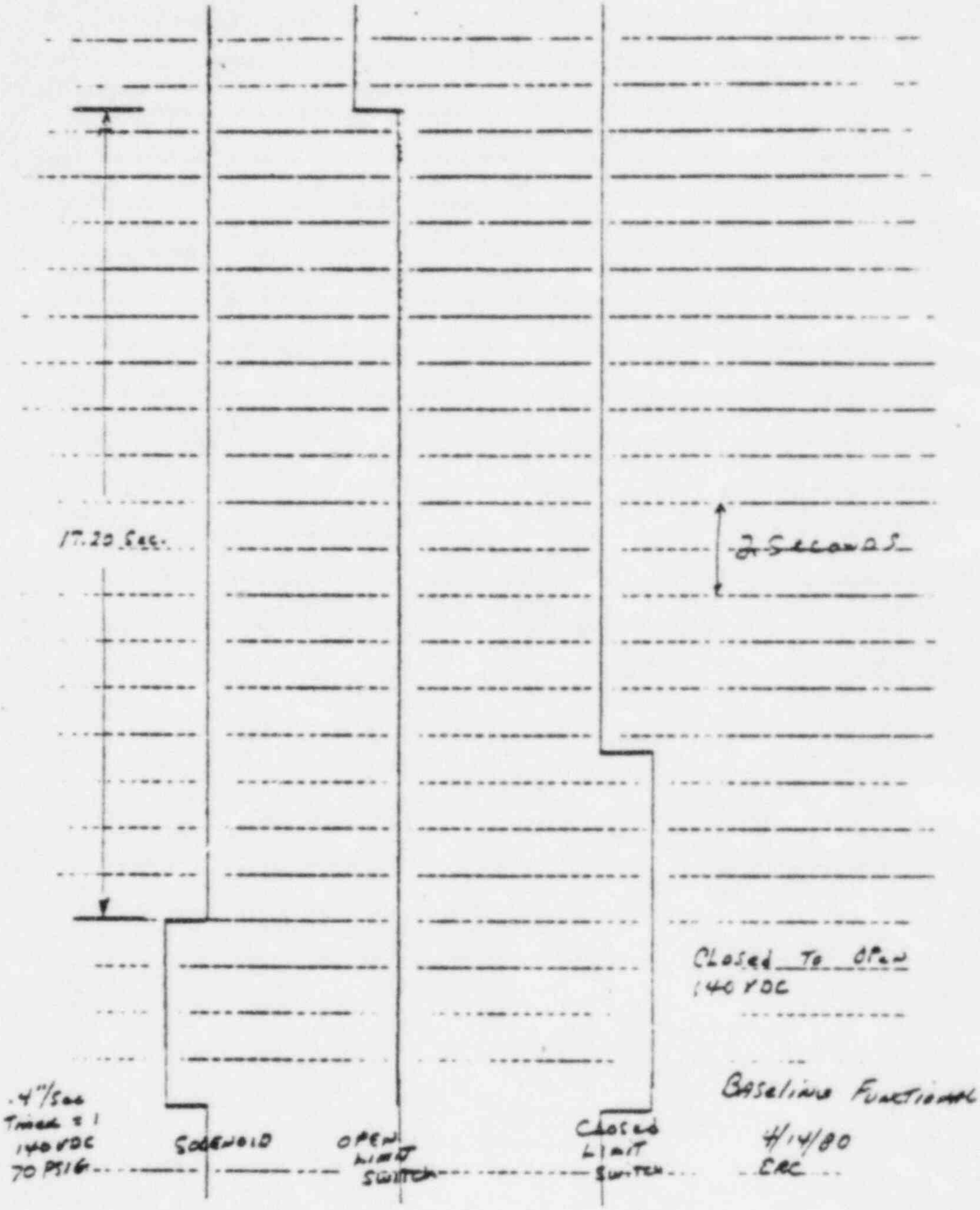
The valve's opening and closing times were as follow:

Solenoid Operating Voltage	Pressure to Solenoid	Stroke Times Close to Open	Stroke Times Open to Close
90 VDC	70 psig	16.75 sec	19.88 sec
125 VDC	70 psig	16.80 sec	19.35 sec
140 VDC	70 psig	17.20 sec	19.55 sec

A typical oscillograph recording showing valve stroking time is presented in Appendix I. Photographs showing the test setup and instrumentation are presented in Appendix II. Data Sheets showing the data obtained are presented in Appendix III, and an Instrumentation Equipment Sheet is presented in Appendix IV of this Section.

APPENDIX I

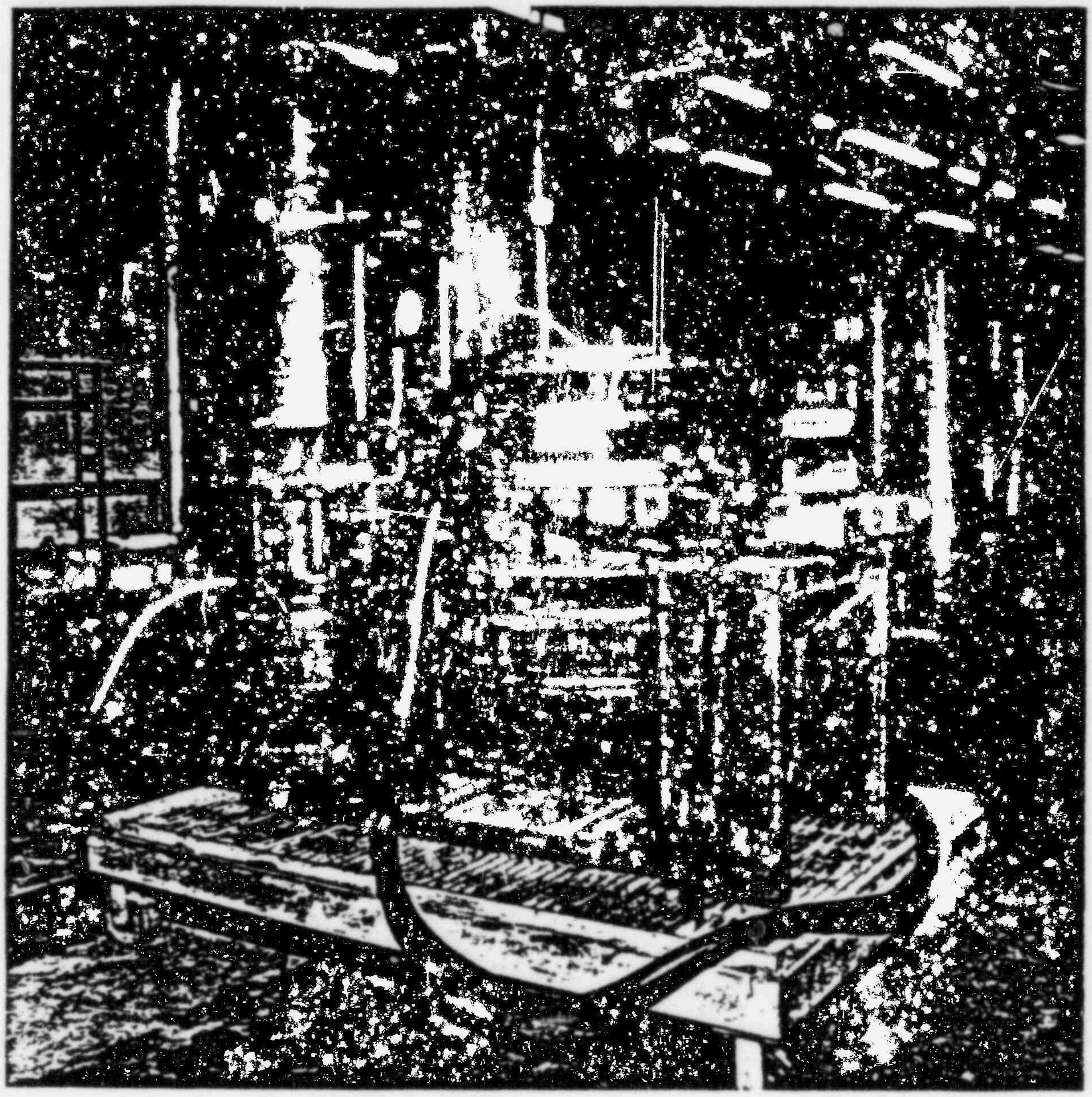
TYPICAL OSCILLOGRAPH RECORDING



TYPICAL OSCILLOGRAPH RECORDING

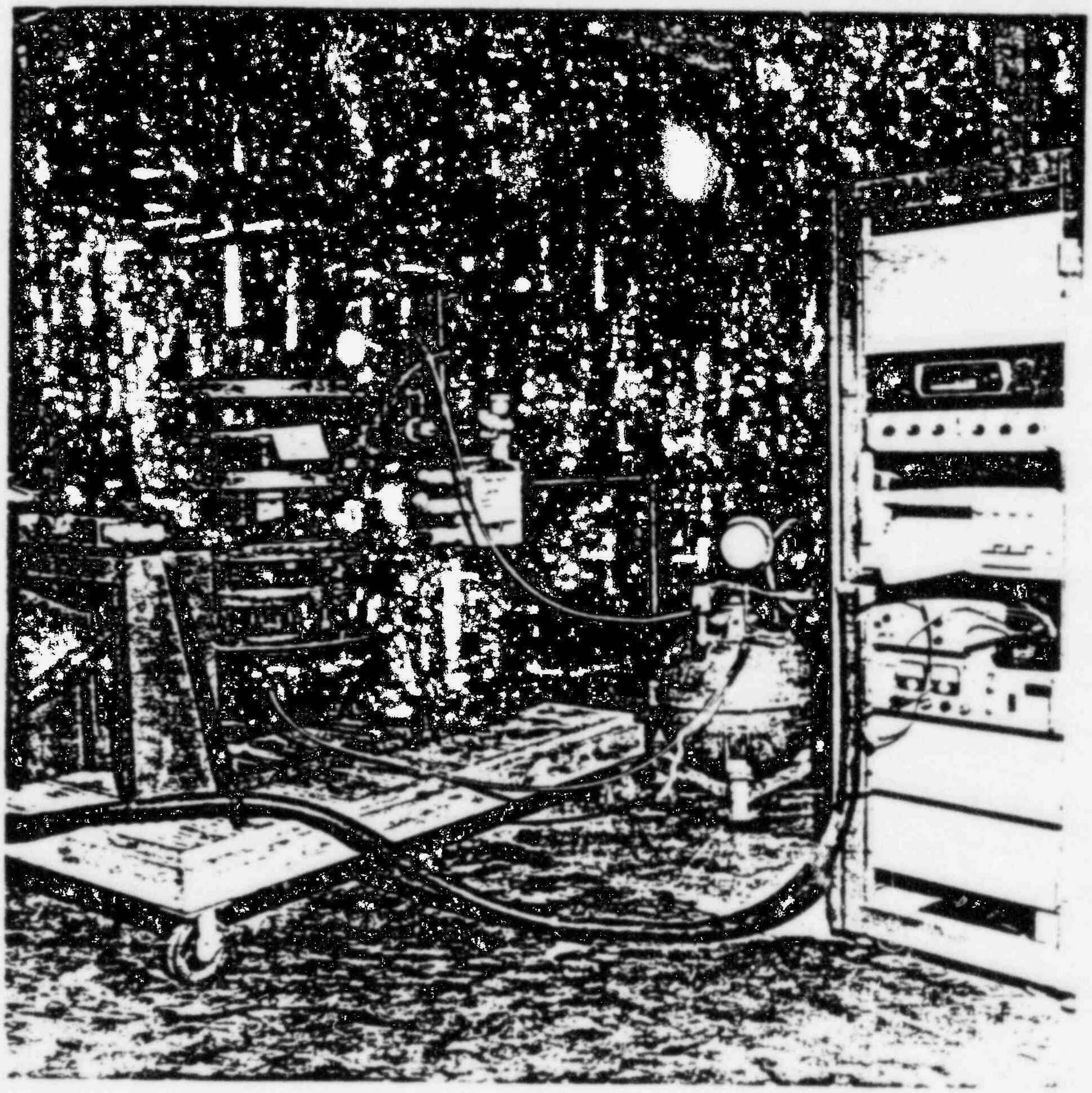
APPENDIX II

PHOTOGRAPHS



PHOTOGRAPH II-1

TEST SETUP



PHOTOGRAPH II-2

INSTRUMENTATION

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APPENDIX III

DATA SHEETS

DATA SHEET

Customer Fisher Controls Company

Specimen 20" Butterfly Valve

Part No. Type 9200

Spec. Fisher Document, FOP-19

Para. 2.0

S/N ---

GSI ---

Amb. Temp. 79°F

Photo Yes

Test Med. GN_2

Specimen Temp. Ambient

WYLE LABORATORIES

Job No. 45088-03

Report No. -

Start Date 4-8-80

Test Title BASELINE FUNCTIONAL

	90 VDC	125 VDC	140 VDC
Type of Gas	GN_2	GN_2	GN_2
Pressure of Gas to Solenoid	70 PSI	70 PSI	70 PSI
Regulator Pressure Inlet:	By Pass	By Pass	By Pass
Outlet:	By Pass	By Pass	By Pass
Time duration of Operating Cycle: (sec)			
Closed to Open: Open to Closed:			
Indicator Light Function	O.K.	O.K.	O.K.
Voltage to Solenoid	90 VDC	125 VDC	140 VDC
Voltage to Limit Switch	90 VDC	125 VDC	140 VDC
Seat Leakage @ 75 PSID for 15 minutes	Zero Leakage		

Regulator was by passed, Stroke time was slow. Test will be run again.

Specimen Failed —

Specimen Passed ✓

NOA Written —

Tested By J Richey Date: 4-8-80

Witness — Date: —

Sheet No. 1 of 3

Approved Earl R Campbell

WH-614A

DATA SHEET

Customer Fisher Controls
Specimen 20" Butterfly Valve
Part No. Type 9200 Amb. Temp. 79°F
Spec. Fisher Document FOP-19 Photo Yes
Para. 2.0 Test Med. GN_2
S/N —— Specimen Temp. Ambient
GSI —— NO

WYLE LABORATORIES
Job No. 45088-03
Report No. —
Start Date 4-8-80

Test Title Baseline Functional

Soleniod Resistance
Terminal 2 to 3 In the Box 938.4 Ω

Contact Resistance Switch No. 2 670 mΩ @ 1ma
Wire 1 and 2 Contact A and B Switch Closed

Contact Resistance Switch No. 2 885 mΩ @ 1ma
Wire 3 and 4 Contact G and H Switch Closed

Solenoid Resistance to Ground .66 gΩ @ 500 VDC

Contact Resistance Switch No. 2 12 g. Ω @ 500 VDC
Wire 1 and 2 Contact A and B Switch Open

Contact Resistance Switch No. 2 9.4 gΩ @ 500 VDC
Wire 3 and 4 Contact G and H Switch Open

Amb. Temperature - 79°F
Humidity - 20%
Lights On Box - Yes

Specimen Failed —
Specimen Passed ✓
NOA Written —

Tested By J. Riching Date: 4-8-80
Witness — Date: —
Sheet No. 2 of 3
Approved Earl R. Campbell

WH-614A

DATA SHEET

Customer Fisher Controls Company

Specimen 20" Butterfly Valve

Part No. Type 9200

Spec. Fisher Document, FOP-19

Para 2.0

S/N ---

GSI ---

Amb. Temp. 68°F

Photo Yes

Test Med. GN_2

Specimen Temp. Ambient

WYLE LABORATORIES

Job No. 45088-03

Report No. —

Start Date 4-14-80

Test Title BASELINE FUNCTIONAL

	90 VDC	125 VDC	140 VDC
Type of Gas	GN_2	GN_2	GN_2
Pressure of Gas to Solenoid	70 PSIG	70 PSIG	70 PSIG
Regulator Pressure Inlet:	140 PSI	140 PSI	140 PSI
Outlet:	70 PSI	70 PSI	70 PSI
Time duration of Operating Cycle: (sec)			
Closed to Open:	16.75 SEC	16.90 SEC.	17.20 SEC
Open to Closed:	19.89 SEC.	19.35 SEC.	19.55 SEC
Indicator Light Function	OK	OK	OK
Voltage to Solenoid	90 VDC	125 VDC	140 VDC
Voltage to Limit Switch	90 VDC	125 VDC	140 VDC
Seat Leakage @ 75 PSID for 15 minutes	Zero Leakage		

Specimen Failed —

Specimen Passed ✓

NOA Written —

Tested By J. Rickey Date: 4-14-80

Witness — Date: —

Sheet No. 3 of 3

Approved Earl R Campbell

WH-614A

APPENDIX IV

INSTRUMENTATION EQUIPMENT SHEEET

INSTRUMENTATION EQUIPMENT SHEET

Date 4-8-80 Job No. 45088-03 Test Area LOCA

Technician S Totherow Customer Fisher Controls Type Test Base Line - Functional

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	Galvo Amp	Honeywell	T66A-500	–	11472	1:1	±2%	1-16-80	7-16-80
2	Oscillograph	Honeywell	1508	–	81026	DC-2.5KHz	±2%	12-11-79	6-11-80
3	Power Supply	Sorensen	DCR 150-5	–	11309	150vdc	±0.1%rdg	2-25-80	8-25-80
4	Power Supply	Electronic Meas.	TR036-0.5	–	80246	36v	±0.1%rdg	11-8-79	5-8-80
5	Digital MultiMeter	Keithley	179TRMS	–	11331	Multi	Mfg. Spec	6-29-79	6-29-80
6	Pressure Gauge	USG	100	–	97751	0-100psi	±1% FS	4-8-80	7-8-80
7	Pressure Gauge	Robertshaw	200	–	98092	0-200psi	±1% FS	3-27-80	6-27-80
8	Megohmmeter	General Radio	1864	3180	11898	.5K-50TΩ	Mfg. Spec	2-12-80	8-12-80
9	Digital MultiMeter	Keithley	164	–	11305	Multi	Mfg. Spec	4-8-80	10-8-80
10	Hygrometer	Hygrodynamics	15-3050	40237-9	95408	0°F-140°F	±5%	10-30-79	10-30-80
11	Pressure Gauge	MAXISAFE	AMP 7327	–	97475	0-600	±1%	1-22-80	4-22-80

Instrument Test Engineer [illegible signature] Checked & Received By Earl R Campbell

WH-1029

Page No. II-14
Report No. 45088-1

APPENDIX V

INSTRUMENTATION EQUIPMENT SHEET

INSTRUMENTATION EQUIPMENT SHEET

Date July 23, 1980 Job No. 45088-03 Test Area Environmental

Technician S. Rice Customer Fisher Controls Type Test Post Radiation Functional

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1.	DMM	Keithley	178	—	11313	Multi	Mfg. Spec.	7-11-80	7-11-81
2.	Visicorder	Honeywell	1508	—	81026	0-1KHZ	±2%	6-18-80	12-18-80
3.	Power Supply	Elec. Measurements	TR036-05	—	80246	0-36vdc	±0.1% Rdg	5-8-80	11-8-80
4.	Power Supply	Sorenson	DCR150-5	—	11309	0-150vdc	±0.1% Rdg	2-25-80	8-25-80
5.	Galvo Amp	Honeywell	T6GIA-500	—	11472	1-1	±2%	7-23-80	1-23-81
6.	Pressure Gauge	USG	—	—	95032	0-200psi	±1% F.S.	6-10-80	9-10-80
7	DMM	Keithley	164	—	11305	Multi	Mfg. Spec.	4-8-80	10-8-80
8.	Megohmmeter	General Radio	1862-C	2374	97892	.5-500KMΩ	±3%	5-7-80	11-7-80
9.	Hygrometer	Hygrodynamics	15-3050	40237-9	95409	0-100%RH 0-190°F	±5%	10-30-79	10-30-80
10.	Power Supply	Harrison Labs	865C	—	11393	0-40vdc	±0.1%	5-9-80	11-9-80
11.	Pressure Gauge	Robertshaw	—	—	98092	0-200psi	±1 PSI	7-18-80	10-18-80
12.	Pressure Gauge	USG	—	—	97745	0-600psi	±1% F.S.	7-23-80	10-23-80

Page No. VIII-16
Report No. 45088-1

Instrument Test Engineer R. H. Hellier Checked & Received By Earl R Campbell

WH-1029

SECTION III

NORMAL LOAD CONDITIONS TESTS

1.0 REQUIREMENTS

The test item shall be installed in a test chamber and the test chamber temperature stabilized for 24 hours at 120°F. The test item shall be operated through ten (10) complete stroking cycles.

The test chamber temperature shall be reduced to ambient temperature and stabilized for a period of 24 hours. A seat leakage test shall be performed using gaseous nitrogen at a differential test pressure of 75 psid.

Upon completion of the above, the same tests shall be repeated. Seat leakage measurements shall be recorded and any measurable increase in seat leakage shall be reported immediately to the Fisher Test Engineer for evaluation.

The test chamber shall be stabilized for 24 hours at 140°F. The test item shall be operated through five (5) complete stroking cycles.

The test chamber shall be reduced to ambient temperature and stabilized for a period of 24 hours. A seat leak test shall be performed using water at a differential test pressure of 150 psid. The seat leakage shall be collected and measured.

Upon completion of the above, the same tests shall be repeated. Seat leakage measurements shall be recorded and any measurable increase in seat leakage shall be reported immediately to the Fisher Test Engineer for evaluation.

The test chamber shall be stabilized for 24 hours at 170°F. The test item shall be operated through two (2) complete stroking cycles.

The test chamber shall be reduced to ambient temperature and stabilized for a period of 24 hours. A seat leak test shall be performed using water at a differential test pressure of 150 psid. The seat leakage shall be collected and measured.

Upon completion of the above, the same tests shall be repeated. Seat leakage measurements shall be recorded and any measurable increase in seat leakage shall be reported immediately to the Fisher Test Engineer for evaluation.

2.0 PROCEDURES

The test item was placed in a temperature-controlled environmental chamber. The test item was electrically wired and plumbed to be operational.

The test chamber temperature was increased to 120°F and stabilized for 24 hours. The test item was operated through ten (10) complete "closed" to "open" to "closed" cycles. The voltage to the solenoid valve was 125 VDC. The pressure to the solenoid valve was 70 psig. Gaseous nitrogen was used to actuate the test item.

The test chamber was returned to room ambient conditions and stabilized for 24 hours. A seat leakage test was performed using gaseous nitrogen at 75 psid as the test media.

The same series of tests was performed a second time at 120°F. A second seat leakage test was performed at room ambient conditions using gaseous nitrogen at 75 psid as the test media.

The test chamber temperature was increased to 140°F and stabilized for 24 hours. The test item was operated through five (5) complete "closed" to "open" to "closed" cycles. The voltage to the solenoid valve was 125 VDC. The pressure to the solenoid valve was 70 psig. Gaseous nitrogen was used to actuate the test item.

The test chamber temperature was reduced to room ambient conditions and stabilized for 24 hours. A seat leakage test was performed using water at 150 psid as the test media.

The same series of tests was performed a second time at 140°F. A second seat leakage test was performed at room ambient conditions using water at 150 psid as the test media.

The test chamber temperature was increased to 170°F and stabilized for 24 hours. The test item was operated through two (2) complete "closed" to "open" to "closed" cycles. The voltage to the solenoid valve was 125 VDC. The pressure to the solenoid valve was 70 psig. Gaseous nitrogen was used to actuate the test item.

The test chamber temperature was reduced to room ambient conditions and stabilized for 24 hours. A seat leakage test was performed using water at 150 psid as the test media.

The same series of tests was performed a second time at 170°F. A second seat leakage test was performed at room ambient conditions using water at 150 psid as the test media.

3.0 RESULTS

The test item was subjected to the tests required by Paragraph 1.0. The tests were performed as described in Paragraph 2.0.

There was zero seat leakage past the valve disc after the required temperature transients from room ambient temperature to 120°F, from room ambient temperature to 140°F, and from room ambient temperature to 170°F. There were two transients performed at each required temperature.

The test item complied with all test requirements without exception. At the request of the Fisher Technical Representative, the test item's disc seat ("T"-ring) was replaced with a new unit and adjusted to seal at 150 psid across the disc.

Typical circular chart recordings showing test chamber temperatures are presented in Appendix I. Photographs showing the test setup and leak test equipment are presented in Appendix II. Data obtained is presented on a Data Sheet in Appendix III, and an Instrumentation Equipment Sheet is presented in Appendix IV of this Section.

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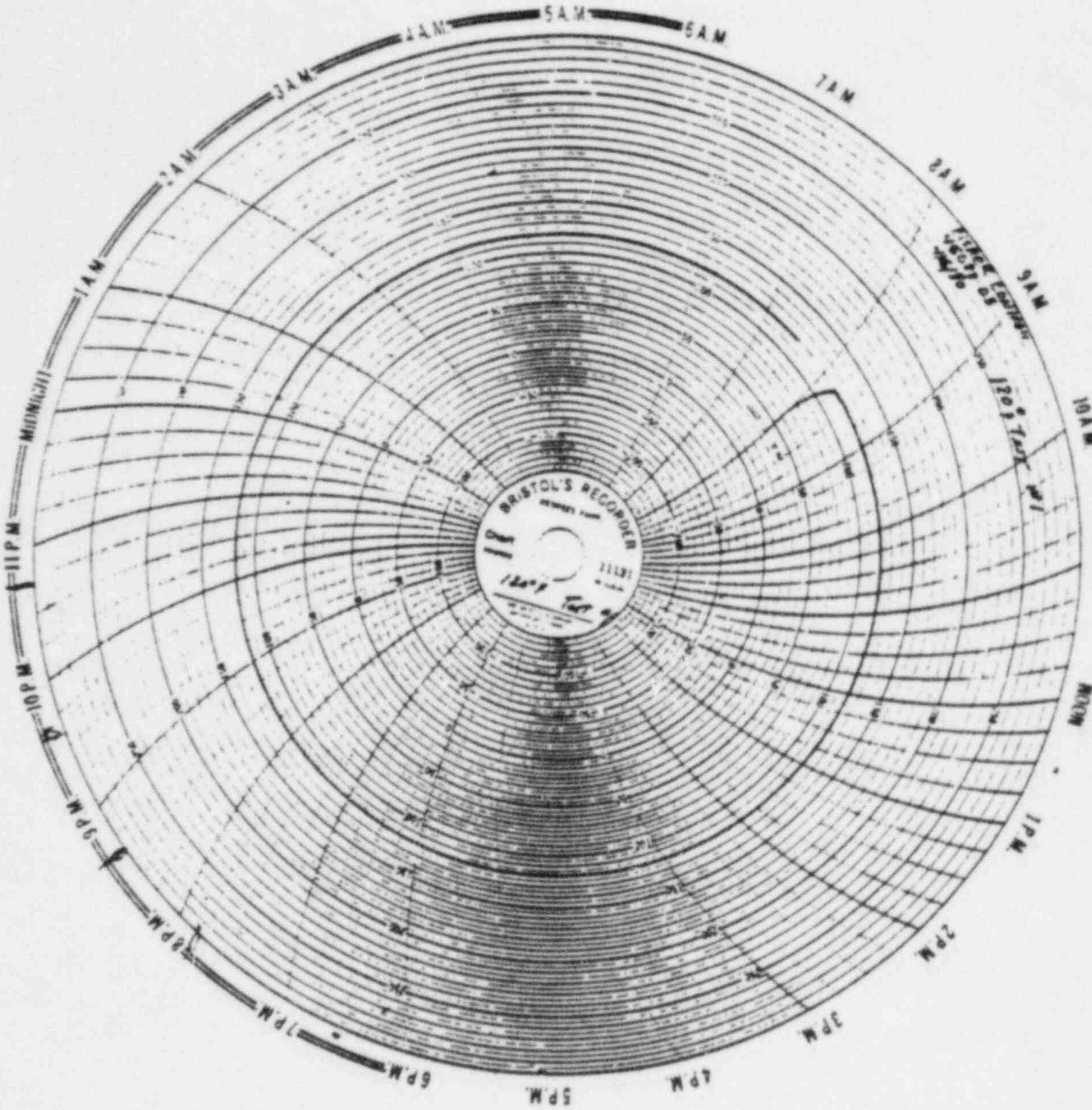
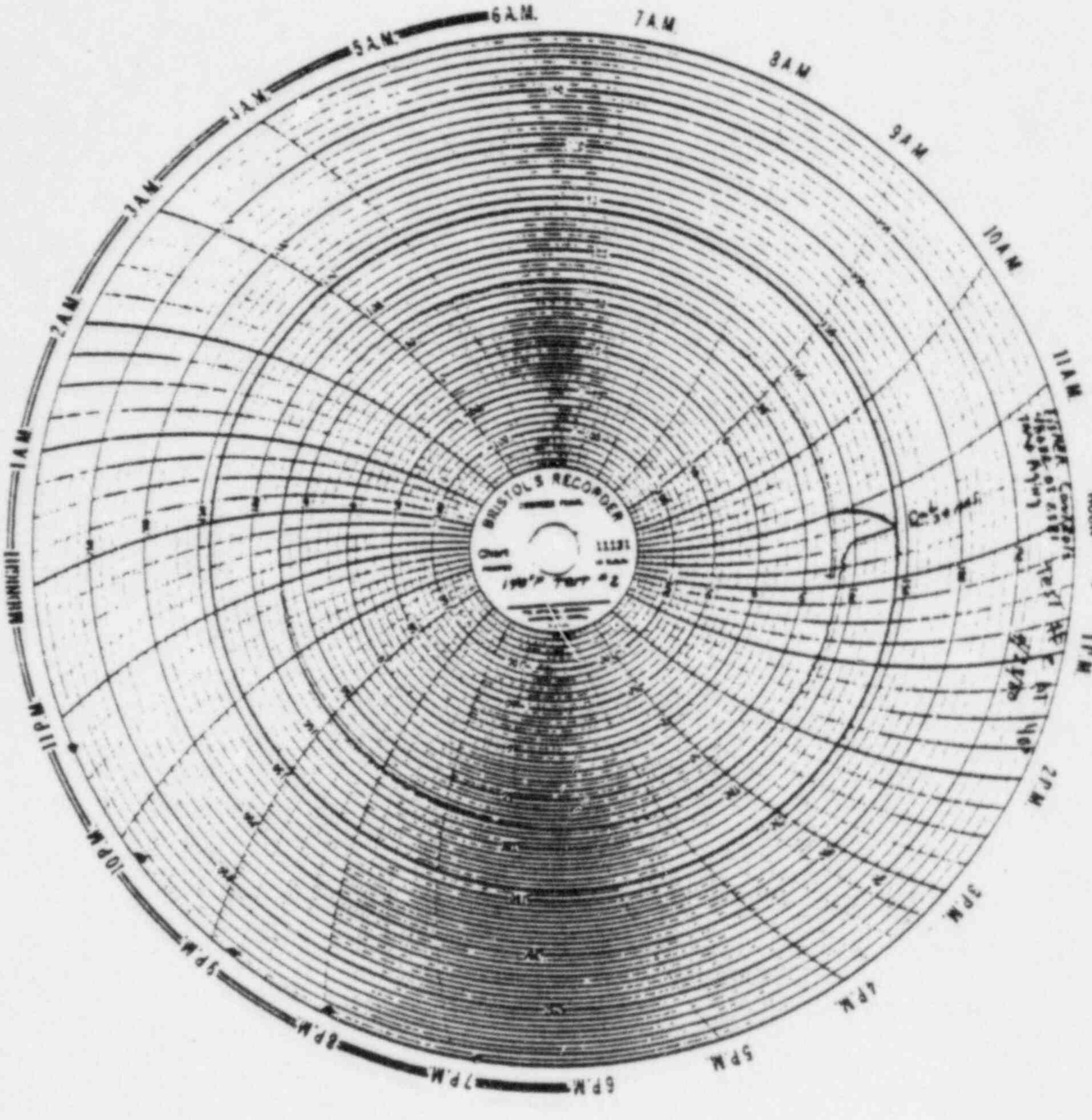
APPENDIX I

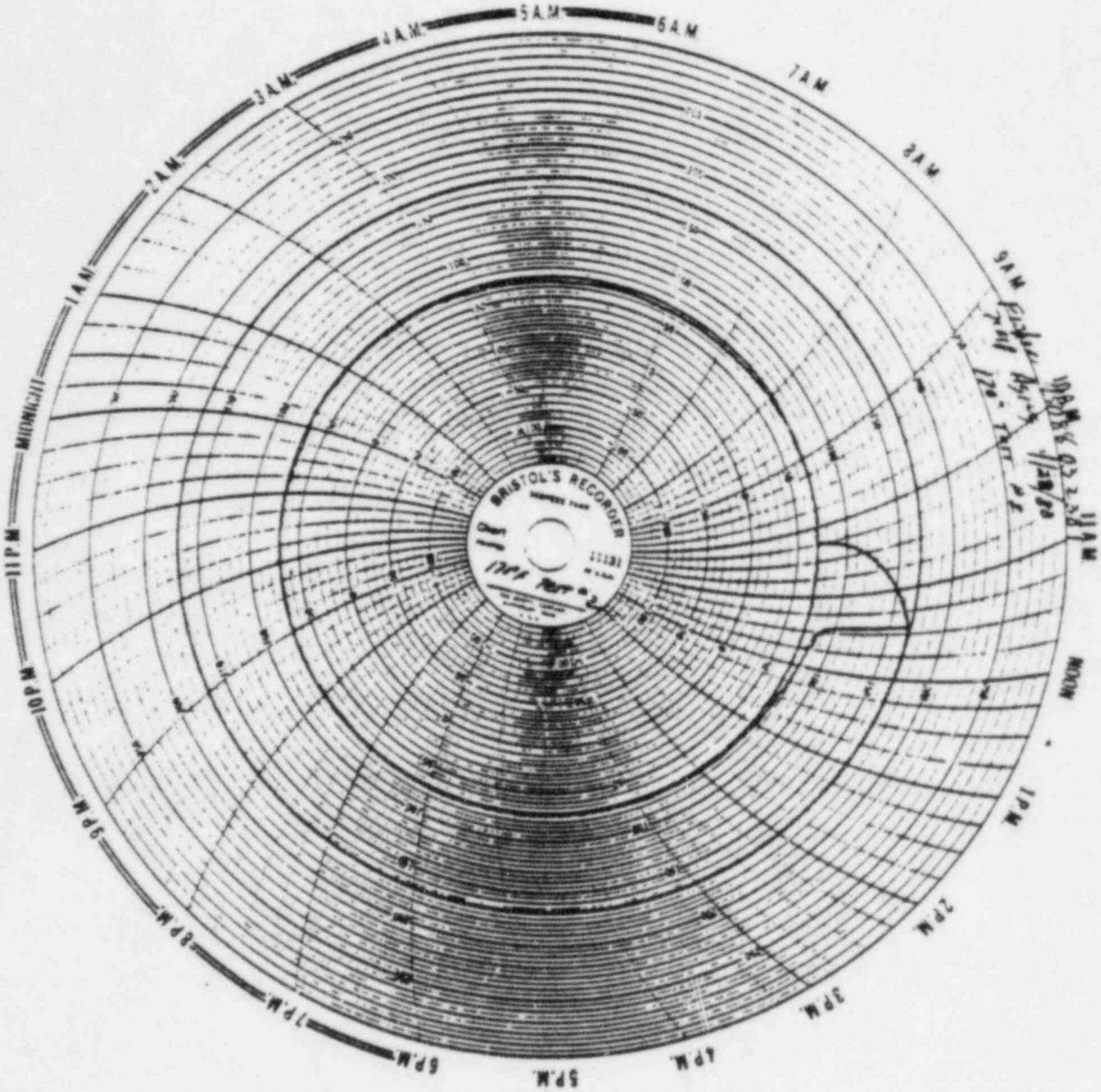
TYPICAL CIRCULAR CHART RECORDINGS



120°F - TEST NO. 1



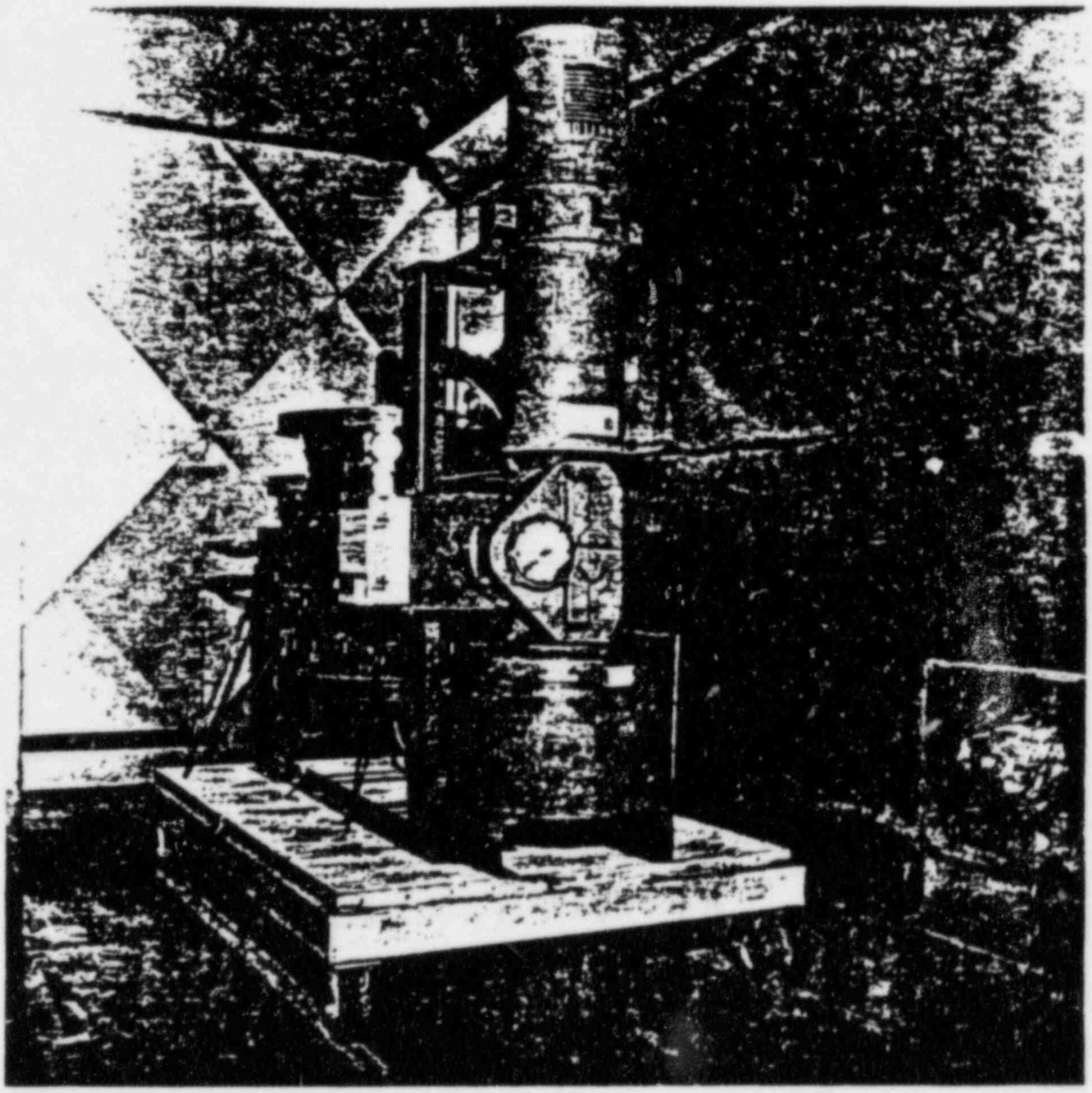
140°F - TEST NO. 2



170°F - TEST NO. 2

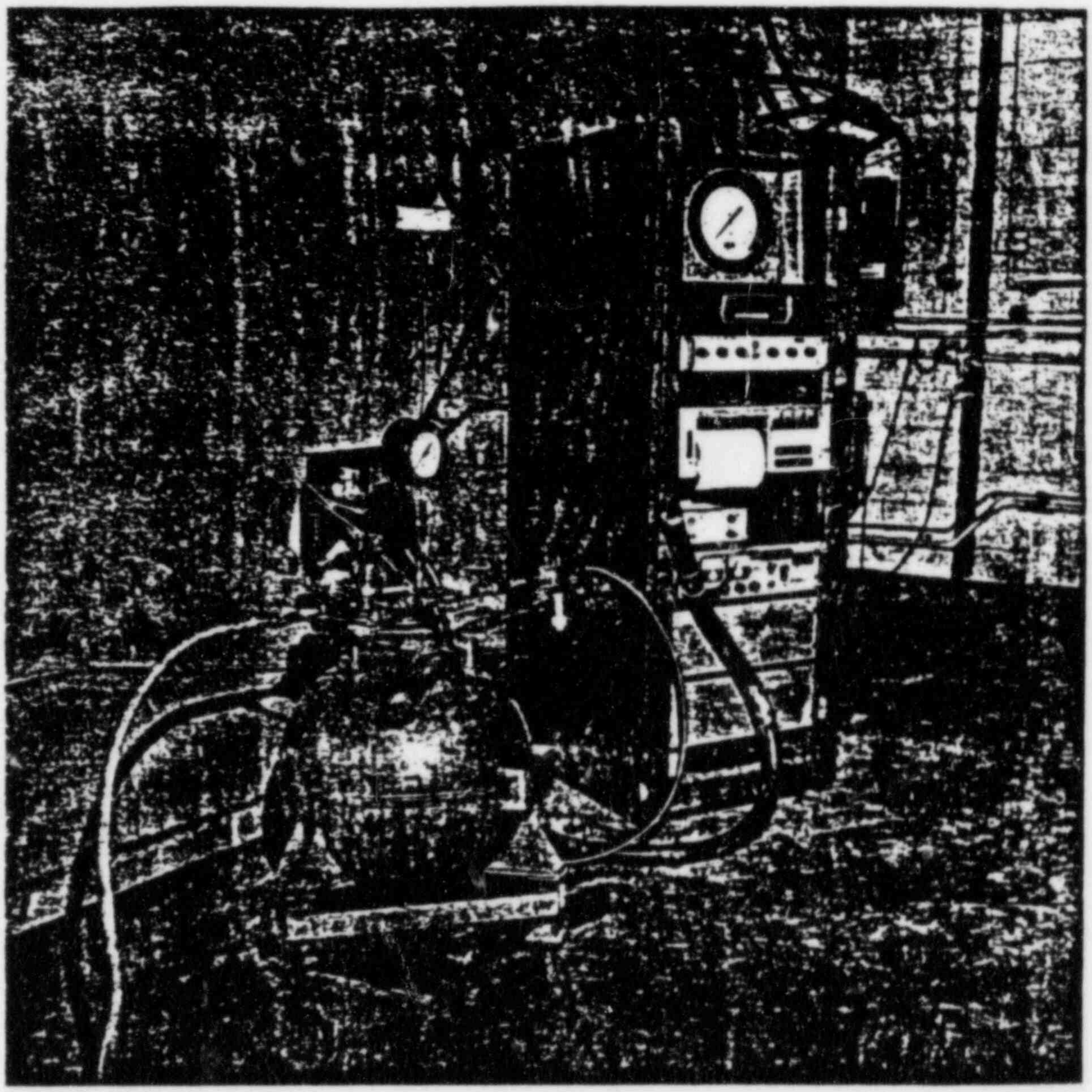
APPENDIX II

PHOTOGRAPHS



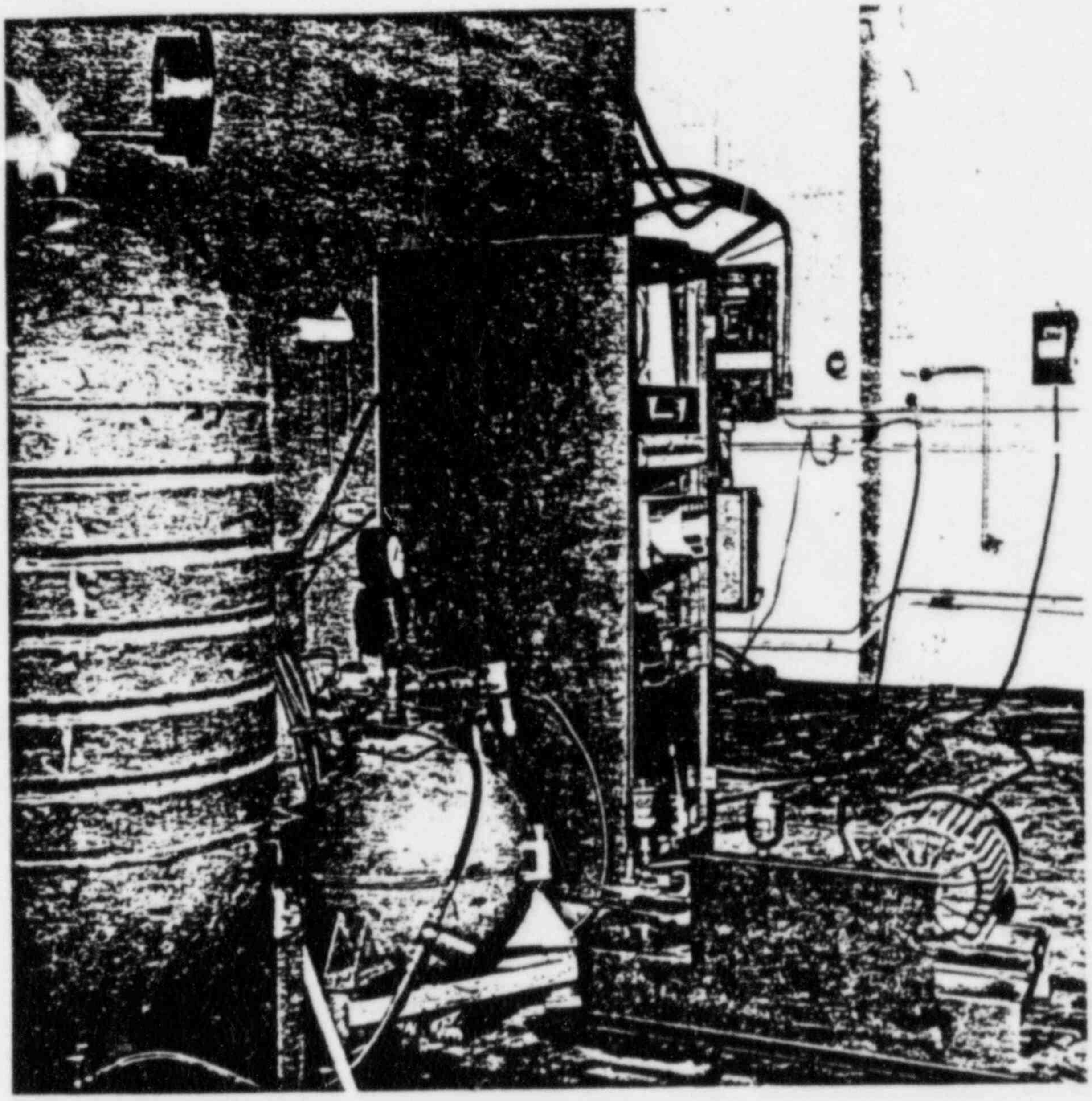
PHOTOGRAPH III-1

TEST ITEM IN TEMPERATURE CHAMBER



PHOTOGRAPH III-2

GASEOUS NITROGEN LEAK TEST EQUIPMENT



PHOTOGRAPH III-3

WATER LEAK CHECK EQUIPMENT

APPENDIX III

DATA SHEET

DATA SHEET

Customer FISHER CONTROLS
Specimen 20" BUTTERFLY VALVE
Part No. TYPE 9200
Spec. FISHER FOP-19 REV. E
Para. 6.0
S/N --
GSI --

Amb. Temp. 73°F
Photo YES
Test Med. GN_2
Specimen Temp. —

WYLE LABORATORIES
Job No. 45088
Report No. —
Start Date 4/16/80

Test Title NORMAL LOAD CONDITIONS TEST

	DATE	TIME	
Start 120°F	4/16/80	08:15	No. of full strokes (120°F) 10
End 120°F	4/17/80	08:15	Leak rate (GN_2 at 75 psid) ZERO
Start 120°F	4/18/80	09:45	No. of full strokes (120°F) 10
End 120°F	4/19/80	09:45	Leak rate (GN_2 at 75 psid) ZERO
Start 140°F	4/20/80	10:20	No. of full strokes (140°F) 5
End 140°F	4/21/80	10:20	Leak rate (H_2O at 150 psid) ZERO
Start 140°F	4/22/80	11:25	No. of full strokes (140°F) 5
End 140°F	4/23/80	11:25	Leak rate (H_2O at 150 psid) ZERO
Start 170°F	4/24/80	13:30	No. of full strokes (170°F) 2
End 170°F	4/25/80	13:30	Leak rate (H_2O at 150 psid) ZERO
Start 170°F	4/28/80	11:30	No. of full strokes (170°F) 2
End 170°F	4/29/80	11:30	Leak rate (H_2O at 150 psid) ZERO

Specimen Failed —
Specimen Passed ✓
NOA Written —

Tested By Michael Luttrell Date: 4/30/80
Witness — Date: —
Sheet No. 1 of 1
Approved Earl R Campbell

WH-614A

APPENDIX IV

INSTRUMENTATION EQUIPMENT SHEET

INSTRUMENTATION EQUIPMENT SHEET

Date 4-16-80 Job No. 45088-03 Test Area Schmidli Chamber

Technician J Richey Customer Fisher Controls Type Test Normal Condition Load Test

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	Pressure Gauge	US	200	—	95032	0-200 PSI	±1% FS	3-11-80	6-11-80
2	Digital MultiMeter	Keithley	179 TRMS	—	11331	MULTI	MFG SPEC	6-29-79	6-29-80
3	Amplifier	Honeywell	T6GA-500	—	11472	1:1	±2%	1-16-80	7-16-80
4	Oscillograph	Honeywell	T508	—	81026	D.C. - 2.5KHZ	±2%	12-11-79	6-11-80
5	Power Supply	Electronic Measurements	TR036-0.5	—	80246	36V	±1%	11-8-79	5-8-80
6	DC Power Sup	Sorensen	DCR 150-5	—	11307	150 VDC	±1% Reg	2-25-80	8-25-80
7	Pressure Gauge	Robert Shaw	200	—	98092	0-200PSI	±1% FS	3-27-80	6-27-80
8	Controller	Bristol	64A	6311-1829	95050	-125°F +300°F	±2% F	3-20-80	6-20-80

Instrument Test Engineer K Burkhart

Checked & Received By Earl R Campbell

WH-1029

SECTION IV

POST-NORMAL LOAD CONDITION FUNCTIONAL TESTS

1.0 REQUIREMENTS

The requirements for these tests are described in Section II, Paragraph 1.0, of this report.

2.0 PROCEDURES

The procedures for these tests are described in Section II, Paragraph 2.0, of this report.

3.0 RESULTS

The test item was subjected to the tests required by Paragraph 1.0. The tests were conducted as outlined in Paragraph 2.0. A rotary potentiometer was attached to the actuator position indicator to record the true stroking time of the test item. Previously, the stroking time was measured from the signal to the solenoid until the appropriate limit switch was actuated.

The test item stroking times were as follow:

		Stroke Times	
Voltage to Solenoid	Pressure to Solenoid	Closed to Open	Open to Closed
90 VDC	70 psig	21.60 sec.	20.30 sec.
125 VDC	70 psig	21.60 sec.	20.05 sec.
140 VDC	70 psig	21.60 sec.	19.40 sec.

There was zero leakage past the disc at 75 psid for 15 minutes.

A typical oscillograph recording is presented in Appendix I. Data obtained is presented on Data Sheets in Appendix II, and an Instrumentation Equipment Sheet is presented in Appendix III of this Section.

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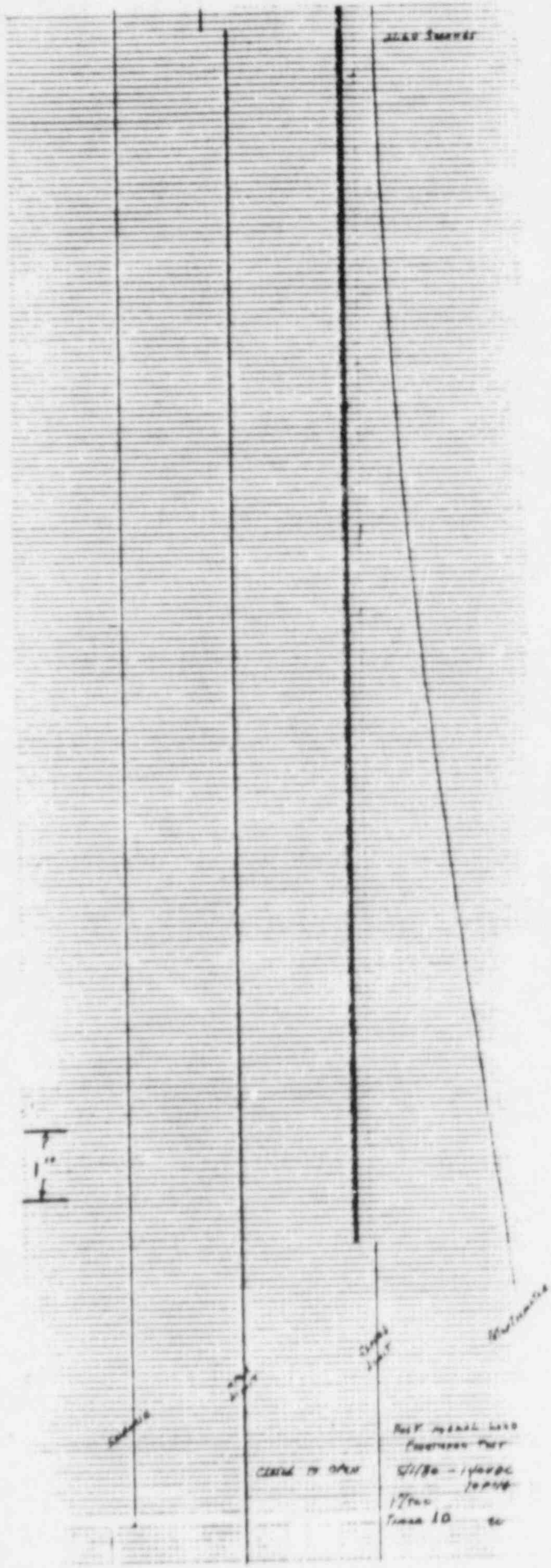
APPENDIX I

TYPICAL OSCILLOGRAPH RECORDING



TYPICAL OSCILLO-
GRAPH RECORDING

55

9510-AX5AC03-5068-5

APPENDIX II

DATA SHEETS

9510-AX5AC03-5068-5

DATA SHEET

Customer Fisher Controls Company

Specimen 20" Butterfly Valve

Part No. Type 9200

Spec. Fisher Document, FOP-19

Para. 2.0

S/N ---

GSI ---

Amb. Temp. 75°F

Photo NO

Test Med. GN_2

Specimen Temp. Amb

WYLE LABORATORIES

Job No. 45087-03-2377

Report No. —

Start Date 5/1/80

Test Title Post Normal Load Conditions FUNCTIONAL

	90 VDC	125 VDC	140 VDC
Type of Gas	GN_2	GN_2	GN_2
Pressure of Gas to Solenoid — close to open / open to close	70 PSI / 70 PSI	70 PSI / 70 PSI	70 PSI / 70 PSI
Regulator Pressure Inlet:	140 PSI / 140 PSI	140 PSI / 140 PSI	140 PSI / 140 PSI
Solenoid Outlet: close to open / open to close	70 PSI / 0 PSI	70 PSI / 0 PSI	70 PSI / 0 PSI
* Time duration of Operating Cycle: (sec)			
Closed to Open:	21.6 sec	21.6 sec	21.6 sec
Open to Closed:	20.3 sec	20.05 sec	[illegible]
Indicator Light Function	OK	OK	OK
Voltage to Solenoid	90V	125V	140V
Voltage to Limit Switch	90V	125V	140V
Seat Leakage @ 60 psig for 15 minutes			

* Ref. O'graph data. O'graph settings 100 millisec/div 1 inch/sec

SUB-STANDARD ORIGINAL NOT SUITABLE FOR LEGIBLE REPRODUCTION

Specimen Failed —

Specimen Passed ✓

NOA Written —

Tested By Harvey Cole Date: 5-1-80

Witness Joe Meyer Date: 5-1-80

Sheet No. 1 of 2

Approved KB Earl R Campbell

WH-614A

057

9510-AX5A CO3-3068-5

DATA SHEET

WYLE LABORATORIES

Customer: Fisher Controls
Specimen: Valve
Part No.: 9220
Spec.: FQP-19
Para.: 405
S/N: —
GSI: NO

Amb. Temp.: 70° F
Photo: NO
Test Med.: —
Specimen Temp.: Amb

Job No.: 45088-03-2377
Report No.: —
Start Date: 5-1-80

Test Title: POST NORMAL LOAD CONDITIONS FUNCTIONAL TEST

Solenoid Resistance
Terminals 2 to 3 in the Box — 15.5Ω

Contact Resistance Switch no. 2 — 289 mΩ @ 1 ma
wire 1 and 2 Contact A and B — Switch closed

Contact Resistance switch no 2 — 334 mΩ @ 1 ma
wire 3 and 4 contact G and H — Switch closed

Solenoid Resistance To ground — 500 MΩ @ 500 V

Contact resistance Switch no 2 — 12 GΩ @ 500 V
wire 1 and 2 contact A and B — Switch open

Contact resistance switch no 2 — 8.8 GΩ @ 500 V
wire 3 and 4 contact G and H — Switch open

Specimen Failed: —
Specimen Passed: ✓
NOA Written: —

Tested By: Larry Cole Date: 5-1-80
Witness: — Date: —
Sheet No. 2 of 2
Approved: KB Earl R Campbell

WH-614A

9510-AX5AC03-5068-5 058

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APPENDIX III

INSTRUMENTATION EQUIPMENT SHEET

INSTRUMENTATION EQUIPMENT SHEET

Date 5-1-80 Job No. 45088-03-2377 Test Area LOCA

Technician Larry Cole Customer Fisher Controls Type Test PRE AGING Functional

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	DMM	Keithley	179	—	11331	0-200VDC	mfg Spec	6-29-79	6-29-80
2	GALVO AMP	Honeywell	T66A 500	—	11472	1-1	±2%	1-16-80	7-16-80
3	O'graph	Honeywell	1508	—	81026	0-1KHZ	±2%	12-11-79	6-11-80
4	D.C. Power Supply	Elect. Measurements	TR036-05	—	80246	0-36V 0-5A	±.1%R	11-8-79	5-8-80
5	D.C. Power Supply	Sorensen	DCR150-5	—	11309	0-150V 0-5A	±.1%R	2-25-80	8-25-80
6	Pressure Guage	MaxiSAFE	—	—	97745	0-600PSI	±1%FS	4-22-80	7-22-80
7	Pressure Guage	Robertshaw	ACRAGAGE	—	78092	0-200PSI	±.1%	3-27-80	6-27-80
8	Megohmmeter	General Radio	1864	—	11898	500KΩ to 200x10^12	mfg spec	2-12-80	8-12-80
9	DMM	KEITHLEY	164	—	11305	Multi	mfg spec	4-8-80	10-8-80

Instrument Test Engineer K Burkhart Checked & Received By Earl K Campbell

WH-1029

SECTION V

AGING SIMULATION

1.0 REQUIREMENTS

The test valve assembly shall be subjected to ten (10) alternate cycles of temperature and humidity with concurrent stroking of the valve during the humidity cycle. The valve shall be stroked using a pressure of 90 psig to the actuator.

Each temperature cycle shall be 2.85 days at 227.8°F (108.8°C). Total exposure at temperature shall be 28.5 days (10 cycles).

Each humidity cycle shall be 48 hours at 140°F (60°C) and 95 $^{+5}_{-0}$ percent humidity. Total exposure to humidity shall be 20 days (10 cycles).

The test valve shall be actuated for 1,000 operating cycles which shall be evenly divided between the ten humidity cycles. The voltage to the electrical appurtenances for operating the valve shall be 125 VDC. When not stroking, the valve shall remain in the closed position. The pressure to the solenoid shall be 90 psig. Both the opening and closing stroke times, as measured from the change in solenoid energization to the limit switch contact at the opposite end of travel, shall be measured and recorded during the first full cycle stroking operation of each humidity cycle.

Throughout the aging simulation sequence, the special test fixture spool-pieces shall remain in place on the valve. A bell flange shall be attached to the inlet side of the valve test fixture and shall remain in place throughout the aging simulation so that the inlet side of the valve can be pressurized when required. The outlet side of the valve fixture shall remain open so as to fully expose the T-ring seal to the test chamber environment.

In order to provide a realistic evaluation of any seat leakage change which might occur during the heat aging simulation, the inlet bell flange shall be pressurized periodically and the seat leakage observed while the valve is experiencing one of the high temperature (227.8°F) cycles. If any leakage is observed during this inspection, a bell flange shall be installed on the outlet side of the valve test fixture so that the leakage can be collected and measured. This test shall be performed at the end of the first, fourth, seventh, and last high temperature cycles. (Reference Table 5, Page 39, Addendum I of this report.)

2.0 PROCEDURES

The test item was placed in the environmental chamber and made operational. The special spool pieces were bolted in place and remained in place throughout this test. The "T"-ring was exposed to the chamber environment. A blind flange was attached to the inlet side of the test item for leak checking purposes. The pressure to the actuator was 90 psig. The voltage to the solenoid was 125 VDC.

The chamber temperature was increased to 228°F and maintained for a period of 2.85 days (68.4 hours). A leak check using gaseous nitrogen at 75 psid for 5 minutes was performed at this temperature. The chamber temperature was decreased to 140°F, 95 $^{+5}_{-0}$ percent relative humidity, and maintained for 2 days (48 hours). During this period, the valve was operated through one hundred (100) full strokes from "closed" to "open" to "closed". The above sequence was repeated for a total of ten (10) times. Leak checks were performed at high temperature (228°F) cycles one (1), four (4), seven (7), and ten (10). The valve was stroked a total of 1,000 times from "closed" to "open" to "closed", in ten equal segments of 100 strokes each at 140°F. Valve stroke times were recorded and measured on the first stroke of each equal segment. When not stroking, the valve remained in the closed position.

The total time at the high temperature was 28.5 days.

The total time at 140°F, 95 $^{+5}_{-0}$ percent relative humidity was 20 days.

The leak checks at 228°F were performed as required.

The 1,000 full strokes were performed at 140°F, 95 $^{+5}_{-0}$ percent relative humidity in ten equal segments as required.

3.0 RESULTS

The test item was subjected to the tests required by Paragraph 1.0. The tests were conducted as outlined in Paragraph 2.0 above. The test item complied with all specified test requirements, although one (1) anomaly was noted (reference Notice of Anomaly No. 1, Appendix I, this section). This anomaly is described below.

Notice of Anomaly No. 1: A facility power outage lasting for approximately 30 minutes caused the thermal aging chamber temperature to be out-of-tolerance. The lowest temperature recorded was 210°F. The test was in the second high temperature cycle.

The test item showed no evidence of seat leakage at 75 psid for 5 minutes in each of the required four (4) leak checks at the high temperature (228°

3.0 RESULTS (Continued)

The test item was successfully stroked through the 1,000 full stroke cycles as required. One hundred (100) strokes were performed during each humidity (140°F, 95 $\pm^{5}_{0}$%) cycle.

The test item's stroke times are shown below:

	Closed to Open	Open to Closed
Cycle #1	12.38 sec	19.55 sec
Cycle #101	13.15 sec	19.00 sec
Cycle #201	13.44 sec	18.23 sec
Cycle #301	12.63 sec	16.50 sec
Cycle #401	12.35 sec	19.19 sec
Cycle #501	12.25 sec	20.63 sec
Cycle #601	12.13 sec	17.25 sec
Cycle #701	12.13 sec	17.88 sec
Cycle #801	12.15 sec	17.40 sec
Cycle #901	12.13 sec	21.44 sec

Notice of Anomaly No. 1 is presented in Appendix I. Typical circular charts showing the test chamber environments are presented in Appendix II. Oscillograph recordings showing the test item stroke times are presented in Appendix III. Photographs showing the test setup and leak check equipment are presented in Appendix IV. Data Sheets showing the leakage data obtained are presented in Appendix V, and Instrumentation Equipment Sheets are presented in Appendix VI.

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APPENDIX I

NOTICE OF ANOMALY

NOTICE OF ANOMALY

NOTICE NO. 1 P. O. NUMBER: H-217770 WYLE JOB NO. 45088

CONTRACT NUMBER: N/A

CATEGORY: ☐ SPECIMEN ☐ PROCEDURE ☒ TEST EQUIPMENT DATE: 5/9/80

TO: Fisher Controls ATTN: Bill Haslett

PART NAME: 20" Butterfly Valve PART NO. Type 9200

TEST: Aging Simulation I. D. NO. --

SPECIFICATION: FQP-19, Rev. E PARA. NO. 4.0

NOTIFICATION MADE TO: Bill Haslett DATE: 5/9/80

NOTIFICATION MADE BY: E. Campbell VIA: Telephone

REQUIREMENTS:

The test valve assembly will be subjected to 10 alternate cycles of temperature and humidity with concurrent stroking of the valve during each humidity cycle.

Each temperature cycle will be 2.85 days at 227.8°F (108.8°C).

DESCRIPTION OF ANOMALY:

A facility power outage lasting for ≈30 minutes caused the thermal aging chamber to be out of the required test temperature. The lowest temperature recorded was 210°F. The test was in the second high temperature cycle.

DISPOSITION – COMMENTS – RECOMMENDATIONS:

At Wyle Laboratories' suggestion and with the customer's approval, 30 minutes will be added to the test at the end of the second high temperature cycle.

DISTRIBUTION:
Original: Dept.
( ) Copies: Customer
2 Copies: Q. C.
2 Copies Project Office
1 Copy: Contracts
1 Copy: Operations Director

TEST WITNESS —

—

REPRESENTING —

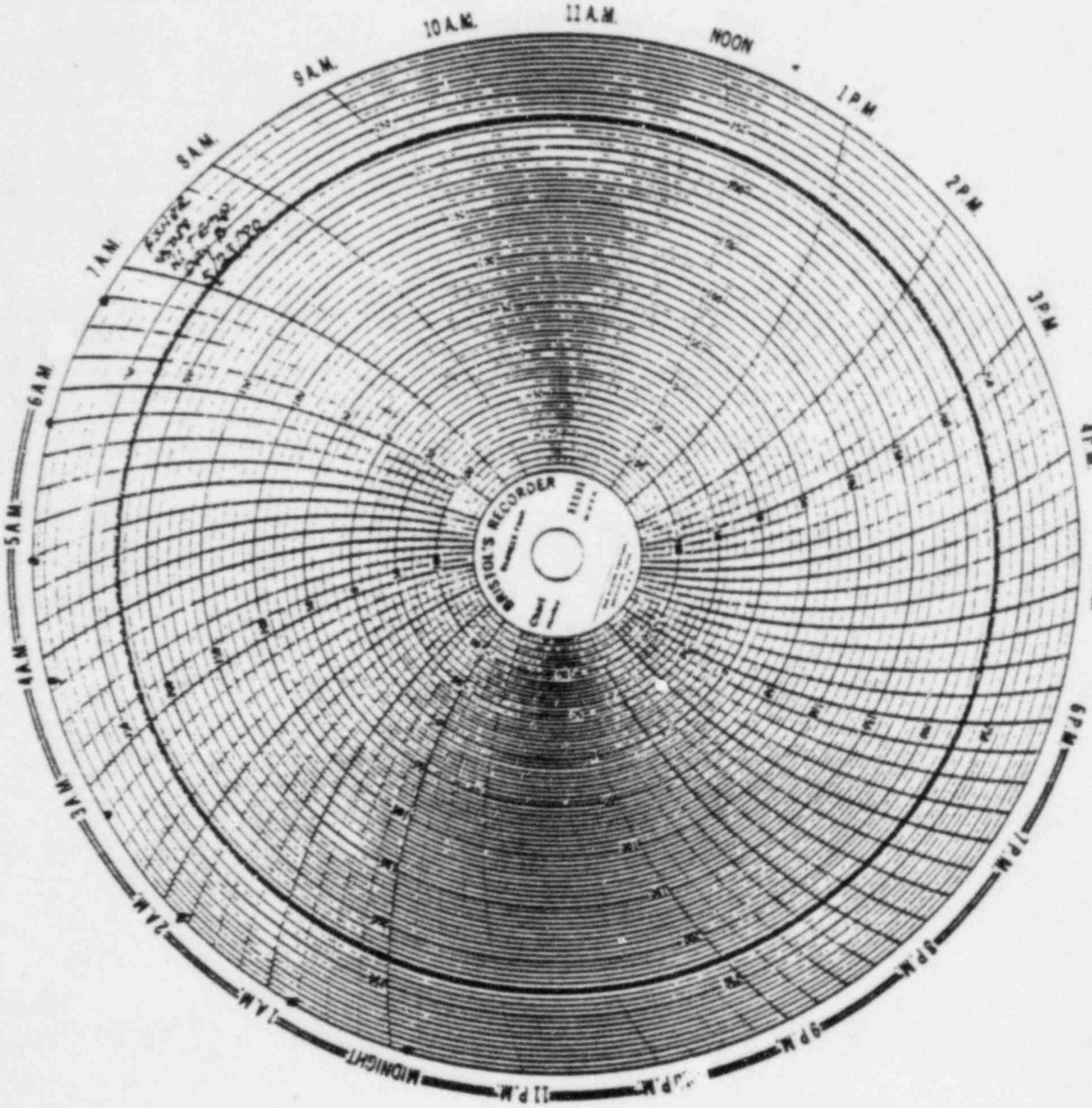
ENGINEER Earl R Campbell

QUALITY CONTROL [signature]

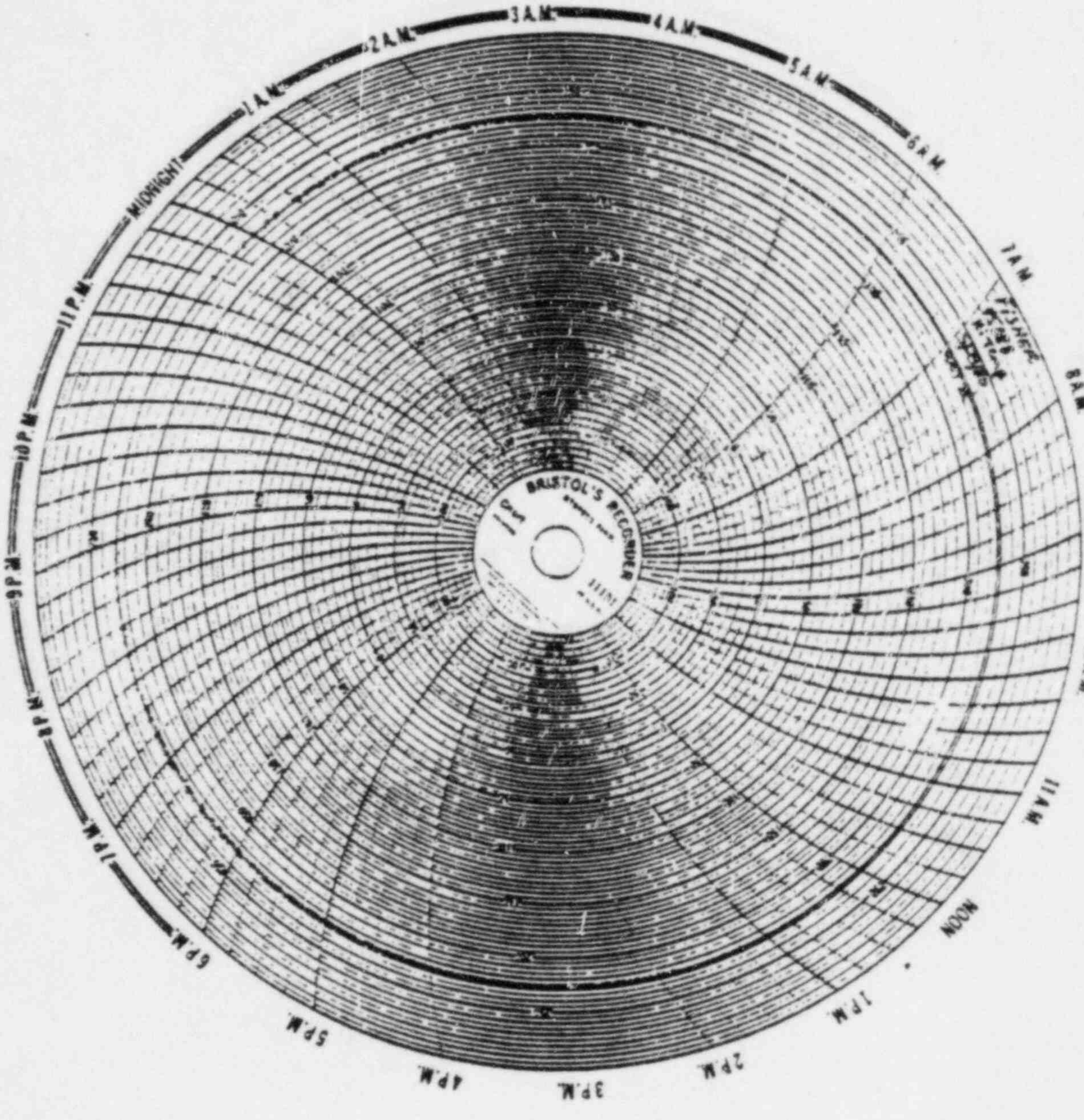
PROJECT MANAGER [signature]

APPENDIX II

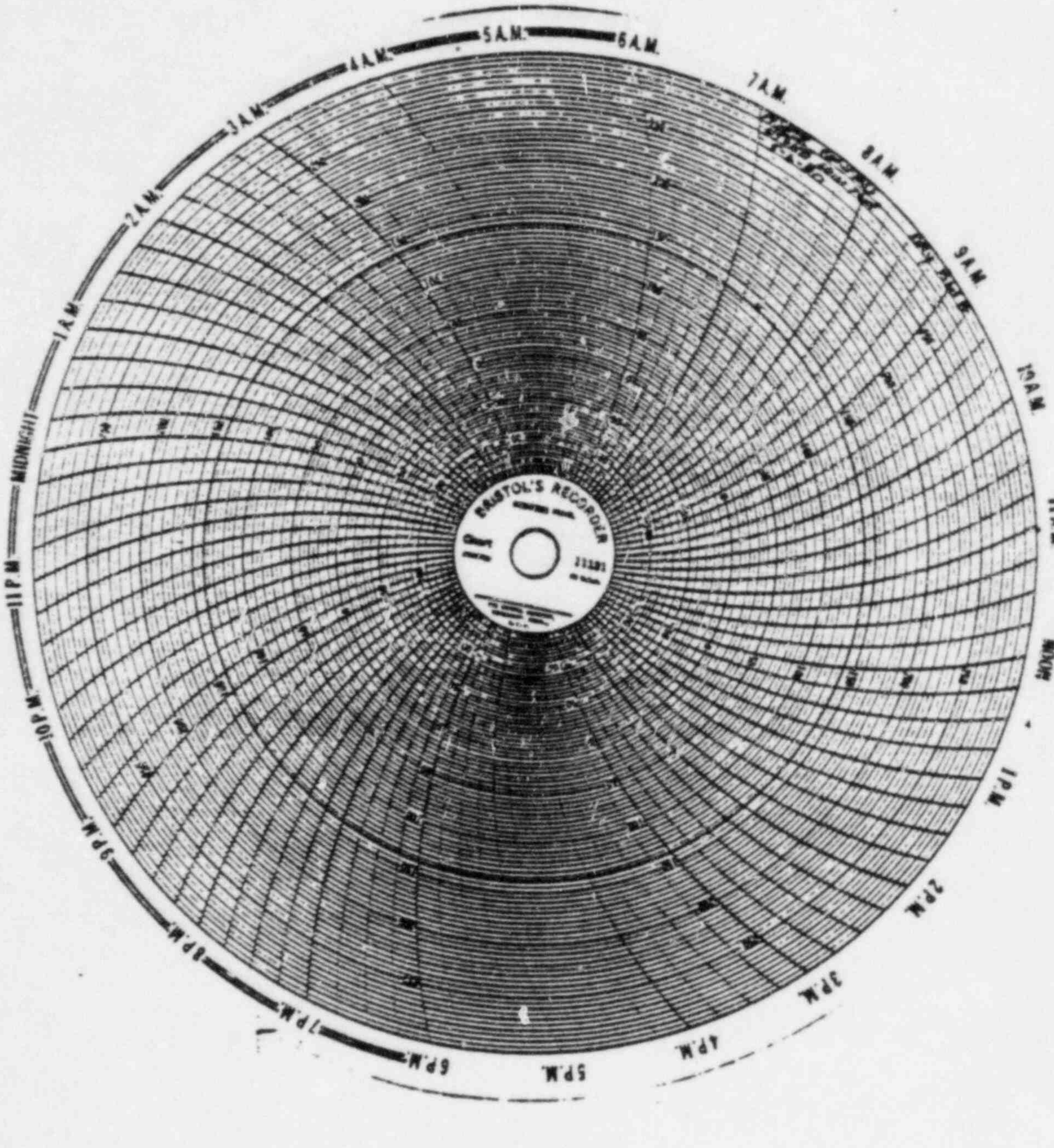
CIRCULAR CHARTS



HIGH TEMPERATURE CYCLE
DRY BULB

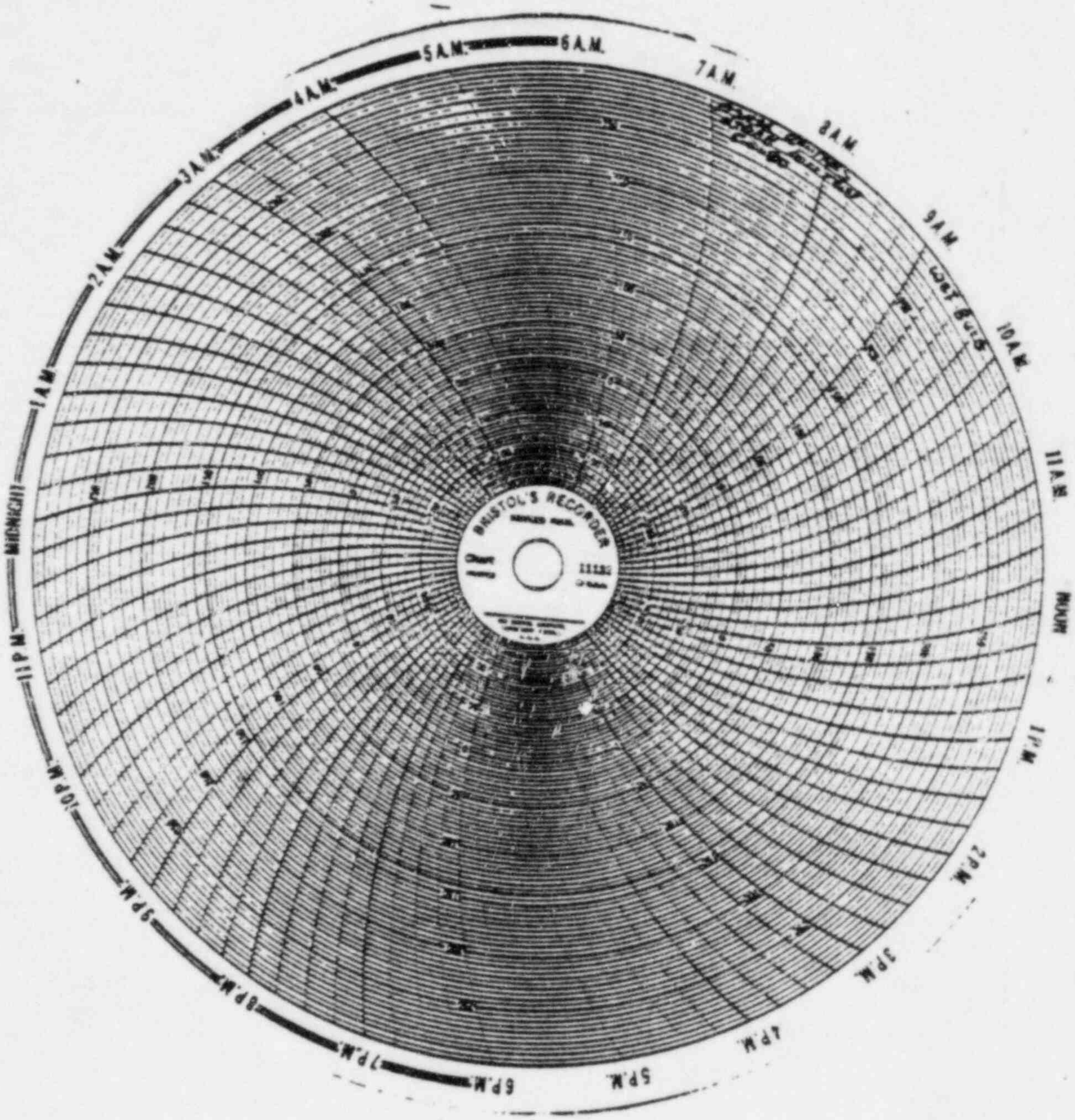


HIGH TEMPERATURE CYCLE
WET BULB



HUMIDITY CYCLE
DRY BULB

Page No. V-11
Report No. 45088-1



HUMIDITY CYCLE
WET BULB

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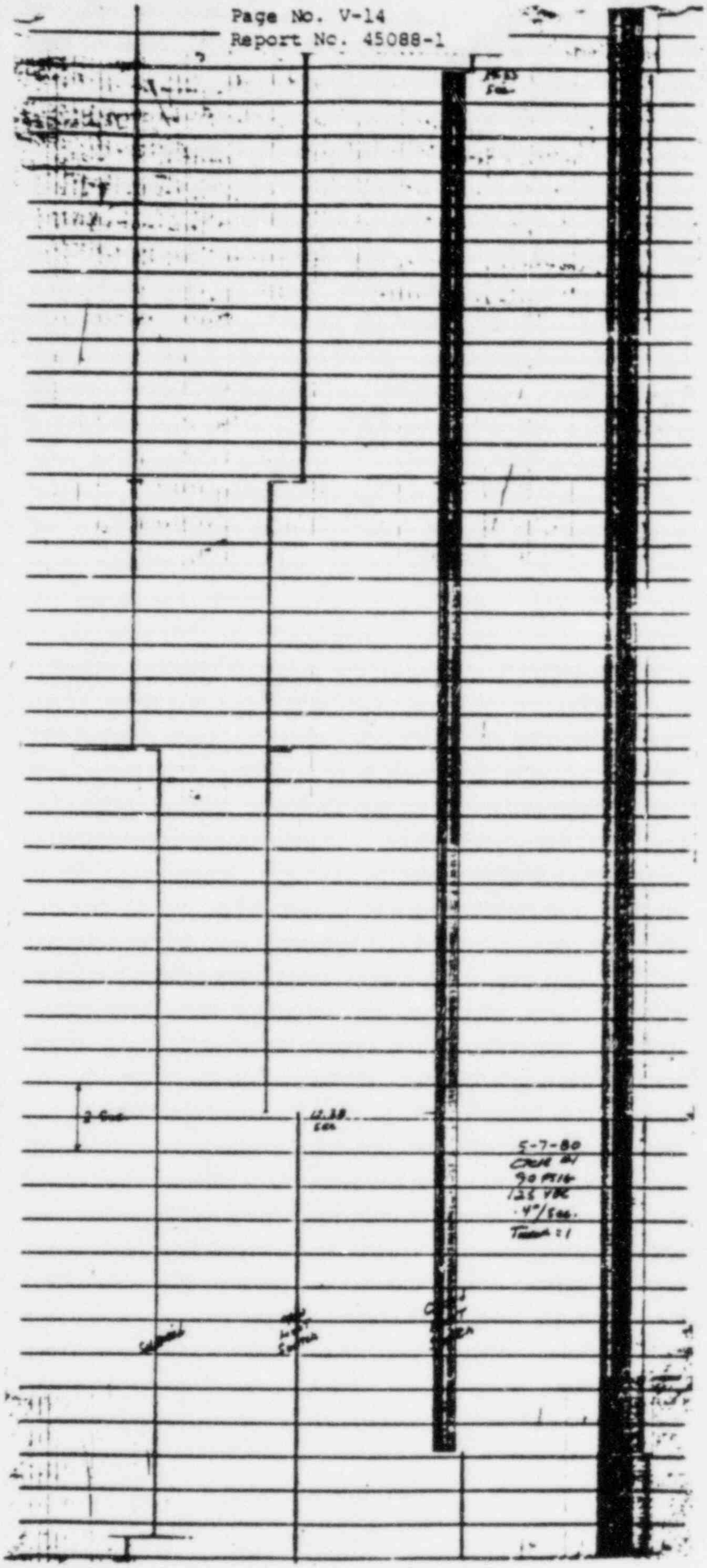
APPENDIX III

OSCILLOGRAPH RECORDINGS



CYCLE #1

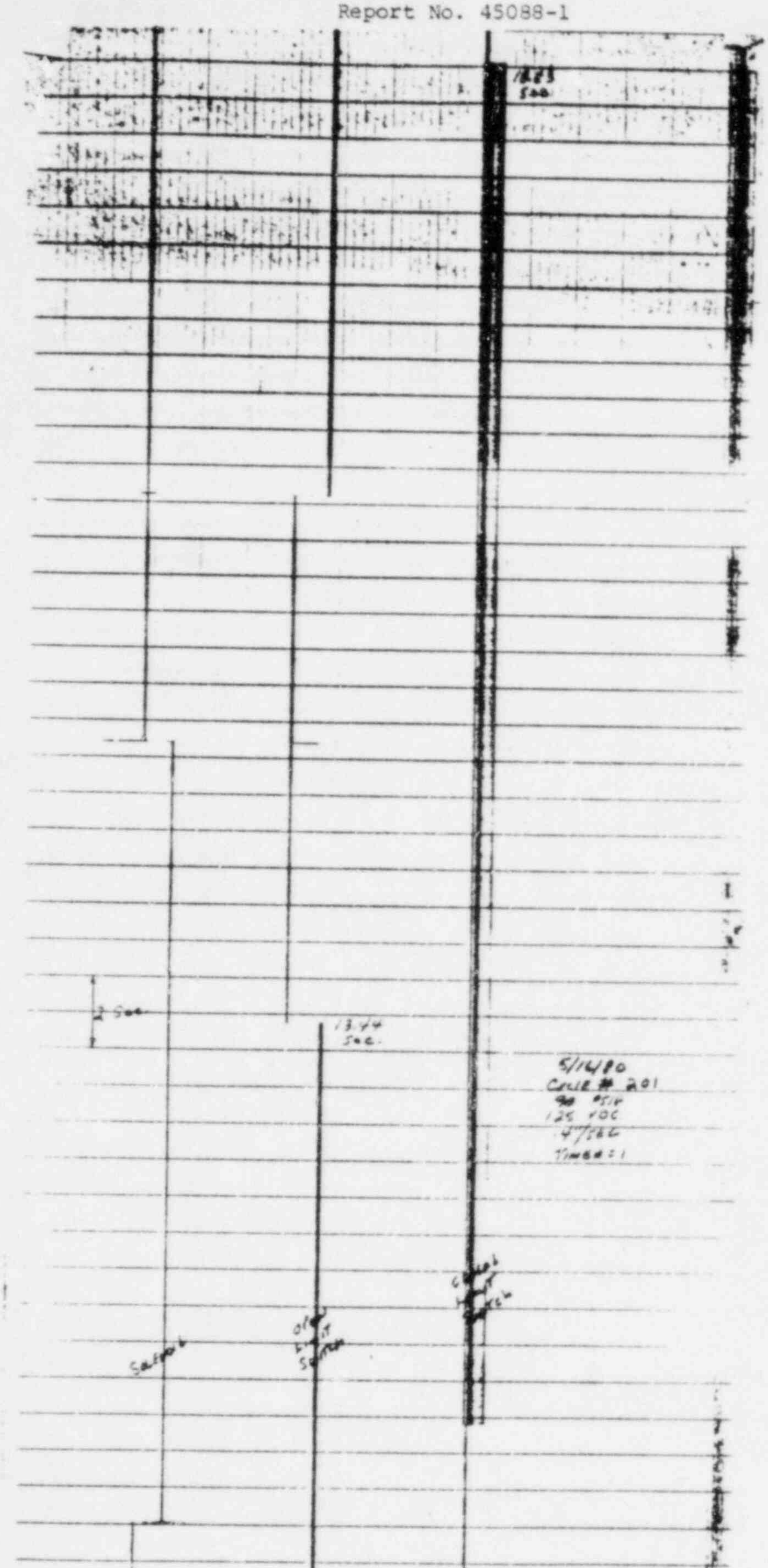
075

9510-AX5A003-5068-5

CYCLE #101

9510-AX5AC03-5068-5

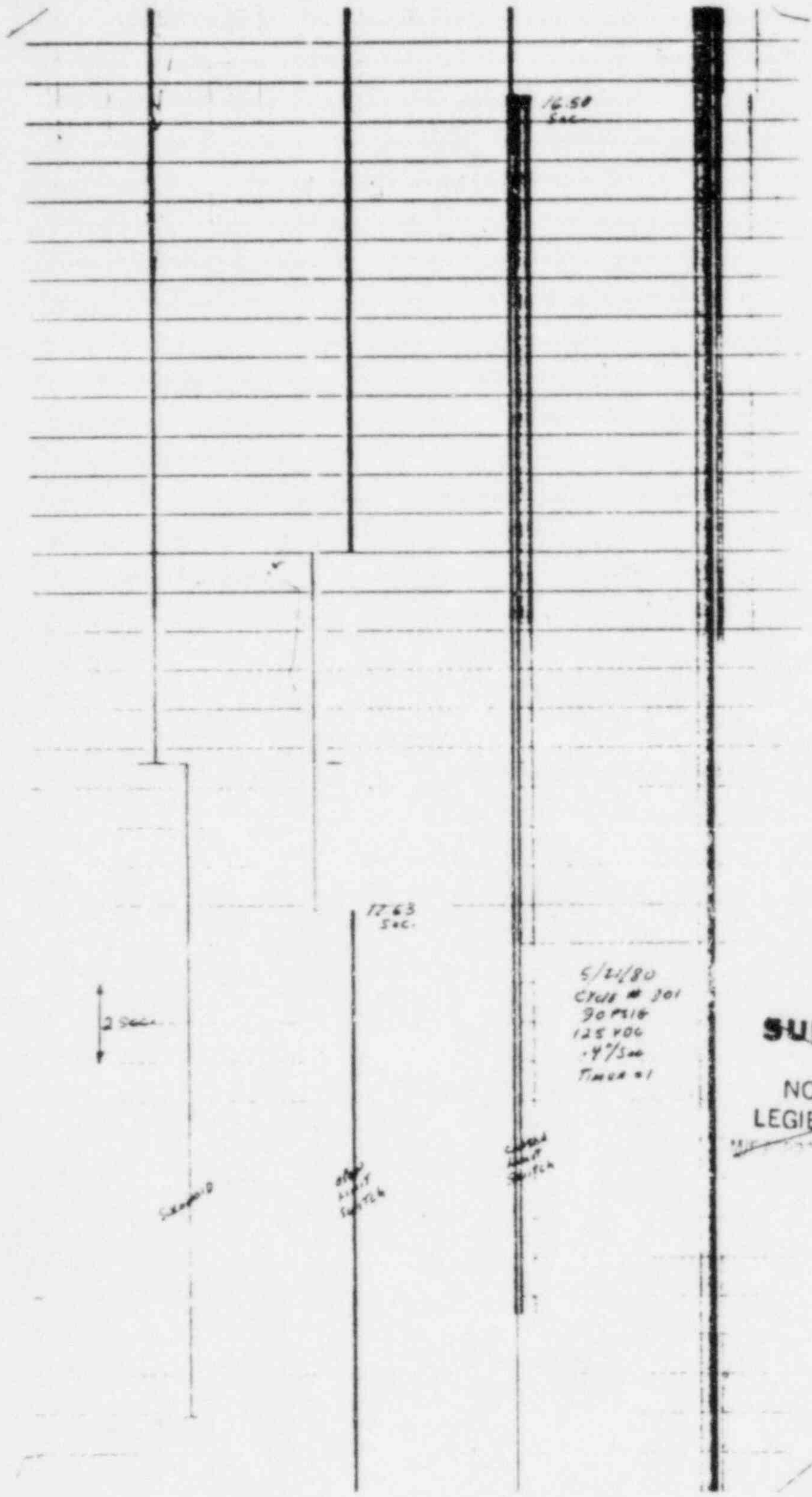
076



CYCLE #201

9510-AX5-C03-5068-5

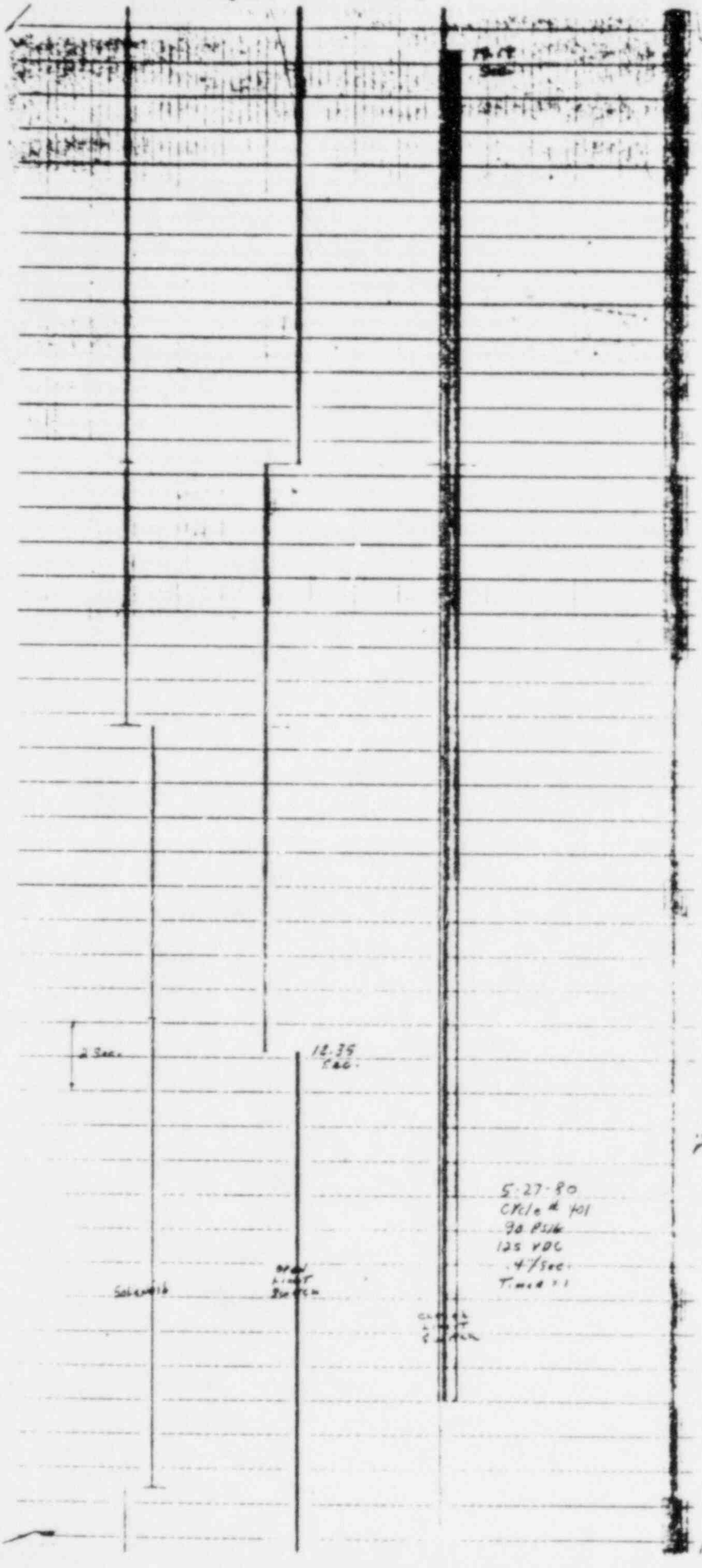
077



CYCLE #301

078

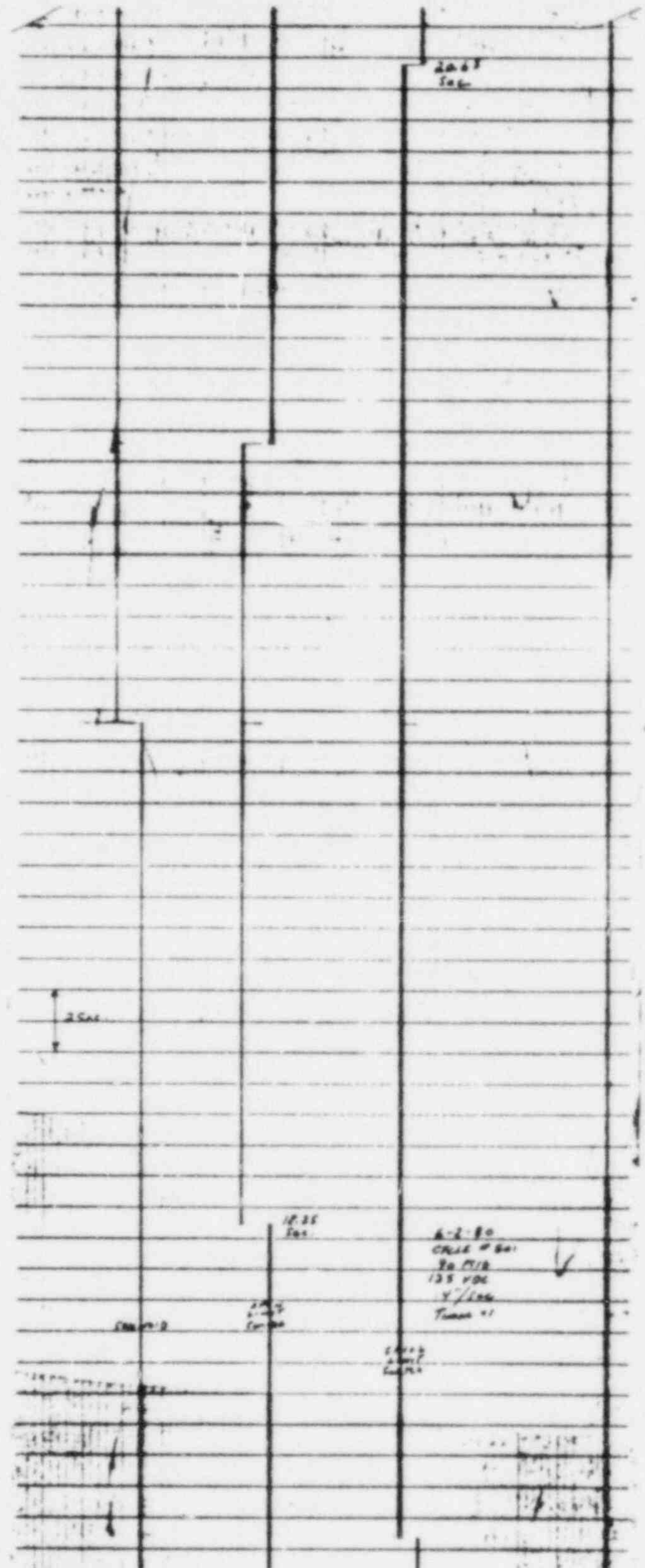
9510-AX5AC03-5068-5 Page No. V-18
Report No. 45088-1



CYCLE #401

9510-AX5A C03-5068-5

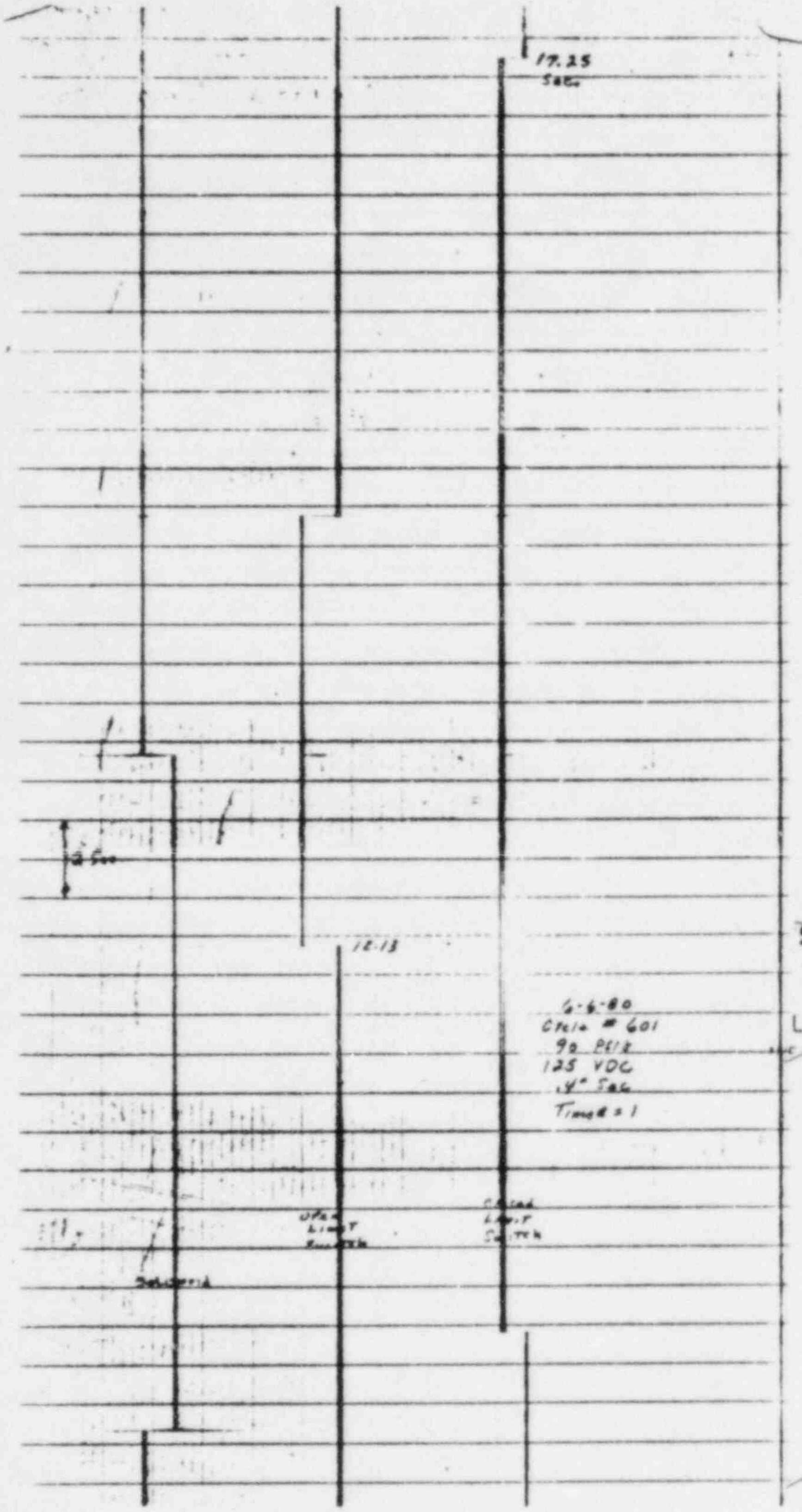
079



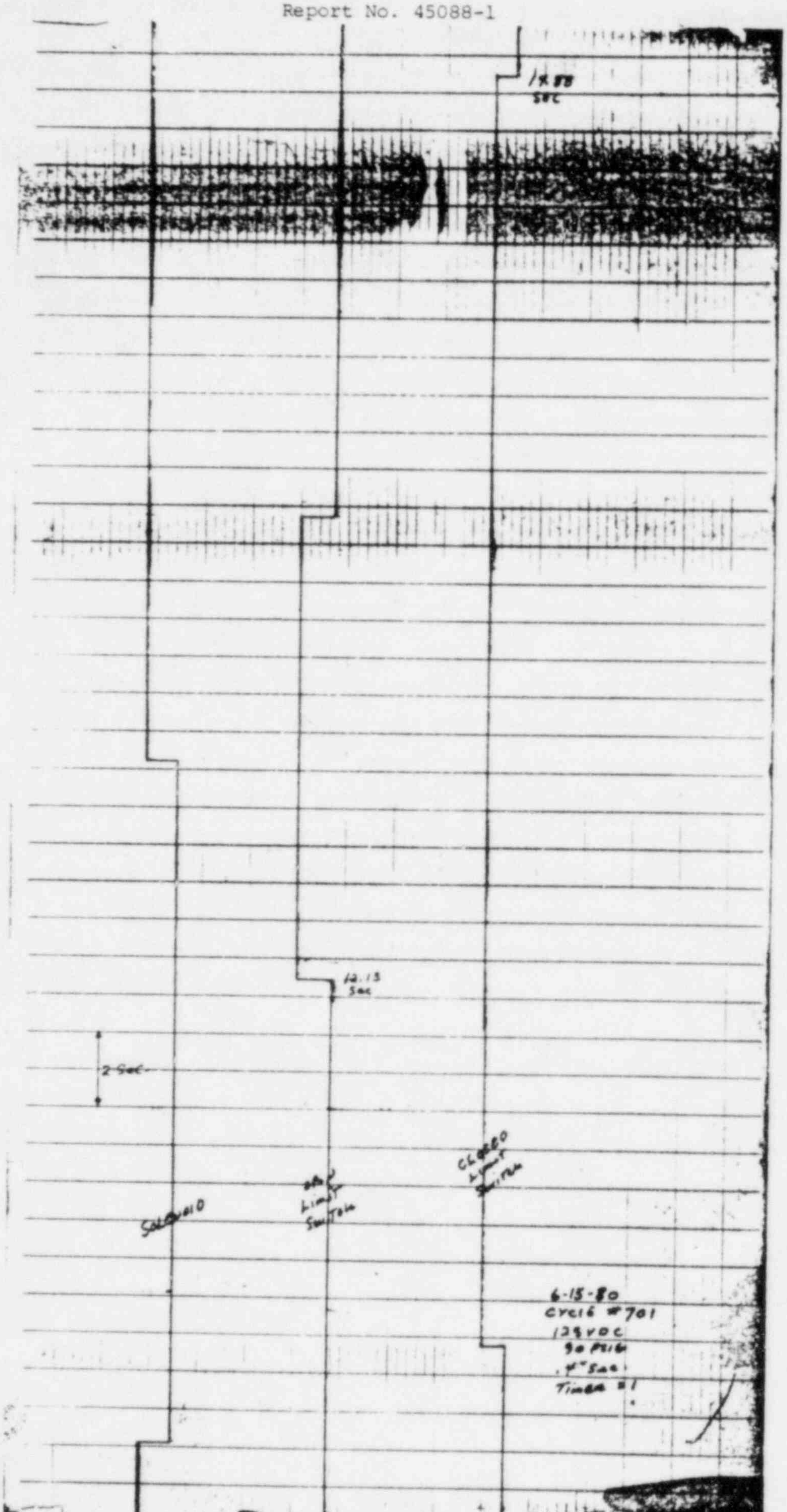
CYCLE #501

080

9510-AX5AC03-5068-5



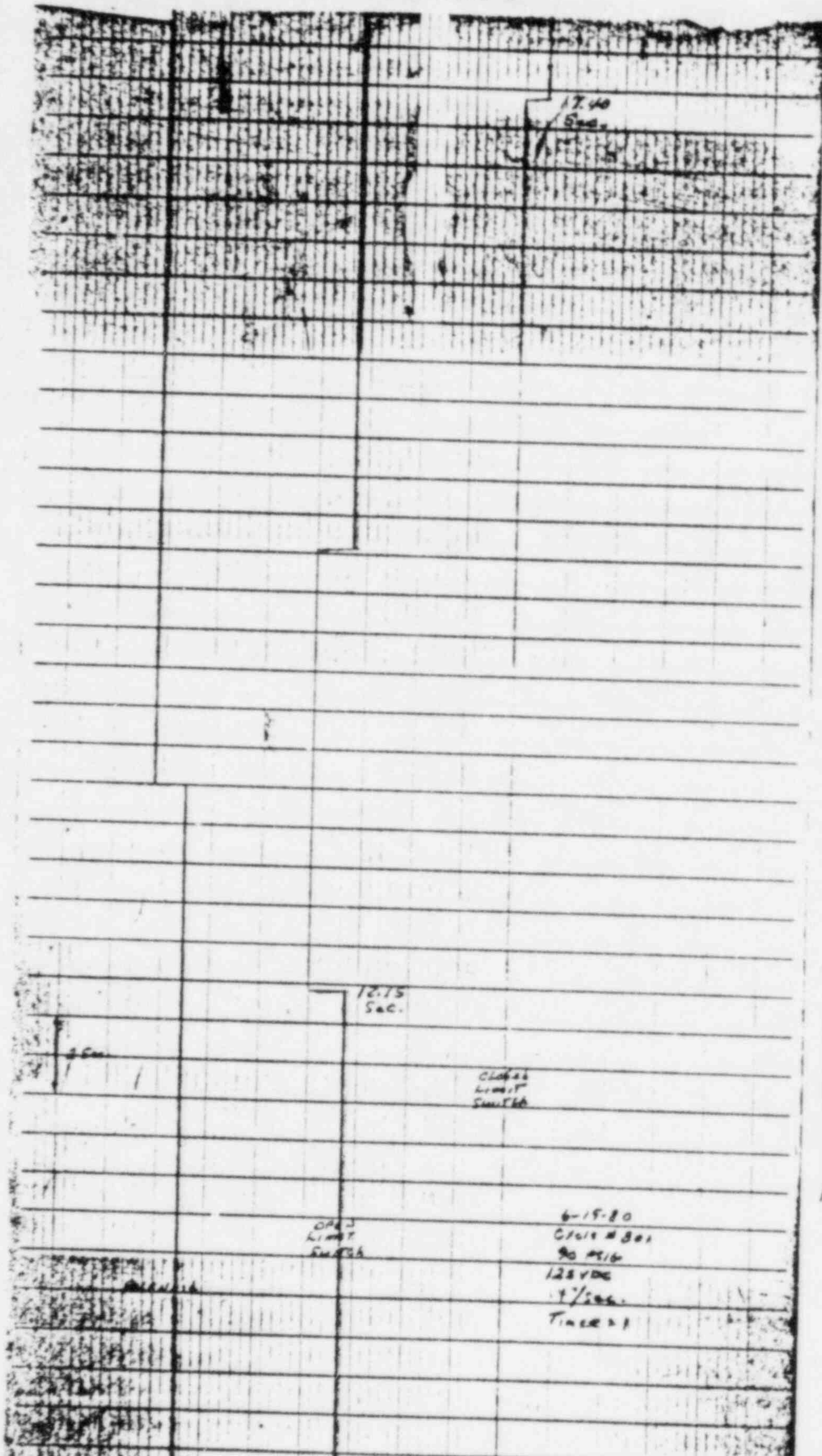
CYCLE #601


12.15 Sec
2 Sec
SOLENOID
OPEN LIMIT SWITCH
CLOSED LIMIT SWITCH
6-15-80
CYCLE #701
125VDC
90 PSIG
.4 Sec
TIMER #1

CYCLE #701

10 - AX5A003 - 5068 - 5

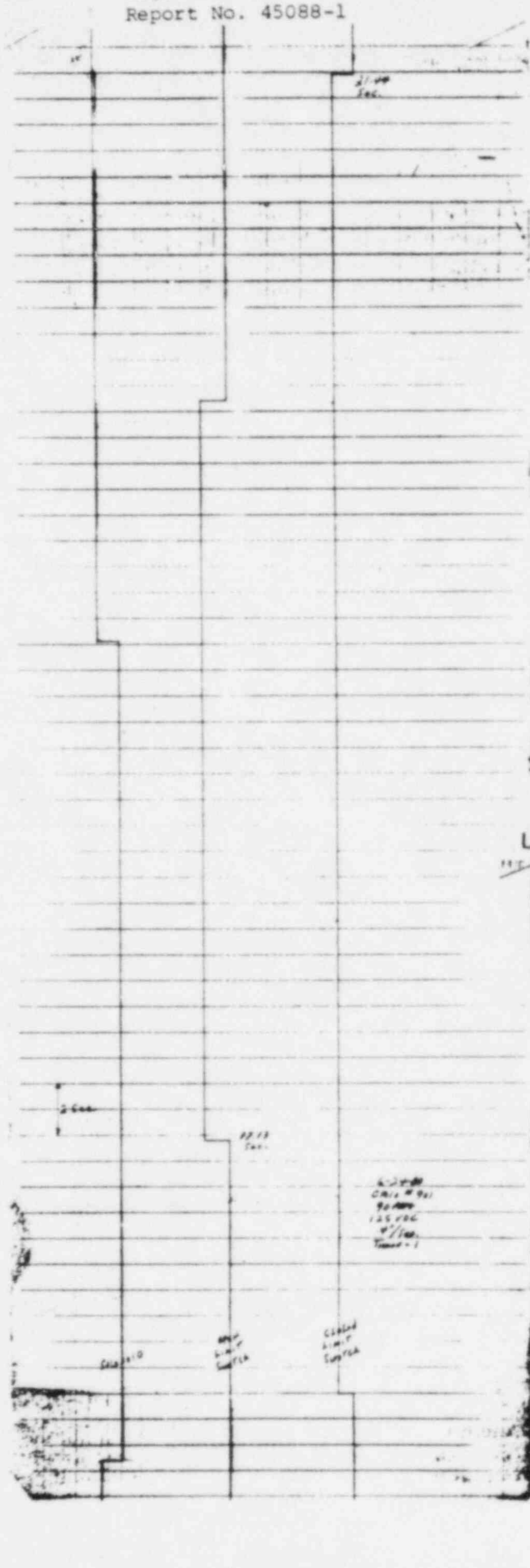
82



CYCLE #801

83

9310-AX5A(0)-5068-5



CYCLE #901

9510-AX5AC03-5068-5

84

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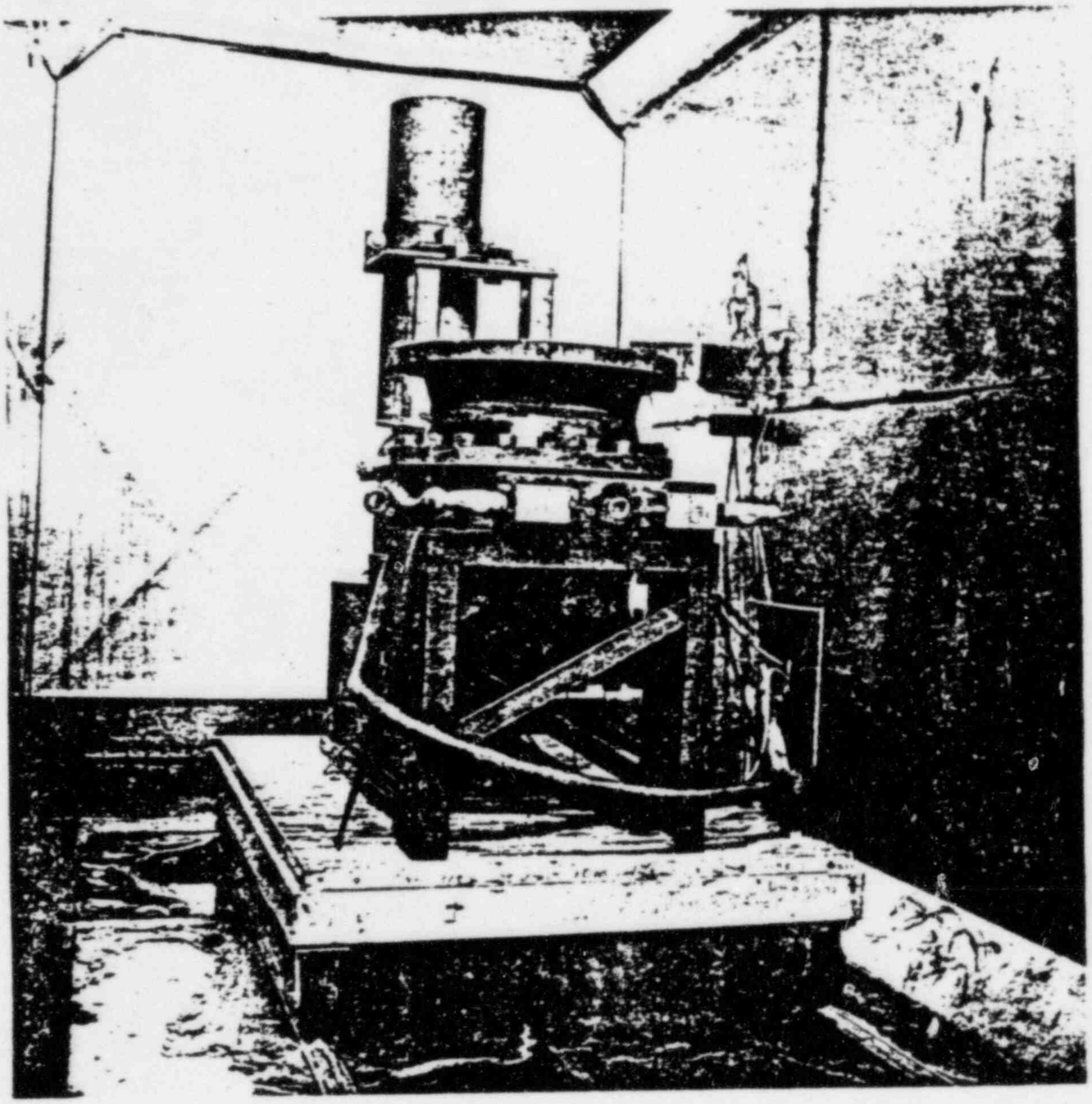
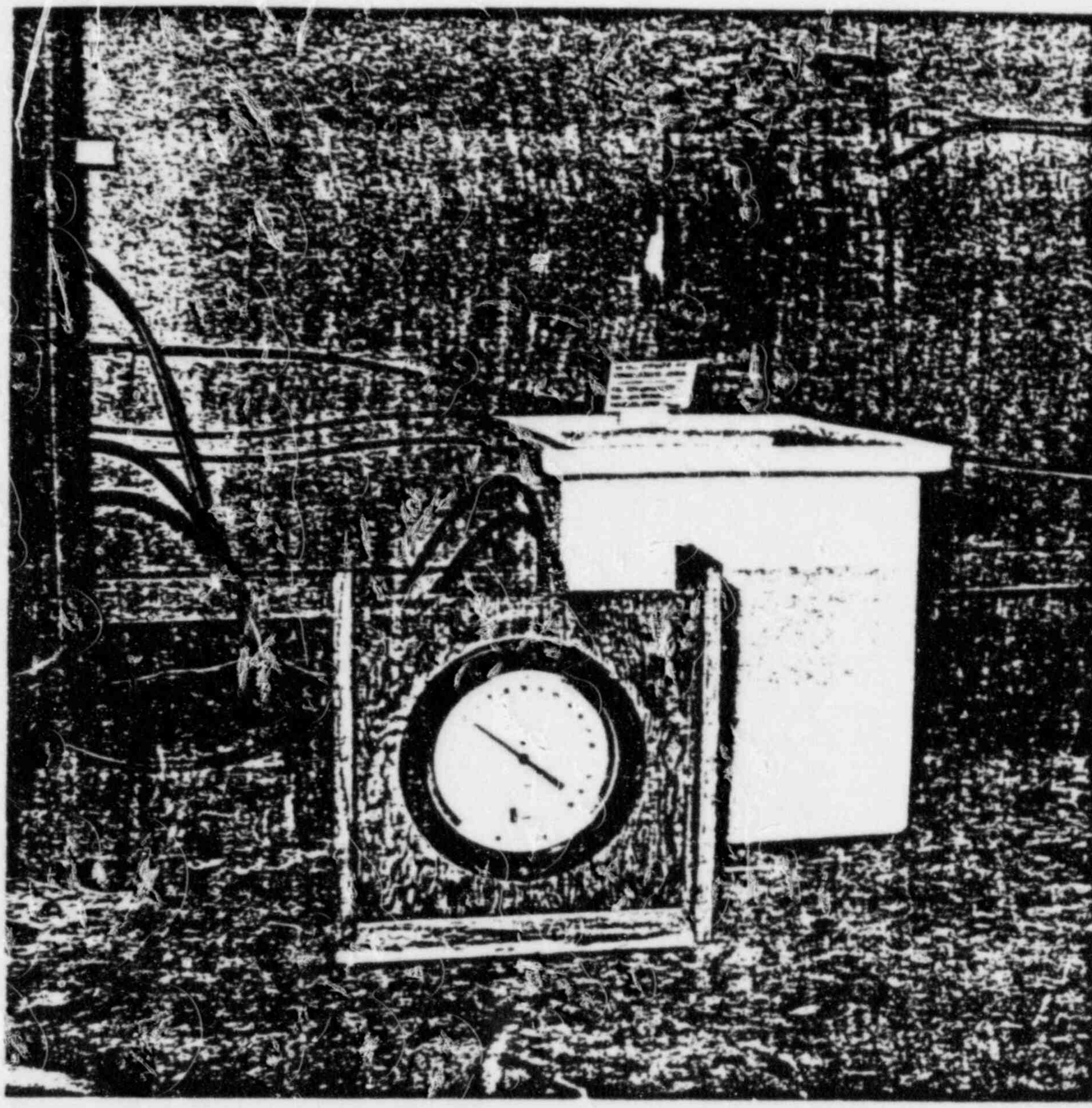
APPENDIX IV

PHOTOGRAPHS



PHOTOGRAPH V-1

20" VALVE/ACTUATOR AFTER AGING SIMULATION



PHOTOGRAPH V-2

LEAK CHECK EQUIPMENT

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APPENDIX V

DATA SHEETS

DATA SHEET

Customer Fisher Controls
Specimen 20" Butterfly Valve
Part No. Type 9200
Spec. FQP-19, Rev. E
Para. 4.5
S/N --
GSI --

Amb. Temp. 76°F
Photo —
Test Med. GN_2
Specimen Temp. 228°F

WYLE LABORATORIE
Job No. 45088
Report No. —
Start Date 5-5-80

Test Title Leak Check @ 228°F - High Temperature Cycle # 1

Temperature	Test Fluid	Test Pressure	Time	Leakage
228°F	GN_2	75 psid	5 min.	ZERO

Specimen Failed —
Specimen Passed ✓
NOA Written —

Tested By M Luttrell Date: 5-5-80
Witness — Date: —
Sheet No. 1 of 4
Approved Earl R Campbell

WH-614A

DATA SHEET

Customer: Fisher Controls
Specimen: 20" Butterfly Valve
Part No.: Type 9200
Spec.: FQP-19, Rev. E
Para.: 4.5
S/N: --
GSI: --

Amb. Temp.: 74°F
Photo: —
Test Med.: GN_2
Specimen Temp.: 228°F

WYLE LABORATORIES
Job No.: 45088
Report No.: —
Start Date: 5-20-80

Test Title: Leak Check @ 228°F - High Temperature Cycle # 4

Temperature	Test Fluid	Test Pressure	Time	Leakage
228°F	GN_2	75 psid	5 min.	ZERO

Specimen Failed: —
Specimen Passed: ✓
NOA Written: —

Tested By: M. Luthell Date: 5-20-80
Witness: — Date: —
Sheet No. 2 of 4
Approved: Earl R Campbell

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer: Fisher Controls
Specimen: 20" Butterfly Valve
Part No.: Type 9200
Spec.: FQP-19, Rev. E
Para.: 4.5
S/N: --
GSI: --

Amb. Temp.: 77°F
Photo: —
Test Med.: GN_2
Specimen Temp.: 228°F

Job No.: 45088
Report No.: —
Start Date: 6-10-80

Test Title: Leak Check @ 228°F - High Temperature Cycle # 7

Temperature	Test Fluid	Test Pressure	Time	Leakage
228°F	GN_2	75 psid	5 min.	ZERO

Specimen Failed: —
Specimen Passed: ✓
NOA Written: —

Tested By: M. Luttrell Date: 6-10-80
Witness: — Date: —
Sheet No. 3 of 4
Approved: Earl R. Campbell

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer: Fisher Controls
Specimen: 20" Butterfly Valve
Part No.: Type 9200
Spec.: FQP-19, Rev. E
Para.: 4.5
S/N: --
GSI: --

Amb. Temp.: 75°F
Photo: —
Test Med.: GN_2
Specimen Temp.: 228°F

Job No.: 45088
Report No.: —
Start Date: 6-23-80

Test Title: Leak Check @ 228°F - High Temperature Cycle # 10

Temperature	Test Fluid	Test Pressure	Time	Leakage
228°F	GN_2	75 psid	5 min.	Zero

Specimen Failed: —
Specimen Passed: ✓
NOA Written: —

Tested By: M. Lottsell Date: 6-23-80
Witness: — Date: —
Sheet No. 4 of 4
Approved: Earl R Campbell

WH-614A

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APPENDIX VI

INSTRUMENTATION EQUIPMENT SHEETS

INSTRUMENTATION EQUIPMENT SHEET

Date 5-1-80 Job No. 45088 Test Area ENV. LAB

Technician Larry Cole Customer Fisher Controls Type Test PRE Aging Functional & AGING SIMULATION

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	DMM	Keithley	179	—	11331	0-200VDC	mfg Spec	6-29-79	6-29-80
2	GALVO AMP	Honeywell	T6GA 500	—	11472	1-1	±2%	1-16-80	7-16-80
3	O'graph	Honeywell	1508	—	81026	0-1KHZ	±2%	12-11-79	6-11-80
4	D.C. Power Supply	Elect. Measurement	FR036-05	—	80246	0-36V 0-5A	±.1%R	11-8-79	5-8-80
5	D.C. Power Supply	Sorensen	DCR150-5	—	11309	0-150V 0-5A	±.1%R	2-25-80	8-25-80
6	Pressure Guage	MaxiSAFE	—	—	97745	0-600PSI	±1/2%FS	4-22-80	7-22-80
7	Pressure Guage	Robertshaw	ACRAGAGE	—	98092	0-200PSI	±1%	3-27-80	6-27-80
8	Megohmmeter	General Radio	1864	—	11898	500KΩ to 200,000MΩ	mfg spec	2-12-80	8-12-80

REVIEWED BY QA
DATE 7/6/9
INITIALS [illegible]

Instrument Test Engineer [signature] Checked & Received By Earl R Campbell

WH-1029

INSTRUMENTATION EQUIPMENT SHEET

Date 5-2-80 Job No. 45088-03 Test Area SCHMIDLI CHAMBER

Technician L. COLE Customer FISHER CONTROLS Type Test THERMAL AGING

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	DMM	KEITHLEY	179	—	11331	0-200VDC	MFG SPEC	6-29-79	6-29-80
2	GLAVO AMP	HONEYWELL	T6GA-80	—	11472	1 TO 1	±2%	1-16-80	7-16-80
3	O'GRAPH	HONEYWELL	1508	—	81026	0 TO 1KHZ	±2%	12-11-79	6-11-80
4	POWER SUPPLY	ELECTRONIC MEAS.	TR812A	2396	80247	0-100VDC	±.1%R	1-7-80	7-7-80
5	DC. POWER SUPPLY	SORENSEN	DCR150-5	—	11309	0-150VDC	±.1%R	2-25-80	8-25-80
6	PRESSURE GAGE	ROBERTSHAW	—	—	98092	0-200PSI	±1%F.S.	3-27-80	6-27-80
7	PRESSURE GAGE	MAXI SAFE	AmP T327	—	97745	0-600PSI	±1%F.S.	4-22-80	7-22-80
8	PRESSURE GAGE	U.S.G.	—	—	95032	0-200PSI	±1%F.S.	3-11-80	6-11-80
* 9	POWER SUPPLY	ELECTRONIC MEAS.	TR36-05	—	80246	0-36V	±.1%R	11-8-79 5-8-80	5-8-80 11-8-80
*	Instrument was	re-calibrated	on 5/8/80. see						

Instrument Test Engineer K Burkhart

Checked & Received By Earl R Campbell

WH-1029

Page No. V-37
Report No. 45088-1

9510-AX5AC03-5068-4

097

INSTRUMENTATION EQUIPMENT SHEET

Date 5-2-80 Job No. 45088-00-2381 Test Area CHAMBER #21

Technician M. LUTTRELL Customer FISHER CONTROLS Type Test Temp-Hum

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	RECORDER	BRISTOL	64A	12A-22566	95286	150-+300	± 1°F	2-15-80	5-15-80
2	RECORDER	BRISTOL	64A	6W-182	95050	150-+300	± 2°F	3-20-80	6-20-80
3	PRESS GAGE	ASHCROFT	MAXISAFE	—	97745	0-600	± 1%	4-22-80	7-22-80
4	PRESS GAGE	ROBERTSHAW	ACRGAGE	—	98088	0-200	± 1%	3-27-80	6-27-80
5	PRESS GAGE	US GAGE	200	—	95032	0-200	± 1%	3-11-80	6-11-80

Instrument Test Engineer [illegible] Checked & Received By Earl R Campbell

WII-1029

INSTRUMENTATION EQUIPMENT SHEET

Date 5·22·80 Job No. 45088 Test Area Environmental

Technician S. Rice Customer Fisher Controls Type Test Thermal Aging

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	Hygrometer	Hygrodynamics	15-3050	40237-9	95409	0-100 %RH, 0-140°F	±5%	10·30·79	10·30·80
2	DMM	Keithley	179	—	11331	Multi.	Mfg. Spec	6·29·79	6·29·80
3.	Galvo Amp	Honeywell	T6GA 500	—	11412	1-1	±2%	1·16·80	7·16·80
4.	Viscorder	Honeywell	1508	—	86026	0-1000HZ	±2%	6·18·80	12·18·80
5.	Power Supply	Electronic Meas.	TR 036	—	80246	0-35vdc	±0.1% Reg	5·8·80	11·8·80
6.	Power Supply	Sorensen	DCR 150-5	—	11309	0-150vdc	±0.1% Reg	2·25·80	8·25·80
7	Power Supply	Electronic Meas.	TR 212-A	—	80247	0-100 vdc	±0.1% Reg	1·7·80	7·7·80
8	Pressure Gauge	USG	—	19558	95032	0-200 PSI	±1% FS	6·10·80	9·10·80
9.	Pressure Gauge	Robert Shaw	—	—	98092	0-200 PSI	±1 PSI	3·27·80	6·27·80
10.	Pressure Gauge	USG	—	—	97745	0-600 PSI	±1% FS	4·22·80	7·22·80
11	DMM	Keithley	164	48003A	11305	Multi	Mfg. Spec	4·8·80	10·8·80
12.	Megohmmeter	General Radio	1863-C	2374	97892	5 Meg to 500K Meg	±3%	5·7·80	11·7·80
13	DMM	Fluke	8012	—	11703	MULTI	MFG. SPEC	5-16-80	8-16-80

Instrument Test Engineer K Burchart

Checked & Received By Earl E Campbell

WH-1029

SECTION VI

POST-AGING SIMULATION FUNCTIONAL TESTS

1.0 REQUIREMENTS

At the conclusion of the entire aging simulation sequence, the valve assembly shall be stabilized at ambient temperature and functional tests performed. The seat leakage test at this point shall be performed for information only because of the unrealistic nature of the compression set which is expected to occur during the high temperature phase of the aging simulation.

Following the functional tests described above, the T-ring seal shall be readjusted for a shut-off pressure differential of 75 psid.

Following readjustment of the T-ring seal, functional tests shall be performed.

2.0 PROCEDURES

The procedures for these tests are described in Section II, Paragraph 2.0, of this report.

3.0 RESULTS

The test item was subjected to the tests required by Paragraph 1.0. The tests were conducted as outlined in Paragraph 2.0 above. There was one (1) Notice of Anomaly written and described below.

After the Thermal/Cycle Aging Test was completed, the following anomalies were observed:

The flexible conduit from the junction box to the control box was split or cracked in 3 places.

A quantity of lubricant (≅1 pint) had leaked from the Bettis Actuator.

The Type EA180 (closed position) Namco Limit Switch had the normal open set of contacts sticking and intermittent.

The electrical measurements required by Paragraph 2.0, FQP-19 Rev. F, were not performed prior to adjusting the T-ring per the Customer's request. Only stroking time and leak checks were performed. The seat leakage was 4102 cu/in./min. of gaseous nitrogen at 10 psig differential across the disc.

3.0 RESULTS (Continued)

After adjusting the T-ring, there was zero leakage across the disc at 75 psid for 15 minutes, and the test item complied with all specified test requirements.

The test item's stroke times after the T-ring adjustment are shown below.

Voltage to Solenoid	Pressure to Solenoid	Stroke Times: Closed to Open	Stroke Times: Open to Closed
90 VDC	72 psig	24.00 sec.	18.53 sec.
125 VDC	73 psig	23.95 sec.	18.55 sec.
140 VDC	72 psig	23.50 sec.	18.13 sec.

Notice of Anomaly No. 2 is presented in Appendix I. Typical oscillograph recordings are presented in Appendix II. Photographs showing the cracks in the flexible conduit, and the lubricant leak are presented in Appendix III. Data Sheets showing data obtained are presented in Appendix IV, and an Instrumentation Equipment Sheet is presented in Appendix V of this Section.

APPENDIX I

NOTICE OF ANOMALY

NOTICE OF ANOMALY

NOTICE NO. 2 P. O. NUMBER: H-217770 WYLE JOB NO. 45088

CONTRACT NUMBER: N/A

CATEGORY: ☒ SPECIMEN ☒ PROCEDURE ☐ TEST EQUIPMENT DATE: June 26, 1980

TO: Fisher Controls ATTN: Orlin Klinkefus, Bill Haslett

PART NAME: 20" Butterfly Valve with a Type T-420B-SR-2-12 Bettis Actuator PART NO. Type 9200

TEST: Thermal/Cycle Aging I. D. NO. -

SPECIFICATION: Fisher-FQP-19 Rev. F PARA. NO. 4.0 and 4.6

NOTIFICATION MADE TO: Bill Haslett DATE: June 26, 1980

NOTIFICATION MADE BY: Earl Campbell VIA: Verbal

REQUIREMENTS:

Each temperature cycle will be 2.85 days at 227.8°F (108.8°C). Total exposure at temperature will be 28.5 days (10 cycles). Each humidity cycle will be 48 hours at 140°F (60°C) and 95^{+5}_{-0} per cent humidity. Total exposure to humidity will be 20 days (10 cycles). The test valve will be actuated for 1,000 operating cycles which will be evenly divided between the ten humidity cycles.

DESCRIPTION OF ANOMALY:

After the Thermal/Cycle Aging Test was completed, the following anomalies were observed:

1) The flexible conduit from the junction box to the control box was split or cracked in 3 places.
2) A quantity of lubricant (≈1 pint) had leaked from the Bettis Actuator.
3) The Type EA180 (closed position) Namco Limit Switch has the normal open set of contacts sticking and intermittent.
4) The electrical measurements required by P.G. 2.0, FQP-19 Rev. F were not performed per the customer's request. Only stroking time and leak checks were performed. The seal leakage was 4102 cu/in/min of GN_2 at 10 PSIG differential.

DISPOSITION – COMMENTS – RECOMMENDATIONS:

Make "T" Ring (Seal) adjustment and perform functional tests and leak check tests per the customer's request.

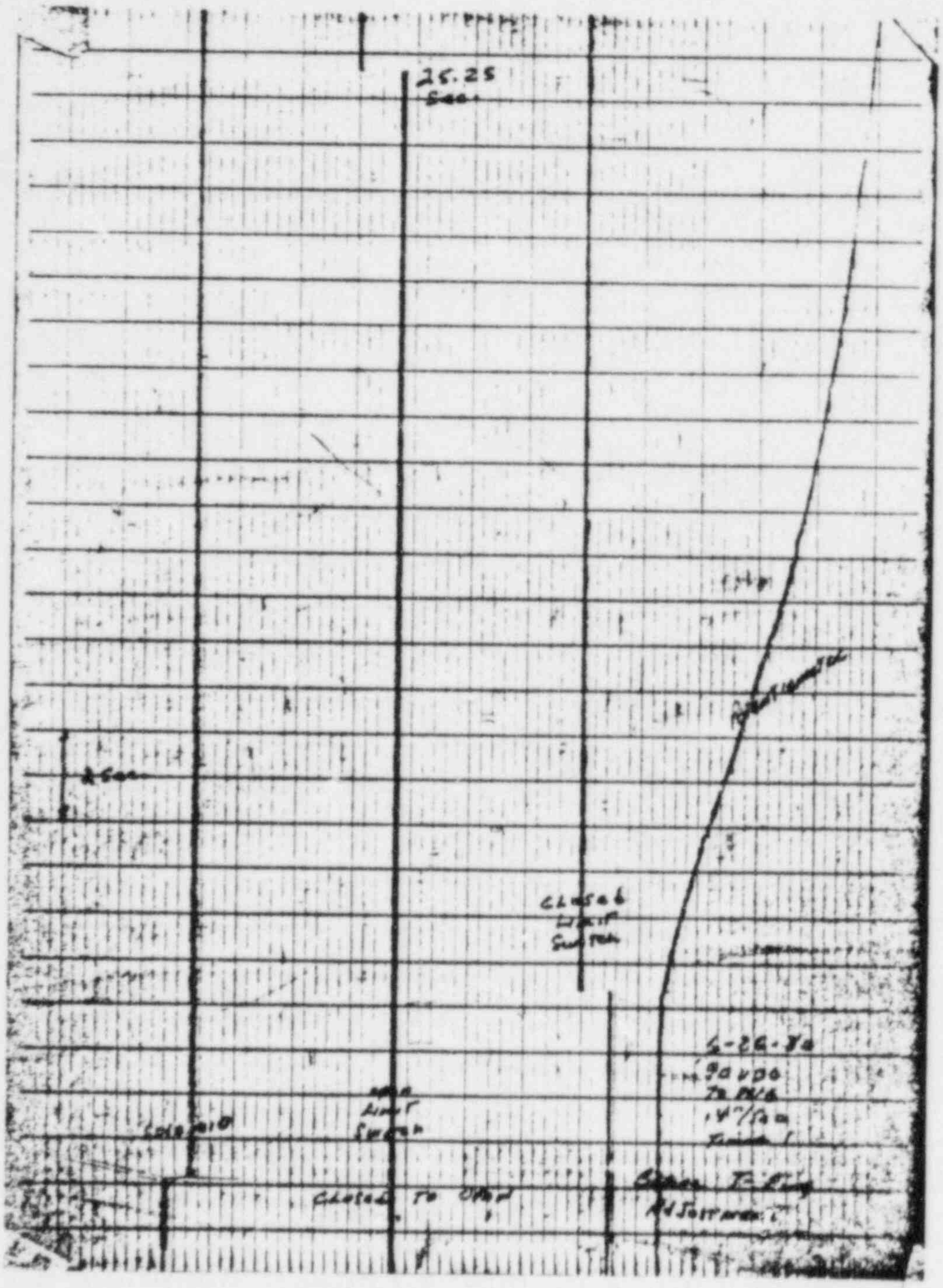
DISTRIBUTION:
Original: Dept.
1 Copies: Customer
2 Copies: Q. C.
2 Copies Project Office
1 Copy: Contracts
1 Copy: Operations Director

TEST WITNESS —
—
REPRESENTING —

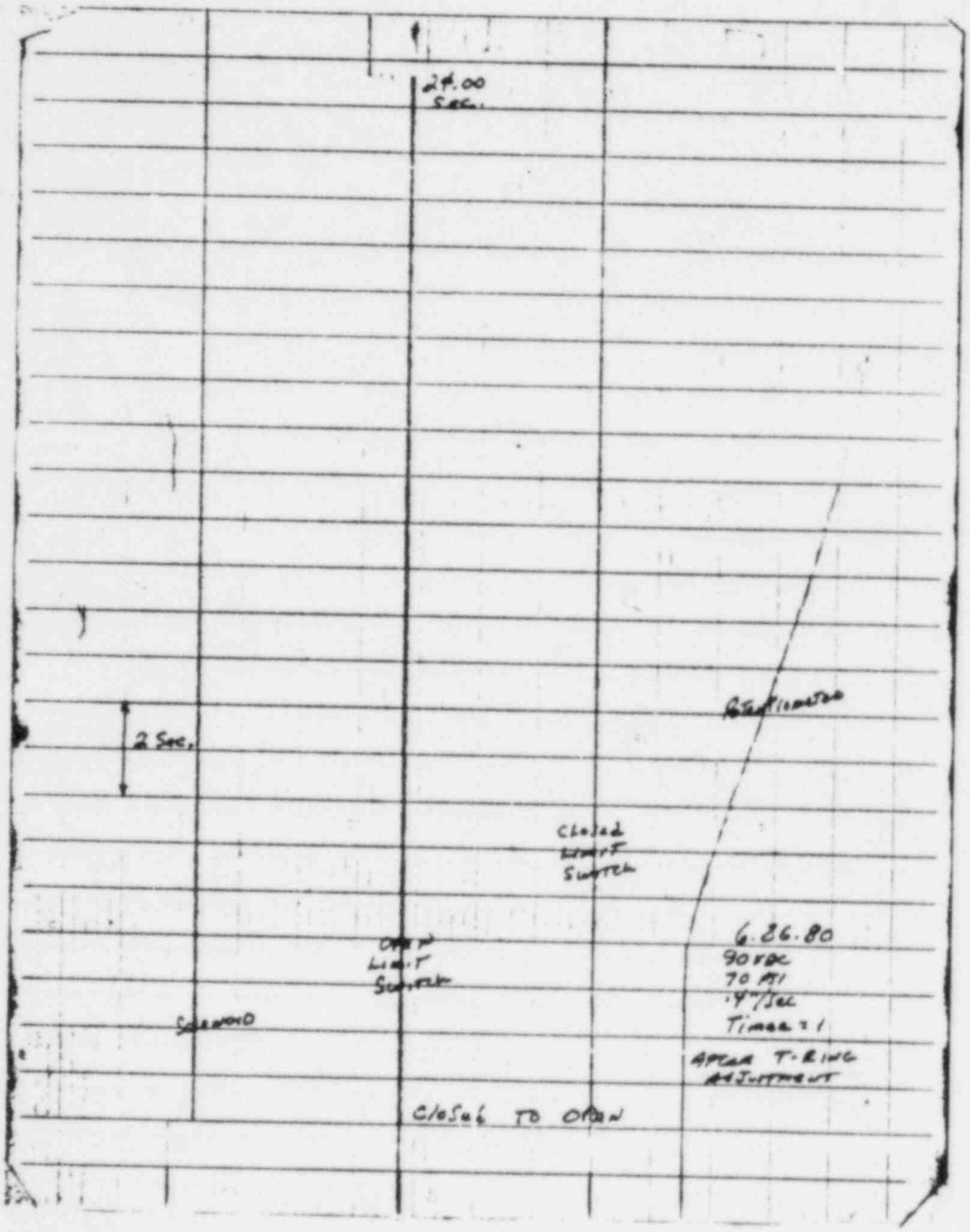
ENGINEER Earl R. Campbell
QUALITY CONTROL [illegible signature]
PROJECT MANAGER Robert A. Hall

APPENDIX II

TYPICAL OSCILLOGRAPH RECORDINGS



BEFORE T-RING ADJUSTMENT



AFTER T-RING ADJUSTMENT

107

7210-AX5AC03-5068-5

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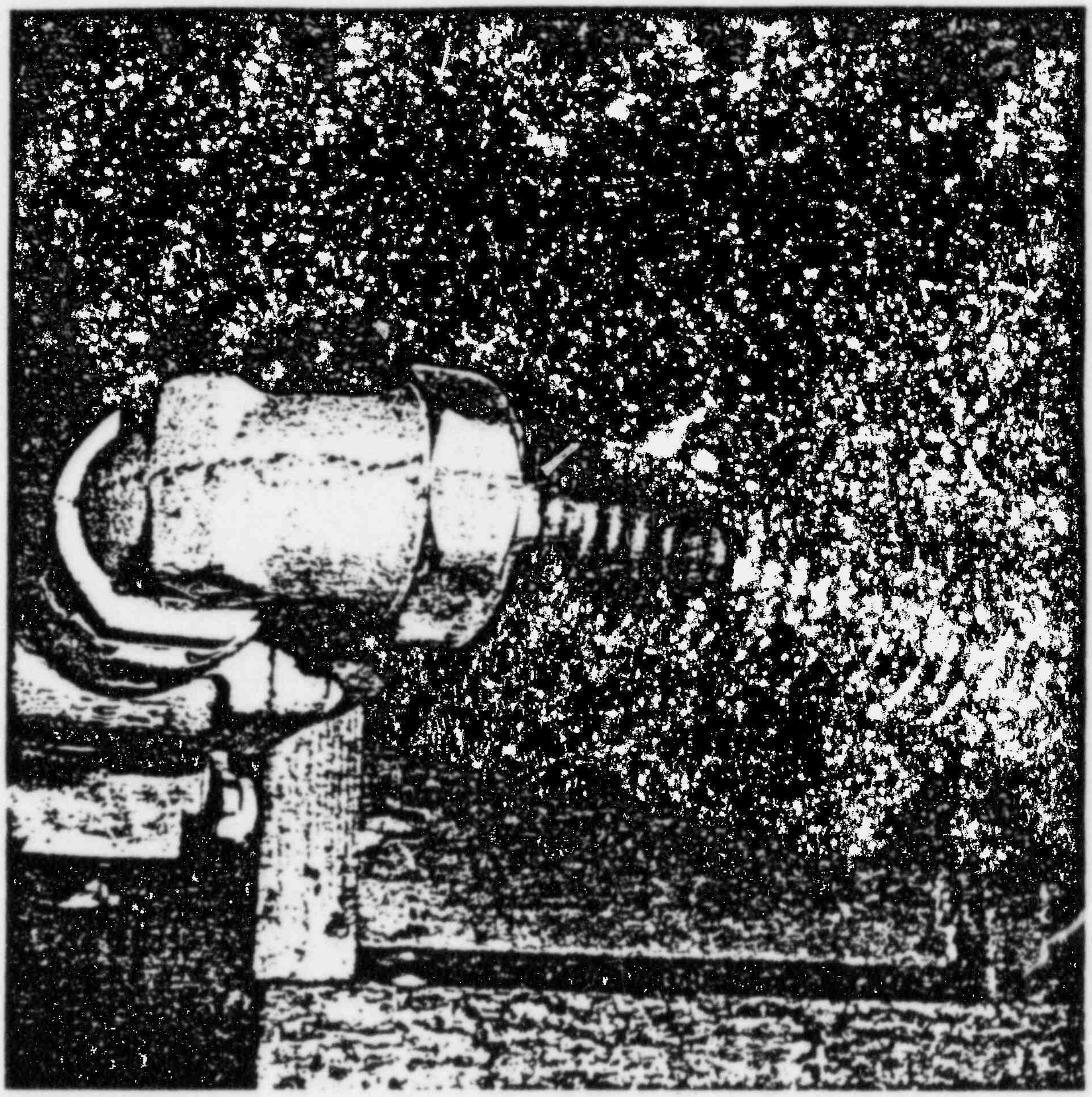
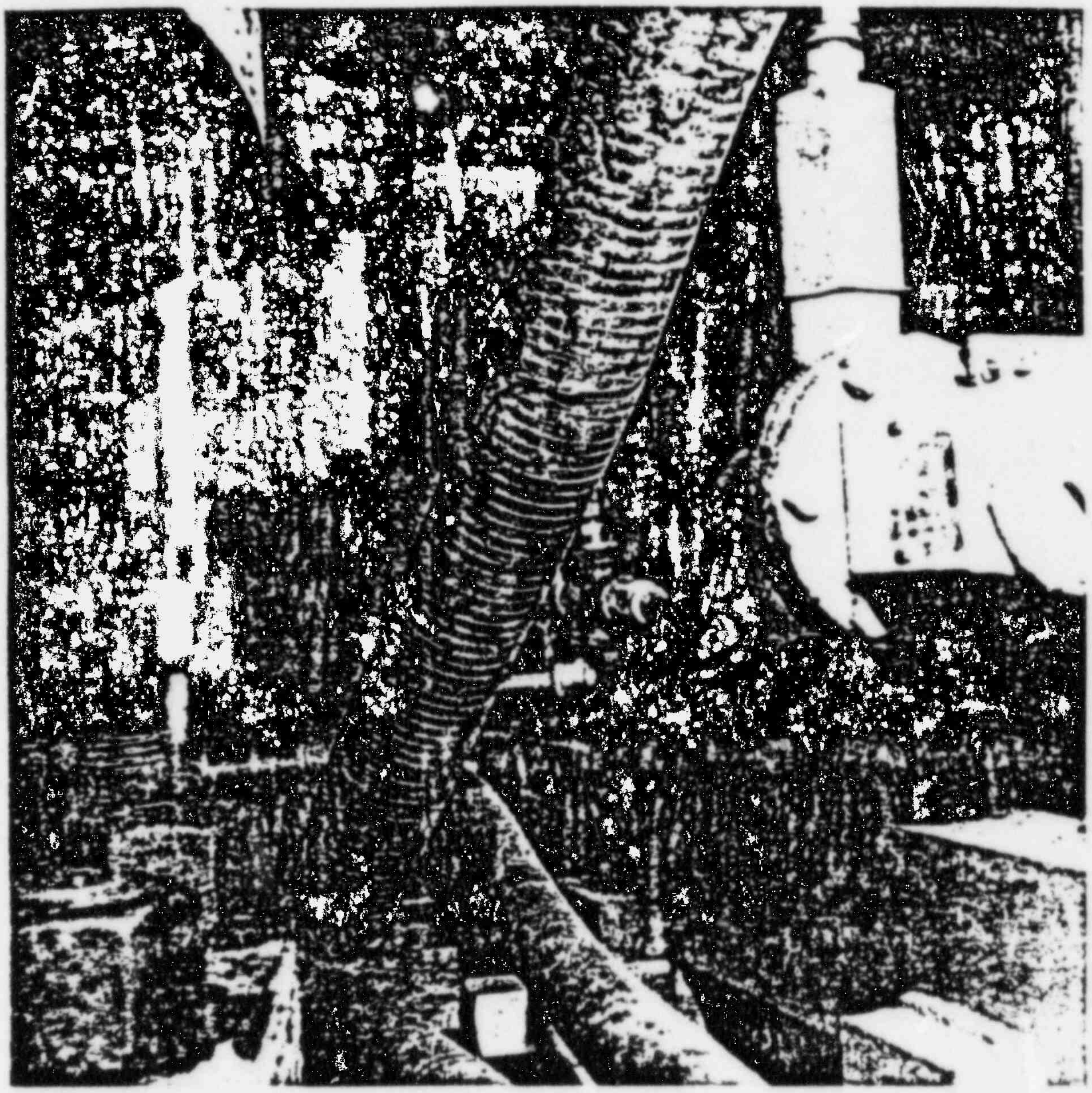
APPENDIX III

PHOTOGRAPHS



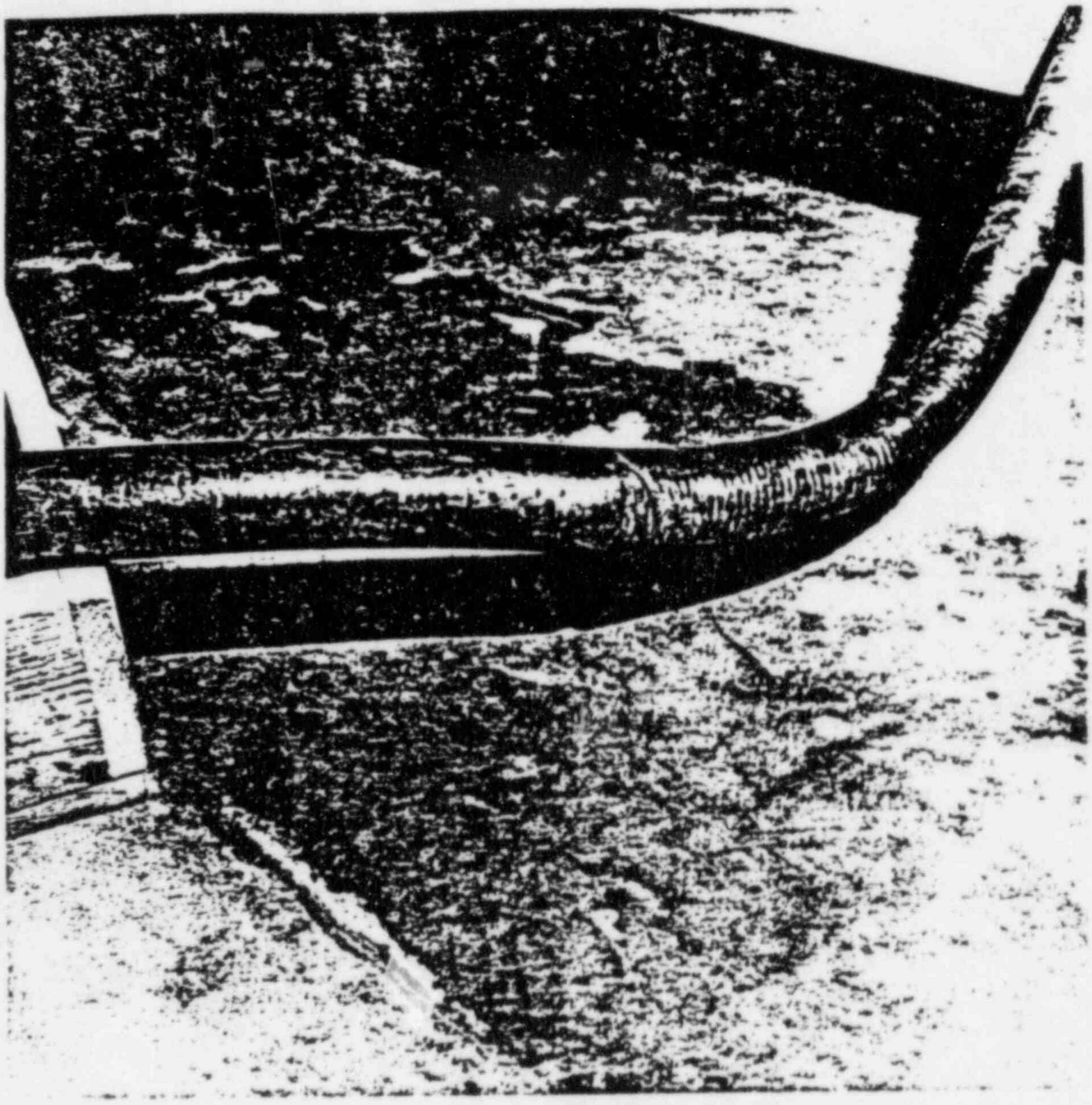
PHOTOGRAPH VI-1

CRACKED FLEXIBLE CONDUIT



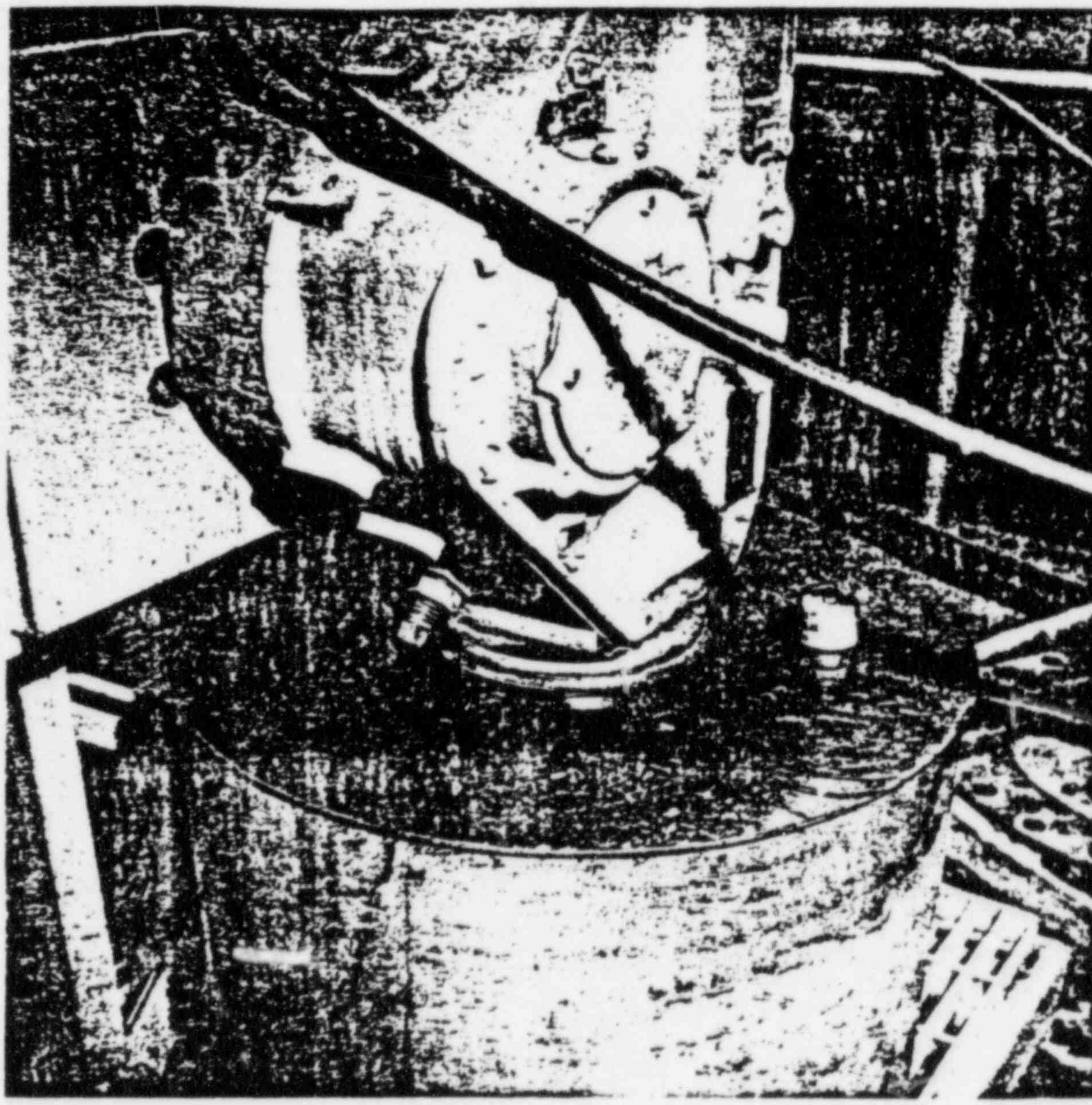
PHOTOGRAPH VI-2

CRACKED FLEXIBLE CONDUIT



PHOTOGRAPH VI-3

CRACKED FLEXIBLE CONDUIT



PHOTOGRAPH VI-4

LUBRICANT LEAK FROM THE BETTIS ACTUATOR

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APPENDIX IV

DATA SHEETS

DATA SHEET

WYLE LABORATORIES

Customer Fisher Controls Company
Specimen 20" Butterfly Valve
Part No. Type 9200
Spec. Fisher Document, FOP-19
Para. 2.0
S/N ---
GSI ---

Amb. Temp. 82°F
Photo Yes
Test Med. GN_2
Specimen Temp. Amb.

Job No. 45088
Report No. —
Start Date 6·26·80

Test Title FUNCTIONAL Before T-Ring Adjustment

	90 VDC	125 VDC	140 VDC
Type of Gas	GN_2	GN_2	GN_2
Pressure of Gas to Solenoid	70 PSI	70 PSI	70 PSI
Regulator Pressure Inlet:	120 PSI	120 PSI	120 PSI
Outlet:	70 PSI	70 PSI	70 PSI
Time duration of Operating Cycle: (sec)			
Closed to Open:	25.25 Sec.	23.75 Sec.	23.00 Sec.
Open to Closed:	19.50 Sec.	18.35 Sec.	18.00 Sec.
Indicator Light Function	O.K.	O.K.	O.K.
Voltage to Solenoid	90 VDC	125 VDC	140 VDC
Voltage to Limit Switch	90 VDC	125 VDC	140 VDC
Seat Leakage @ ~~psig~~ for 15 minutes 10 PSIG sc	4102 $IN^3/MIN.$ (Information Only)		

Specimen Failed —
Specimen Passed ✓
NOA Written —

Tested By Robert R Coleman Date: 6·26·80
Witness — Date: —
Sheet No. 1 of 3
Approved Earl R Campbell

WH-A14A

DATA SHEET

Page No. VI-17
Report No. 45088-1

WYLE LABORATORIES

Customer: Fisher Controls Company
Specimen: 20" Butterfly Valve
Part No.: Type 9200
Spec.: Fisher Document, FOP-19
Para.: 2.0
S/N: ---
GSI: ---

Amb. Temp.: 82°F
Photo: Yes
Test Med.: GN_2
Specimen Temp.: AMB.

Job No.: 45088
Report No.: —
Start Date: 6-26-80

Test Title: FUNCTIONAL After T-Ring Adjustment

	90 VDC	125 VDC	140 VDC
Type of Gas	GN_2	GN_2	GN_2
Pressure of Gas to Solenoid	72 PSI	73 PSI	72 PSI
Regulator Pressure Inlet:	140 PSI	140 PSI	140 PSI
Outlet:	72 PSI	72 PSI	72 PSI
Time duration of Operating Cycle: (sec)			
Closed to Open:	24.00 Sec.	23.95 Sec.	23.50 Sec.
Open to Closed:	18.53 Sec	18.55 Sec.	18.13 Sec.
Indicator Light Function	O.K.	O.K.	O.K.
Voltage to Solenoid	90 VDC	125 VDC	140 VDC
Voltage to Limit Switch	90 VDC	125 VDC	140 VDC
Seat Leakage @ ~~60 psig~~ 75 PSIG for 15 minutes	Zero		

Specimen Failed: —
Specimen Passed: ✓
NOA Written: —

Tested By: Robert R Colema Date: 6-26-80
Witness: — Date: -
Sheet No. 2 of 3
Approved: Earl R Campbell

DATA SHEET

Customer Fisher Controls
Specimen 20" Butterfly Valve
Part No. Type 9200
Spec. FQP-19, Rev. E
Para. 2.0
S/N ---
GSI ---

Amb. Temp. 82°F
Photo Yes
Test Med. GN_2
Specimen Temp. Amb.

WYLE LABORATORIES
Job No. 45088
Report No. —
Start Date 6·26·80

Test Title Post Thermal Atint

o	Solenoid Resistance		
	- Terminal 2 to 3 in the box		841 Ω
o	Contact Resistance, Switch No. 2		
	- Wire 1 & 2, Contact A & B	(Switch closed)	953 mΩ @ 1ma.
o	Contact Resistance, Switch No. 2		
	- Wire 3 & 4, Contact G & H	(Switch closed)	5.9 Ω
o	Solenoid Resistance to Ground		100 MΩ @ 500VDC
o	Contact Resistance, Switch No. 2		
	- Wire 1 & 2, Contact A & B	(Switch open)	1.3×10^5 MΩ @ 500VDC
o	Contact Resistance, Switch No. 2		
	- Wire 3 & 4, Contact G & H	(Switch open)	1.4×10^5 MΩ @ 500VDC

Ambient Temperature: 82°F
Relative Humidity: 60%
Lights on Box: O.K.

Specimen Failed —
Specimen Passed ✓
NOA Written —

Tested By Robert R Coleman Date: 6·26·80
Witness — Date: —
Sheet No. 3 of 3
Approved Earl R Campbell

WH-614A

APPENDIX V

INSTRUMENTATION EQUIPMENT SHEET

INSTRUMENTATION EQUIPMENT SHEET

Date 6-26-80 Job No. 45088-03 Test Area Environmental

Technician S. Rice Customer Fisher Controls Type Test Post Thermal Aging

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1.	Hygrometer	Hygrodynamics	15-3050	40237-9	95409	0-100 %Hum 0-140°F	± 5%	10-30-79	10-30-80
2.	DMM	Keithley	179	—	11331	Multi	Mfg. Spec	6-29-79	6-29-80
3.	Galva Amp	Honeywell	T6GA-500	—	11412	1-1	± 2%	1-16-80	7-16-80
4.	Viscorder	Honeywell	1508	—	81026	0-1000Hz	± 2%	6-18-80	12-18-80
5.	Power Supply	Electronic Meas.	TR036	—	80246	0-35vdc	± 0.1% Reg	5-8-80	11-8-80
6.	Power Supply	Sorensen	DCR 150-5	—	11309	0-150vdc	± 0.1% Reg	2-25-80	8-25-80
7.	Power Supply	Electronic Meas.	TR212-A	—	80247	0-100vdc	± 0.1% Reg	1-7-80	7-7-80
8.	Pressure Gauge	USG	—	19558	95032	0-200 PSI	± 1% FS	6-10-80	9-10-80
9.	Pressure Gauge	Robertshaw	—	—	98092	0-200 PSI	± 1 PSI	3-27-80	6-27-80
10.	Pressure Gauge	USG	—	—	97745	0-600 PSI	± 1% F.S.	4-22-80	7-22-80
11	DMM	Keithley	164	48003A	11305	Multi	Mfg. Spec	4-8-80	10-8-80
12.	Megohmmeter	General Radio	1862-C	2374	97892	5 Meg to 600K Meg	± 3%	5-7-80	11-7-80
13	DMM	Fluke	8012	—	11703	MULTI	MFG. SPEC	5-16-80	8-16-80

Page No. VI-20
Report No. 45088-1

Instrument Test Engineer K Bembaut

Checked & Received By Earl R Campbell

WH-1029

SECTION VII

NUCLEAR RADIATION EXPOSURE

1.0 REQUIREMENTS

The radiation exposures for normal operation and a Design Basis Event (DBE) shall be combined into a single exposure. The test valve assembly shall be uniformly exposed to a source of Cobalt-60 for a period that will yield an exposure of 1.0×10^7 Rads equivalent air dose.

The radiation dose rate shall be low enough to limit the temperature rise of the valve to 20°C. In no event shall the radiation dose rate exceed 1.0 Megarad per hour.

2.0 PROCEDURES

The test item was transported to Isomedix, Inc., Parsippany, New Jersey, and exposed to a source of Cobalt-60 for a time that yielded a total integrated dose of 1.0×10^7 Rads of gamma radiation (air-equivalent).

The dose rate was 0.11 Megarad/hour and the total exposure time was 99 hours, yielding a total dose of 10.8 Megarads gamma radiation. The test item was rotated 180° halfway through the test to allow a uniform dose of radiation.

3.0 RESULTS

The test item was subjected to the test required by Paragraph 1.0. The test was conducted as described in Paragraph 2.0 above. There was no visual evidence of damage or degradation due to the exposure to the gamma radiation. A Letter of Certification, and sketches showing the test setup are presented in Appendix I of this Section.

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APPENDIX I

LETTER OF CERTIFICATION
AND
SKETCHES SHOWING TEST SETUP

ISOMEDIX

July 22, 1980

Mr. Earl Campbell
Wyle Labs
7800 Governors Lane West
Huntsville, Alabama 35807

Dear Mr. Campbell:

This will summarize parameters pertinent to the irradiation of one (1) 20" Butterfly valve, as per your Purchase Order No. 4-4613-5, dated June 23, 1980. This is Phase I of Wyle Job No. 45088.

The specimen was exposed for a period of 99 hours at an average dose rate of .11 megarads per hour. The calculated dose based on dosimetry is 11 megarads. Incorporating the ±3% accuracy of the dosimetry system, therefore, the reported minimum dose is 10 megarads. Halfway through the exposure, the specimen was rotated 180 degrees to give a more uniform dose distribution.

Dosimetry was performed using Harwell Red 4034 Perspex dosimeters utilizing a Bausch and Lomb Model 710 spectrophotometer as the readout instrument. This system is calibrated directly with NBS, with the last calibration being June 6, 1980. A copy of the dosimetry correlation report is available upon request.

Irradiation was conducted in air at ambient temperature and pressure. Radiant heat from the source heated the samples somewhat, but the temperature did not exceed 85 degrees F, as indicated by previous measurements on an oil solution in the same relative position.

Irradiation was initiated on July 4, 1980 and was completed on July 10, 1980.

Sincerely yours,
ISOMEDIX, INC.

David P. Constantine

David P. Constantine
Production Manager

DPC:pv
cc: George Dietz

Isomedix Inc. • 25 Eastmans Road, Parsippany, New Jersey 07054 • (201) 887-2666

MINIMUM REQUIREMENTS FOR RADIATION TESTING

A. Irradiation Performance

1. Butterfly Valve
   Start Date 7-4-80 End Date 7-10-80

2. Cumulative dosage in air.

3. Irradiation geometry (See attached sheet.)
   a. Irradiation chamber or room.
   b. Source location(s), size, quantity, & distance(s) to specimen.
   c. Dosimetry location(s).
   d. Specimen location.
   e. Was specimen or source on a conveyor, turntable, or moved during testing? Yes

B. Nomenclature:

1. Wyle Purchase Order Number: 4-4613-S

2. Test Specimen description
   a. Manufacturer: Fisher
   b. Specimen name(s): 20" Butterfly Valve

C. Irradiation Source:

1. Type of source: Encapsulated source

2. Isotope: CO-60

3. Type(s) of radiation: Gamma

4. Energy of radiation: 2.5 MEV/disintegration

5. Source quantity or power used for irradiation: Approx. 1.1 Mci

D. Dosimetry Used:

1. Type: Red Perspex

2. Manufacturer and model number: Harwell 4034 J

3. Accuracy ±2%

4. Calibration traceability to NBS: Yes. Latest calibration date - June 6, 1980

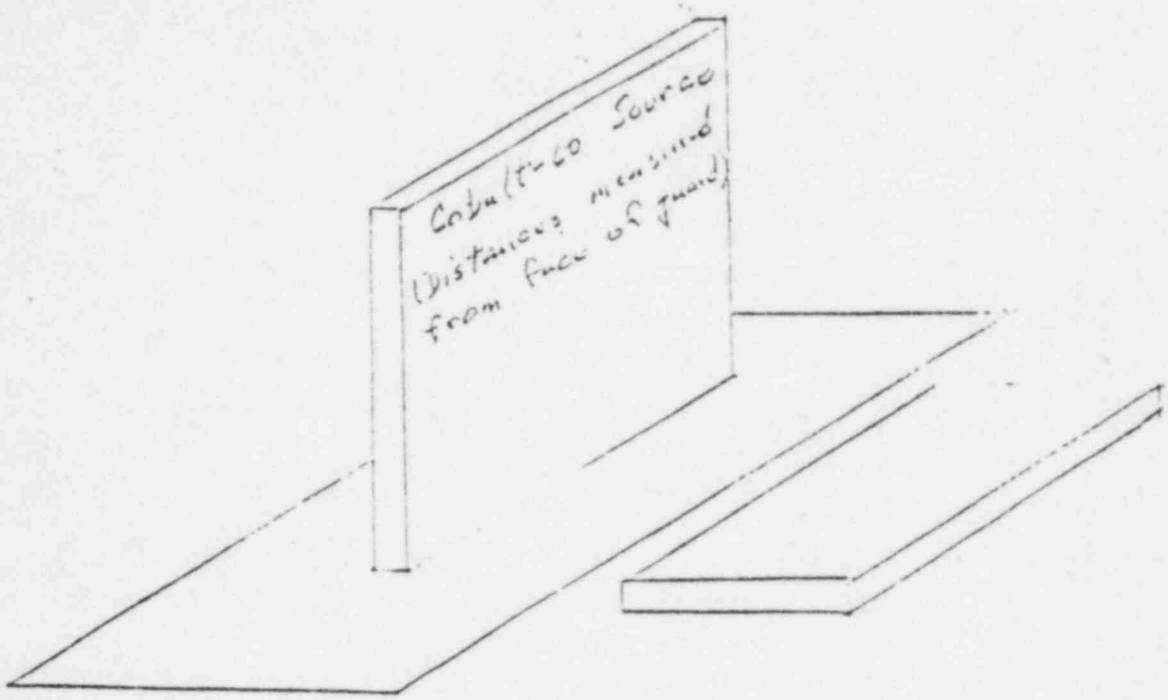
9510-AX5AC03-5068-5

125

ISOMEDIX

CLIENT: Wyle Labs
PURCHASE ORDER: 4-4613-S
PROJECT NO. —
TEST ITEM(S) 20" Butterfly Valve

DATE EXPOSURE BEGAN: 7-4-80
DATE EXPOSURE COMPLETED: 7-10-80
TOTAL HOURS OF EXPOSURE: 99



DISTANCES: Source guard to midpoint of test item: 120 in.
Source guard to closest point of test item: 106 in.
Source guard to farthest point of test item: 134 in.

Number of times that test item was rotated for improved uniformity of dose: ONCE

DOSIMETRY RESULTS Type:	Dosimeter No.	Distance To Guard (in)	Exposure Time (hours)	Measured Dose (Mrd)	(Calculated) Average Dose Rate (Mrd/hr)	Total Mrd
☒ Harwell Red	A		99		0.11	10.8
	B					
☐ AECL Perspex	C					
	D					

PREPARED BY: David P. Constantine DATE 7-21-80

ISOMEDIX INC.

SECTION VIII

POST-RADIATION FUNCTIONAL TESTS

1.0 REQUIREMENTS

The requirements for these tests are outlined in Section II, Paragraph 1.0, of this report.

2.0 PROCEDURES

The procedures for these tests are described in Section II, Paragraph 2.0, of this report.

3.0 RESULTS

The test item was subjected to the tests required by Paragraph 1.0. The tests were conducted as described in Paragraph 2.0 above.

The test item complied with all specified test requirements although one anomaly was noted (reference Notice of Anomaly No. 3, Appendix I, of this Section), and is described below.

The 1/4" copper tube, connecting the solenoid valve and Versa valve, was bent during shipment. There was gaseous nitrogen leakage past the piston of the pneumatic actuator (Bettis P/N T420B-SR2-12) at a rate of 314.3 cc/sec.

The leakage past the actuator piston stopped after the valve was operated several times.

The test item's stroke times are shown below:

		Stroke Times	
Voltage to Solenoid	Pressure to Solenoid	Closed to Open	Open to Closed
90 VDC	72 psi	25.20 sec	18.75 sec
125 VDC	72 psi	24.00 sec	18.68 sec
140 VDC	72 psi	23.75 sec	18.55 sec

There was zero leakage past the valve disc at 75 psid for 15 minutes.

3.0 RESULTS (Continued)

Notice of Anomaly No. 3 is presented in Appendix I. A typical oscillograph recording showing valve stroke time is presented in Appendix II. Photogrpahs showing the bent 1/4" copper tube on the Versa valve and the test setup are presented in Appendix III. Data Sheets showing the data obtained are presented in Appendix IV, and an Instrumentation Equipment Sheet is presented in Appendix V of this Section.

APPENDIX I

NOTICE OF ANOMALY

NOTICE OF ANOMALY

NOTICE NO. 3 P. O. NUMBER: H-217770 WYLE JOB NO. 45088

CONTRACT NUMBER: N/A

CATEGORY: ☒ SPECIMEN ☐ PROCEDURE ☐ TEST EQUIPMENT DATE: July 28, 1980

TO: Fisher Controls ATTN: Orlin Klinkefus & Bill Haslett

PART NAME: 20" Butterfly Valve PART NO. Type 9200

TEST: Post-Radiation Functional Test I. D. NO. ----------

SPECIFICATION: Fisher FQP-19 Rev. F PARA. NO. 3.1

NOTIFICATION MADE TO: Bill Haslett DATE: 7-24-80

NOTIFICATION MADE BY: Earl Campbell VIA: Verbal

REQUIREMENTS:

Following the radiation exposure, functional tests shall be performed per Section 2.0. The seat leakage test at this point will be performed for information only.

DESCRIPTION OF ANOMALY:

The 1/4" copper tube, connecting the solenoid valve and Versa valve, was bent during shipment. There was GN_2 leakage past the piston of the pneumatic actuator (Bettis P/N T420B-SR2-12) at a rate of 314.3 cc/sec.

DISPOSITION – COMMENTS – RECOMMENDATIONS:

The bent copper tube does not impair the operability of the test item. Continue testing per the Customer's request.

DISTRIBUTION:
Original: Dept.
( ) Copies: Customer
2 Copies: Q. C.
2 Copies Project Office
1 Copy: Contracts
1 Copy: Operations Director

TEST WITNESS —

—

REPRESENTING —

ENGINEER Earl R. Campbell

QUALITY CONTROL [signature]

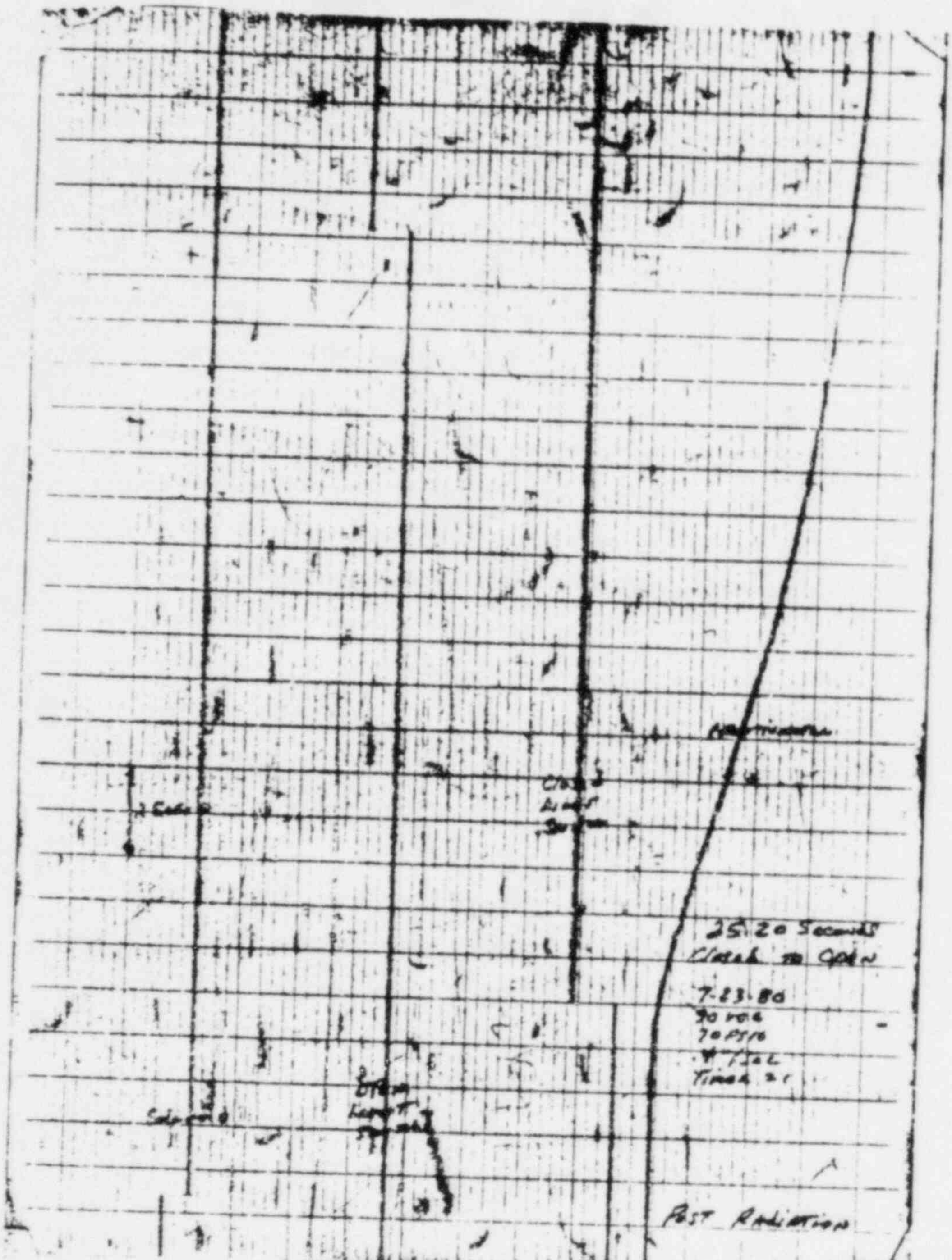
PROJECT MANAGER [signature]

APPENDIX II

TYPICAL OSCILLOGRAPH RECORDING

9510-AX5AC03-5068-5

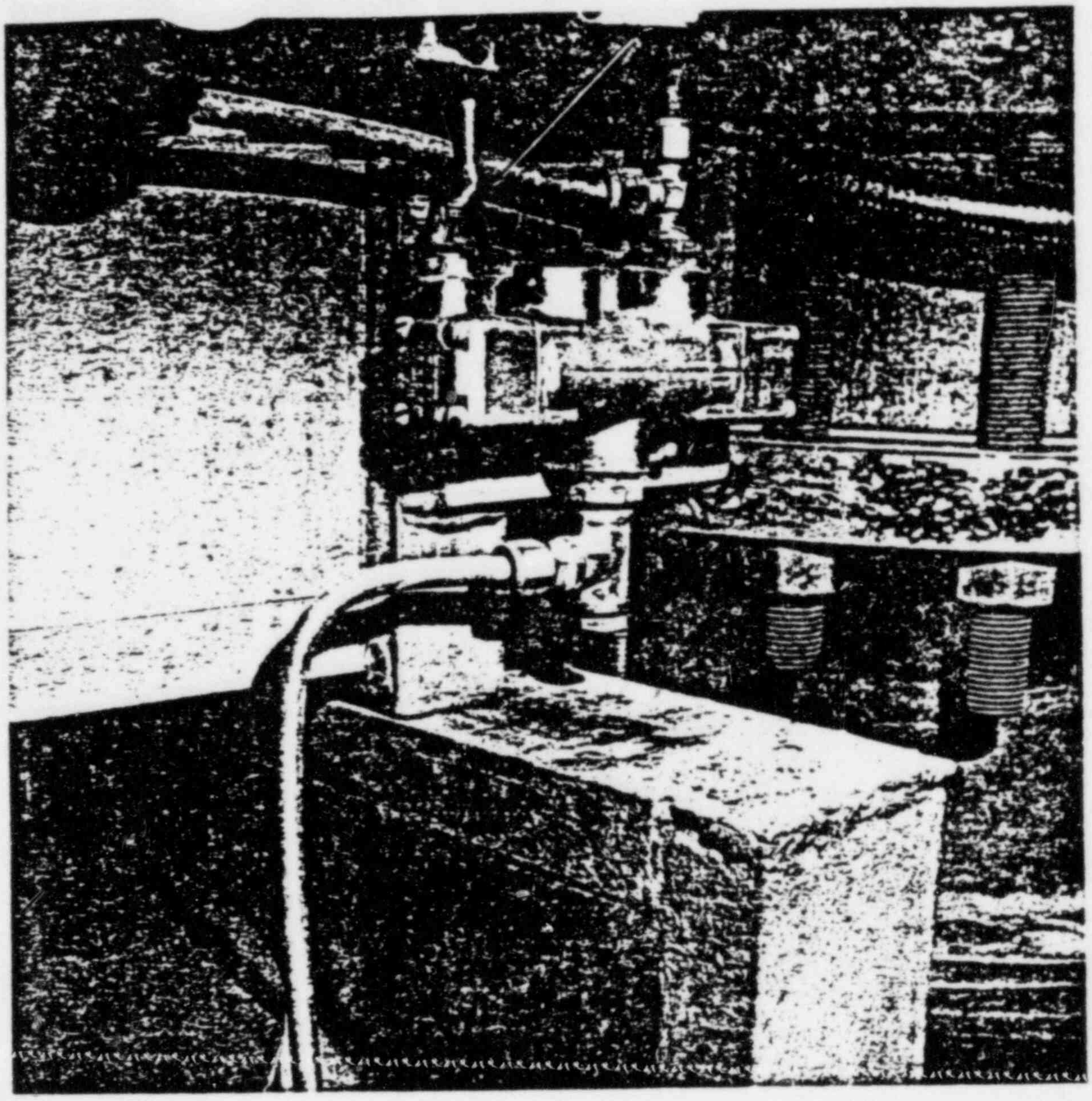
131



POST-RADIATION
TYPICAL STROKE TIME

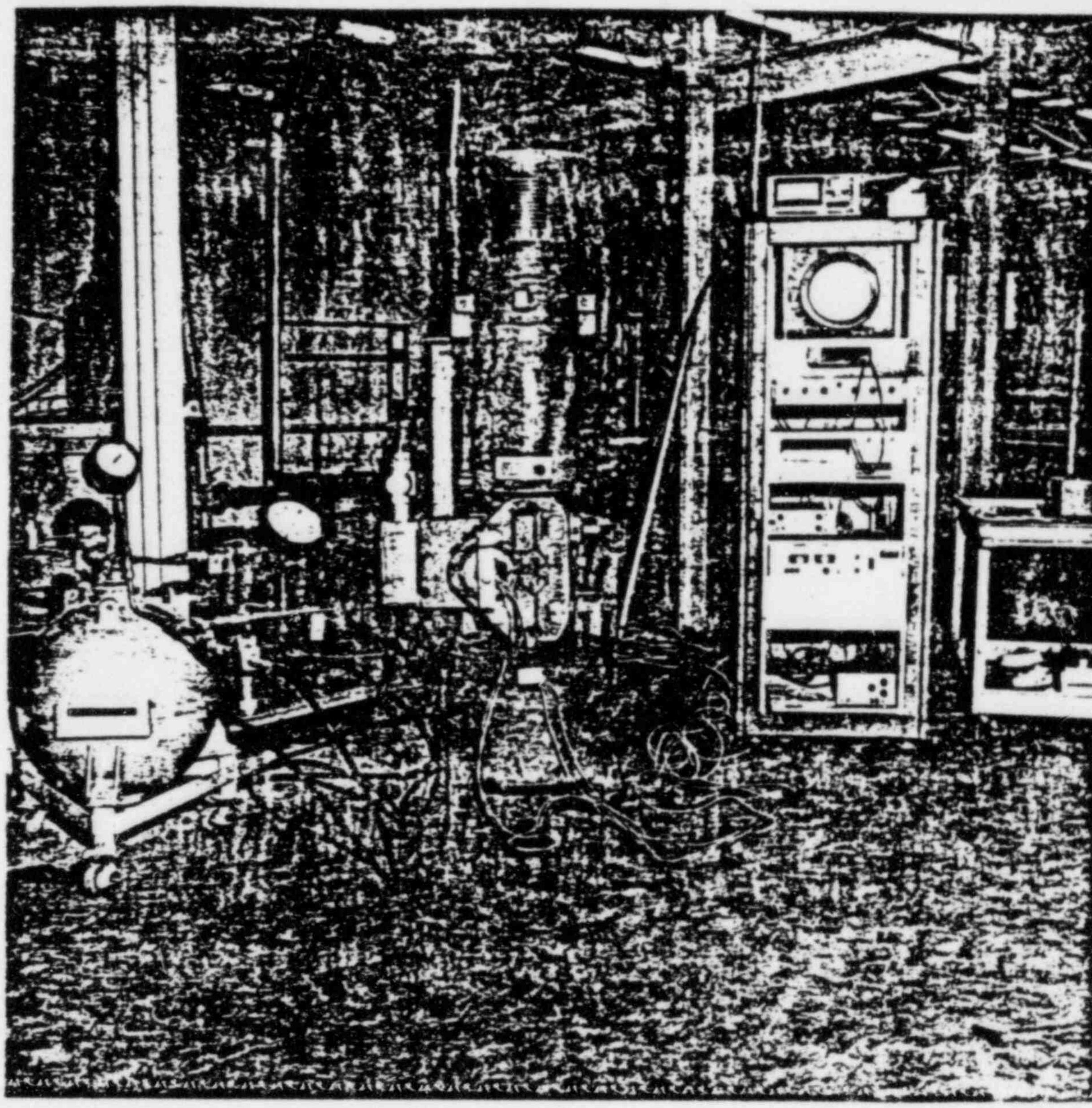
APPENDIX III

PHOTOGRAPHS



PHOTOGRAPH VIII-1

BENT COPPER TUBING
ON
VERSA VALVE



PHOTOGRAPH VIII-2

TEST SETUP
POST-RADIATION FUNCTIONAL

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APPENDIX IV

DATA SHEETS

DATA SHEET

Customer Fisher Controls Company

Specimen 20" Butterfly Valve

Part No. Type 9200

Spec. Fisher Document, FOP-19

Para. 2.0

S/N ---

GSI ---

Amb. Temp. 81°F

Photo Yes

Test Med. GN_2

Specimen Temp. Room Amb.

WYLE LABORATORIES

Job No. 45088-03

Report No. —

Start Date 7.23.80

Test Title BASELINE FUNCTIONAL Post Radiation

	90 VDC	125 VDC	140 VDC
Type of Gas	GN_2	GN_2	GN_2
Pressure of Gas to Solenoid	72 PSIG	72 PSIG	72 PSIG
Regulator Pressure Inlet:	142 PSIG	142 PSIG	142 PSIG
Outlet:	72 PSIG	72 PSIG	72 PSIG
Time duration of Operating Cycle: (sec)			
Closed to Open:	25.20 sec.	24.00 sec.	23.75 sec.
Open to Closed:	18.75 sec.	18.68 sec.	18.55 sec.
Indicator Light Function	O.K.	O.K.	O.K.
Voltage to Solenoid	90vdc	125 vdc	140 vdc
Voltage to Limit Switch	90vdc	125 vdc	140 vdc
Seat Leakage @ ~~60 psig~~ for 15 minutes 75 PSID	Zero Leakage @ 75 PSIG		

Specimen Failed —

Specimen Passed ✓

NOA Written —

Tested By Stephen Rice Date: 7.23.80

Witness — Date: —

Sheet No. 1 of 2

Approved KB Earl R Campbell

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer Fisher Controls
Specimen 20" Butterfly Valve
Part No. Type 9200
Spec. FQP-19, Rev. E
Para. 2.0
S/N ---
GSI ---

Amb. Temp. 81°F
Photo Yes
Test Med. —
Specimen Temp. Room Amb.

Job No. 45088-03
Report No. —
Start Date 7-23-80

Test Title Post Radiation Functional

o	Solenoid Resistance	922 Ω
	- Terminal 2 to 3 in the box	
o	Contact Resistance, Switch No. 2	165 milliohms @ 1 MA.
	- Wire 1 & 2, Contact A & B (Switch closed)	
o	Contact Resistance, Switch No. 2	166 milliohms @ 1 M.A.
	- Wire 3 & 4, Contact G & H (Switch closed)	
o	Solenoid Resistance to Ground	0.61×10^4 Megohms @ 500VDC
o	Contact Resistance, Switch No. 2	1.2×10^5 Megohms @ 500VDC
	- Wire 1 & 2, Contact A & B (Switch open)	
o	Contact Resistance, Switch No. 2	1.3×10^6 Megohms @ 500VDC
	- Wire 3 & 4, Contact G & H (Switch open)	

Ambient Temperature: 81°F

Relative Humidity: 72%

Lights on Box: O.K.

Specimen Failed —
Specimen Passed ✓
NOA Written —

Tested By Stephen Rice Date: 7-23-80
Witness — Date: —
Sheet No. 2 of 2
Approved By Earl R Campiesi

WH-614A

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SECTION IX

SEISMIC SIMULATION

1.0 TEST REQUIREMENTS

The Seismic Test Program shall be performed in accordance with the Fisher Controls Seismic Qualification Plan FQP-23, Revision 9 (see Addendum II, Section XV of this Test Report), and the specific instructions as given by the Fisher Controls Technical Representative (see Appendix IV of this Section).

1.1 Specimen Mounting

The specimen shall be attached to a Wyle-fabricated mounting fixture and the fixture, in turn, shall be placed on the Wyle Multiaxis Seismic Simulator Table such that the base of the test fixture shall be flush with the top of the test table. The specimen shall be oriented initially such that its longitudinal axis shall be colinear with the longitudinal axis of the table. For the second orientation of tests, the specimen shall be rotated 90 degrees in the horizontal plane.

1.2 Resonance Search

A low-level (approximately 0.2 g horizontally and vertically) biaxial sine sweep in each test orientation shall be performed to establish major resonances. The tests shall be performed over the frequency range of 1 Hz to 40 Hz at a sweep rate of one-third octave per minute. The test shall be performed with the horizontal and vertical inputs in-phase (0°) and repeated with the inputs out-of-phase (180°). A resonance is defined as a response in line with the input and with an order of magnitude three (3) times the input. The tests shall be performed with the valve in the closed position with a 75 psig internal air pressure.

1.3 Sine Beat Tests

1.3.1 Non-Operating Tests

The specimen shall be subjected to biaxial sine beat tests in each test orientation at the frequencies and input levels shown in Table IX-I (within the limitations of the test table). Each sine beat test shall consist of ten (10) oscillations per beat, five beats per test frequency, with a two-second pause between beats. The tests shall be performed with the valve in the closed position with a 75 psig internal air pressure. The tests shall be performed with the horizontal and vertical inputs in-phase (0°) and repeated with the inputs out-of-phase (180°).

1.0 TEST REQUIREMENTS (Continued)

1.3 Sine Beat Tests (Continued)

1.3.1 Non-Operating Tests (Continued)

After testing at 5 Hz, 15 Hz, 25 Hz, and 33 Hz in each phase in each orientation, the fasteners on the specimen shall be checked for tightness. Loose fasteners on the specimen shall be tightened and their locations documented. Prior to each fastener tightness inspection, the specimen shall be cycled from closed to open and back to closed to verify that the specimen is still operational.

1.3.2 Operating Tests

In addition to the sine beat tests described in Paragraph 1.3.1, the specimen shall be subjected to operating tests in each test orientation. Each test shall consist of cycling the specimen from closed to open and back to closed while simultaneously exciting the specimen with five (5) biaxial sine beats. The test duration shall be the time required for the specimen to cycle from closed to open to closed. The cycling of the specimen shall be performed with a 75 psig internal air pressure. The timing of the five (5) sine beats shall be spaced over the cycling duration such that at least one (1) sine beat is applied during each portion of the cycle.

The operating tests shall be performed at the following frequencies:

a) Major resonant frequencies

b) Frequency of maximum specimen response (measured at the actuator center of gravity)

c) Frequency where malfunctions or deviations occurred during the resonance search tests.

1.4 Specimen Acceleration Response

Fifteen (15) unidirectional piezo-electric accelerometers shall be located on the specimen. The placement of the accelerometers shall be at the discretion of the Fisher Controls Technical Representative. Oscillograph recorders shall provide a record of each accelerometer response. Tabulated data of the specimen response accelerometers from the sine beat tests shall be included in the test report.

1.0 TEST REQUIREMENTS (Continued)

1.5 Stroking Time Tests

Stroking time tests shall be performed prior to and after the seismic testing. The tests shall involve stroking the valve from closed to open to closed using the pushbutton control box provided with the specimen by Fisher Controls. The tests shall be performed with an internal air pressure of 75 psig in the test fixture. Stroking time and valve position versus time shall be recorded.

1.6 Pressure Integrity Tests

Pressure integrity tests shall be performed prior to and after the seismic testing. The tests shall be performed for a three-minute period with the specimen in the open position and an approximate internal air pressure of 75 psig.

1.7 Seat Leakage Tests

Seat leakage tests shall be performed prior to and after the seismic testing. The seat leakage tests shall be performed for a one-minute period with approximately 75 psi air pressure differential across the valve.

1.8 Pneumatic Supply

Gaseous nitrogen (GN_2) at pressures of 140 psig and 75 psig shall be provided by Wyle during the test program. The 140 psig pressure shall be supplied to the 95H regulator for the operation of the specimen. The 75 psig pressure shall be connected to the test fixture to perform leak tests and to simulate in-service loads.

1.9 Electrical Power

Electrical power of 125 VDC for operation of the specimen shall be furnished by Wyle during the test program.

1.10 Electrical Monitoring

Two (2) electrical monitoring channels shall be provided during the test program. One (1) channel shall monitor the supply voltage (125 VDC) to the solenoid valve and the other channel shall monitor a potentiometer so that the valve motion can be measured.

The stroking times of the valve shall be recorded.

Both monitoring channels shall be recorded on an oscillograph recorder. Any deviations shall be recorded and the Fisher Controls Technical Representative notified.

1.0 TEST REQUIREMENTS (Continued)

1.11 Pressure Monitoring

Three (3) pressure transducers shall be provided during the test program to monitor the pressures at the following locations:

1) Inlet pressure to the 95H regulator

2) Outlet pressure of the 95H regulator

3) Operating pressure into the actuator cylinder.

The output signals of the pressure transducers shall be recorded on an oscillograph recorder.

A pressure gage shall be used to monitor the 75 psig pressure in the test fixture.

2.0 TEST PROCEDURES

The Seismic Test Program was performed in accordance with the Fisher Controls Seismic Qualification Plan FQP-23, Revision 9 (See Addendum II, Section XV of this Test Report), and the specific instructions of the Fisher Controls Technical Representative as given both verbally and as documented in Appendix IV of this Section.

2.1 Specimen Mounting Procedures

The specimen was attached to a Wyle-fabricated mounting fixture and the fixture, in turn, was placed on the Wyle Multiaxis Seismic Simulator Table such that the base of the test fixture was flush with the top of the test table. The specimen was oriented initially for testing in the longitudinal/vertical orientation, as shown in Photograph IX-1 (longitudinal is in line with flow through the specimen). For the second orientation of tests, the speciman was rotated 90 degrees in the horizontal plane to the lateral/vertical orientation.

2.2 Resonance Search Procedures

The specimen was subjected to low-level (approximately 0.2 g horizontally and vertically) biaxial sine sweeps in each test orientation. The tests were performed over the frequency range of 1 Hz to 40 Hz with a sweep rate of one-third octave per minute. The tests were performed with the horizontal and vertical inputs in-phase (0°) and repeated with the inputs out-of-phase (180°). The tests were performed with the valve in the closed position with a 75 psig internal air pressure.

2.0 TEST PROCEDURES (Continued)

2.2 Resonance Search Procedures (Continued)

The test program was performed in two (2) test series at the request of the Fisher Controls Technical Representative. The resonance search tests were performed in the longitudinal/vertical orientation during Test Series I and in the lateral/vertical orientation during Test Series II.

2.3 Sine Beat Test Procedures

2.3.1 Non-Operating Test Procedures

The specimen was subjected to biaxial sine beat tests in each test orientation at the frequencies and input levels shown in Table IX-I (within the limitations of the test table). Each sine beat test consisted of ten (10) oscillations per beat, five beats per test frequency, with a two-second pause between beats. The tests were performed with the valve in the closed position with a 75 psig internal air pressure. The tests were performed with the horizontal and vertical inputs in-phase (0°) and repeated with the inputs out-of-phase (180°).

At the direction of the Fisher Controls Technical Representative, two (2) additional non-operating tests (Runs 85 and 86) were performed in the longitudinal/vertical orientation at a test frequency of 19 Hz out-of-phase. The input level for these two tests was adjusted above the required input (for Test Series II) to expose the appurtenances to the desired accelerations determined by the Fisher Controls Technical Representative.

After testing at 5 Hz, 15 Hz, 25 Hz and 33 Hz in each phase in each orientation, the fasteners on the specimen were checked for tightness. Prior to each fastener tightness inspection, the specimen was cycled from closed to open and back to closed to verify that the specimen was still operational.

2.3.2 Operating Test Procedures

In addition to the sine beat tests described in Paragraph 2.3.1, the specimen was subjected to operating tests in each test orientation. Each test consisted of cycling the specimen from closed to open and back to closed while simultaneously exciting the specimen with five (5) biaxial sine beats. The test duration was the time required for the specimen to cycle from closed to open to closed. The cycling of the specimen was performed with a 75 psig internal air pressure. The timing of the five sine beats was spaced over the cycling duration as follows:

2.0 TEST PROCEDURES (Continued)

2.3.2 Operating Test Procedures (Continued)

1) The first two (2) sine beats were applied (2 seconds apart) during the stroking cycle from closed to open.

2) The third sine beat was applied after the specimen had reached the fully-open position.

3) The last two (2) sine beats were applied (2 seconds apart) during the stroking cycle from open to closed.

All operating tests after Test Run 78 were performed using the above timing sequence. During Test Run 78, all five (5) beats were applied during the closed to open portion of the stroking cycle. Test Run 79 was a repeat of Test Run 78 except the above timing sequence was used.

The operating tests were performed at the frequencies of maximum specimen response determined during the testing described in Paragraph 2.3.1 and at the resonant frequencies (below 33 Hz) determined during the resonance search testing described in Paragraph 2.2. No malfunctions or deviations occurred during the resonance search tests.

In the longitudinal/vertical orientation, the operating tests were performed at the following test frequencies (as directed by the Fisher Controls Technical Representative): 31.5 Hz, 19 Hz and 15.5 Hz, out-of-phase; 31.5 Hz, 22.5 Hz and 15.5 Hz, in-phase.

In the lateral/vertical orientation, the operating tests were performed at the following test frequencies (as directed by the Fisher Controls Technical Representative): 33 Hz, 30 Hz, 17.5 Hz and 19 Hz, out-of-phase; 30 Hz, 31 Hz and 33 Hz, in-phase.

2.4 Specimen Acceleration Response Procedures

Fifteen (15) unidirectional piezo-electric accelerometers were located on the specimen as shown in Photographs IX-2 through IX-5. The placement of the accelerometers was at the discretion of the Fisher Controls Technical Representative. Oscillograph recorders provided a record of each accelerometer response for all test runs. FM tape recorders provided a record of each accelerometer response for selected test runs. The horizontal and vertical control accelerometers were located on the neck flange of the fixture as shown in Photograph IX-3.

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2.0 TEST PROCEDURES (Continued)

2.5 Stroking Time Test Procedures

Stroking time tests were performed prior to and after the seismic tests. The tests involved stroking the valve from closed to open and back to closed with an internal air pressure of 75 psig. Stroking time and valve position versus time were recorded. The specimen was operated using a pushbutton control box provided by Fisher Controls as part of the test specimen.

At the request of the Fisher Controls Technical Representative, an additional stroking time test was performed prior to rotating the specimen from the longitudinal/vertical orientation to the lateral/vertical orientation.

2.6 Pressure Integrity Test Procedures

Pressure integrity tests were performed prior to and after the seismic testing. The tests were performed for a three-minute period with the specimen in the open position and an approximate internal air pressure of 75 psig. The packing seal and retaining ring were observed for leakage. A soap solution was used to detect leakage.

At the request of the Fisher Controls Technical Representative, an additional pressure integrity test was performed prior to rotating the specimen from the longitudinal/vertical orientation to the lateral/vertical orientation.

2.7 Seat Leakage Test Procedures

Seat leakage tests were performed prior to and after the seismic tests. The seat leakage tests were performed for a one-minute period with approximately 75 psig air pressure differential across the valve.

At the request of the Fisher Controls Technical Representative, an additional seat leakage test was performed prior to rotating the specimen from the longitudinal/vertical orientation to the lateral/vertical orientation.

2.8 Pneumatics Procedures

Gaseous nitrogen (GN_2) at pressures of 140 psig and 75 psig was provided by Wyle during the test program. The 140 psig pressure was supplied to the 95H regulator for the operation of the specimen. The 75 psig pressure was connected to the test fixture to perform leak tests and to simulate in-service loads.

2.0 TEST PROCEDURES (Continued)

2.9 Electrical Powering Procedures

Standard electrical power of 125 VDC for operation of the specimen was furnished by Wyle during the test program.

2.10 Electrical Monitoring Procedures

Two (2) electrical monitoring channels were provided during the test program. One channel monitored the supply voltage (125 VDC) to the solenoid valve. The other channel monitored a potentiometer so that the valve motion could be measured.

The stroking times of the valve were recorded.

Both monitoring channels were recorded on an oscillograph recorder.

2.11 Pressure Monitoring Procedures

Three (3) pressure transducers were provided during the test program to monitor the pressures at the following locations:

1) Inlet pressure to the 95H regulator

2) Outlet pressure of the 95H regulator

3) Operating pressure into the actuator cylinder.

The output signals of the pressure transducers were recorded on an oscillograph recorder.

A pressure gage was used to monitor the 75 psig pressure in the test fixture.

3.0 TEST RESULTS

3.1 Specimen Mounting Results

The specimen was attached to a Wyle-furnished mounting fixture and the fixture, in turn, was mounted to the Wyle Multiaxis Seismic Simulator Table as shown in Photograph IX-1.

3.0 TEST RESULTS (Continued)

3.2 Resonance Search Results

The resonance search tests are described in Tables IX-II and IX-III, including test run numbers, axes, phase, and input accelerations.

Transmissibility plots (the in-line specimen response accelerometers divided by the control accelerometers) from the resonance search tests (Test Runs 1, 2, 87 and 88) are presented in Appendix I.

As determined by the Fisher Controls Technical Representative, resonances (below 33 Hz) were found in the longitudinal/vertical orientation at 15.5 Hz and 31.5 Hz both in- and out-of-phase and in the lateral/vertical orientation at 17.5 Hz, 30 Hz and 33 Hz, out-of-phase; 30 Hz and 33 Hz, in-phase.

3.3 Sine Beat Test Results

3.3.1 Non-Operating Test Results

During Test Run 21 (at 16 Hz, in-phase), the mounting bolts which attach the actuator to the mounting bracket loosened as described in Notice of Anomaly No. 4, Revision B.

During Test Run 23 (at 17 Hz, in-phase), Test Run 57 (at 14 Hz, out-of-phase), and Test Run 58 (at 15 Hz, out-of-phase), the mounting bolts which attach the mounting bracket to the valve body loosened as described in Notice of Anomaly No. 4, Revision B, and as shown in Photographs IX-6 and IX-7.

At the direction of the Fisher Controls Technical Representative, the test program was interrupted after Test Run 58 (at 15 Hz, out-of-phase). The test specimen was removed from the test machine for a re-evaluation of the specimen problems and the testing requirements. Test Runs 1 through 58 were performed on July 26 and 27, 1980, and are referred to as Test Series I.

On September 8, 1980, the test program was resumed with Test Run 59 (at 16 Hz, out-of-phase). Test Runs 59 through 169 were performed September 8, 9 and 10, 1980, and are referred to as Test Series II. The 7/8"-diameter, Grade 5 fasteners, which attach the bracket to the actuator were replaced prior to test with Grade 8, socket-head cap screws and torqued to 340 ft-lbf. The 3/4"-diameter, Grade 5 fasteners, which attach the bracket to the valve body, were replaced with Grade 8, socket-head cap screws and torqued to 215 ft-lbf. In addition to the fastener replacement, the maximum required input level was reduced during Test Series II (from 4.5 g to 3.0 g), as shown in Table IX-I.

3.0 TEST RESULTS (Continued)

3.3.1 Non-Operating Test Results (Continued)

The only fastener looseness detected during Test Series II was during the regularly-scheduled fastener tightness inspection performed after Test Run 116 (at 25 Hz, in-phase). The 4/5"-diameter, Grade 8 cap screws which attach the bracket to t e valve body were retorqued to 215 ft-lbf. No further problems with these fasteners or any others were experienced.

Smooth operation of the specimen was noted during each stroking cycle prior to the fastener tightness inspections; however, problems with an indicator light were experienced as described in Notice of Anomaly No. 4, Revision B. Post-test inspection at the end of the Seismic Test Program revealed that the problems which were thought to be in connection with the limit switch were actually caused by a loose connection in the junction box on the specimen, as documented in Notice of Anomaly No. 4, Revision B, and Photograph IX-8.

Descriptions of the test runs are contained in Tables IX-II and IX-III, including run numbers, test frequency, phase, input levels, and unfiltered specimen response accelerations.

Table IX-IV describes the maximum desired acceleration levels to which the appurtenances on the test specimen were to be exposed as requested by the Fisher Controls Technical Representative. Most of these desired levels were reached at some point during the regulator test program; however, two (2) additional tests (Runs 85 and 86) at higher input levels were performed as directed by the Fisher Controls Technical Representative to expose the junction box and upper limit switch to the desired acceleration levels.

In the course of trying to isolate the problem with the limit switch, two (2) contact resistance tests were performed on the pushbutton control box used to operate the test specimen. Test 1 was performed after Test Run 124 (at 33 Hz, in-phase) and Test 2 was performed after Test Run 125 (at 40 Hz, in-phase). The results of these two tests are included in Appendix II of this Section.

With the exception of the problems described above and documented in Notice of Anomaly No. 4, Revision B, it was demonstrated that the specimen possessed sufficient integrity to withstand, without compromise of structure or mechanical functions, the prescribed non-operating sine beat testing.

3.3.2 Operating Test Results

Tables IX-II and IX-III contain test run descriptions, including run numbers, test frequency, phase, input levels and stroking times.

Smooth operation of the specimen was noted during all cycling tests; however, problems with one of the indicator lights were experienced as

3.0 TEST RESULTS (Continued)

3.3.1 Operating Test Results (Continued)

described in Paragraph 3.3.1 and Notice of Anomaly No. 4, Revision B. The cause of this problem was determined to be a loose connection in the junction box as shown in Photograph IX-8.

With the exception of the problems described above and documented in Notice of Anomaly No. 4, Revision B, it was demonstrated that the specimen possessed sufficient integrity to withstand, without compromise of structure or mechanical functions, the prescribed operating sine beat testing.

3.4 Specimen Acceleration Response Results

Transmissibility plots (the in-line specimen response accelerometers divided by the control accelerometers) for the resonance search tests are contained in Appendix I of this Section.

Specimen response unfiltered accelerometer data (g's) from the sine beat tests are presented in Tables IX-II and IX-III.

3.5 Stroking Time Test Results

The opening time was measured from the time the pushbutton control energized the solenoid until the movement of the valve disc stopped in the fully-open position.

The closing time was measured from the time the pushbutton control de-energized the solenoid until the movement of the valve disc stopped in the fully-closed position.

The pretest opening and closing times for Test Series I were 24.3 seconds and 16.2 seconds, respectively. There was no post-test stroking time tests for Test Series I. The pretest opening and closing times for Test Series II were 25.6 seconds and 14.8 seconds, respectively.

The mid-test opening and closing times (prior to re-orientation of the test specimen) were 25.1 seconds and 16 seconds, respectively.

The post-test opening and closing times were 27.0 seconds and 14.2 seconds, respectively. The longer post-test opening time was the result of a severe leakage in the "Swagelok" fitting which connected a copper line on the specimen to the inlet of the actuator cylinder. Closer inspection of the leakage at the completion of the Seismic Test Program revealed that the flexing of the copper line during the seismic excitation resulted in the fatigue and eventual fracture of the copper at the fitting connection, as documented in Notice of Anomaly No. 4, Revision B.

The stroking times for each of the operating sine beat tests (see Paragraph 2.3.2) as well as prior to each fastener tightness inspection (see Paragraph 2.3.1) are contained in Tables IX-II and IX-III.

3.0 TEST RESULTS (Continued)

3.6 Pressure Integrity Test Results

The pressure integrity test prior to Test Series I revealed a slight leakage between the retaining ring and the valve body and between the retaining ring and the spool fixture. No packing leakage was observed. There was no pressure integrity test performed at the end of Test Series I.

The pressure integrity test prior to Test Series II revealed a slight leakage at the same locations as observed prior to Test Series I. In addition, a slight packing leakage was observed on the actuator side of the valve. No packing leakage was observed on the limit switch side of the valve.

The leakage observed prior to the re-orientation of the specimen was similar to that observed prior to the beginning of Test Series II.

The pressure integrity test at the completion of Test Series II revealed a slight increase in the previously-observed leakage, as shown in Photographs IX-9 and IX-10. In addition to these previously-observed leaks, additional leaks were observed in the specimen's pneumatic circuit at the filter and at the outlet of the 95H regulator, as shown in Photograph IX-11.

3.7 Seat Leakage Test Results

No leakage was detected during any of the seat leakage tests performed prior to, during or after the seismic tests.

3.8 Pneumatics Results

Some problems were experienced with the pneumatic circuit of the specimen as described in Paragraphs 3.5 and 3.6 above and as documented in Notice of Anomaly No. 4, Revision B.

3.9 Electrical Powering Results

No problems were experienced with providing the electrical powering requirements.

3.10 Electrical Monitoring Results

As described in Paragraph 3.3.1, some problems were experienced with the indicator lights on the pushbutton control box. It was originally thought that these problems were caused by the faulty operation of the upper limit switch, as documented in Notice of Anomaly No. 4, Revision B. Post-test inspection at the end of the Seismic Test Program revealed that the indicator light problems were actually caused by a loose (and eventually broken) connection in the junction box on the specimen.

3.0 TEST RESULTS (Continued)

3.10 Electrical Monitoring Results (Continued)

With the exception of the problems described in the foregoing, it was demonstrated that the specimen possessed sufficient integrity to withstand, without compromise of electrical functions, the prescribed simulated seismic environment.

3.11 Pressure Monitoring Results

It was demonstrated that the specimen possessed sufficient integrity to withstand, without compromise of mechanical functions, the prescribed simulated seismic environment.

NOTICE OF ANOMALY

Revision B

NOTICE NO. 4 P. O. NUMBER: H-217770 WYLE JOB NO. 45088

CONTRACT NUMBER: N/A

CATEGORY: ☒ SPECIMEN ☐ PROCEDURE ☐ TEST EQUIPMENT DATE: 8/21/90

TO: Fisher Controls Company ATTN: Jon Milliken

PART NAME: 20" Butterfly Valve w/Bettis Actuator PART NO. 605A-1.0

TEST: Seismic Simulation I. D. NO. N/A

SPECIFICATION: Fisher FCP-23, Revision 9 PARA. NO. 5.0 and 6.0

NOTIFICATION MADE TO: Jon Milliken DATE: 7/27/90

NOTIFICATION MADE BY: B. Pinkerton/B. Quinn VIA: Verbal

REQUIREMENTS:

1) The specimen will be examined for possible damage following all violent tests...

2) Indicator lights may flicker, flutter, or dim, but must return to their fully illuminated condition.

DESCRIPTION OF ANOMALY:

1A) During Test Run 21 (at 16 Hz, in-phase), two (2) mounting bolts (7/8" dia) which attach the Bettis Actuator to the mounting bracket loosened such that excessive relative motion of the Actuator was observed. The safety wire on these fasteners was cut and each was torqued to 150 ft-lb.

1B) During Test Run 23 (at 17 Hz, in-phase) and again during Test Run 25 (at 19 Hz, in-phase), the four (4) mounting bolts (3/4" dia) which attach the Actuator mounting bracket to the valve body loosened such that excessive relative motion of the Actuator was observed. The safety wire on these fasteners was cut and each was torqued to 115 ft-lb.

1C) During Test Run 57 (at 14 Hz, out-of-phase) and again during Test Run 58 (at 15 Hz, out-of-phase), the four (4) 3/4" dia bolts required tightening. After retorquing to 130 ft-lb (instead of 115 ft-lb), the fasteners continued to loosen while attempting to set the test levels for Test Run 59 (at 16 Hz, out-of-phase). After retorquing to 160 ft-lb and with the application of one sine beat at 16 Hz, the fasteners loosened again. The four fasteners were replaced with new 3/4"-10, Grade 5 bolts and retorqued to 160 ft-lb. With the application of one sine beat at 16 Hz, the fasteners loosened again.

1D) Post-test inspection at the end of the seismic test program revealed a severe leakage in the "swagelok" fitting which connected a copper line on the specimen to the inlet of the Actuator cylinder. Closer inspection revealed that the flexing of the copper line during the seismic excitation resulted in the fatigue and eventual fracture of the copper at the fitting connection.

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TEST WITNESS Jon Milliken

REPRESENTING Fisher Controls

ENGINEER Bobby L. Quinn

QUALITY CONTROL

PROJECT MANAGER

NOTICE OF ANOMALY

2) Erratic operation of the green indicator light on the push-button control box was observed during Test Series I which was thought to be related to a faulty limit switch. During Test Series II similar erratic operation was detected until Test Run 136, at which time the indicator light went out and stayed out for the remainder of the test program.

DISPOSITION - COMMENTS - RECOMMENDATIONS

1A) At the direction of the Fisher Controls Technical Representative, the test
1B) program was interrupted after Test Run 58. The test specimen was removed
1C) from the test machine for a re-evaluation of the specimen problems and the testing requirements. The test program was later resumed with Test Run 59 after replacing the Grade 5 fasteners with Grade 8 fasteners and after reducing the input acceleration requirements from 4.5 g to 3.0 g.

1D) At the direction of the Fisher Controls Technical Representative, the damaged end of the copper line was repaired and reinstalled into the original Swagelok fitting prior to the post-seismic functional tests.

2) Post-test inspection at the end of the seismic test program revealed that the problems which were thought to be in connection with the limit switch were actually caused by a loose connection in the junction box on the specimen. This loose connection eventually broke and the green indicator lamp would no longer light. The functional operation of the specimen was not affected by the loose or broken connection. At the direction of the Fisher Controls Technical Representative, the broken connection was repaired after the post-seismic functional tests.

TABLE IX-I

SINE BEAT TEST REQUIREMENTS

TEST FREQUENCY (Hz)	BIAXIAL INPUT* ACCELERATION LEVEL	
	TEST SERIES I	TEST SERIES II
1.0	1.5	1.5
1.25	2.2	2.2
1.6	3.0	3.0
2.0	3.75	3.0
2.5	4.5	3.0
3.15	4.5	3.0
4.0 through 19.0	4.5	3.0
20.0	4.25	3.0
21.0	4.05	3.0
22.0	3.85	3.0
23.0	3.65	3.0
24.0	3.45	3.0
25.0	3.25	3.0
26.0	3.05	3.0
27.0	2.95	2.95
28.0	2.75	2.75
29.0	2.60	2.60
30.0	2.40	2.40
31.0	2.30	2.30
32.0	2.10	2.10
33.0	2.00	2.00
40.0	2.00	2.00

*For actual inputs, see Tables IX-II and IX-III

TABLE IX-II

TEST RUN DESCRIPTIONS
FOR THE 20" ENVIRONMENTAL TEST VALVE
(LONGITUDINAL/VERTICAL ORIENTATION)

RUN NO.	FRE-QUENCY Hz	PHASE	HCA*(g) FILTERED	VCA*(g) FILTERED	HCA (g) UNFILTERED	VCA (g) UNFILTERED	SPECIMEN ACCELEROMETERS (g) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	** STROKE TIME (sec)	REMARKS
1	1-60	IN	0.2	0.2	—	—	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
2	1-60	OUT	0.2	0.2	—	—	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
3	1.0	IN	0.38	0.38	0.5	0.5	0.7	0.4	0.8	0.9	0.9	0.9	0.8	1.0	0.8	0.7	0.7	0.8	0.7	0.8	0.8		
4	1.25	IN	0.47	0.47	0.5	0.5	0.7	0.4	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.7	0.7	0.8	0.7	0.8	0.8		
5	1.6	IN	0.6	0.6	0.6	0.6	0.8	0.4	0.8	0.8	0.8	0.9	0.8	0.9	0.8	0.8	0.7	0.8	0.7	0.8	0.8		
6	2.0	IN	0.75	0.75	0.9	0.9	0.9	0.4	0.9	1.0	0.9	1.0	0.9	1.1	0.9	0.9	0.8	1.0	0.9	0.9	0.9		
7	2.5	IN	0.96	0.96	1.0	1.0	1.0	0.4	1.0	1.2	1.1	1.6	1.0	1.8	1.0	1.2	1.0	1.2	1.1	1.1	1.1		
8	3.15	IN	1.2	1.2	1.4	1.5	1.4	0.6	1.4	2.0	1.8	2.1	1.8	2.0	2.0	2.0	1.6	2.1	1.9	2.0	2.0		
9	4	IN	1.6	1.6	2.0	2.0	2.0	0.6	2.0	2.8	2.6	2.8	2.0	3.0	2.1	2.1	2.0	2.8	2.6	2.2	2.8		
10	5	IN	1.9	1.9	[illegible]	2.8	4.0	1.0	3.5	5.0	4.8	5.0	5.0	5.0	5.0	4.8	4.2	4.2	4.0	4.0	4.0	2.2/4.2	
11	6	IN	2.2	2.2	4.0	2.2	5.0	1.2	5.0	6.0	5.5	7.0	6.8	6.6	7.0	6.6	6.0	5.0	5.0	5.0	5.0		
12	7	IN	2.7	2.7	4.2	4.0	5.0	1.2	5.0	6.5	5.5	7.0	6.8	7.2	7.0	6.6	6.0	5.0	5.0	5.0	5.0		
13	8	IN	3.2	3.2	5.0	5.0	5.0	1.2	5.0	7.0	6.0	7.0	8.0	8.0	7.0	7.0	6.5	6.0	5.5	5.0	5.0		
14	9	IN	3.5	3.5	5.6	5.0	5.5	2.2	5.5	7.0	6.0	8.0	8.0	8.0	9.0	7.0	6.5	6.0	5.5	5.5	5.5		
15	10	IN	3.7	3.7	5.6	5.0	6.0	4.0	6.0	7.0	6.0	9.0	8.0	8.5	9.5	7.5	6.5	6.0	5.5	6.0	6.0		
16	11	IN	4.0	4.0	5.6	4.8	6.5	5.0	6.0	7.0	7.0	10.0	9.5	9.0	9.5	7.5	7.0	6.0	5.5	6.0	6.0		
17	12	IN	4.5	4.5	6.0	5.6	7.0	5.0	8.0	8.0	8.0	11.0	10.5	10.0	11.0	7.5	7.5	7.0	6.0	6.5	6.5		
18	13	IN	4.5	4.5	5.4	5.0	8.0	6.0	8.0	8.0	7.5	12.0	9.0	9.0	9.5	9.0	7.5	7.0	7.5	7.0	7.5		
19	14	IN	4.5	4.5	5.0	5.0	8.0	6.0	6.5	8.0	8.0	12.0	12.0	10.0	10.5	10.5	8.0	7.5	7.5	7.0	8.0		
20	15	IN	4.5	4.35	5.0	4.8	9.0	5.0	7.0	9.0	8.0	12.0	12.0	11.5	11.0	10.5	8.0	7.5	7.5	7.0	8.0	[illegible]/4.2	
21	16	IN	4.5	4.5	5.0	5.0	10.0	7.0	8.0	9.5	8.0	14.0	12.0	14.0	12.0	11.0	8.0	8.0	8.0	8.0	8.5		
22	16	IN	4.5	4.2	6.0	5.8	11.0	7.0	12.0	17.5	12.0	15.0	15.0	16.0	14.0	15.0	12.0	12.0	8.5	12.0	12.0		
23	17	IN	4.5	4.1	5.0	5.8	8.0	6.0	16.0	12.0	16.0	16.0	16.0	17.0	16.0	16.0	17.5	13.0	12.0	12.0	12.0		
24	18	IN	4.5	4.1	5.5	5.5	9.0	8.0	13.0	13.0	12.0	18.0	14.0	14.0	15.0	14.0	13.0	12.0	9.0	14.0	13.0		
25	19	IN	4.5	4.0	5.5	7.0	6.0	6.0	12.0	11.0	12.0	16.0	14.0	14.0	14.0	14.0	13.0	11.0	9.0	10.0	12.0		
26	20	IN	4.1	4.1	5.2	6.0	6.0	6.0	10.0	10.5	12.0	16.0	14.0	14.0	17.0	14.0	13.0	11.0	9.5	10.0	11.0		
27	21	IN	4.2	4.1	5.0	5.5	8.0	6.0	10.0	12.0	12.0	14.0	16.0	12.0	14.0	16.0	12.0	10.0	10.0	11.0	8.5		
28	22	IN	4.5	4.0	6.8	5.0	15.0	10.0	10.0	15.0	12.0	25.0	18.0	18.0	18.0	18.0	16.0	10.0	10.0	11.0	15.0		
29	23	IN	4.2	4.2	6.6	5.0	10.0	8.0	10.0	15.0	12.0	25.0	20.0	18.0	20.0	18.0	14.0	13.0	10.0	12.0	8.0		max. RESPONSE
30	24	IN	3.4	3.4	4.2	4.0	8.0	6.0	8.0	8.0	8.0	28.0	18.0	14.0	12.0	18.0	14.0	10.0	8.0	8.0	10.0		
31	25	IN	3.2	2.2	4.2	4.0	2.0	6.0	8.0	4.0	6.0	28.0	16.0	14.0	18.0	16.0	12.0	10.0	8.0	8.0	10.0	[illegible]	
32	26	IN	3.0	3.0	4.0	4.0	6.0	6.0	9.0	10.0	6.0	28.0	6.0	14.0	18.0	14.0	11.0	10.0	8.0	8.0	10.0		
33	27	IN	2.9	2.9	3.4	3.4	7.0	7.0	7.5	10.0	5.5	26.0	12.0	14.0	18.0	12.0	7.0	9.0	7.5	8.0	9.0		
34	28	IN	2.7	2.7	3.0	3.0	8.0	8.0	7.5	10.0	5.5	20.0	12.0	12.0	16.0	10.0	7.0	8.0	6.0	8.0	8.0		
35	29	IN	2.6	2.6	3.0	3.0	8.0	8.0	7.0	10.0	5.0	20.0	10.0	10.0	10.0	10.0	7.5	8.5	7.0	8.0	8.6		
36	30	IN	2.4	2.4	2.8	2.8	7.0	7.0	6.0	8.0	6.0	18.0	10.0	10.0	10.0	8.0	7.0	8.0	6.0	8.0	8.0		
37	31	IN	2.3	2.3	2.8	2.8	7.0	7.0	6.0	8.0	6.0	16.0	10.0	10.0	12.0	8.0	7.0	8.0	6.0	8.0	8.0		
38	32	IN	2.1	2.1	2.8	2.8	7.0	6.0	5.5	8.0	3.5	16.0	8.0	9.0	9.0	8.0	6.0	8.0	5.5	7.0	7.0		
39	33	IN	2.0	2.0	2.6	2.6	6.0	6.5	5.0	8.0	3.5	14.0	8.0	9.0	8.0	8.0	5.0	6.5	5.0	6.0	6.0	[illegible]	
40	40	IN	2.0	2.0	3.0	2.8	4.0	3.5	3.0	6.0	2.0	8.0	6.0	8.0	6.0	6.0	3.0	6.0	4.0	4.0	4.0		
41	1.0	OUT	0.38	0.38	0.5	0.5	0.7	0.3	0.7	0.8	0.7	0.8	0.7	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.7		
42	1.25	OUT	0.47	0.47	0.5	0.6	0.7	0.3	0.7	0.8	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8		
43	1.6	OUT	0.60	0.60	0.7	1.2	0.8	0.4	0.8	1.2	0.8	1.0	0.8	1.2	1.0	1.2	0.8	1.0	0.8	1.0	0.8		
44	2.0	OUT	0.75	0.75	0.9	1.5	1.0	0.5	0.8	1.2	0.8	1.2	0.8	1.4	1.0	1.4	0.8	1.0	0.8	1.0	0.8		
45	2.5	OUT	0.96	0.96	1.1	1.5	1.2	0.5	0.8	1.6	0.8	1.4	1.0	1.6	1.0	1.4	1.0	1.2	0.8	1.2	1.2		
46	3.15	OUT	1.2	1.2	1.5	2.1	2.8	1.0	1.6	2.0	1.6	3.0	2.0	2.8	1.8	2.2	1.6	2.2	1.6	2.0	1.8		
47	4.	OUT	1.6	1.6	2.0	2.8	2.8	0.8	1.8	3.0	2.0	3.2	2.0	3.2	2.2	2.8	1.6	2.0	2.0	2.2	2.6		
48	5	OUT	1.9	1.9	3.0	4.0	5.0	6.0	6.0	6.0	4.8	8.0	6.0	7.0	5.0	5.0	4.8	4.8	4.0	5.0	5.0	[illegible]	
49	6	OUT	2.2	2.2	4.8	4.0	5.5	5.5	5.0	8.0	6.0	15.0	14.0	12.0	12.0	12.0	9.0	6.0	5.5	5.5	5.5		
50	7	OUT	2.7	2.7	4.2	4.0	6.0	2.0	6.0	5.0	3.5	8.0	5.5	6.0	6.0	5.5	5.0	5.0	4.0	4.0	4.0		
51	8	OUT	3.2	3.2	4.2	5.2	6.0	2.0	5.5	7.0	5.0	12.0	9.0	8.5	8.0	9.5	5.5	5.5	5.0	5.5	5.0		
52	9	OUT	3.5	3.5	4.8	5.8	6.0	2.0	6.0	9.0	8.0	14.0	12.0	12.0	10.0	10.0	8.0	8.5	6.5	7.0	6.5		
53	10	OUT	3.7	3.7	4.8	5.6	6.0	2.0	6.0	9.0	8.0	16.0	12.0	12.0	12.0	12.0	8.0	7.0	6.0	6.0	6.0		
54	11	OUT	4.0	4.0	4.8	4.8	8.0	2.0	6.0	10.0	7.5	14.0	12.0	10.0	10.0	9.0	8.0	7.0	6.0	6.0	6.0		
55	12	OUT	4.5	4.5	4.8	5.2	8.0	2.0	6.0	10.0	6.5	14.0	12.0	10.0	11.0	10.0	7.5	6.5	5.5	5.5	5.5		
56	13	OUT	4.5	4.5	5.2	5.6	10.0	6.0	8.0	10.0	8.0	16.0	12.0	12.0	15.0	14.0	9.0	8.0	7.5	7.5	8.0		
57	14	OUT	4.5	4.5	5.0	5.2	12.0	8.0	8.0	12.0	9.5	14.0	14.0	16.0	16.0	15.0	10.0	8.5	8.5	8.0	10.0		
58	15	OUT	4.5	4.5	5.0	6.0	14.0	10.0	12.0	14.0	12.0	18.0	14.0	18.0	12.0	19.0	15.0	14.0	14.0	14.0	14.0	[illegible]	

*Actual horizontal and vertical inputs (g)
**Opening/closing times (seconds)

TABLE IX-II (Continued)

TEST RUN DESCRIPTIONS
FOR THE 10" ENVIRONMENTAL TEST VALVE
(LONGITUDINAL/VERTICAL ORIENTATION)

RUN NO.	FREQUENCY (Hz)	PHASE	HCA* (g) FILTERED	VCA* (g) FILTERED	HCA (g) UNFILTERED	VCA (g) UNFILTERED	Specimen Accelerometers (g) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	** STROKE TIME sec	REMARKS
59	16	OUT	3.0	3.0	4.0	4.0	9.5	4.0	8.5	9.5	10.0	12.5	12.0	12.5	12.0	13.0	7.5	8.0	8.0	9.5	8.0		
60	17	OUT	3.0	3.1	4.0	4.0	12.2	7.5	10.6	12.2	12.3	20.3	16.6	16.6	16.6	15.2	8.6	12.0	10.0	11.3	11.5		
61	18	OUT	3.0	3.0	3.6	3.6	16.6	12.3	12.0	20.0	12.3	20.0	16.6	12.3	12.3	18.6	8.6	8.0	8.6	10.6	11.3		
62	19	OUT	3.0	3.0	4.0	4.0	18.6	12.5	12.3	20.0	16.0	21.9	20.0	26.3	21.3	24.6	16.6	15.3	12.3	11.3	14.0		MAX. RESPONSE
63	20	OUT	2.0	2.3	2.6	3.6	14.6	12.0	12.0	16.6	9.3	26.6	18.6	15.5	13.3	16.6	10.6	12.3	12.0	11.3	8.0		
64	21	OUT	3.0	3.0	3.6	3.4	12.0	8.0	8.0	16.0	13.3	21.3	16.6	16.6	17.3	16.6	12.0	11.3	8.3	10.6	10.6		
65	22	OUT	3.1	3.1	3.6	3.2	12.6	7.3	7.3	13.3	8.6	21.9	12.3	13.3	16.6	12.3	9.3	12.0	8.0	10.6	8.0		
66	23	OUT	3.1	3.0	3.6	3.2	12.0	7.3	6.6	15.2	10.0	23.5	12.0	12.6	13.3	12.0	6.6	8.0	7.3	8.6	7.5		
67	24	OUT	3.1	3.2	3.6	3.6	12.0	7.3	7.3	18.6	13.3	17.3	12.3	13.3	13.3	13.3	6.6	10.6	7.3	9.1	7.5		
68	25	OUT	3.1	3.1	3.6	3.4	12.0	7.3	7.3	14.6	14.6	17.3	12.3	12.9	12.9	12.3	9.3	12.0	11.3	8.0	10.6	25.6/26.8	
69	26	OUT	3.0	3.0	3.2	3.2	9.0	7.0	8.3	16.0	15.5	16.6	12.3	12.9	12.3	12.3	6.5	10.0	8.0	8.5	7.5		
70	27	OUT	3.0	3.0	3.2	3.2	8.0	7.0	8.0	8.6	14.6	17.3	15.3	14.6	14.6	12.3	7.0	6.0	7.5	8.5	7.5		
71	28	OUT	2.8	2.75	3.0	3.0	6.0	5.0	6.5	14.0	17.3	12.9	12.0	12.5	12.5	10.6	7.0	8.0	7.0	10.0	8.0		
72	29	OUT	2.6	2.6	2.8	2.8	7.0	5.0	8.0	12.3	12.3	12.3	13.3	13.3	12.3	12.0	7.0	8.3	6.0	6.5	7.0		
73	30	OUT	2.4	2.4	2.8	2.9	6.0	5.0	7.5	12.3	14.6	11.9	12.6	12.5	12.3	10.6	7.0	6.0	5.5	6.5	6.0		
74	31	OUT	2.3	2.3	2.6	2.6	6.0	5.5	8.0	12.0	10.6	8.6	15.9	17.0	16.6	12.0	8.0	6.0	5.5	6.0	6.5		
75	32	OUT	2.1	2.1	2.4	2.4	6.0	3.5	6.5	8.6	10.6	10.6	10.6	10.6	9.3	7.9	6.0	6.0	5.0	6.0	5.5		
76	33	OUT	2.0	2.0	2.2	2.2	8.0	2.0	5.0	8.0	12.3	7.9	7.9	7.9	7.9	6.6	6.0	5.0	6.5	5.0	5.0	22.5/16.5	
77	40	OUT	2.0	2.0	2.2	2.2	7.0	3.0	6.0	12.0	6.6	11.9	10.6	10.6	14.0	7.3	7.0	6.5	6.0	7.5	7.0		
78	31.5	OUT	2.2	2.2	2.6	2.6	6.0	6.0	5.5	8.0	10.0	18.6	13.3	13.3	16.6	13.3	7.5	6.0	5.0	6.0	6.0	22.5/16.6	
79	31.5	OUT	2.2	2.2	2.6	2.6	6.0	5.5	5.5	8.3	12.0	18.6	12.5	12.5	13.3	13.3	6.5	6.0	5.5	5.5	6.0	22.6/16.6	
80	19	OUT	2.0	2.0	2.4	3.8	20.0	12.3	13.3	21.5	12.6	15.1	22.5	21.3	20.6	21.1	16.6	18.3	12.6	18.3	15.9	22.7/16.9	
81	15.5	OUT	3.0	3.0	3.2	3.2	14.9	6.6	10.6	16.6	13.3	15.9	12.3	13.3	16.6	11.9	11.9	9.3	7.9	7.9	7.9	22.9/16.9	
82	15.5	IN	3.0	3.0	3.8	3.6	12.6	10.6	11.9	12.6	12.3	19.9	13.3	10.6	16.6	16.6	10.6	10.6	9.3	10.6	9.3	22.9/16.9	
83	22.5	IN	2.25	2.25	2.8	2.8	6.0	2.5	6.0	11.0	7.0	11.9	11.9	11.9	11.9	6.6	6.0	7.0	5.0	7.0	7.0	22.6/16	
84	31.5	IN	2.25	2.25	2.8	2.9	7.0	8.0	9.0	12.0	16.0	22.6	17.3	16.6	13.9	14.6	8.5	9.5	8.0	10.0	7.5	22.6/16	
85	19	OUT	2.5	2.5	3.6	3.8	16.0	9.0	10.0	20.0	13.3	5.5	3.5	7.0	6.5	6.3	10.5	6.6	11.6	10.0	9.0		
86	19	OUT	3.25	3.25	3.6	4.6	17.5	13.3	13.9	21.8	18.6	19.0	20.0	7.0	7.5	6.0	12.6	12.6	16.6	11.6	11.6		

*Actual horizontal and vertical inputs (g)
**Opening/closing times (seconds)

TABLE IX-III

TEST RUN DESCRIPTIONS
FOR THE 20" ENVIRONMENTAL TEST VALVE
(LATERAL/VERTICAL ORIENTATION)

RUN NO.	FREQUENCY Hz	PHASE	HCA*(g) FILTERED	VCA*(g) FILTERED	HCA (g) UNFILTERED	VCA (g) UNFILTERED	SPECIMEN ACCELEROMETERS (g) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	** STROKE TIME (SEC)	REMARKS
87	1.60	IN	0.2	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
88	1.60	OUT	0.2	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		
89	1.0	IN	0.3	0.3	0.36	0.40	0.3	0.6	0.6	0.8	0.6	0.6	0.6	0.7	0.6	0.8	0.6	0.8	0.6	0.6	0.7		
90	1.25	IN	0.47	0.47	0.50	0.50	0.5	0.6	0.6	0.8	0.6	0.6	0.5	0.7	0.6	0.6	0.5	0.7	0.6	0.6	0.7		
91	1.6	IN	0.60	0.60	0.62	0.62	1.3	0.7	0.6	0.8	0.7	0.8	0.6	0.8	0.7	0.8	0.6	0.8	0.7	0.9	0.8		
92	2.0	IN	0.75	0.75	1.2	0.90	1.3	1.2	1.2	1.4	1.4	1.4	1.0	1.3	0.9	1.3	1.2	1.3	1.3	1.3	1.5		
93	2.5	IN	0.96	0.96	1.6	1.2	0.5	2.0	1.4	2.5	1.3	1.7	1.3	1.8	1.3	1.8	1.3	1.6	1.5	1.6	1.6		
94	3.15	IN	1.2	1.2	2.4	1.5	0.9	2.5	2.0	2.8	3.0	4.1	3.3	3.0	2.4	2.7	1.8	3.2	2.1	2.7	2.3		
95	4	IN	1.6	1.6	3.0	2.2	4.7	2.8	2.4	1.5	4.7	5.0	2.4	1.5	3.1	3.3	2.7	5.0	2.5	2.2	2.5		
96	5	IN	1.9	1.9	3.2	3.0	3.4	6.0	6.0	6.5	6.0	6.0	5.0	6.0	5.0	5.5	6.0	5.5	6.0	5.0	6.5	25.5/10.9	
97	6	IN	2.2	2.2	3.8	4.0	4.6	7.0	7.0	7.0	8.5	16.1	6.0	10.0	11.0	12.0	10.0	11.0	7.0	8.0	8.0		
98	7	IN	2.7	2.7	4.2	4.2	7.5	7.3	7.3	7.3	7.9	10.6	6.9	6.9	10.3	11.9	11.9	11.9	6.6	7.9	7.3		
99	8	IN	3.0	3.0	5.0	5.0	7.3	8.0	10.6	11.9	10.6	10.6	11.3	6.9	10.6	10.6	10.6	11.9	9.3	9.3	9.3		
100	9	IN	3.1	3.25	4.2	4.8	7.3	8.0	8.6	11.9	11.9	17.5	10.6	6.9	10.6	7.9	13.3	11.9	7.9	9.3	9.5		
101	10	IN	3.1	3.1	4.0	4.2	6.0	6.6	7.3	7.9	7.9	11.9	10.6	10.6	7.9	10.6	7.9	10.6	7.9	7.3	7.3		
102	11	IN	3.0	3.0	4.0	4.0	6.6	7.3	8.0	7.9	7.9	10.6	13.3	11.9	11.9	13.3	10.6	10.6	9.3	9.3	10.6		
103	12	IN	3.1	3.1	4.0	3.8	7.3	8.0	8.0	9.3	9.3	10.6	13.3	13.3	13.3	12.6	9.3	11.9	7.9	11.9	10.6		
104	13	IN	3.1	3.1	4.0	3.9	8.0	10.6	10.6	10.6	11.9	17.6	10.6	10.6	10.6	10.6	10.6	13.9	10.6	11.9	10.6		
105	14	IN	3.0	3.1	3.9	3.9	10.6	12.0	12.0	10.6	11.9	22.6	11.9	10.6	10.6	9.3	13.3	17.3	10.6	13.3	11.9		
106	15	IN	2.1	3.25	4.2	4.2	18.5	13.3	13.3	13.3	11.9	22.6	19.9	26.6	21.2	23.9	16.6	15.9	11.9	11.9	12.6	25.4/10.9	
107	16	IN	3.0	3.0	4.0	4.2	12.0	12.0	13.3	11.9	11.9	26.6	23.9	25.3	20.6	26.3	10.6	26.3	13.3	13.3	13.3		
108	17	IN	3.0	3.0	4.0	4.0	13.3	14.0	16.0	11.9	11.9	29.3	23.9	26.6	22.6	31.9	10.6	21.3	10.6	15.9	15.9		
109	18	IN	3.0	3.0	4.0	4.0	10.6	12.0	12.0	10.6	11.9	25.3	19.9	23.9	23.9	23.9	10.6	10.6	11.9	11.9	11.9		
110	19	IN	3.0	3.0	3.6	4.0	10.6	10.6	10.6	7.9	10.6	19.9	10.6	10.6	10.6	19.9	13.6	23.3	15.9	13.9	13.3		
111	20	IN	3.25	3.0	4.0	3.8	7.3	8.0	8.0	10.6	9.3	11.3	13.3	17.3	10.6	14.6	10.6	13.3	11.9	10.6	13.3		
112	21	IN	3.1	3.0	3.8	3.8	7.3	8.0	8.0	11.9	7.9	11.3	10.6	11.9	13.3	10.6	11.9	13.3	10.6	11.9	11.9		
113	22	IN	3.1	3.1	3.6	3.6	6.0	6.6	6.6	11.9	7.3	13.3	9.3	11.9	9.3	9.3	7.3	10.6	12.8	7.9	10.6		
114	23	IN	3.0	3.0	3.6	3.6	5.3	6.6	6.0	10.6	7.9	11.9	9.3	10.6	7.9	9.3	7.3	10.6	11.9	9.3	11.9		
115	24	IN	3.0	3.0	3.4	3.6	5.0	6.0	5.0	11.9	6.0	11.9	10.6	10.6	9.3	6.9	7.0	17.5	12.3	10.6	8.3		
116	25	IN	3.25	3.25	3.8	4.0	6.0	7.5	6.0	13.3	9.5	11.3	12.3	15.9	0.3	10.6	9.0	25.3	19.9	11.9	25.3	25.2/10.0	
117	26	IN	3.25	3.0	4.0	3.8	5.0	6.0	5.5	15.9	11.5	13.3	11.9	11.9	11.9	11.9	6.5	27.9	11.9	11.9	19.9		
118	27	IN	3.0	3.0	3.8	3.6	6.0	5.5	5.5	13.3	14.0	11.9	7.9	10.6	10.6	10.6	6.5	26.6	10.6	11.9	12.8		
119	28	IN	2.75	2.75	3.8	3.6	5.0	5.5	7.0	15.9	10.6	13.3	11.9	11.9	11.9	9.3	5.0	19.9	10.6	10.6	12.3		
120	29	IN	2.6	2.6	3.0	3.0	6.0	7.0	10.0	17.9	19.9	10.6	17.3	15.9	14.6	11.3	9.0	17.5	14.6	10.6	17.3		
121	30	IN	2.4	2.5	2.0	2.0	10.0	10.0	16.0	19.9	21.3	25.3	22.9	19.9	24.6	19.9	18.0	15.9	15.9	12.3	19.9		
122	31	IN	2.3	2.4	3.6	3.0	13.3	10.6	15.0	16.6	19.3	19.9	26.6	25.3	21.3	26.6	11.6	11.9	12.3	17.3	12.3		MAX. RESPONSE
123	32	IN	2.1	2.3	2.2	3.2	14.0	14.6	14.0	19.9	19.9	25.9	27.9	27.3	25.3	25.3	16.6	19.9	12.7	15.9	15.9		
124	33	IN	2.1	2.1	2.1	3.0	14.6	14.6	16.6	10.6	19.9	33.3	31.9	20.6	21.9	26.6	16.6	25.3	14.6	19.3	14.6	26.5/16.5	
125	40	IN	2.25	2.5	3.9	3.9	14.6	13.3	14.0	13.3	17.9	26.6	32.2	27.3	27.9	26.6	19.9	25.3	17.3	18.6	14.6		
126	1.0	OUT	0.33	0.33	0.38	0.40	0.3	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.7	0.7	0.7	0.7		
127	1.25	OUT	0.47	0.47	0.60	0.50	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.8	0.7	0.7	0.7	0.8	0.8		
128	1.6	OUT	0.60	0.60	0.90	0.70	0.3	1.1	0.8	1.0	0.8	0.8	0.7	0.8	0.7	1.3	0.8	0.1	0.9	0.9	0.9		
129	2.0	OUT	0.75	0.75	1.2	0.90	0.3	1.3	1.2	1.8	1.3	1.4	1.2	1.4	1.2	1.4	1.2	1.3	1.3	1.3	1.4		
130	2.5	OUT	0.96	0.96	1.8	1.2	0.5	1.9	1.6	2.6	1.9	1.9	1.4	1.9	1.8	2.1	1.3	1.8	1.3	1.8	1.9		
131	3.15	OUT	1.2	1.2	2.4	1.5	1.3	3.3	1.9	3.3	2.3	3.9	2.9	2.4	2.6	3.3	1.8	3.3	2.6	3.3	2.8		
132	4	OUT	1.6	1.6	2.8	2.4	3.3	3.3	2.3	3.9	4.6	5.3	4.9	4.6	4.6	4.6	3.9	4.9	4.6	4.3	4.6		
133	5	OUT	1.9	1.9	4.0	3.8	5.9	5.3	5.8	5.3	5.9	7.3	6.6	6.3	7.9	5.9	5.3	6.6	5.9	5.9	5.8	26.0/10.0	
134	6	OUT	2.2	2.2	4.2	4.8	8.0	7.0	7.5	6.5	8.0	12.0	11.5	10.0	12.0	10.0	8.0	7.5	7.5	8.0	8.0		
135	7	OUT	2.7	2.7	4.8	4.6	6.0	7.0	7.5	8.0	8.5	9.0	8.5	15	10.0	8.6	7.5	8.0	7.5	7.5	7.5		
136	8	OUT	3.0	3.0	5.0	4.8	5.0	6.0	7.5	8.0	7.5	9.5	8.0	9.0	9.0	9.0	7.5	8.0	8.0	8.0	8.0		
137	9	OUT	3.0	3.0	5.4	4.8	5.0	7.5	7.5	8.5	9.0	11.5	10.0	9.5	10.0	11.5	8.0	8.0	8.0	9.5	9.0		
138	10	OUT	3.0	3.0	5.4	5.4	6.5	7.5	8.5	9.5	13.5	11.0	10.0	10.0	11.5	11.0	8.0	9.0	8.0	10.0	9.0		
139	11	OUT	3.0	3.0	5.8	5.4	7.0	8.0	8.5	10.0	11.5	12.5	12.0	12.0	11.0	12.0	8.0	8.5	8.0	9.5	8.0		
140	12	OUT	3.0	3.0	6.0	5.0	8.0	9.0	10.0	8.0	11.0	8.0	11.0	10.0	11.5	11.0	8.0	8.0	7.5	8.0	9.0		
141	13	OUT	3.0	3.0	5.0	5.0	8.0	9.5	10.5	11.0	14.0	16.0	11.0	12.0	6.0	13.5	11.5	11.0	9.0	12.0	10.0		
142	14	OUT	3.0	3.0	5.0	5.0	10.6	12.0	13.3	10.6	10.6	19.9	19.3	17.3	10.6	11.6	13.3	10.6	11.9	17.3	13.3		
143	15	OUT	3.0	3.0	5.0	5.2	8.0	8.0	12.0	10.6	19.9	19.9	18.6	13.9	18.6	15.9	13.3	14.6	12.6	17.3	17.3	25.0/16.0	

*Actual horizontal and vertical inputs (g)
**Opening/closing times (seconds)

TABLE IX-III (Continued)

TEST RUN DESCRIPTIONS
FOR THE 10" ENVIRONMENTAL TEST VALVE
(LATERAL/VERTICAL ORIENTATION)

RUN NO.	FREQUENCY (Hz)	PHASE	HCA* (g) FILTERED	VCA* (g) FILTERED	HCA (g) UNFILTERED	VCA (g) UNFILTERED	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	** STROKE TIME (sec)	REMARKS
144	16	OUT	3.0	3.0	5.0	5.0	12.0	13.3	12.6	22.6	22.6	13.9	14.9	17.3	19.9	16.6	14.3	15.9	16.6	15.9	13.9		
145	17	OUT	3.0	3.0	5.2	5.2	18.3	14.0	13.3	21.3	21.3	27.9	21.3	19.9	44.3	27.9	15.9	17.3	23.3	23.3	15.9		
146	18	OUT	3.0	3.0	5.2	5.2	14.0	15.3	17.3	26.6	26.6	38.6	17.9	23.3	16.6	27.3	18.6	9.8	16.6	19.9	19.9		
147	19	OUT	3.0	3.0	5.2	5.2	16.6	17.5	17.3	22.9	26.6	38.6	26.6	21.3	26.6	27.9	19.9	21.3	17.3	26.3	19.9		MAX. RESPONSE
148	20	OUT	3.0	3.0	4.0	4.0	12.0	12.6	12.6	17.8	15.9	25.3	23.9	15.9	19.9	13.3	16.6	19.9	16.6	14.6	11.9		
149	21	OUT	3.0	2.0	4.0	4.0	12.0	12.0	12.0	11.9	14.6	22.6	19.9	15.3	21.3	19.9	11.9	15.9	11.9	14.6	11.3		
150	22	OUT	3.0	2.0	4.0	4.0	14.6	13.0	10.6	14.6	11.9	19.9	19.3	16.6	9.9	13.9	19.6	16.6	13.3	13.3	11.9		
151	23	OUT	3.0	3.0	3.8	3.8	7.0	7.0	7.5	6.0	6.0	14.0	12.0	10.0	10.5	10.0	6.5	10.0	6.5	8.0	7.5		
152	24	OUT	3.0	3.0	3.8	3.8	6.5	7.0	7.0	6.0	6.5	12.0	12.0	11.5	11.0	10.5	7.0	8.0	6.0	8.0	7.0		
153	25	OUT	3.0	3.0	3.6	3.6	6.0	6.5	7.5	6.5	6.5	11.0	11.0	9.5	10.0	9.5	7.5	8.0	5.5	8.0	7.0	15.4/16.0	
154	26	OUT	3.0	3.0	3.4	3.4	6.0	6.0	7.0	6.0	6.5	13.3	13.9	11.9	11.9	12.6	6.0	7.0	5.5	7.0	6.0		
155	27	OUT	2.9	3.0	3.2	3.4	6.0	6.0	7.5	5.5	7.5	13.3	12.6	12.6	11.9	12.6	6.5	7.0	6.0	6.5	6.9		
156	28	OUT	2.8	2.0	3.2	3.2	5.5	5.5	7.0	6.0	8.0	11.9	12.6	14.6	11.9	14.6	6.0	6.5	6.5	5.5	5.0		
157	29	OUT	2.6	2.6	3.0	3.0	4.5	5.0	6.5	6.0	8.0	8.0	8.0	6.0	9.0	6.0	5.0	6.0	4.0	5.0	4.0		
158	30	OUT	2.4	2.4	2.9	2.9	4.7	4.0	6.0	3.5	8.0	7.5	7.0	5.5	8.0	5.5	4.5	5.0	4.0	4.0	4.0		
159	31	OUT	2.3	2.3	2.6	2.6	4.0	4.0	6.0	3.0	7.0	7.5	7.0	5.5	7.0	5.0	4.0	5.0	4.0	4.0	4.0		
160	32	OUT	2.1	2.1	2.4	2.4	3.0	3.5	5.5	7.5	7.0	7.5	6.5	6.0	7.0	4.5	4.5	6.0	4.5	4.0	4.5		
161	33	OUT	2.0	2.0	2.2	2.2	3.0	3.5	5.5	7.0	6.0	7.0	8.0	6.0	7.0	6.0	4.0	8.0	6.0	4.0	6.0	15.5/8.9	
162	40	OUT	2.0	2.0	2.4	2.4	5.3	5.3	6.0	2.5	4.6	4.3	4.1	4.7	4.7	4.7	3.9	3.9	3.9	5.3	4.6		
163	33	OUT	2.0	2.0	2.2	2.2	3.7	4.6	4.6	2.6	4.3	4.1	4.3	4.2	4.8	5.6	3.4	5.6	4.8	7.4	4.3	15.8/8.5	
164	30	OUT	2.4	2.4	2.9	2.8	6.0	5.5	6.0	6.0	6.0	7.0	8.0	7.0	8.0	8.5	6.0	6.5	6.0	5.0	4.0	[illegible]	
165	17.5	OUT	3.0	3.0	4.0	4.0	10.5	11.0	13.0	18.0	18.0	20.0	18.0	16.0	18.0	17.0	11.5	13.0	9.5	11.5	10.0	[illegible]	
166	30	IN	2.4	2.4	3.1	3.0	4.5	9.0	10.0	5.0	13.0	17.0	20.0	-	-	18.0	13.0	13.0	17.0	16.0	14.0	[illegible]	LOOSE ACCEL ON SOLENOID
167	33	IN	2.0	2.0	3.4	3.0	4.0	4.0	16.0	7.0	12.5	20.0	20.0	18.0	20.0	24.0	16.0	16.0	11.0	14.0	13.0	[illegible]	
168	31	IN	2.3	2.3	3.2	3.2	4.0	13.0	13.0	8.3	12.5	26.6	22.6	21.3	19.9	9.9	16.0	8.0	[illegible]	13.9	12.0	[illegible]	
169	19	OUT	3.0	3.0	4.0	3.8	12.0	16.3	16.3	26.6	21.3	26.6	26.3	21.3	26.6	26.6	8.0	8.0	4.0	8.0	[illegible]	[illegible]	

*Actual horizontal and vertical inputs (g)
**Opening/closing times (seconds)

TABLE IX-IV

MAXIMUM ACCESSORY RESPONSES FOR THE NOMINAL 3g SINE BEAT TESTING

Accel. No.	6H, 7V	8H, 9V	12H, 13V	14H, 15V	10H, 11V	4H, 5V
Accessory	95H Reg.	ASCO	NAMCO #1	NAMCO #2	Versa	Term. Box
Desired Response (g)	22.0	20.1	18.0	18.0	20.1	26.8
Measured Response (g)	37.2	27.9	26.6	21.3	24.6	27.9
Freq.@ Mea. Resp. (Hz)	40.0	40.0	27.0	19.0	19.0	19.0
Phase	In	In	In	Out	Out	Out
Orientation	Lateral	Lateral	Lateral	Lateral	Lateral	Lateral
Filtered Input, H	2.25	2.25	3.0	3.0	3.0	3.0
Filtered Input, V	2.5	2.5	3.0	3.0	3.0	3.0
Wiley Run No.	125	125	118	147	147	147

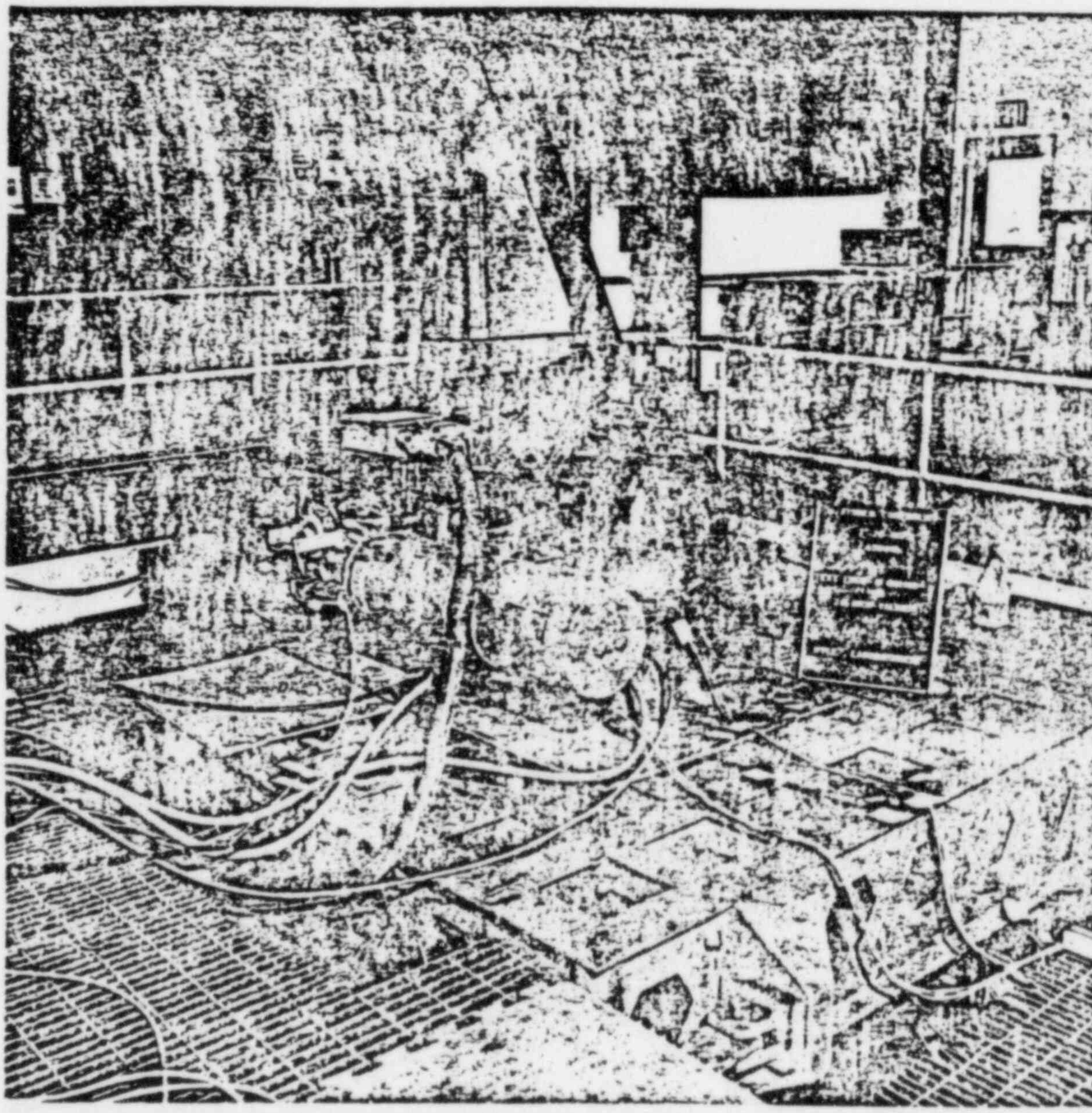
Comments

The desired response levels were met or exceeded in the longitudinal orientation for each accessory except the "Namco #1" and the "Term. Box". Two (2) additional tests were performed in the longitudinal orientation to excite these two accessories as described below.

MAXIMUM ACCESSORY RESPONSES FOR ACCESSORIES NOT MEETING THE DESIRED RESPONSE FOR THE NOMINAL 3g SINE BEAT TESTING (IN THE LONGITUDINAL ORIENTATION)

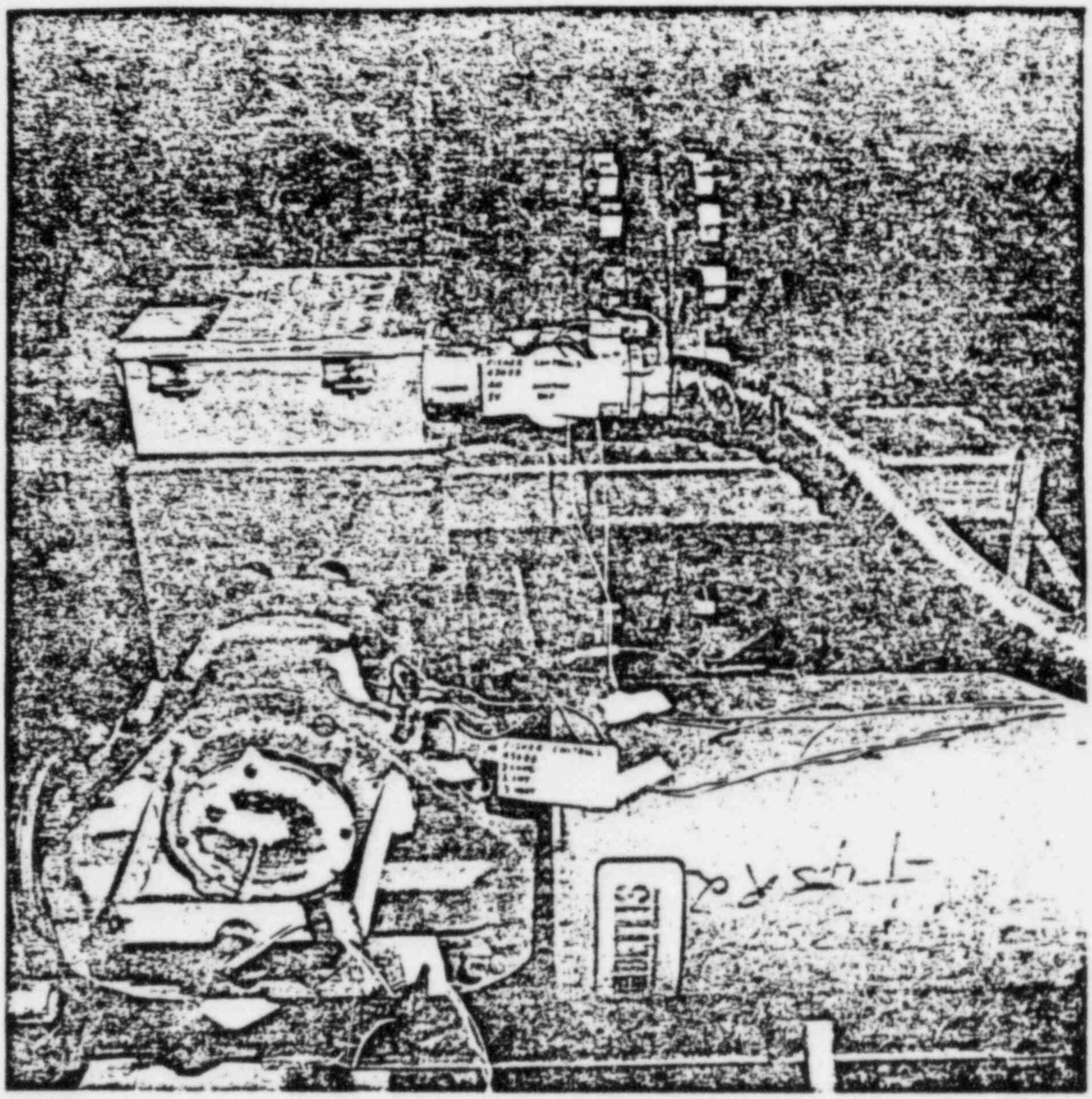
Accel. No.			12H, 13V			4H, 5V
Accessory			NAMCO #1			Term. Box
Desired Response (g)			18.0			26.8
TRIAL 1						
Filtered Input, H			2.5			2.5
Filtered Input, V			3.5			3.5
Measured Response (g)			14.6			20.0
Freq.@ Mea. Resp. (Hz)			19.0			19.0
Phase			Out			Out
Orientation			Longitudinal			Longitudinal
Wiley Run No.			85			85
TRIAL 2						
Filtered Input, H			3.25			3.25
Filtered Input, V			3.25			3.25
Measured Response (g)			18.6			26.8
Freq.@ Mea. Resp. (Hz)			19.0			19.0
Phase			Out			Out
Orientation			Longitudinal			Longitudinal
Wiley Run No.			86			86

Comments



PHOTOGRAPH IX-1

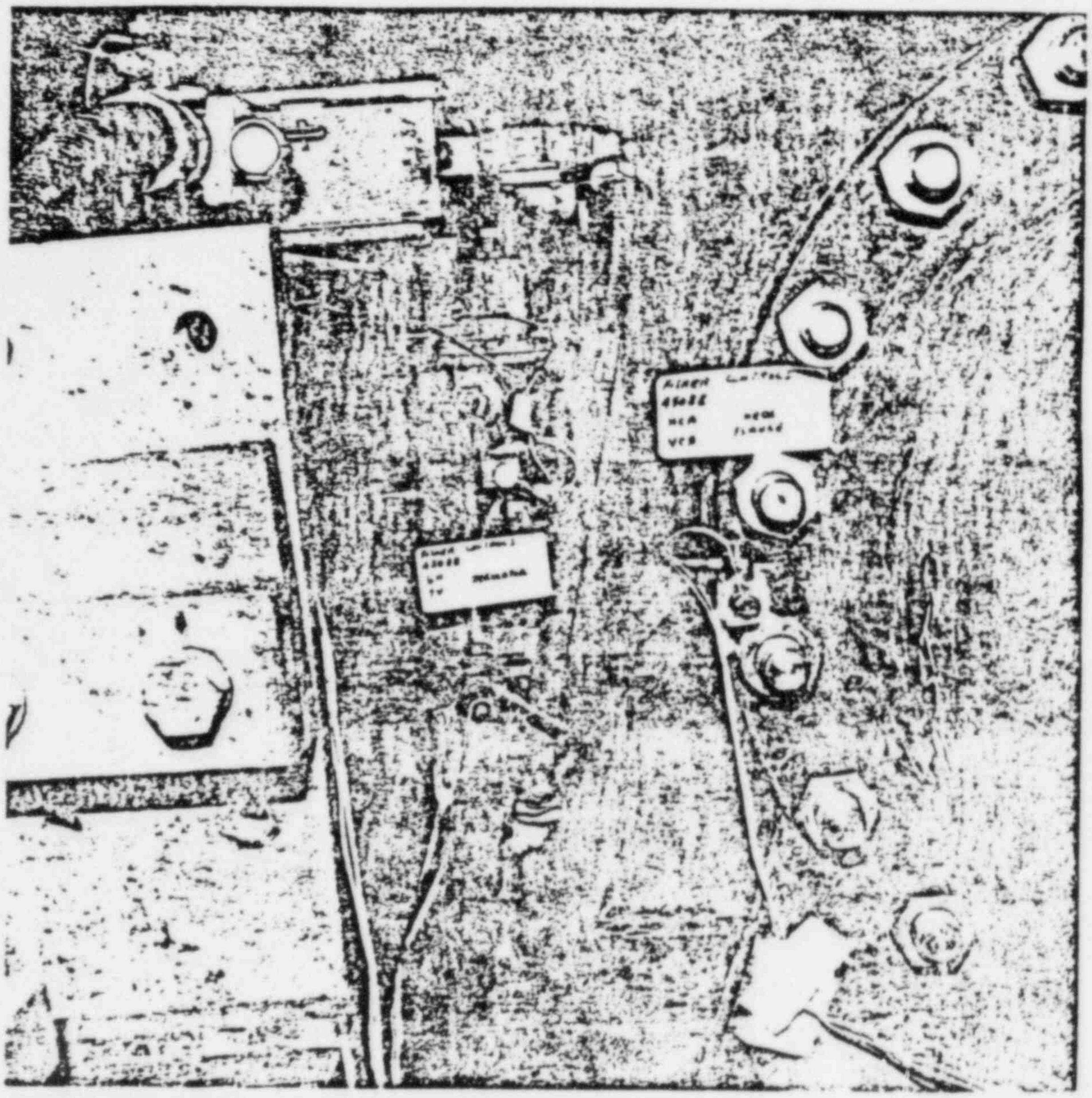
THE SPECIMEN MOUNTED ON THE
WYLE MULTIAXIS SEISMIC SIMULATOR TABLE
FOR TESTING IN THE LONGITUDINAL/VERTICAL TEST ORIENTATION



PHOTOGRAPH IX-2

ACCELEROMETER LOCATIONS 1 LONGITUDINAL, 2 LATERAL
AND 3 VERTICAL AT THE ACTUATOR CENTER OF GRAVITY

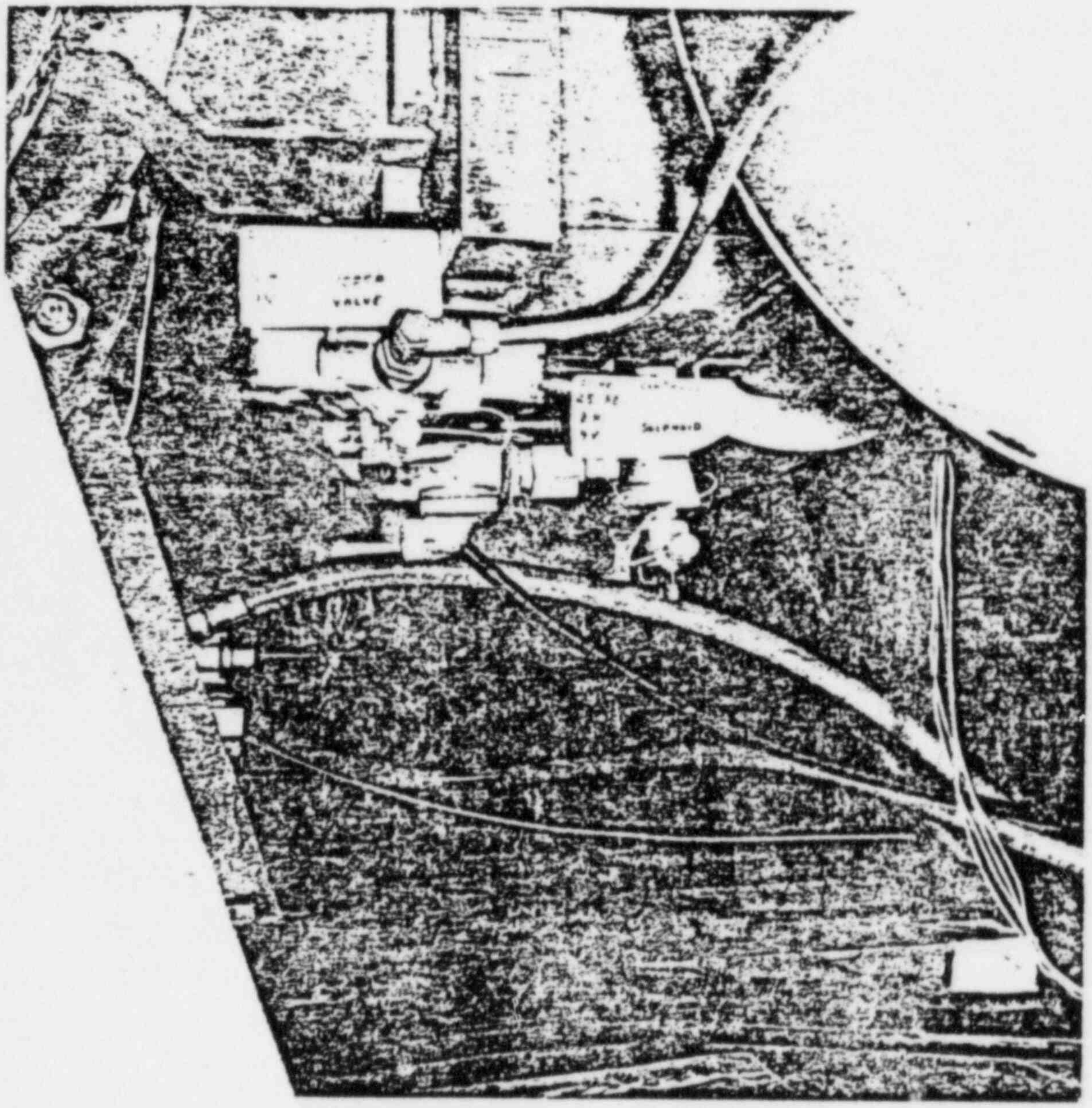
ACCELEROMETER LOCATIONS 4H AND 5V ON THE JUNCTION BOX



PHOTOGRAPH IX-3

ACCELEROMETER LOCATIONS 6H AND 7V
ON THE 95H PRESSURE REGULATOR

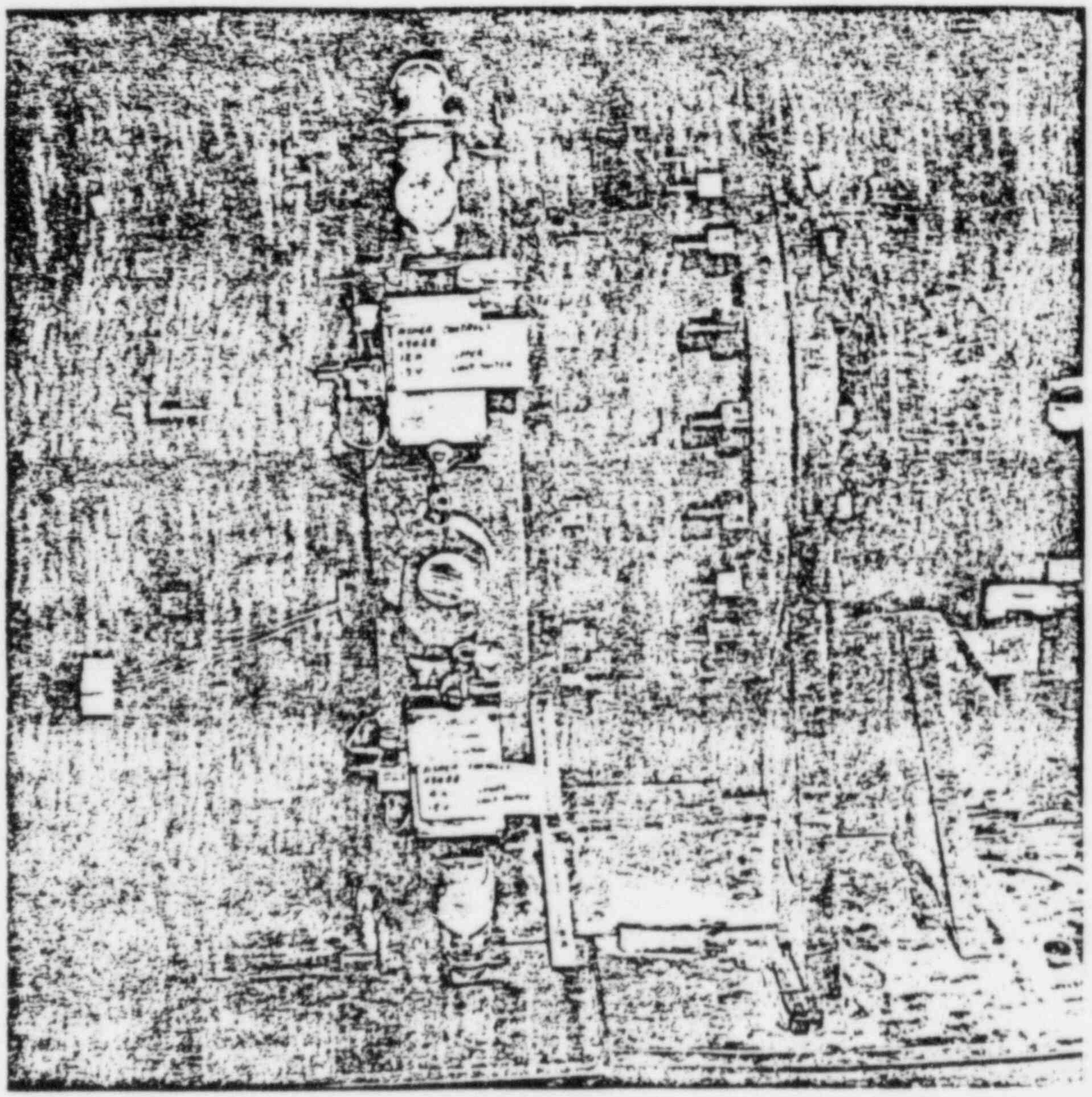
LOCATION OF THE HORIZONTAL AND VERTICAL CONTROL
ACCELEROMETERS ON THE NECK FLANGE OF THE TEST FIXTURE



PHOTOGRAPH IX-4

ACCELEROMETER LOCATIONS 8H AND 9V
ON THE SOLENOID VALVE

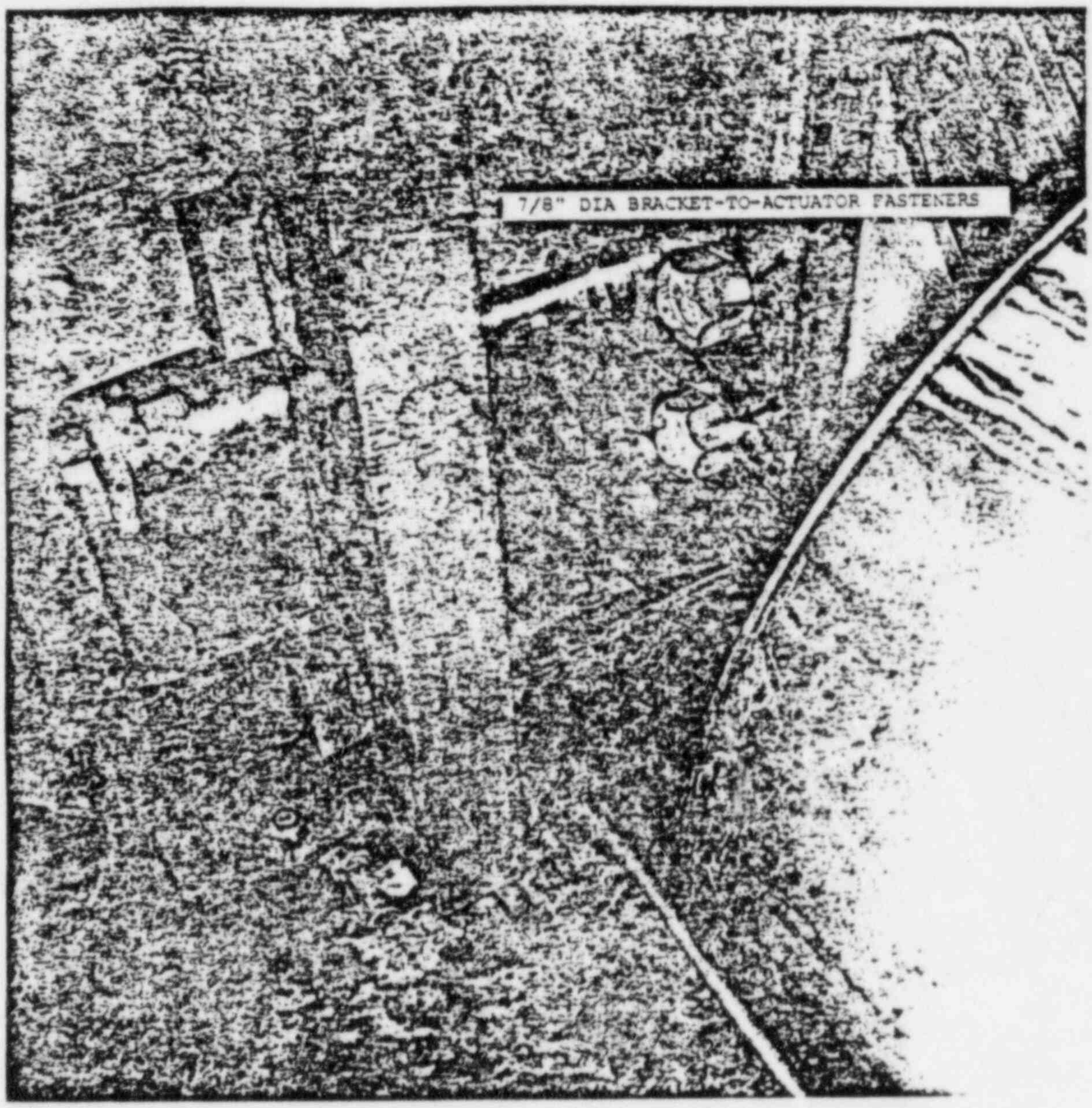
ACCELEROMETER LOCATIONS 10H AND 11V ON THE
"VERSA" 3-WAY AIR-OPERATED VALVE



PHOTOGRAPH IX-5

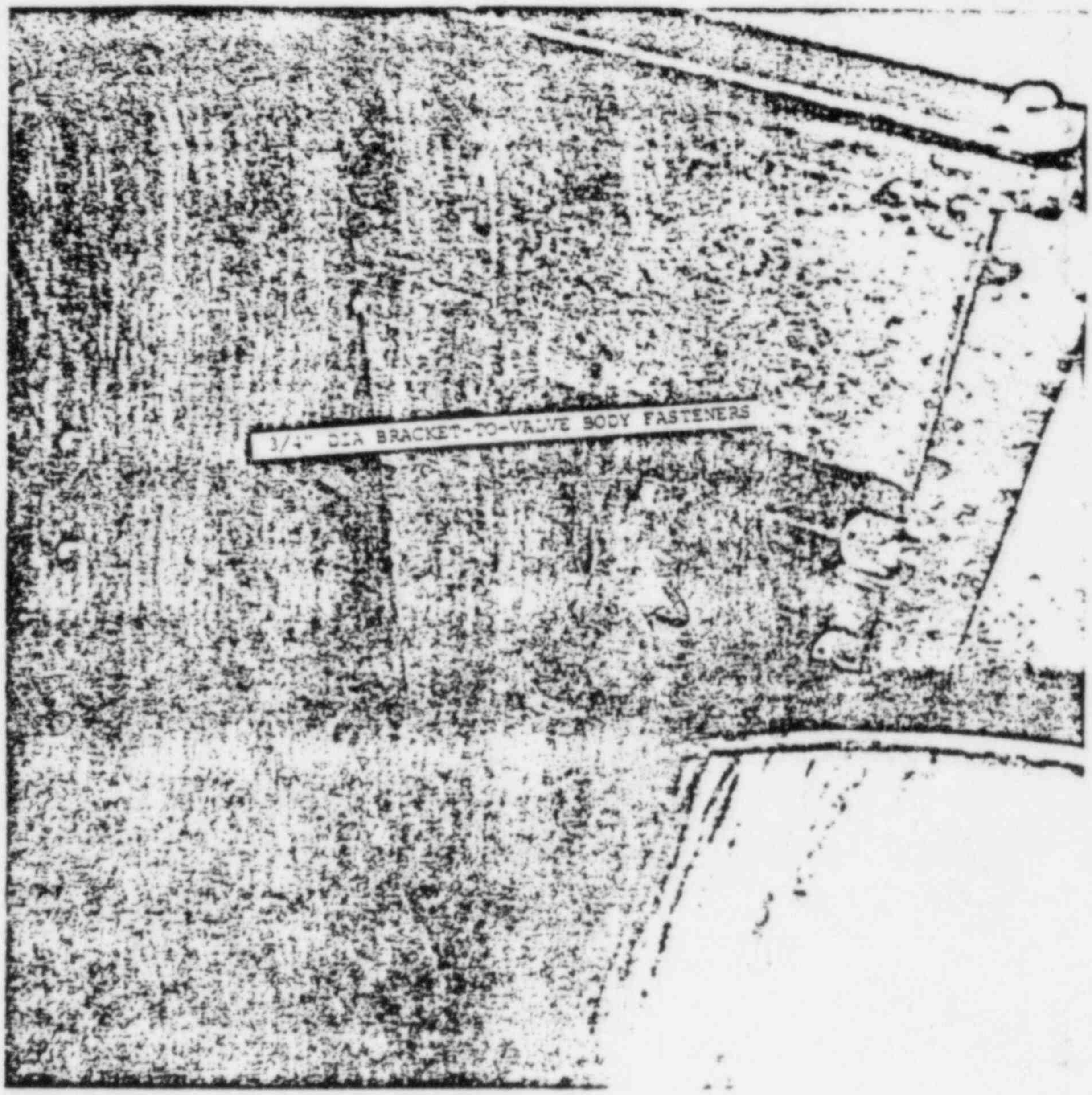
ACCELEROMETER LOCATIONS 12H AND 13V
ON THE UPPER LIMIT SWITCH

ACCELEROMETER LOCATIONS 14H AND 15V
ON THE LOWER LIMIT SWITCH



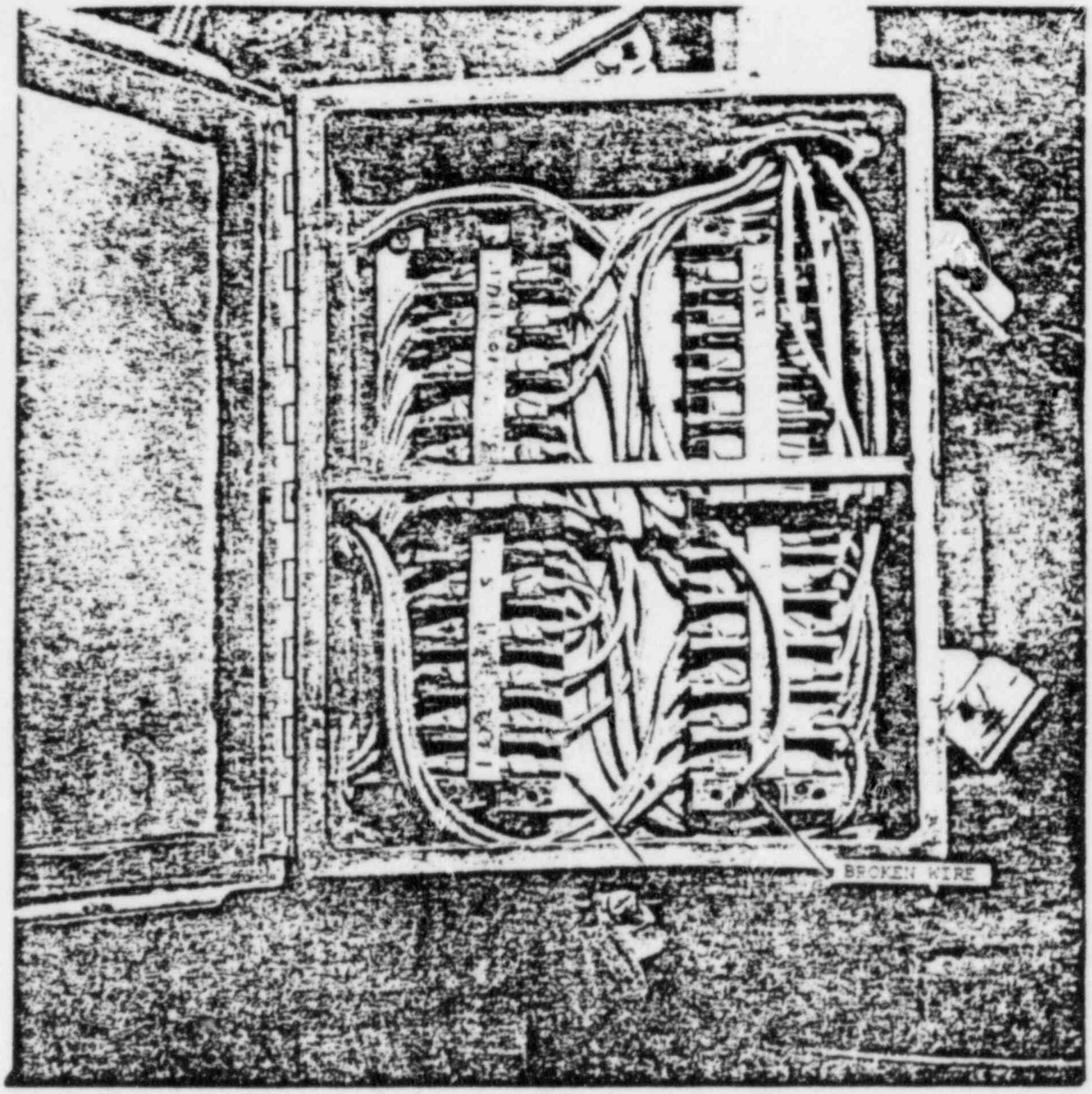
PHOTOGRAPH IX-6

TWO OF THE MOUNTING BOLTS (7/8" DIA.)
WHICH ATTACH THE BETTIS ACTUATOR
TO THE MOUNTING BRACKET



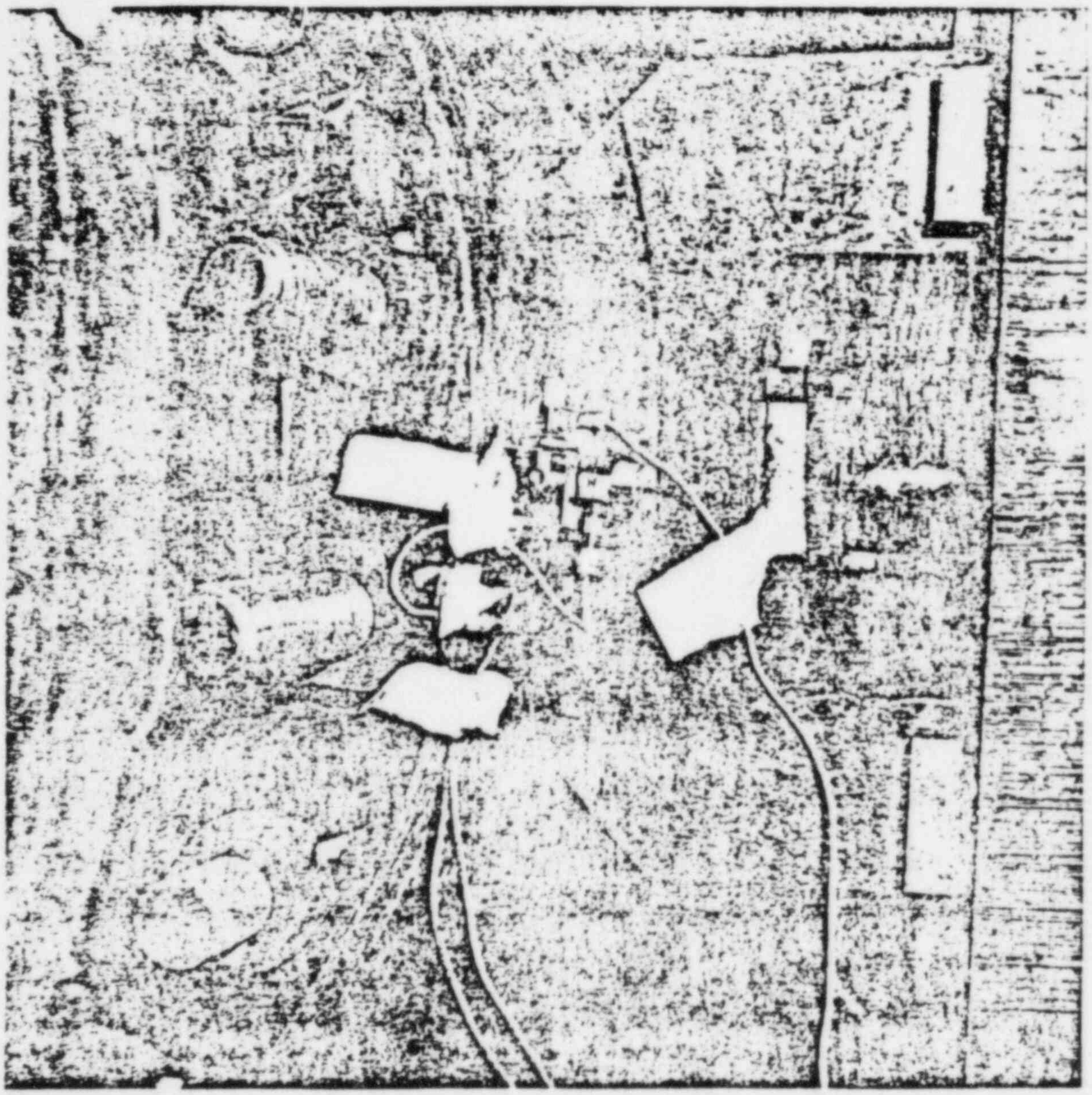
PHOTOGRAPH IX-7

TWO OF THE MOUNTING BOLTS (3/4" DIA.)
WHICH ATTACH THE MOUNTING BRACKET
TO THE VALVE BODY



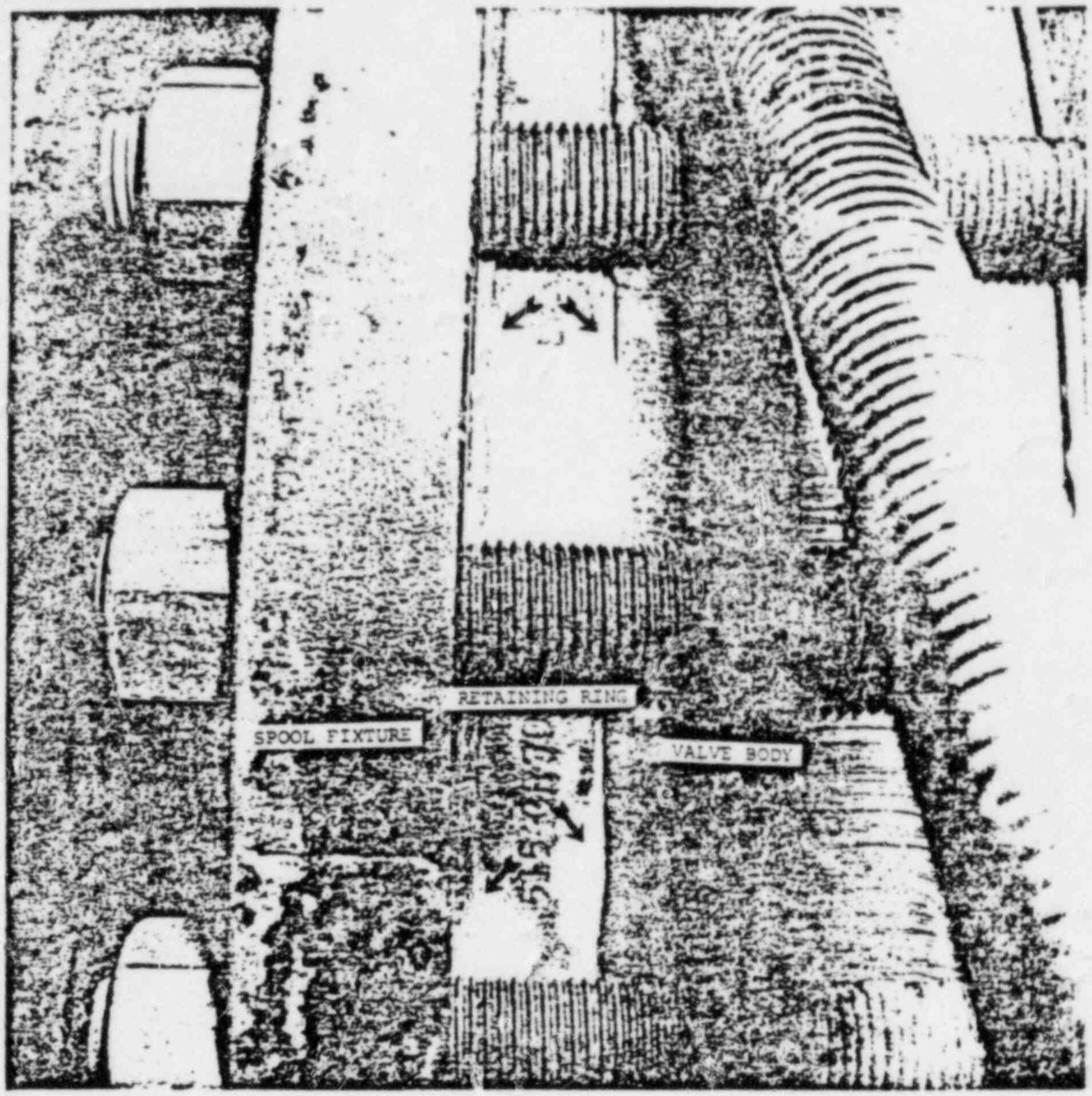
PHOTOGRAPH IX-8

BROKEN CONNECTION IN THE JUNCTION BOX



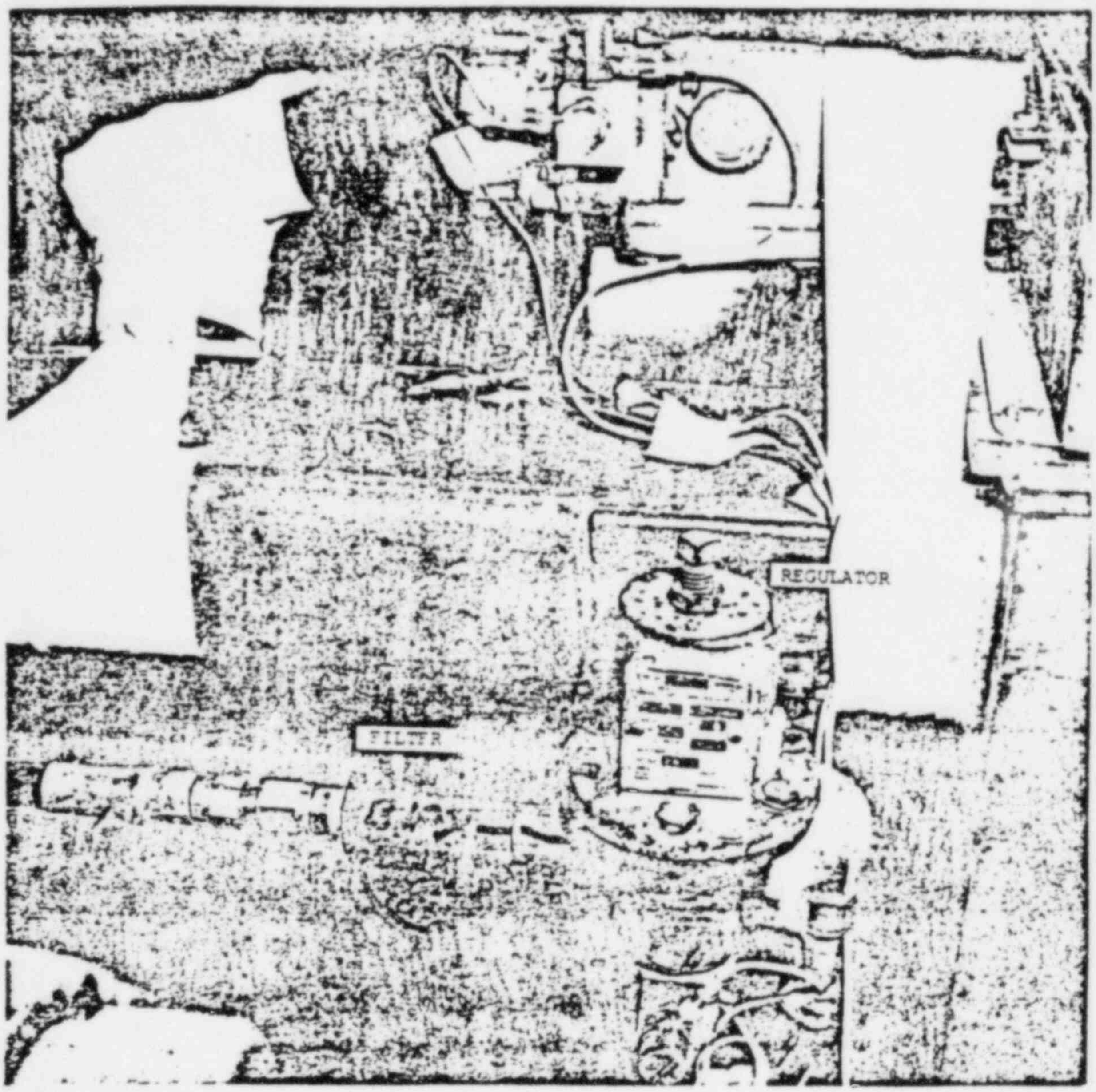
PHOTOGRAPH IX-9

PACKING LEAKAGE ON ACTUATOR SIDE OF VALVE BODY



PHOTOGRAPH IX-10

LEAKAGE BETWEEN THE RETAINING RING AND VALVE BODY AND BETWEEN THE RETAINING RING AND SPOOL FIXTURE



PHOTOGRAPH IX-11

LEAKAGE AROUND FILTER AND AT THE
OUTLET CONNECTION OF THE 95H REGULATOR

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APPENDIX I

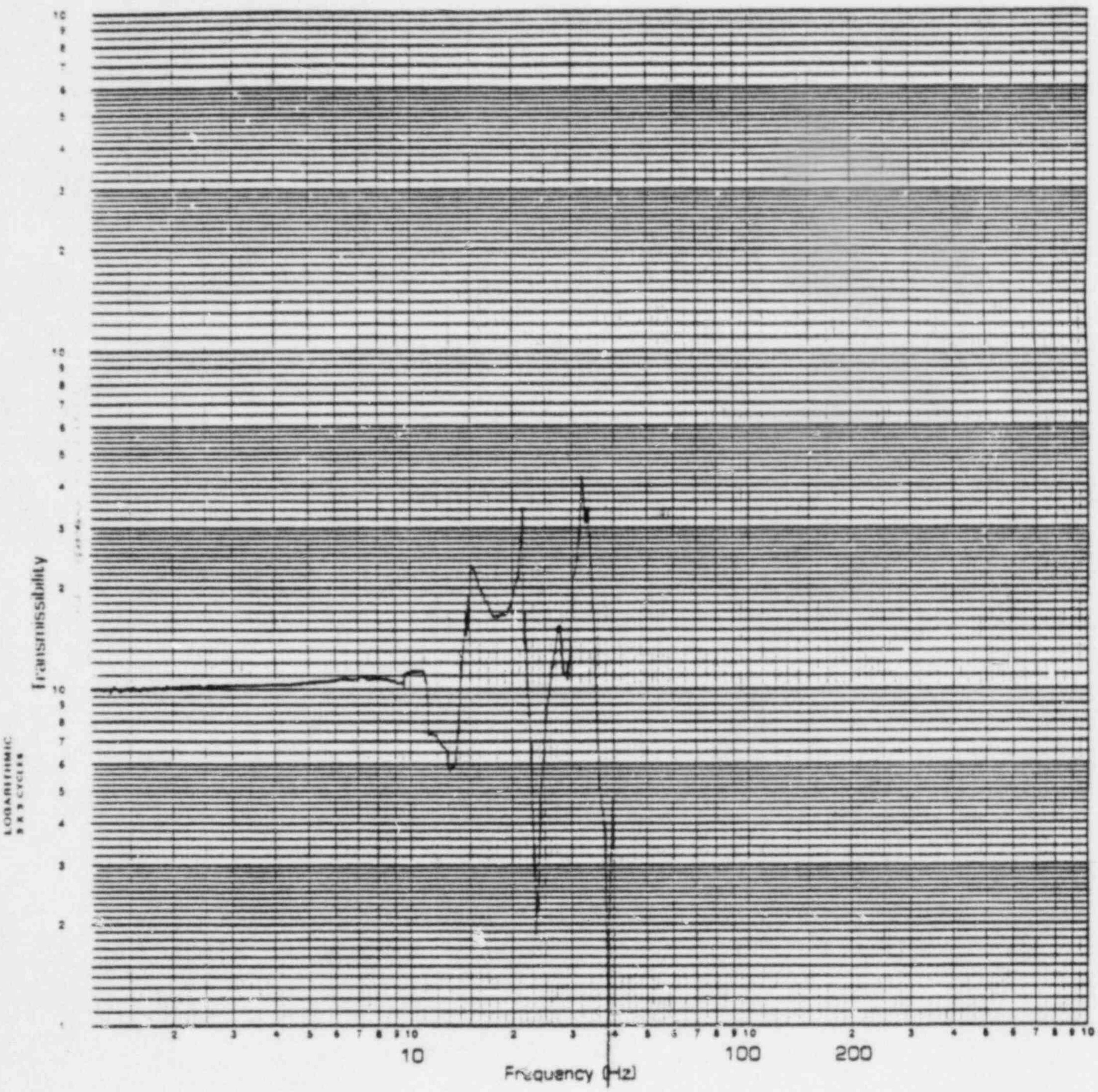
TRANSMISSIBILITY PLOTS

RUN	AXES	PHASE
1	Longitudinal/Vertical	In
2	Longitudinal/Vertical	Out
87	Lateral/Vertical	In
88	Lateral/Vertical	Out

NOTE: HCA = Horizontal Control Accelerometer
VCA = Vertical Control Accelerometer

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

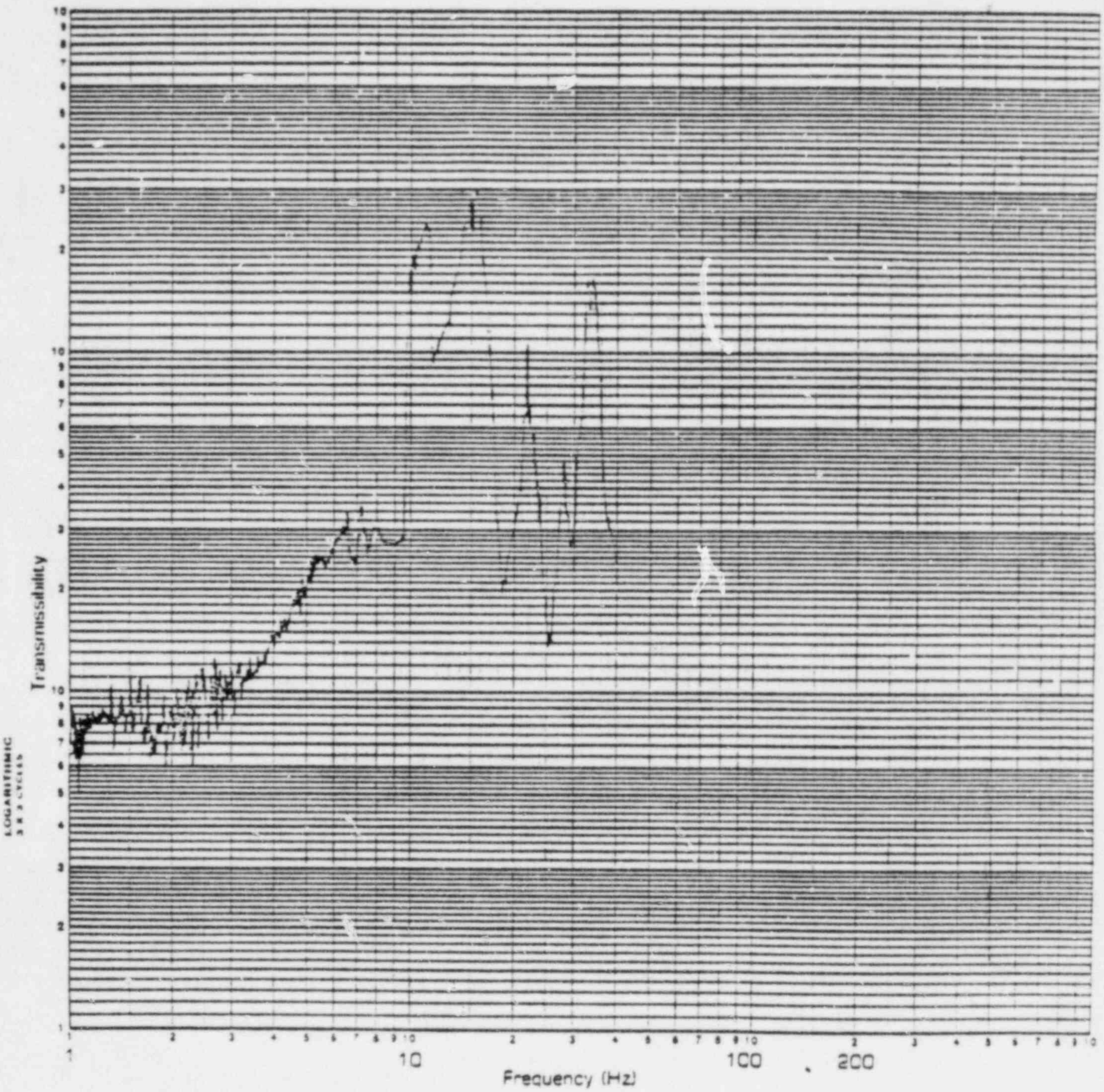
ACCEL NO. LLONG NO. HCa

AXIS LONG/V

TEST RUN NO. 1

FULL SCALE TRANSMISSIBILITY

-- 0.1 ☐ 1.0 ☐ 10 ☒ 100 ☐ 1000 ☐



SPECIMEN 20"

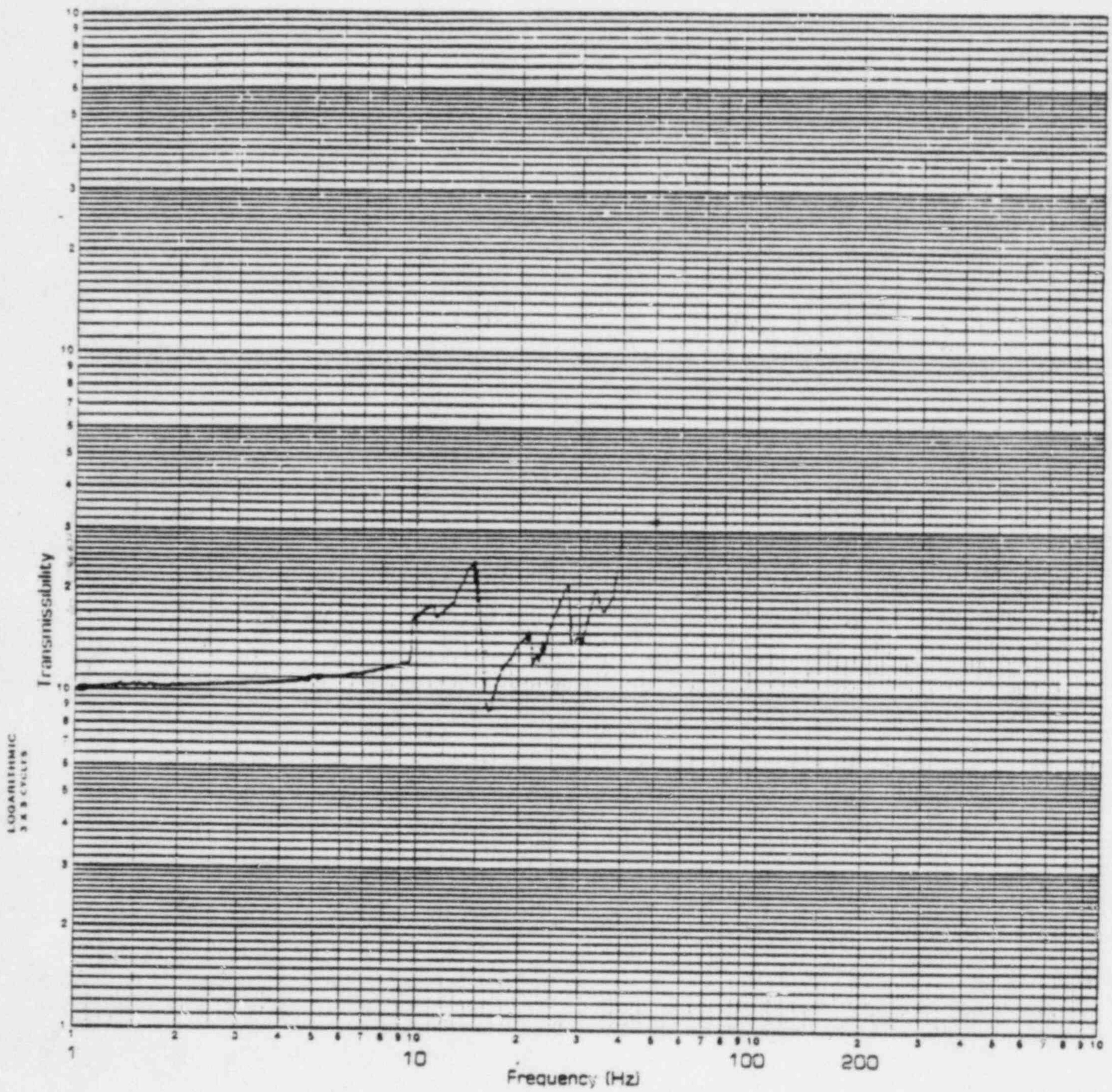
ACCEL NO. 2LAT NO. HC4

AXIS LONG/V

TEST RUN NO. 1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN '20"

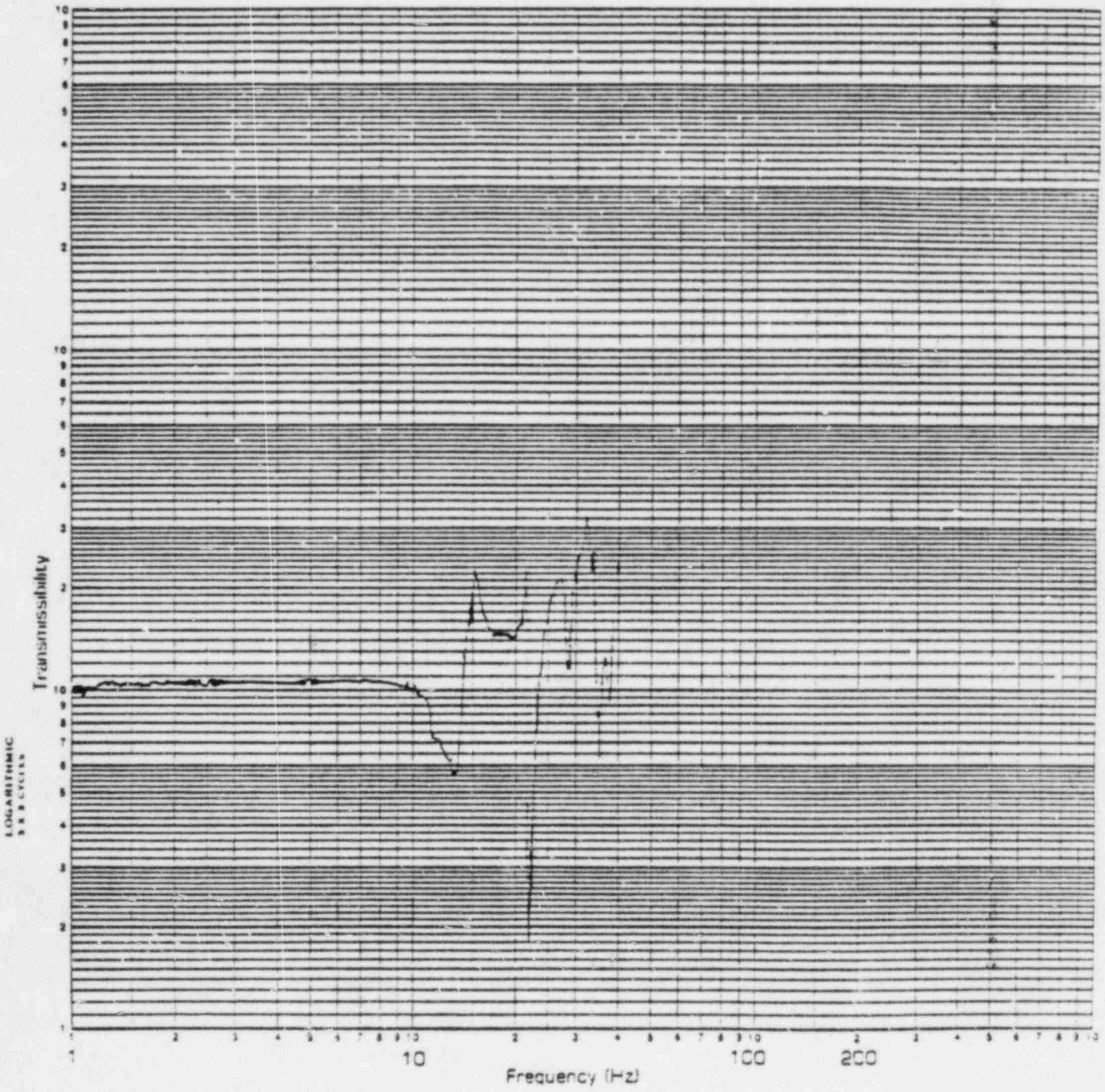
AXIS LONG/V

ACCEL NO. 3V NO. VCA

TEST RUN NO. 1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

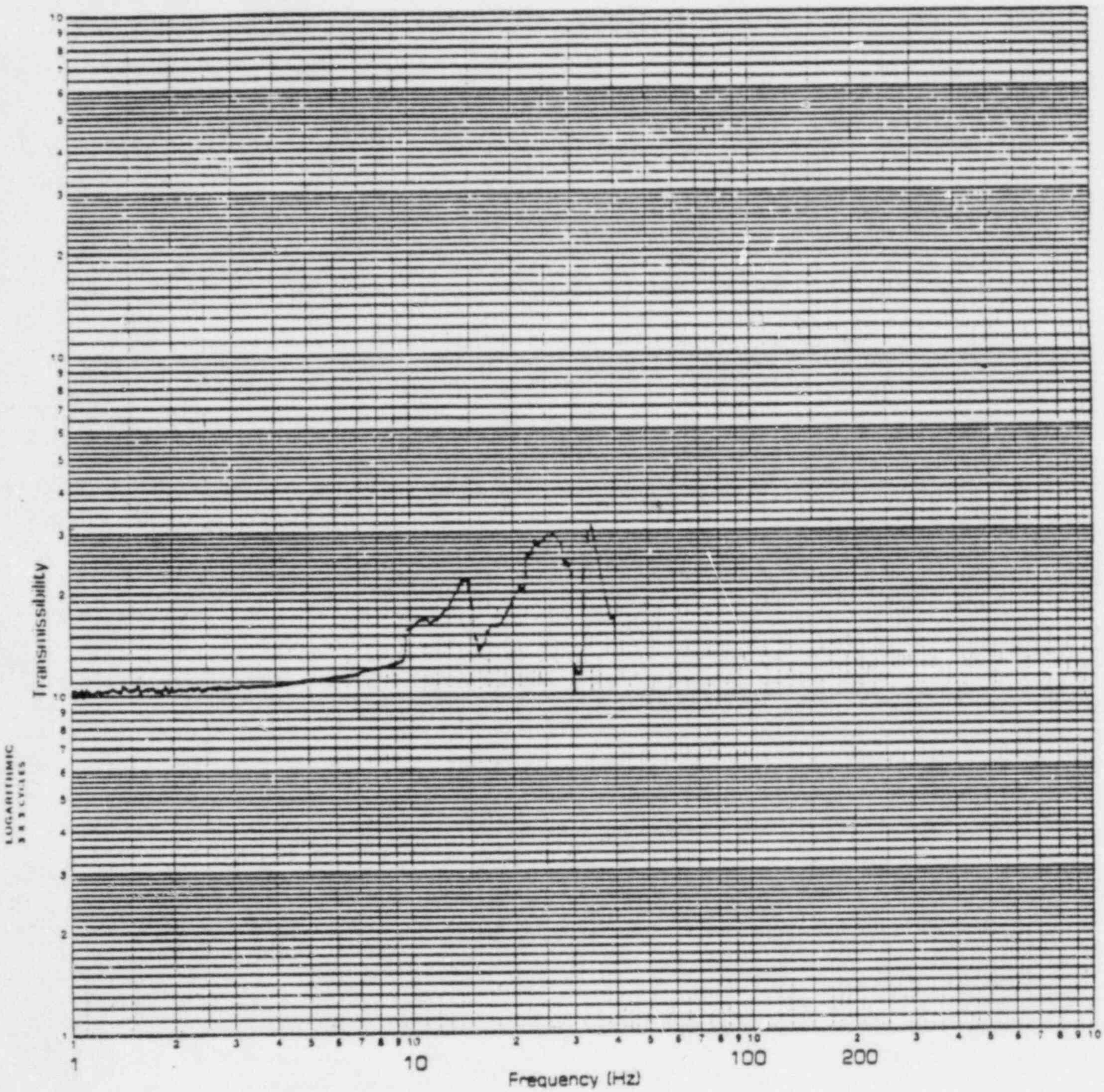
AXIS LONG | V

ACCEL NO. Y LONG NO. HCA

TEST RUN NO. 1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

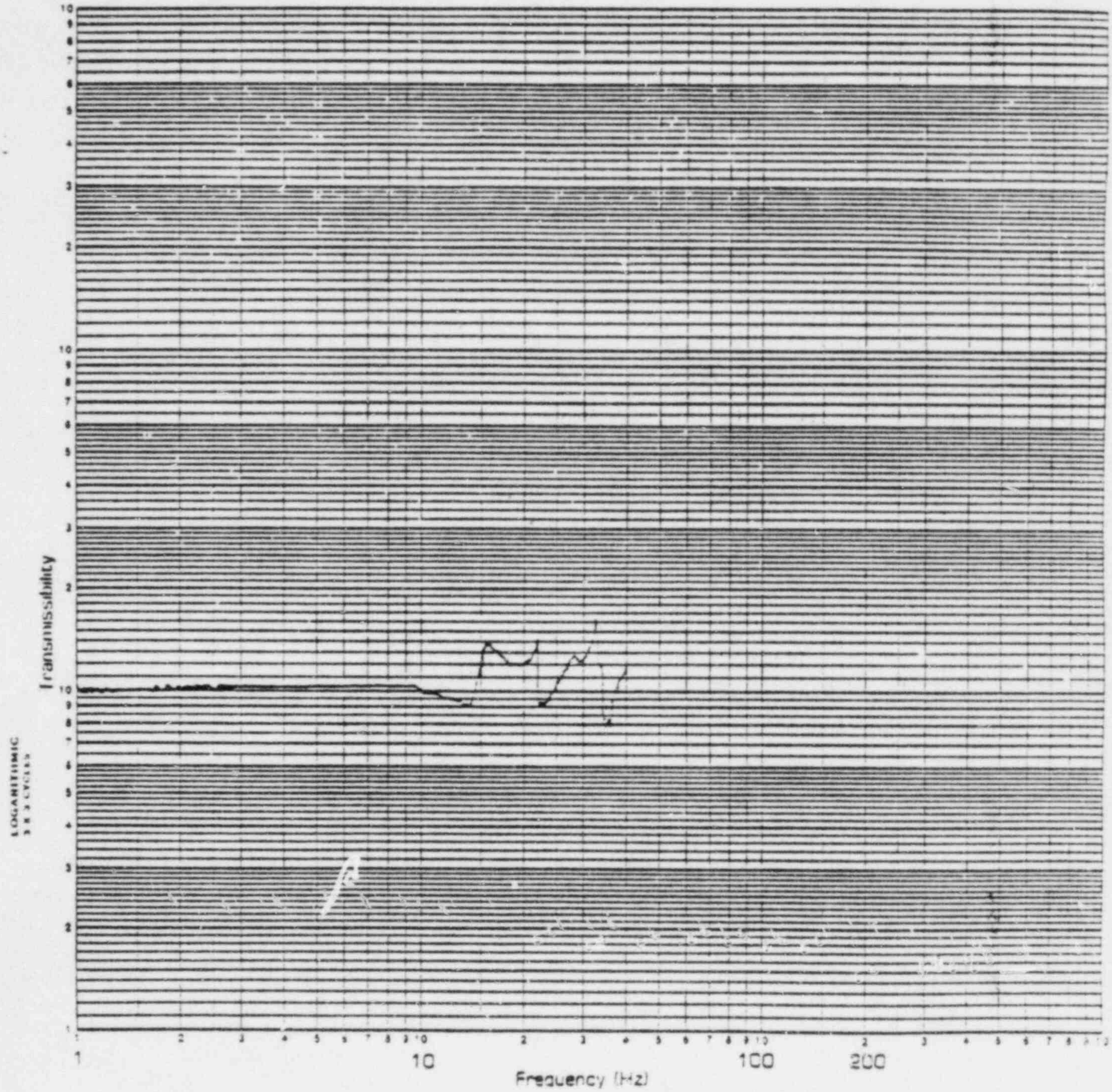
ACCEL NO. 5V NO. VCA

AXIS LONG/V

TEST RUN NO. 1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

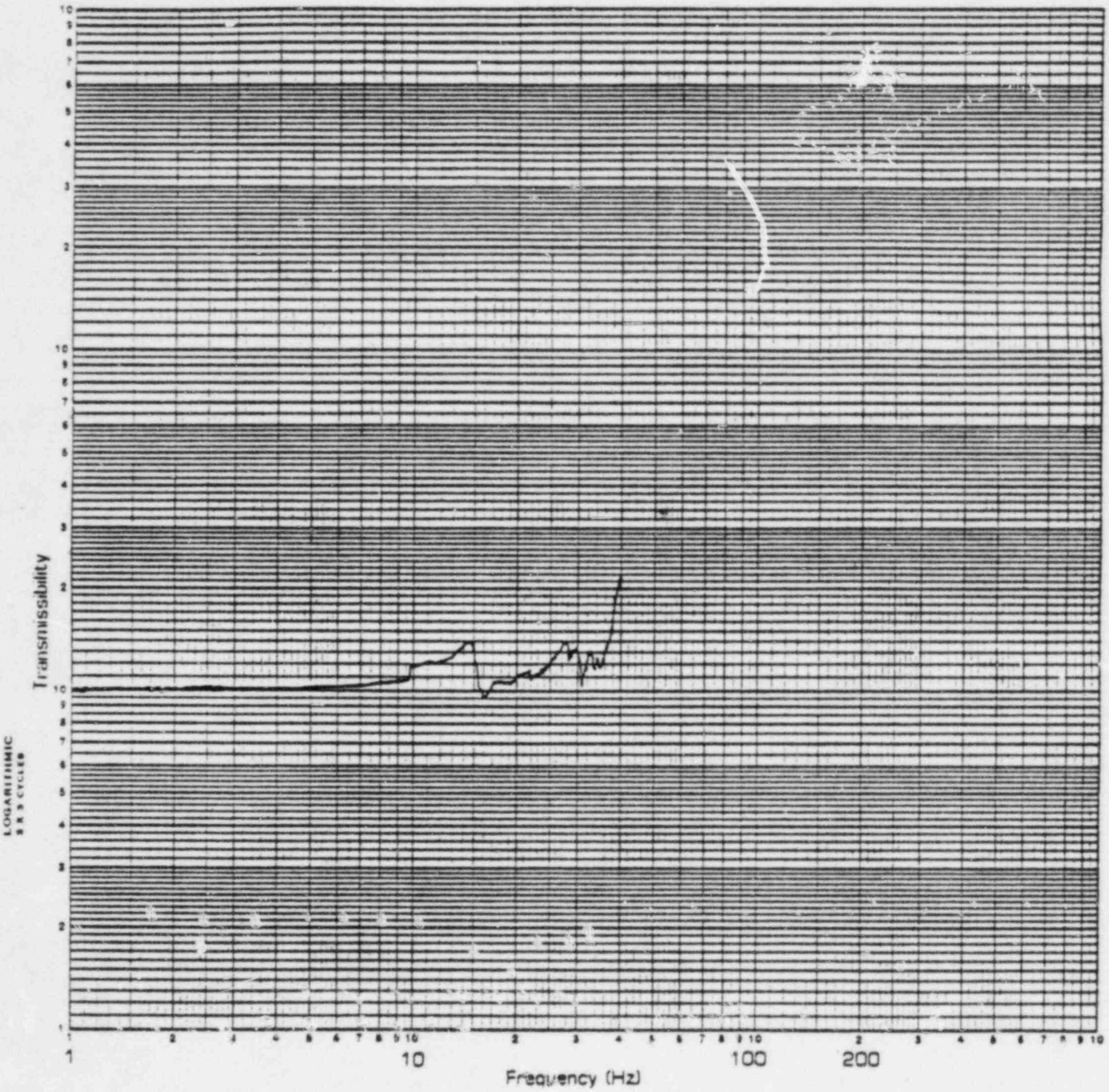
ACCEL NO. 6 LONG NO. HCA

AXIS LONG/V

TEST RUN NO. 1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

AXIS LONG/V

ACCEL NO. 7V NO. VCA

TEST RUN NO. 1

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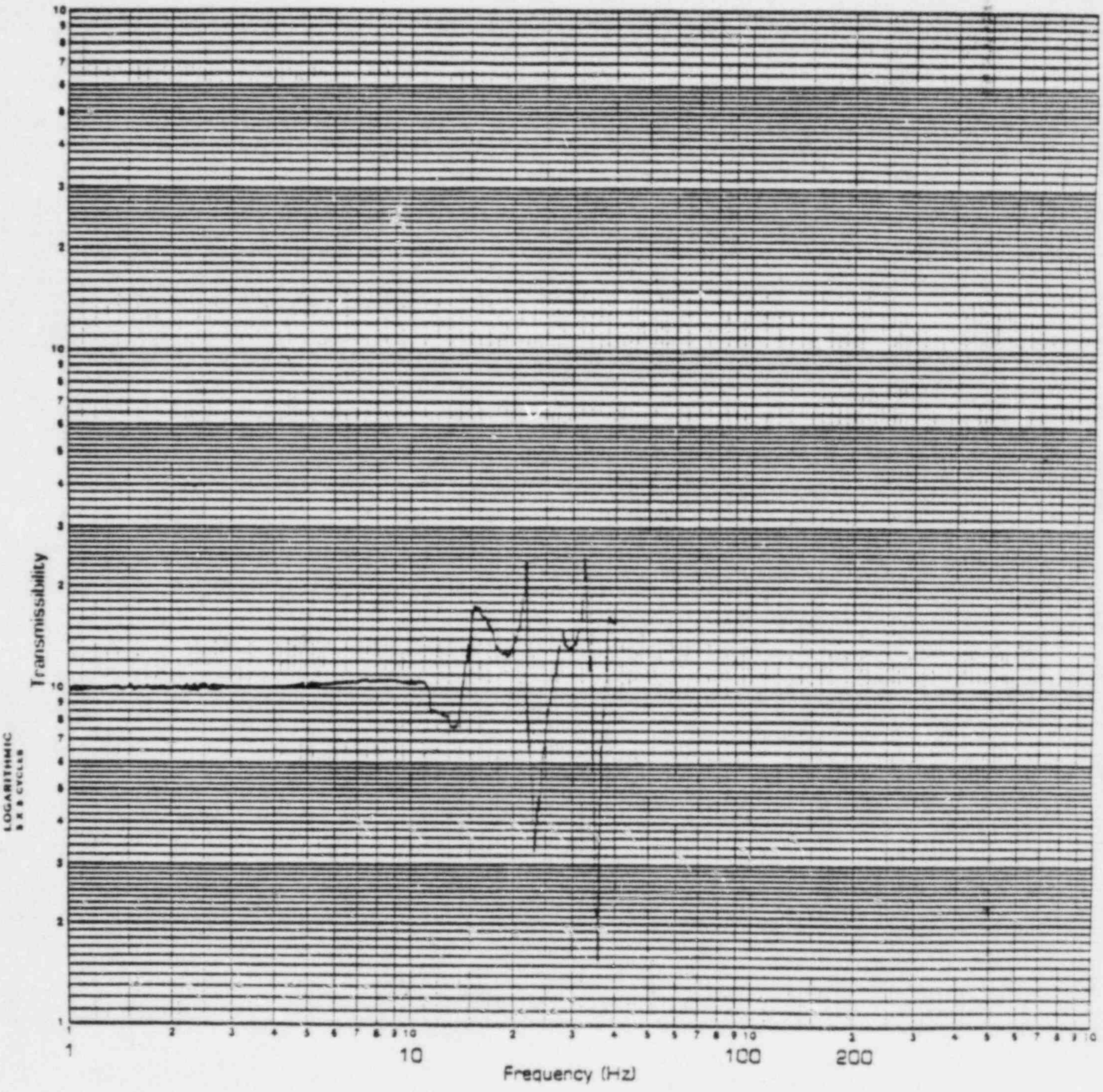
Report No. 45088-1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

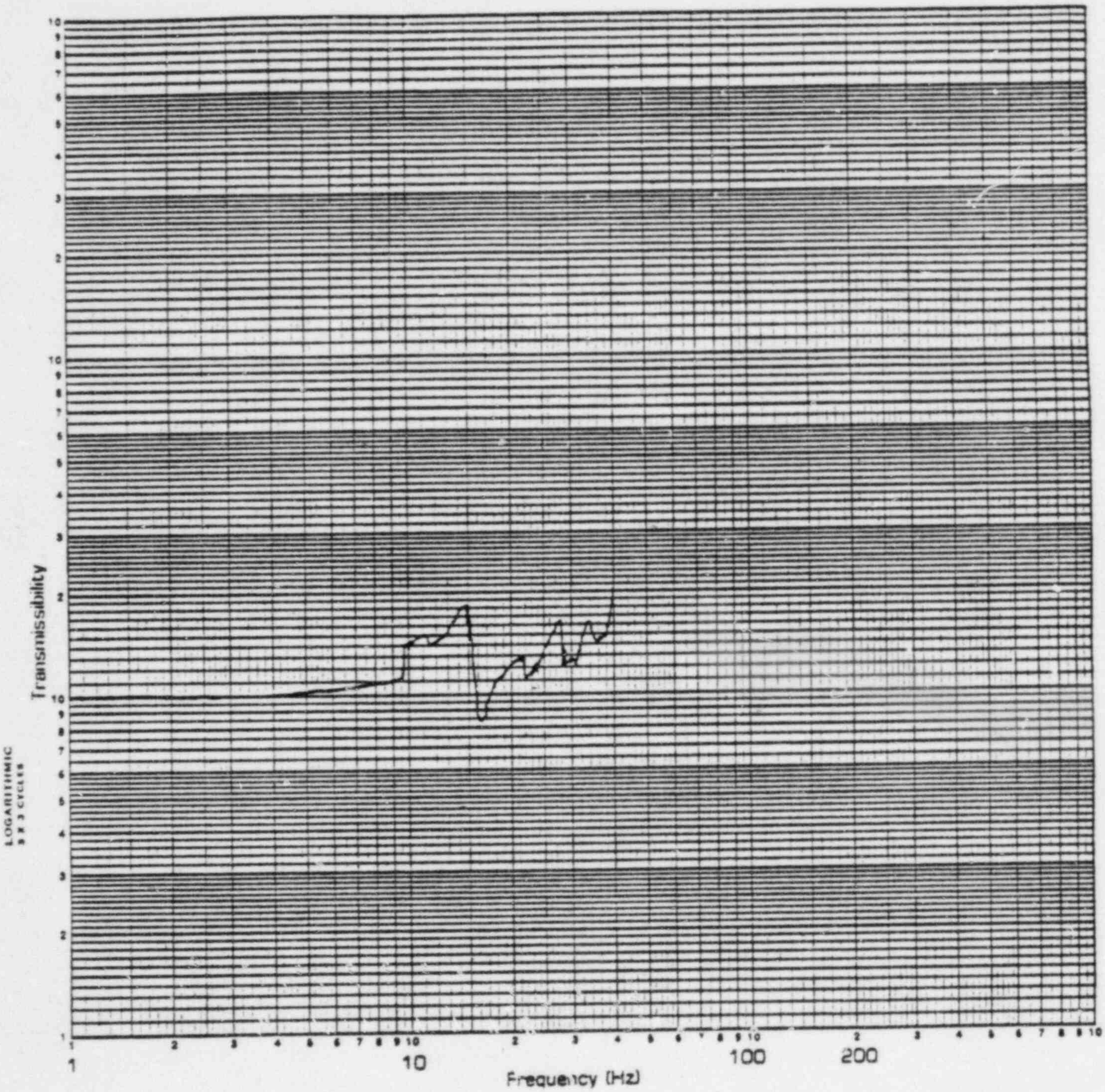
AXIS LONG/V

ACCEL NO. 8LONG NO. HC-1

TEST RUN NO. 1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

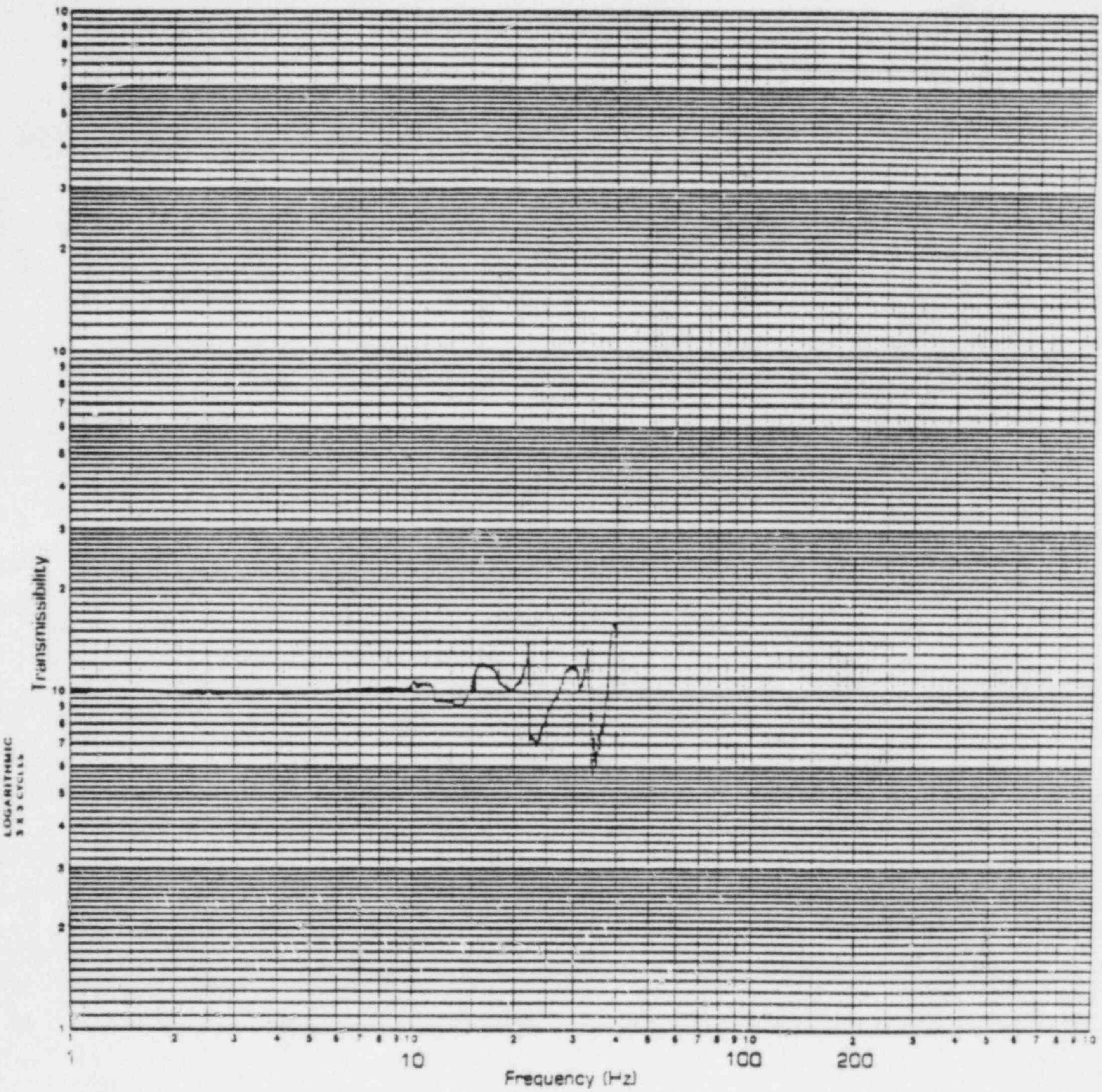
AXIS LONG/V

ACCEL NO. 9V NO. VCA

TEST RUN NO. 1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

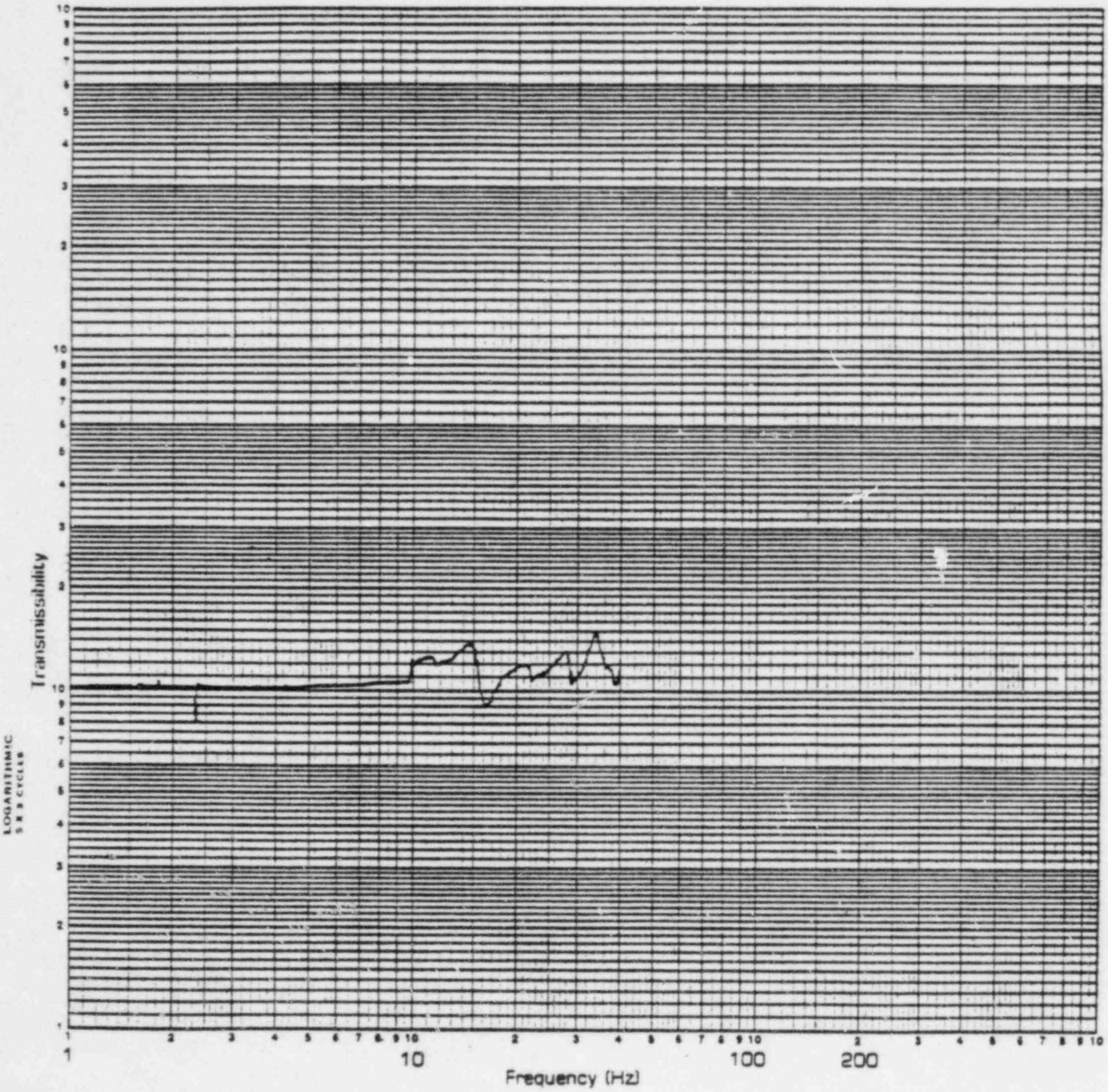
AXIS LONG/V

ACCEL NO. 10 LONG GND. HCA

TEST RUN NO. 1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

AXIS LONG/V

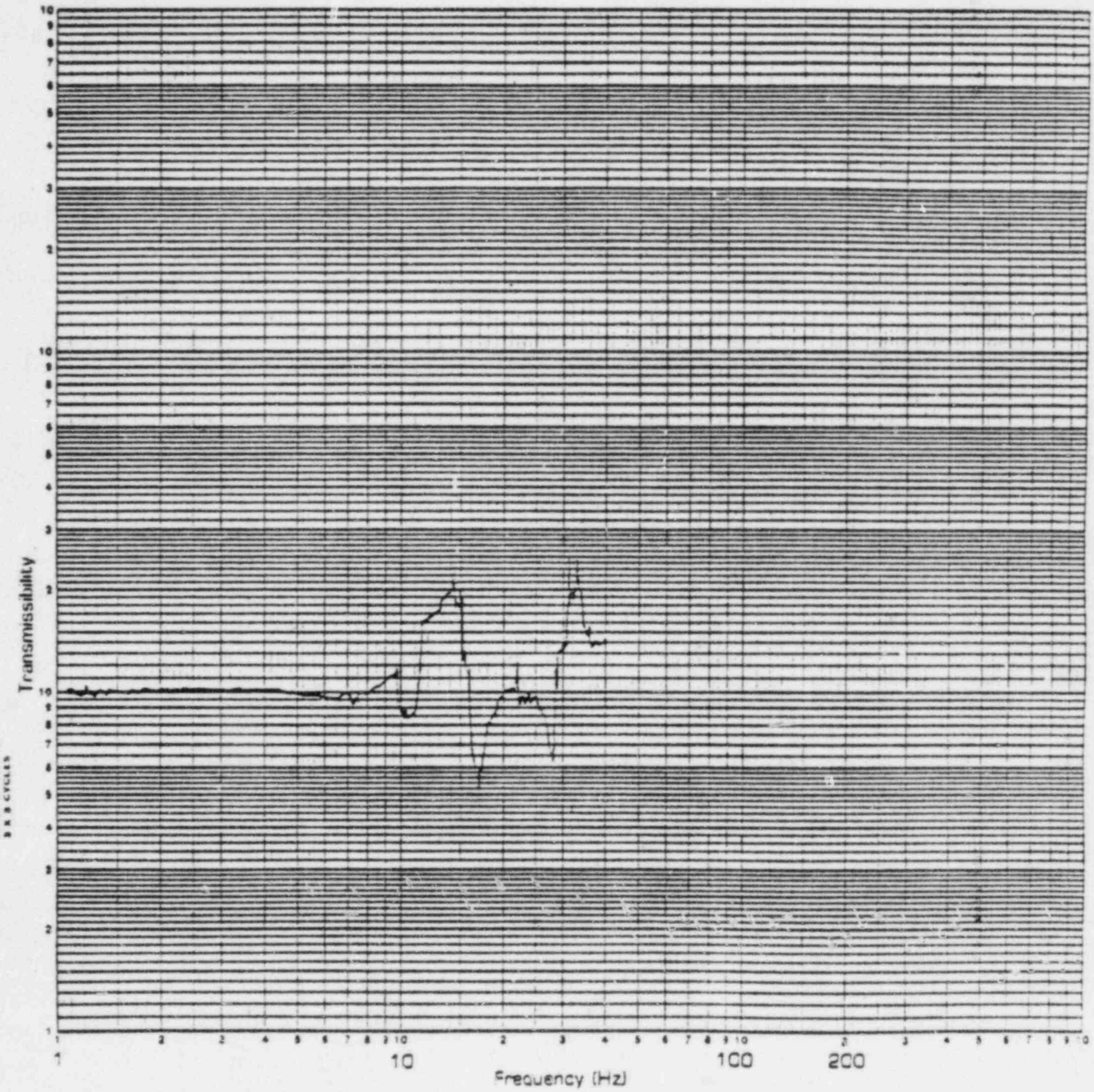
ACCEL NO. 11V NO. VCA

TEST RUN NO. 1

Page No. IX-45
Report No. 45088-1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

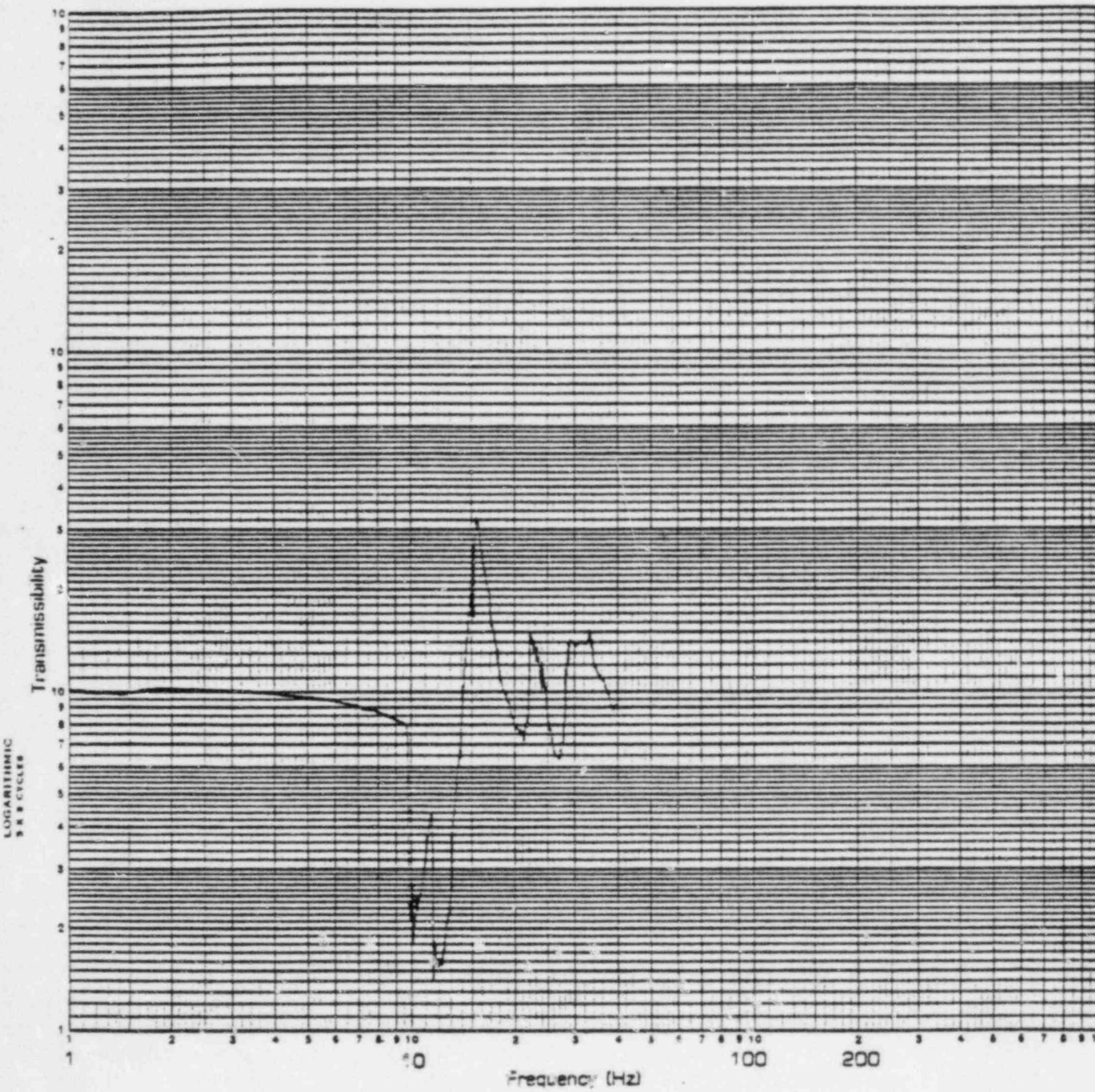
ACCEL NO. 12 LONG NO. 16A

AXIS LONG/V

TEST RUN NO 1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☑ 1000 ☐



SPECIMEN 20"

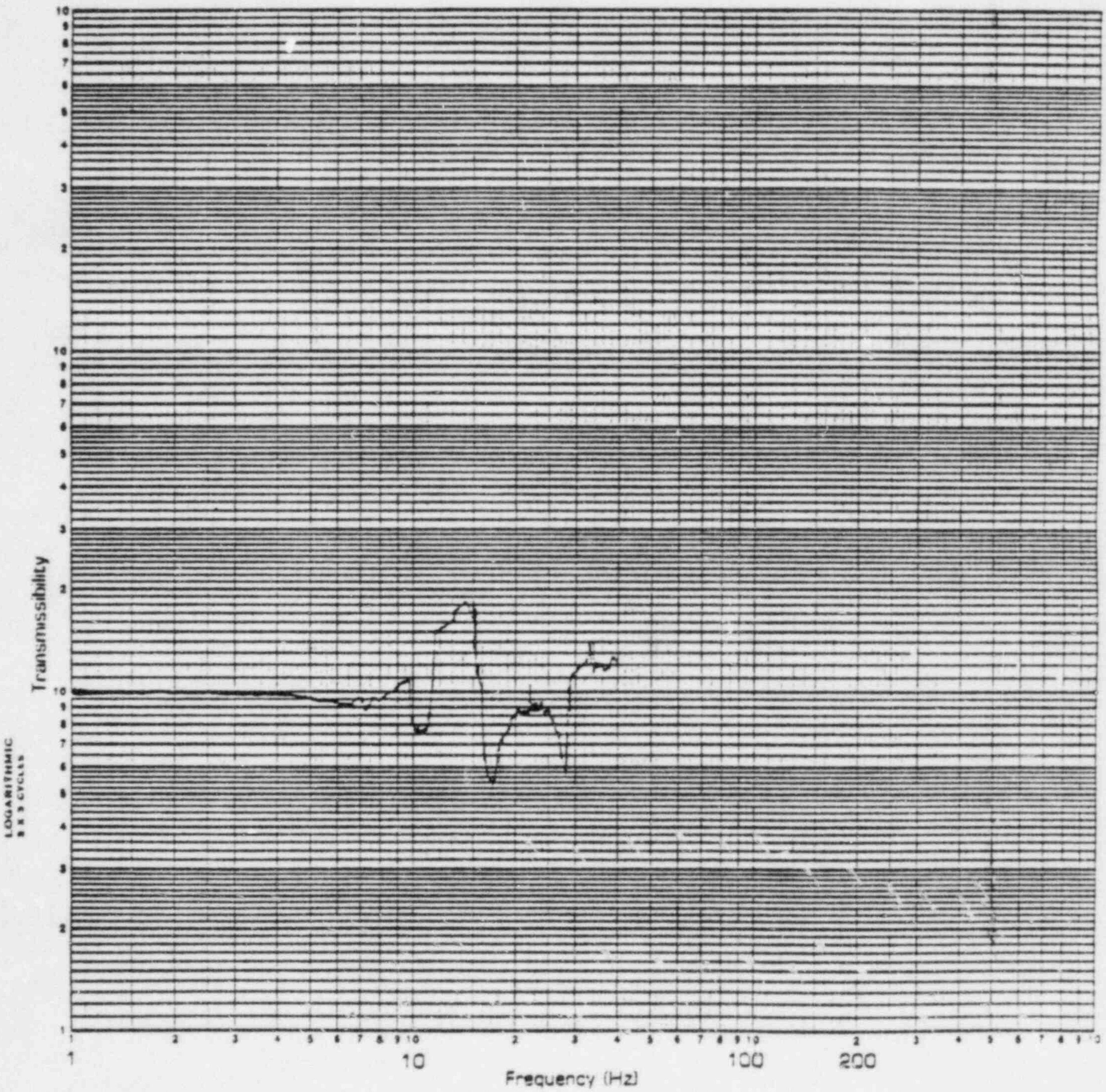
AXIS LONG/V

ACCEL NO. 13V NO. VCA

TEST RUN NO. 1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

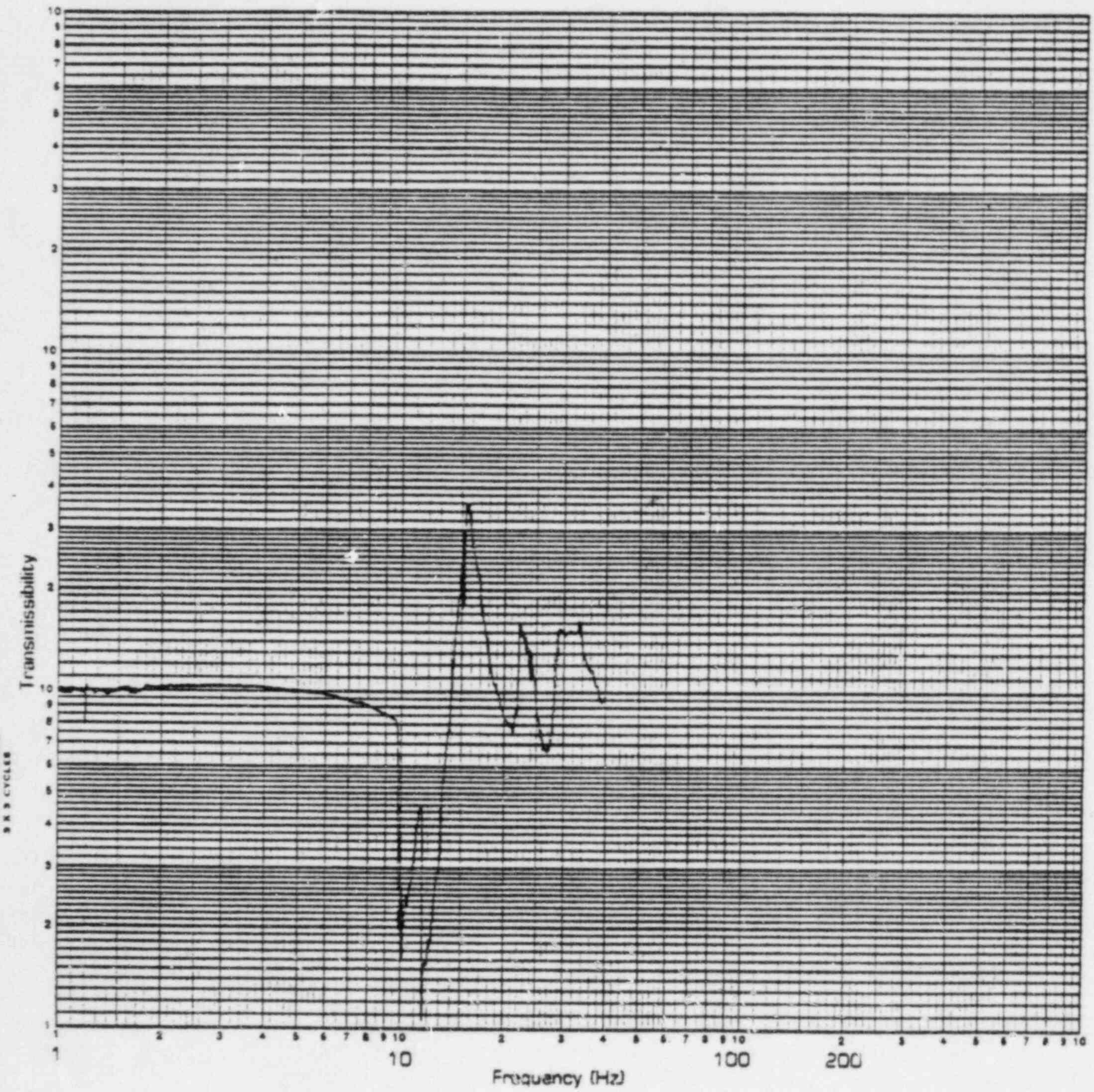
ACCEL NO. 14 LONG NO. 14CA

AXIS LONG/V

TEST RUN NO. 1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

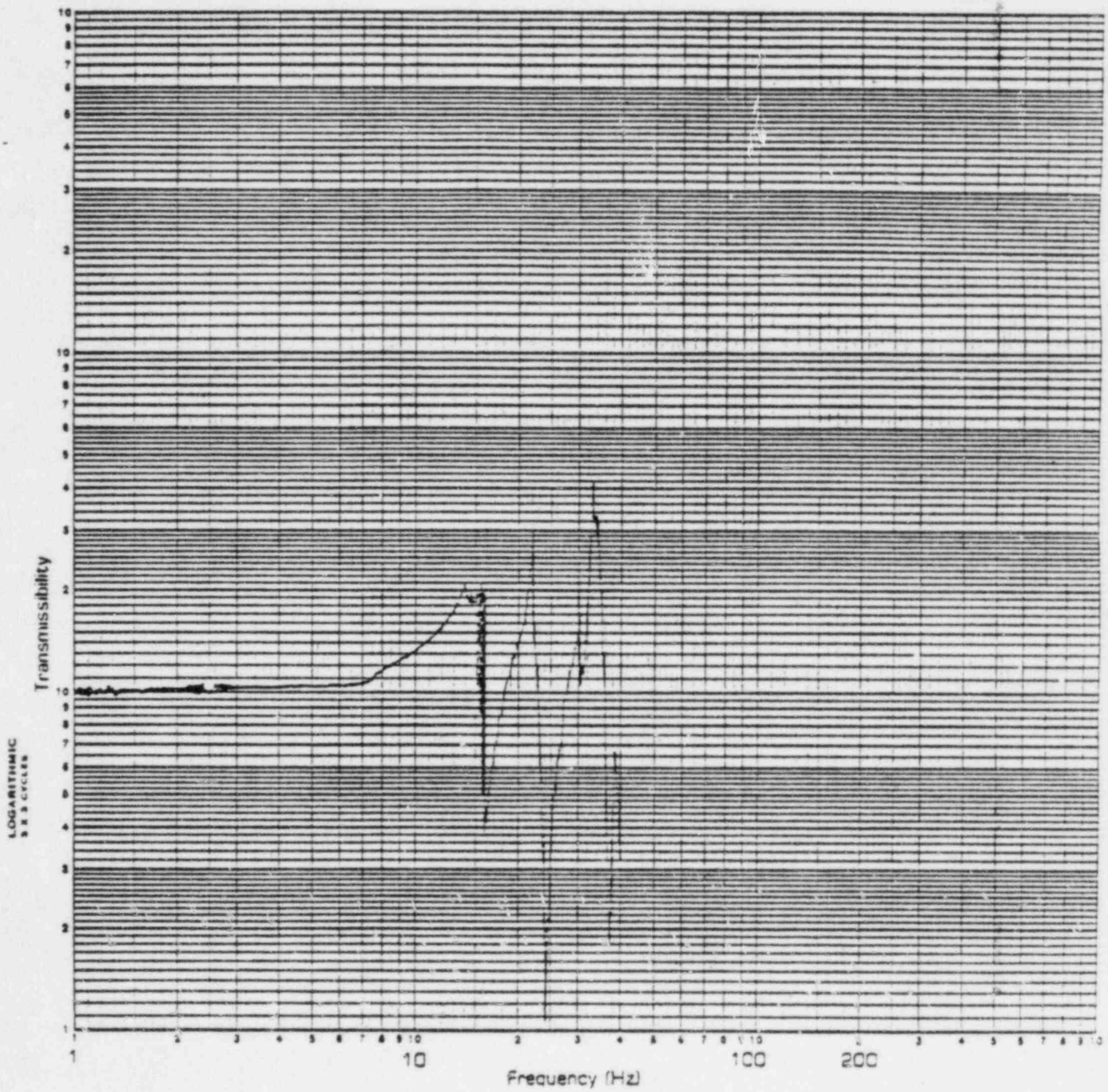
AXIS LONG/V

ACCEL NO. 15V NO. VCA

TEST RUN NO. 1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

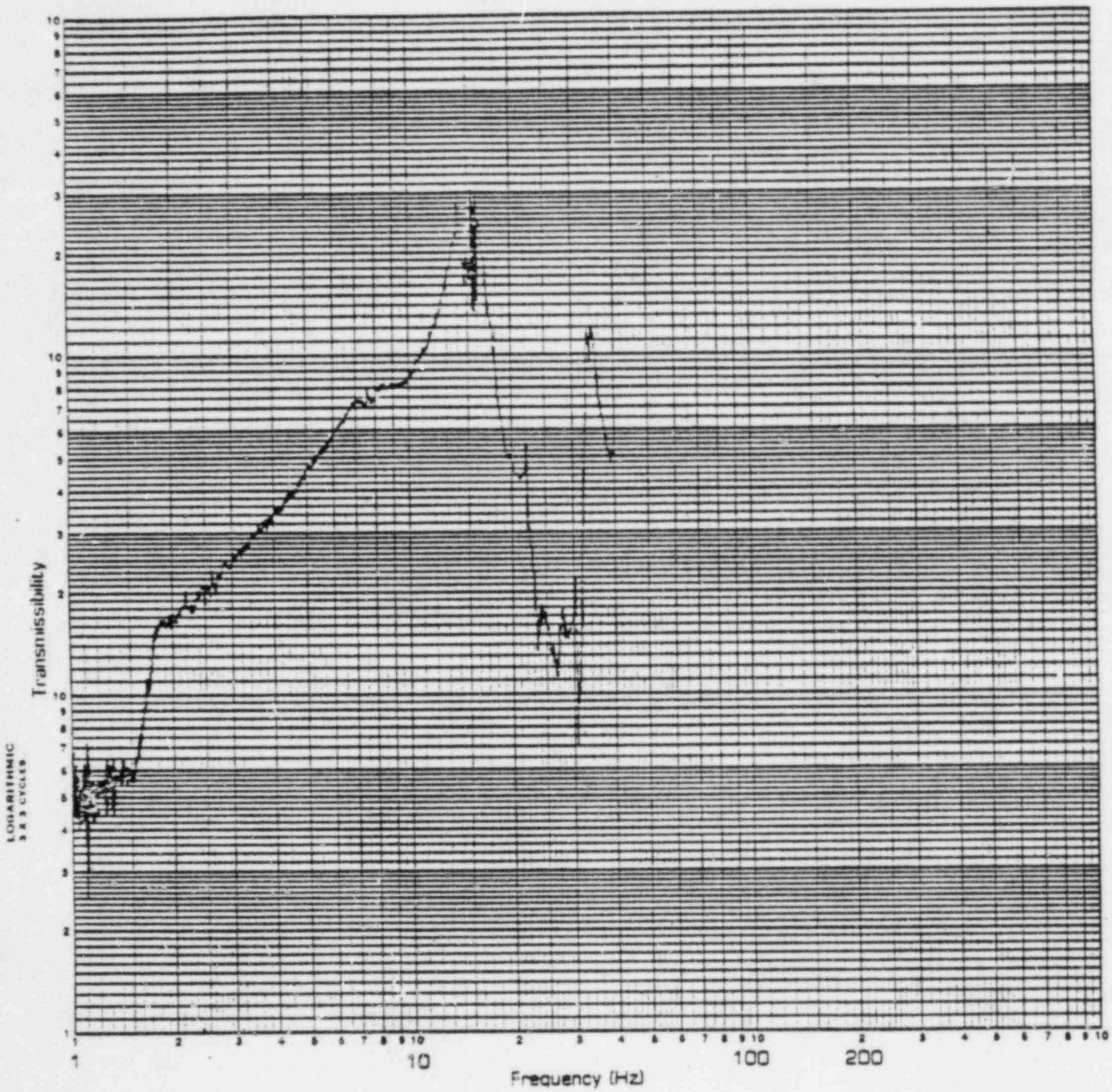
AXIS LONG/V

ACCEL NO. LONG NO. HCA

TEST RUN NO. 2

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☒ 100 ☐ 1000 ☐



SPECIMEN 20"

AXIS LONG/V

ACCEL NO. 2LAT NO. HCA

TEST RUN NO. 2

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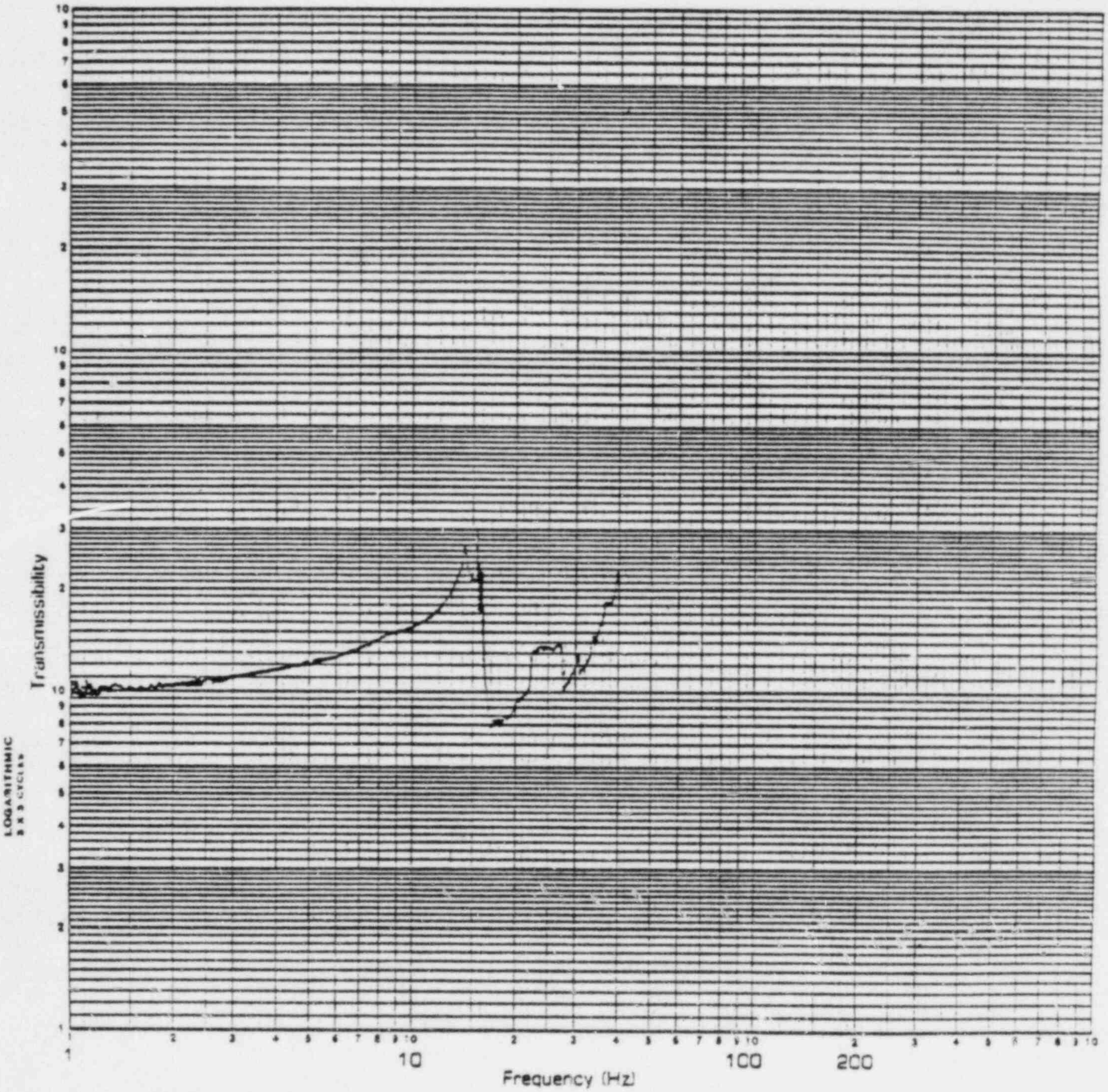
Report No. 45088-1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☑ 1000 ☐



SPECIMEN 20"

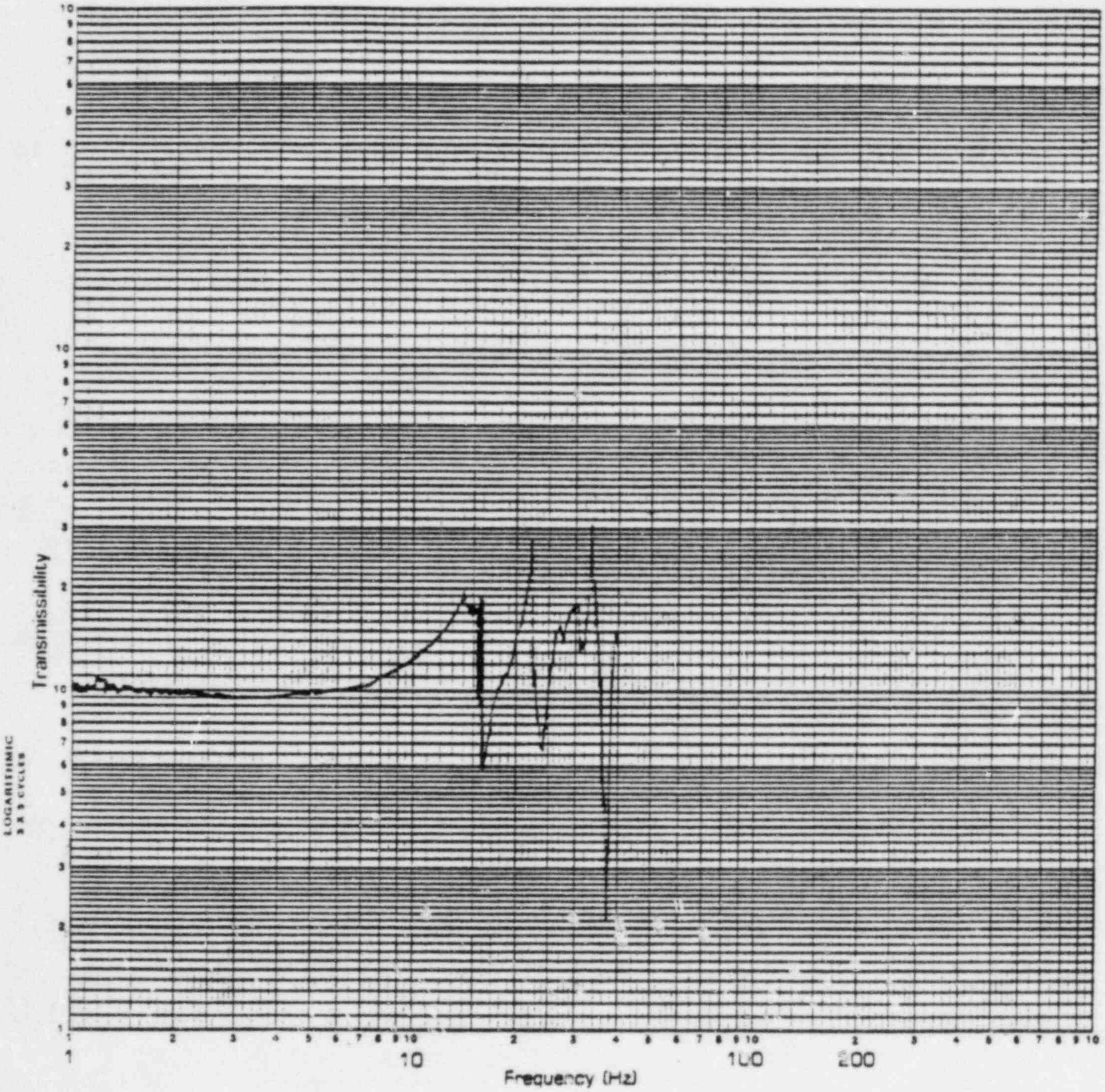
AXIS LONG/V

ACCEL NO. 3V NO. VCA

TEST RUN NO. 2

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

ACCEL NO. 4LONG NO. HCA

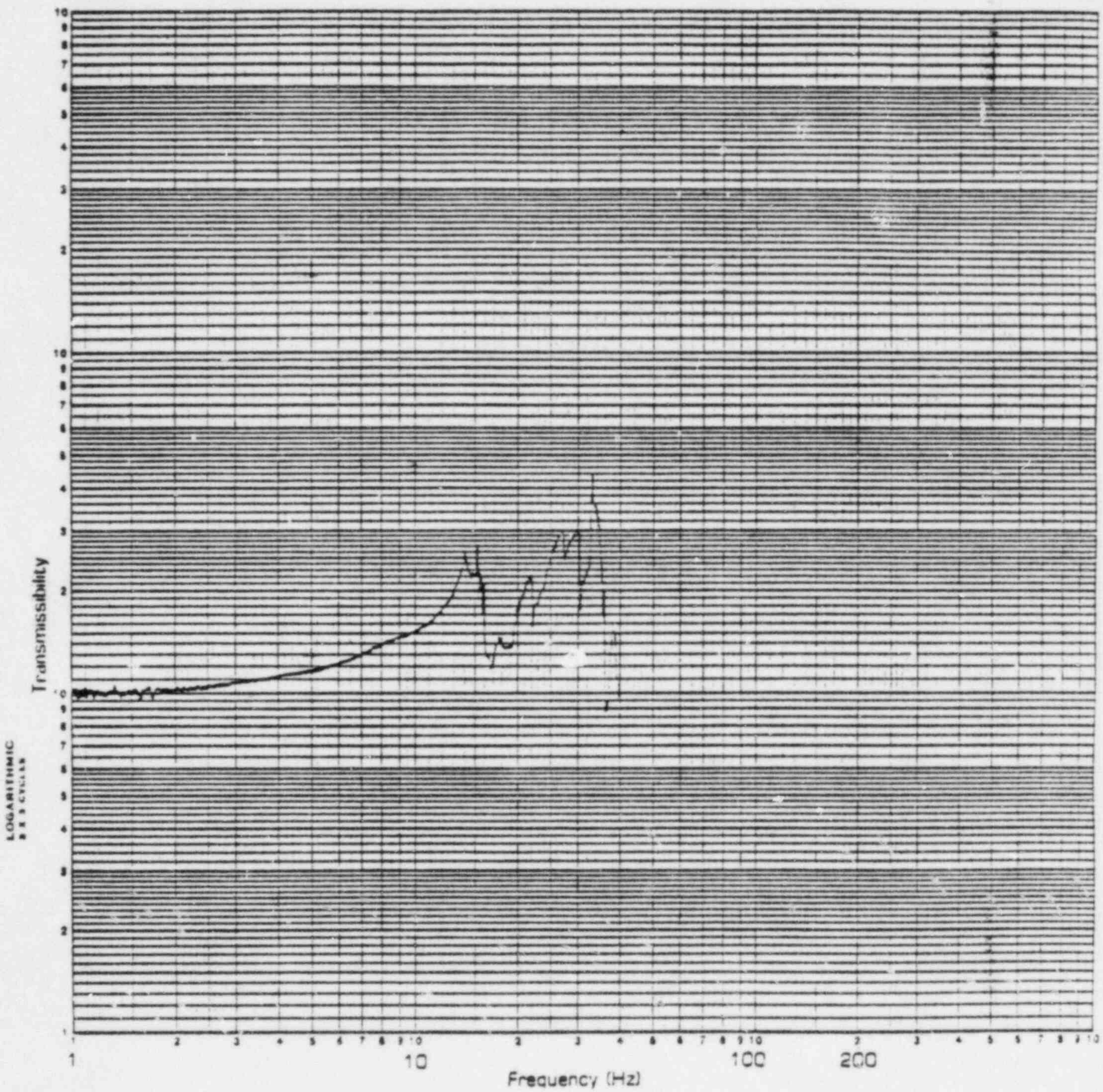
AXIS LONG/V

TEST RUN NO. 2

Page No. IX-53
Report No. 45088-1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

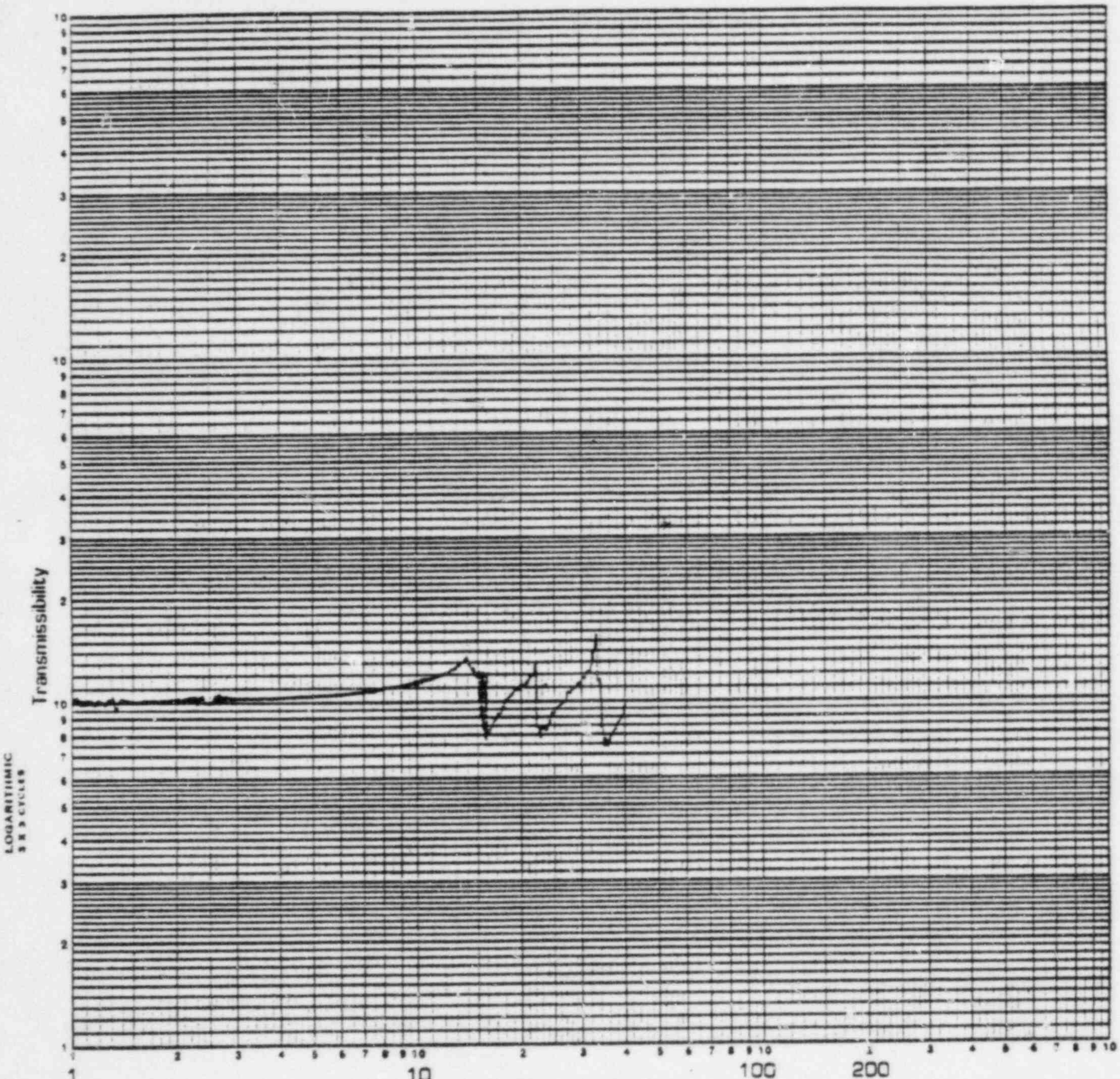
AXIS LONG/V

ACCEL NO. 5V NO. VCA

TEST RUN NO. 2

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

AXIS LONG/V

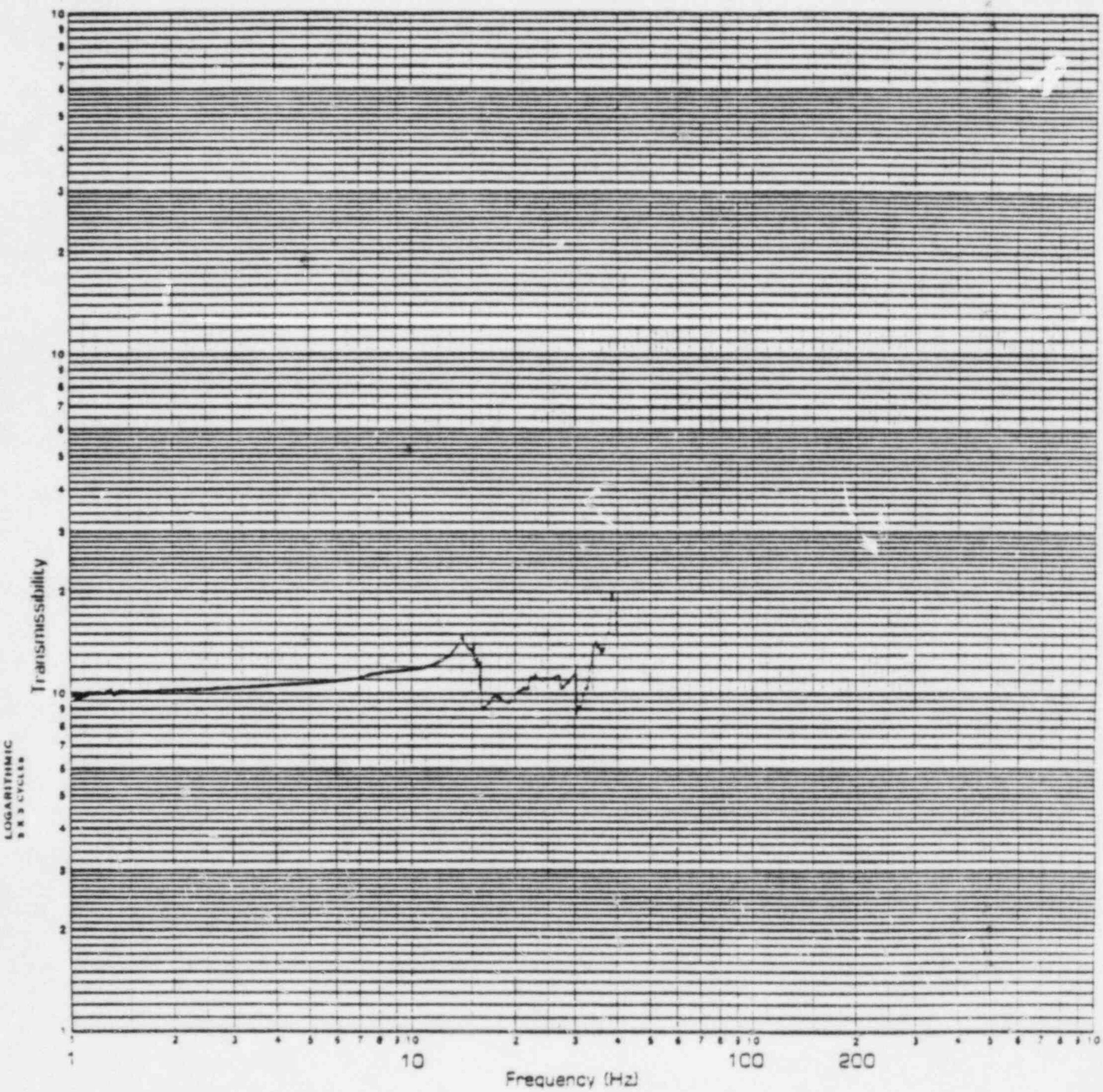
ACCEL NO. 6 LONG NO. HCA

TEST RUN NO. 2a

Page No. IX-55
Report No. 45088-1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☑ 1000 ☐



SPECIMEN 20"

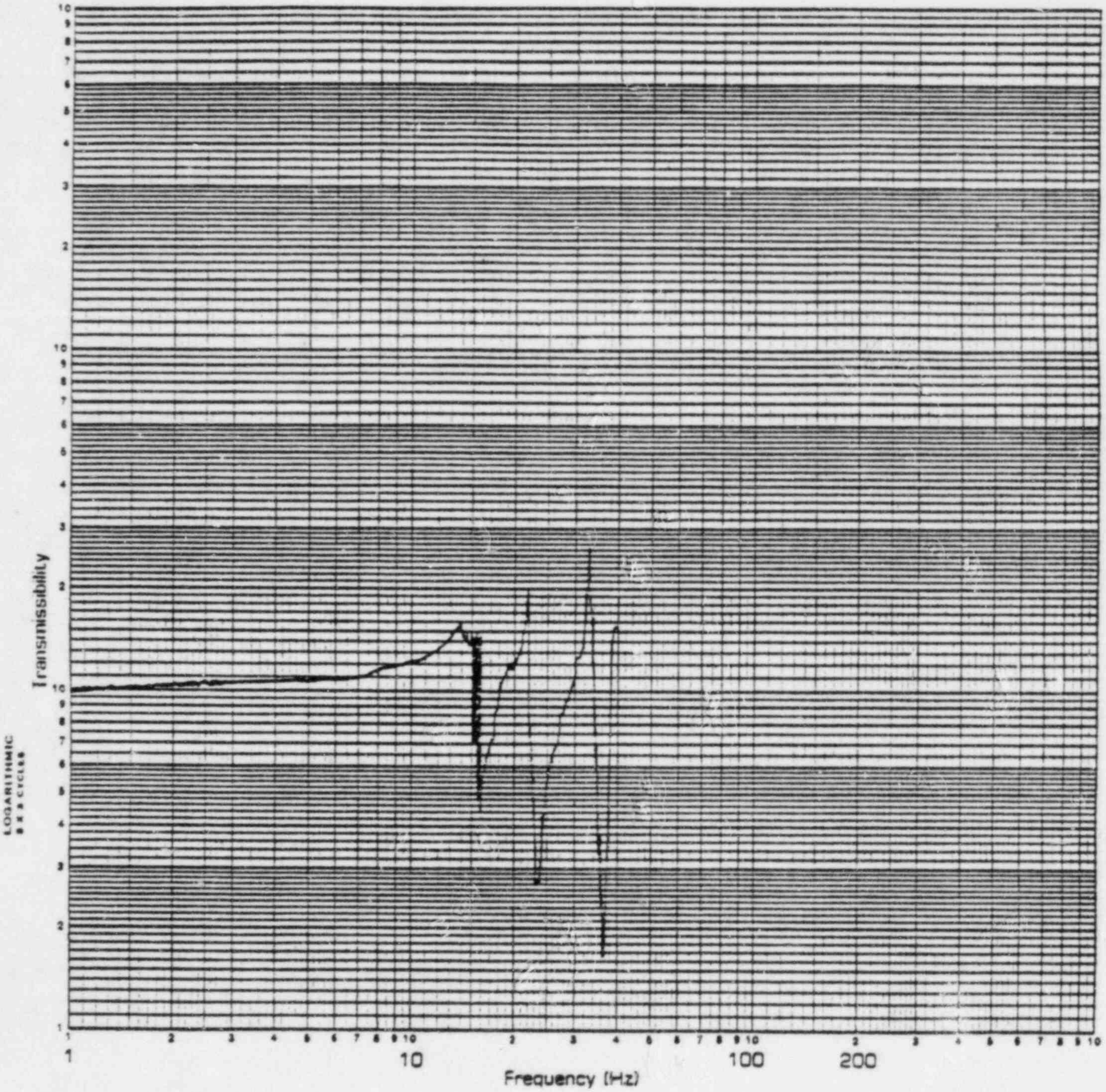
ACCEL NO. 7V NO. VCA

AXIS LONG/V

TEST RUN NO. 2

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

AXIS LONG/V

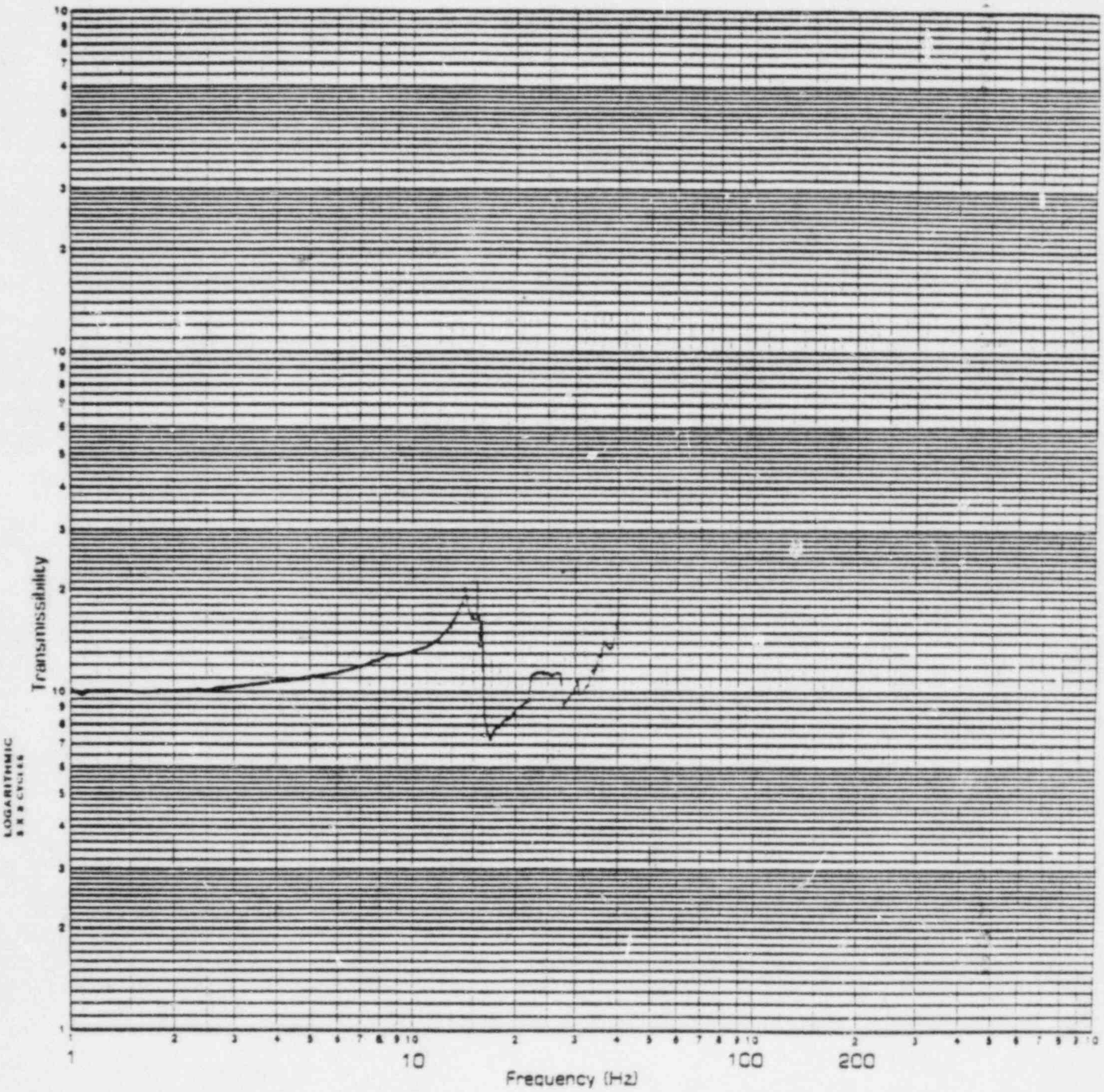
ACCEL NO. 8 LONG NO. HCA

TEST RUN NO. 2

Page No. IX-57
Report No. 45088-1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

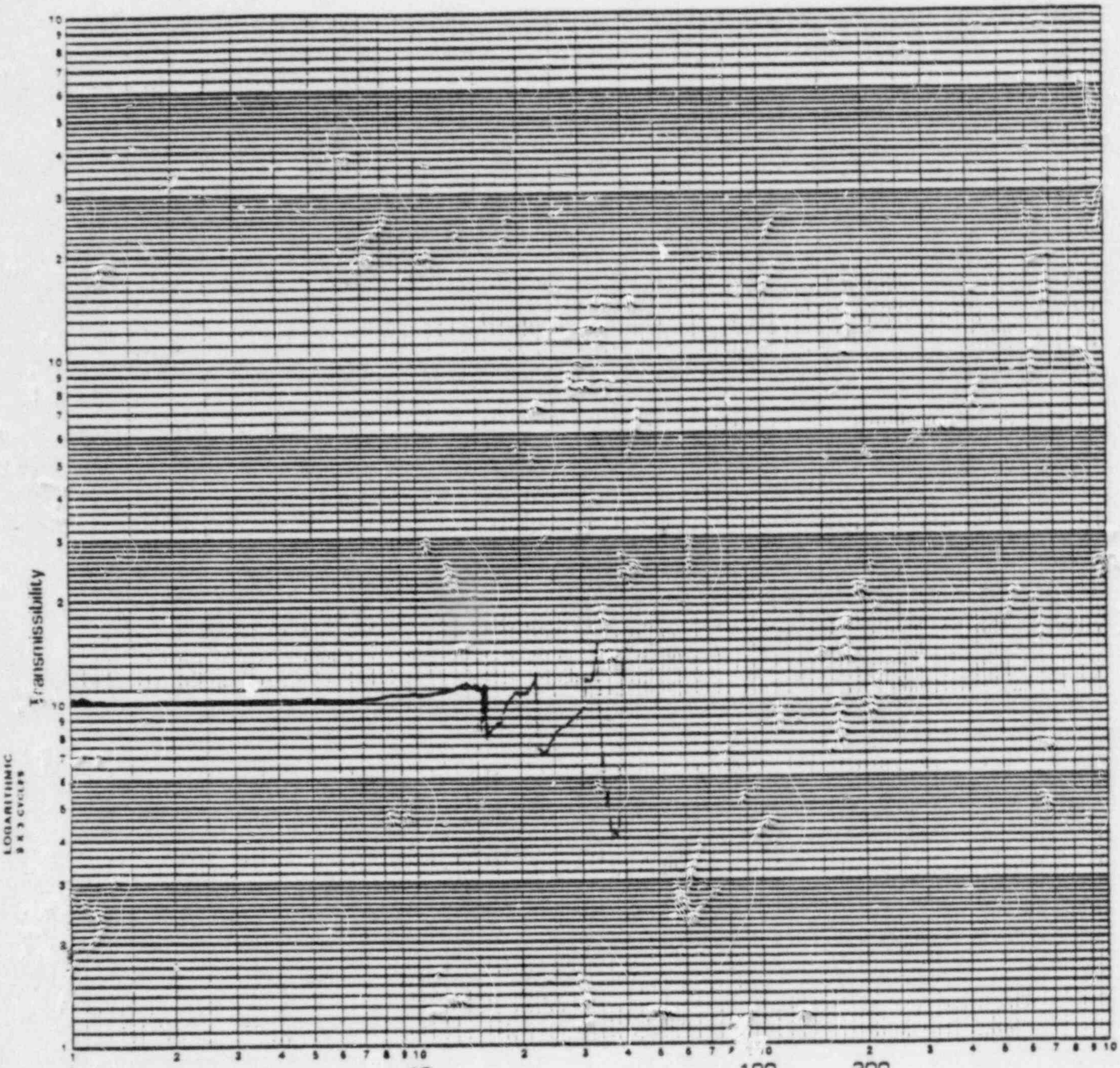


SPECIMEN 20"   ACCEL NO. 9V   NO. VCA

AXIS LONG/V   TEST RUN NO. 2

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

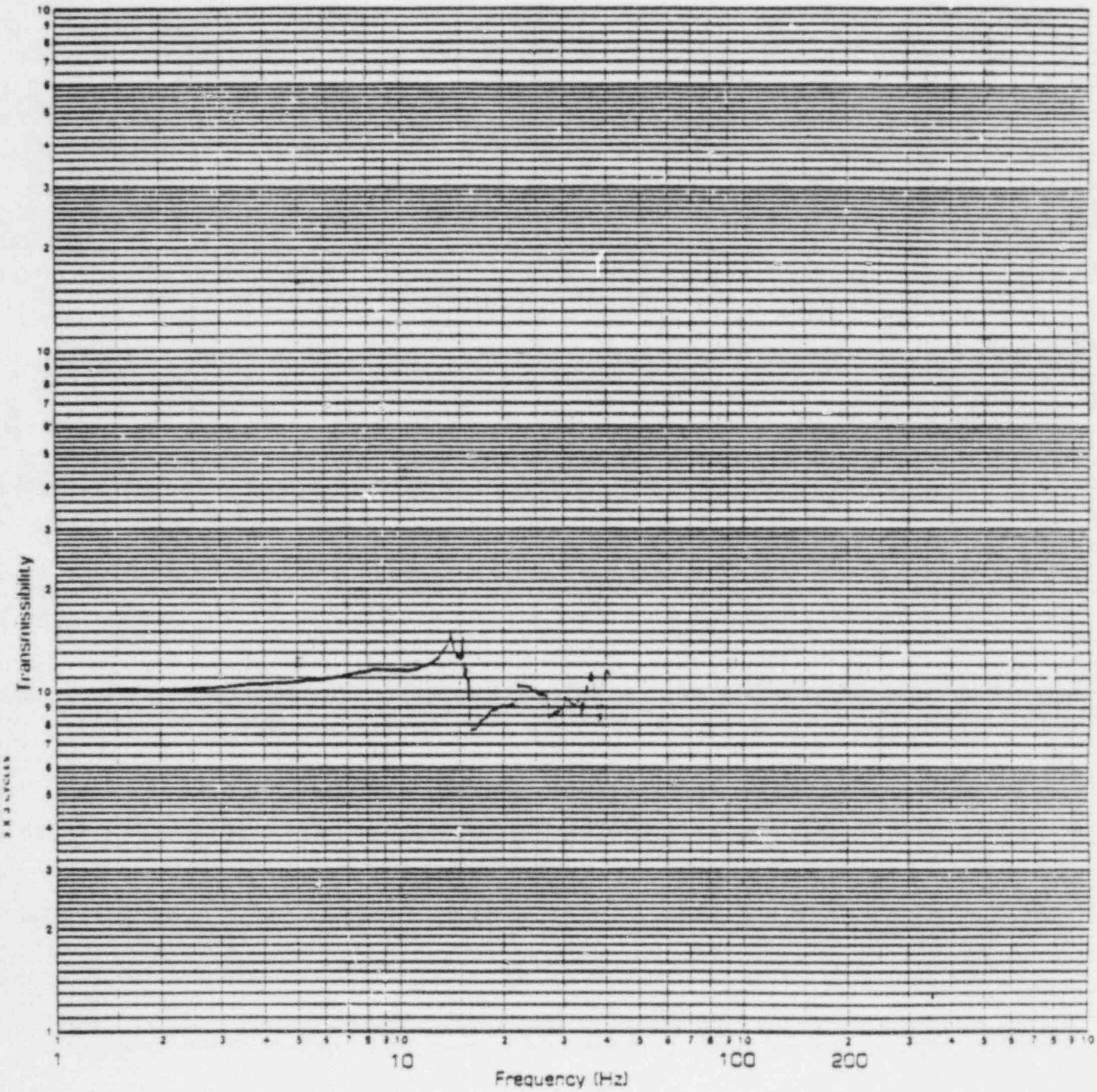
AXIS Long'l

ACCEL NO. [illegible] NO. [illegible]

TEST RUN NO. 2

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

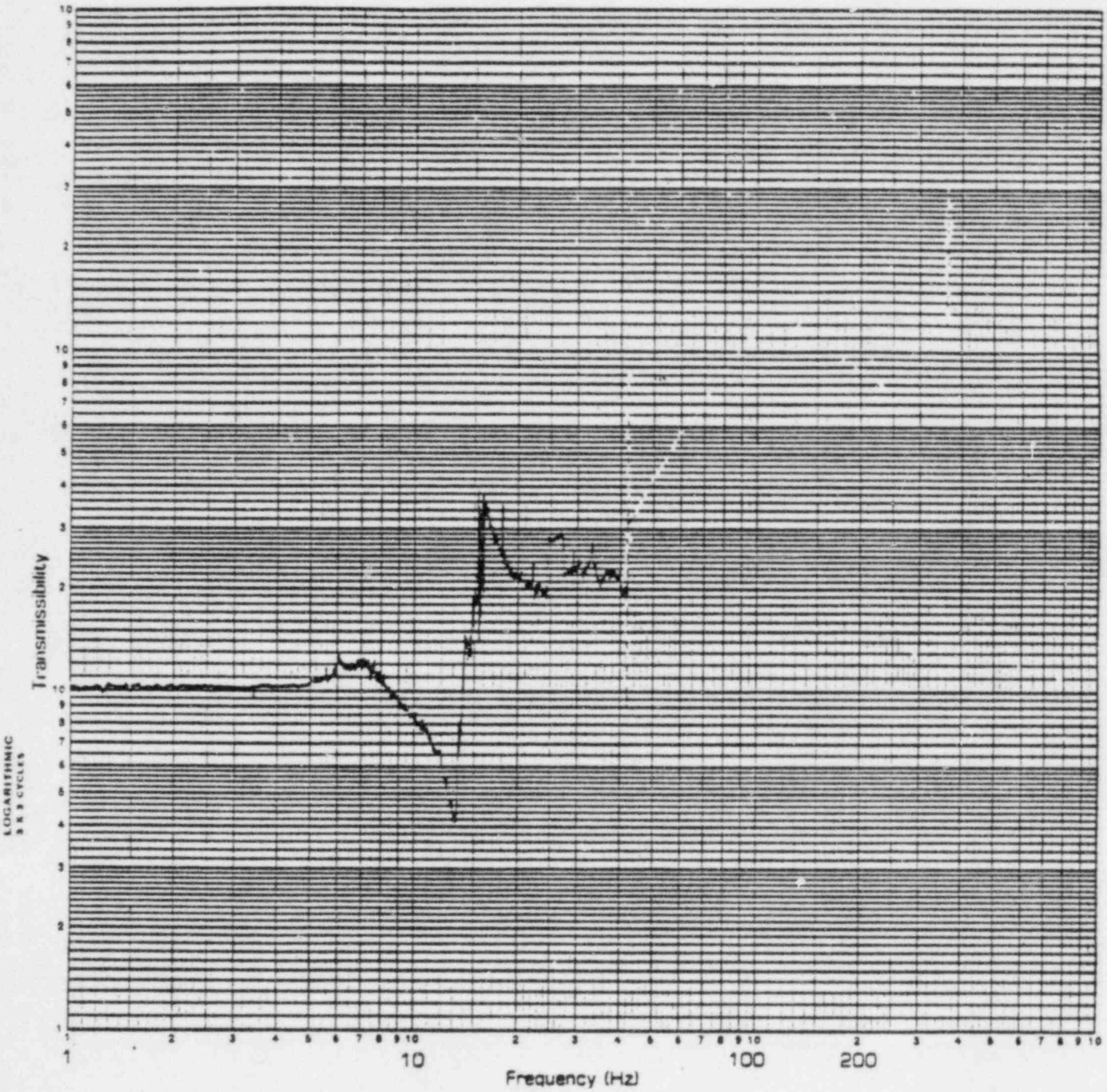
AXIS LONG/U

ACCEL NO. 11 V NO. VCP

TEST RUN NO. 2

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20°

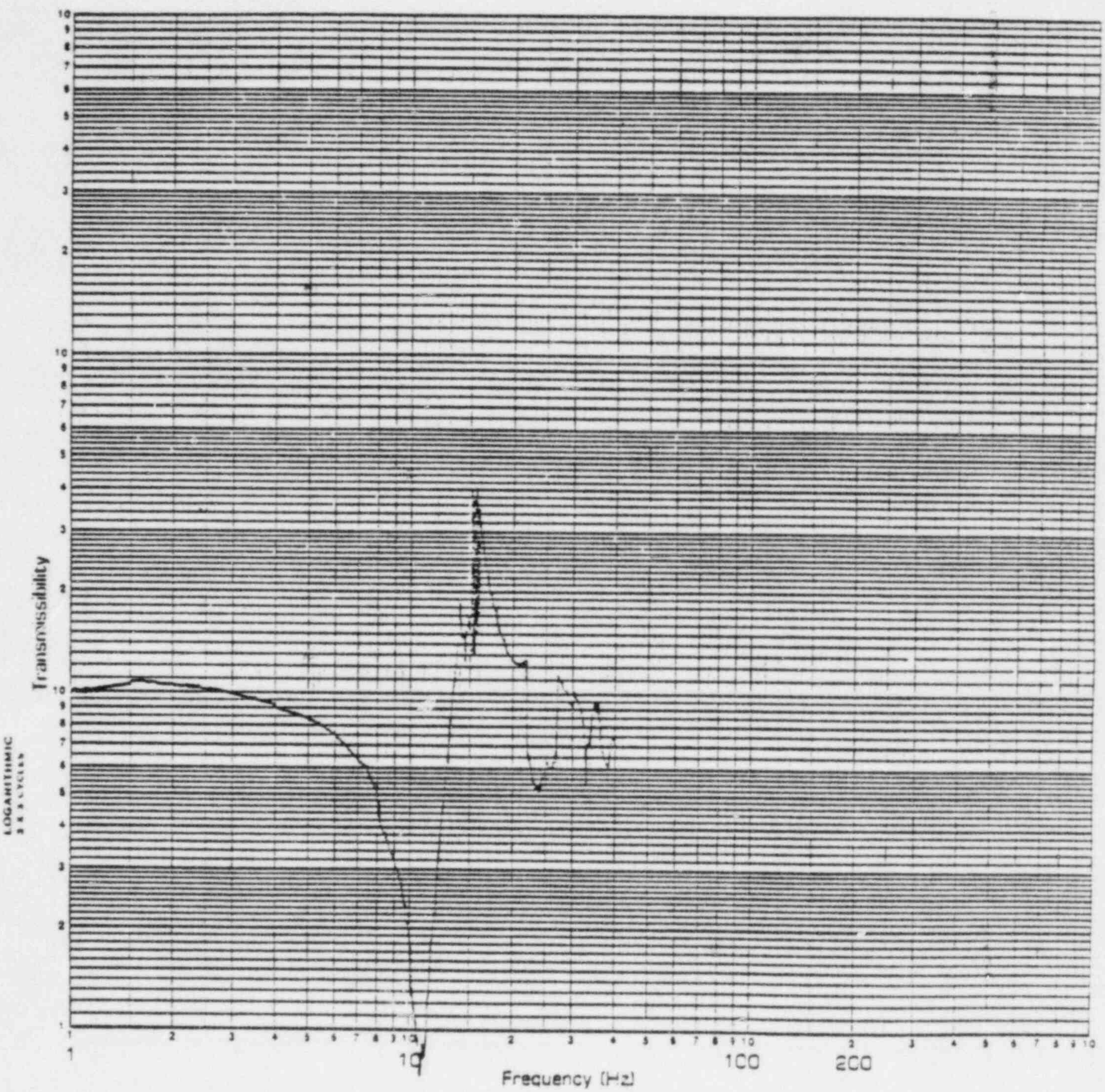
AXIS LONG/V

ACCEL NO. 12 LONG NO. HCA

TEST RUN NO. 2

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

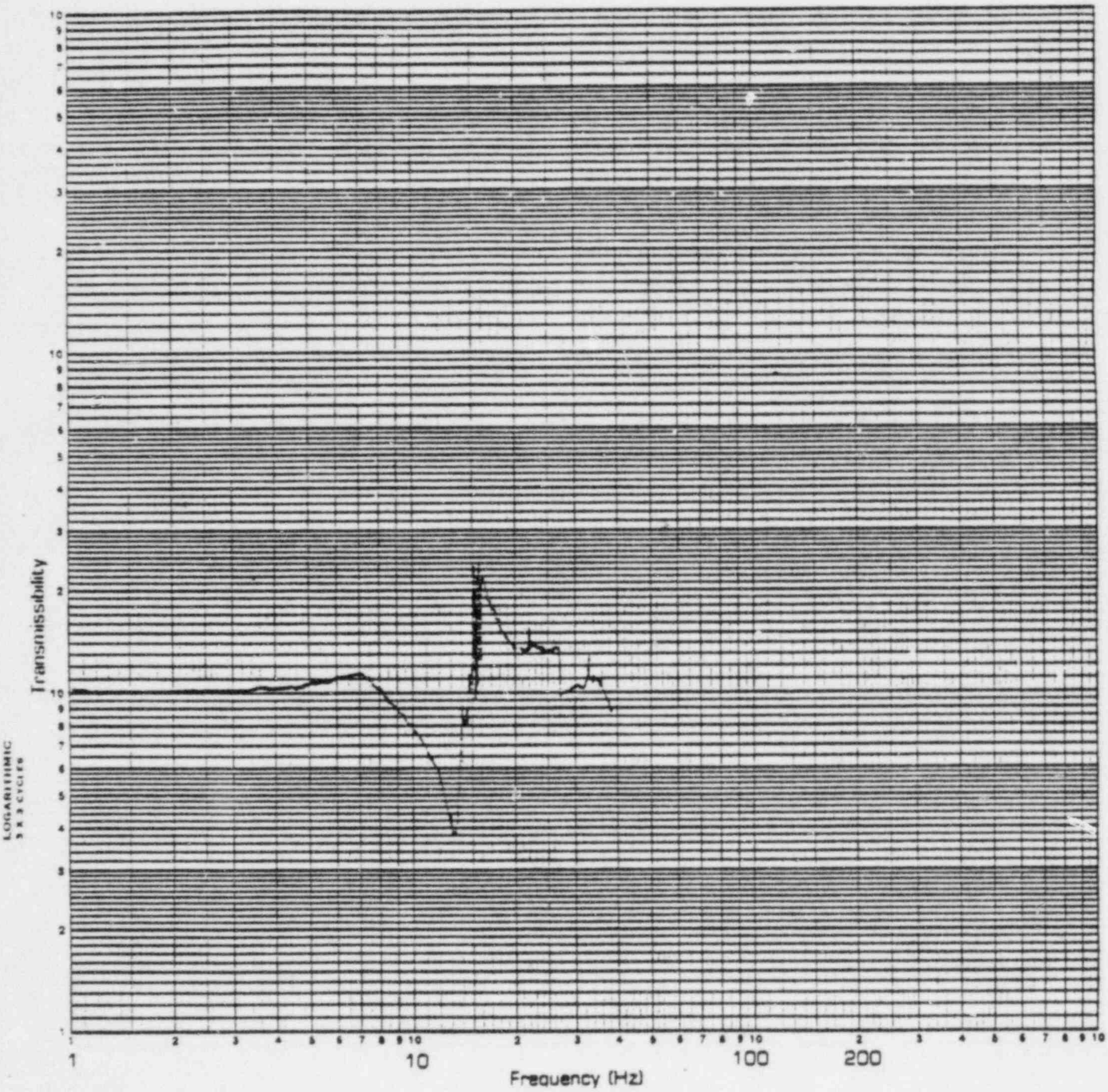
AXIS Long/V

ACCEL NO. 13 V NO. VCA

TEST RUN NO. 2

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

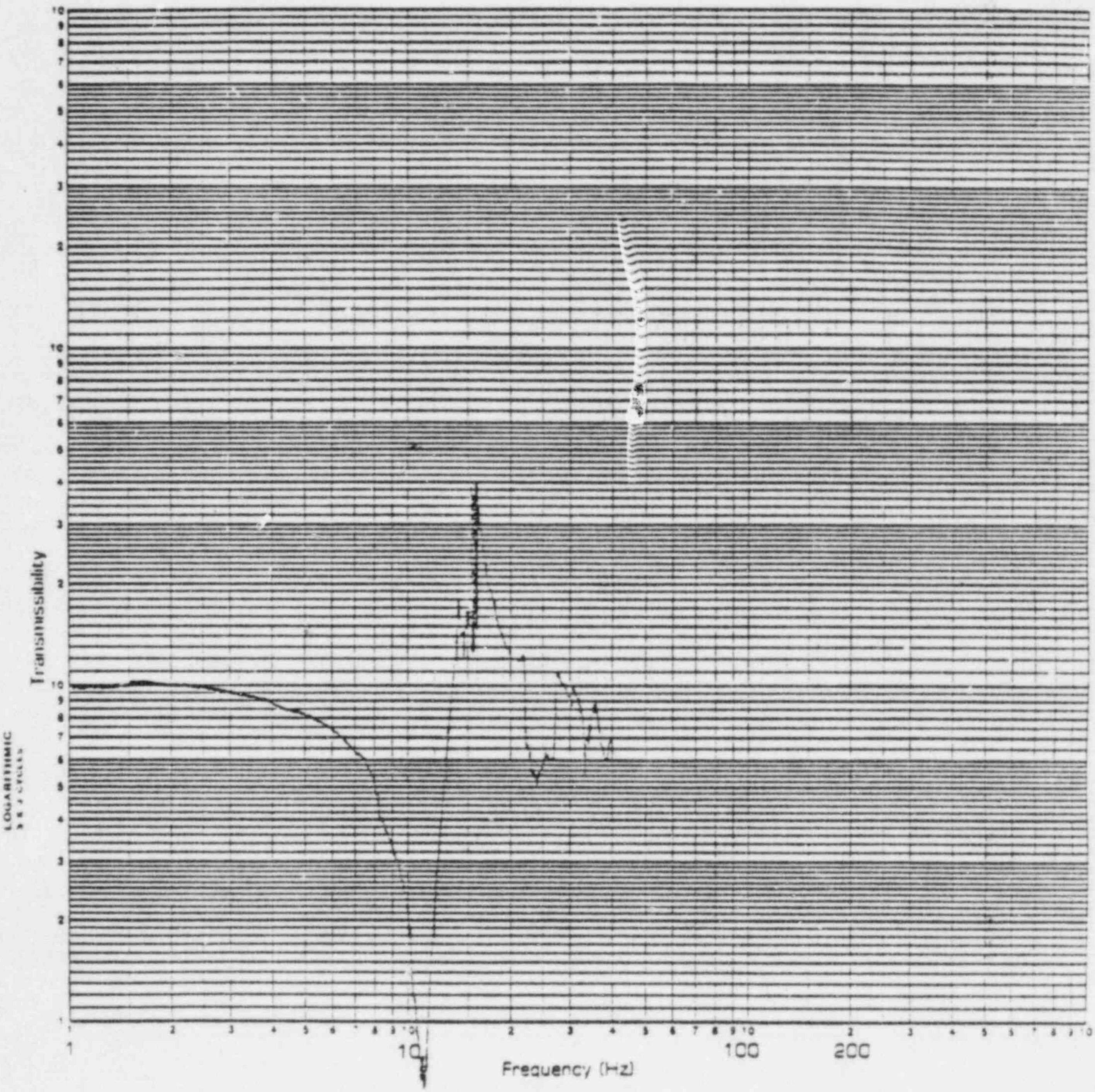
AXIS LONG/V

ACCEL NO. 14 LONG NO. HCA

TEST RUN NO. 2

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

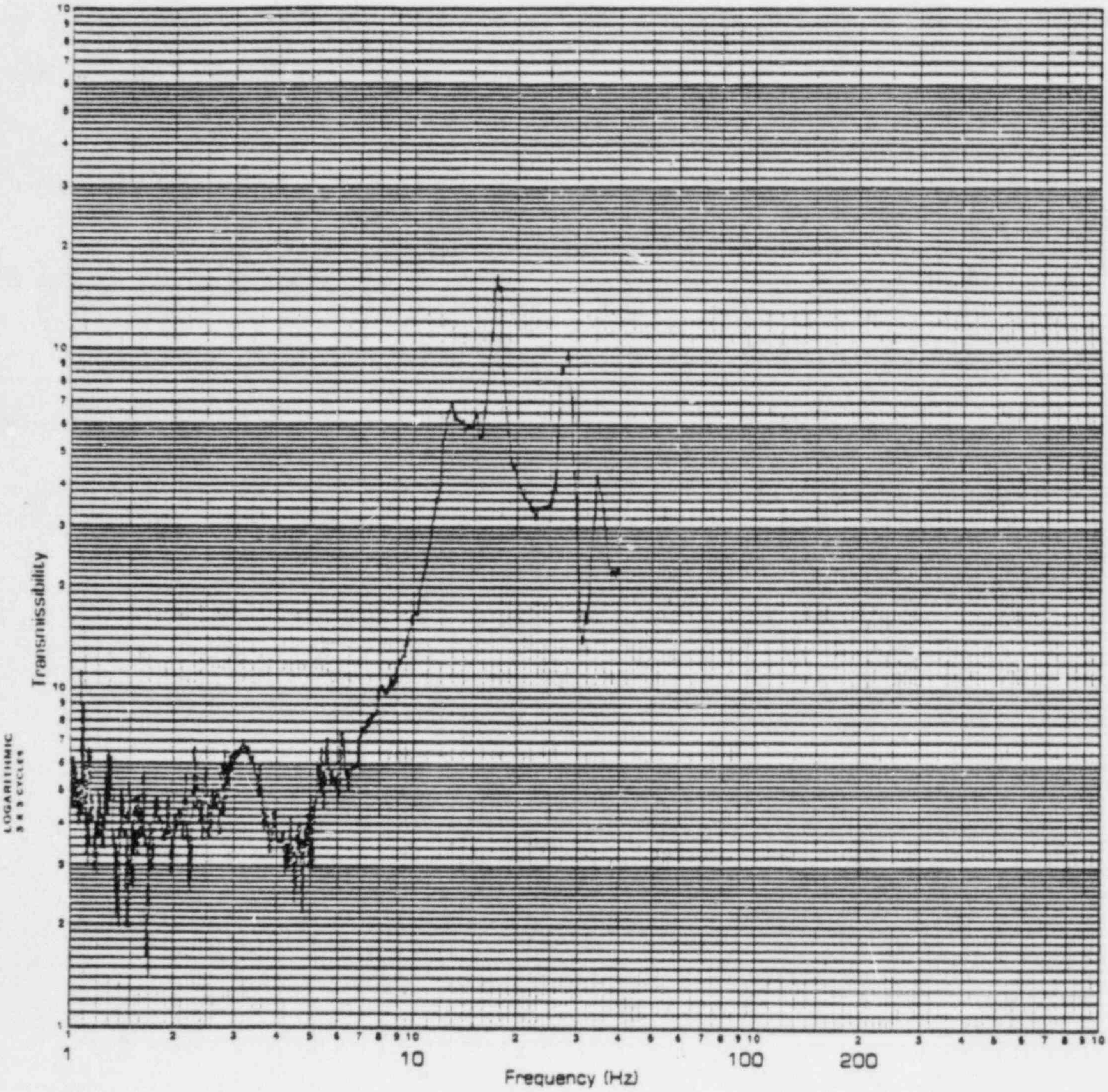
AXIS LONG/U

ACCEL NO 15 V NO. VCA

TEST RUN NO. 2

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☒ 100 ☐ 1000 ☐



SPECIMEN 20°

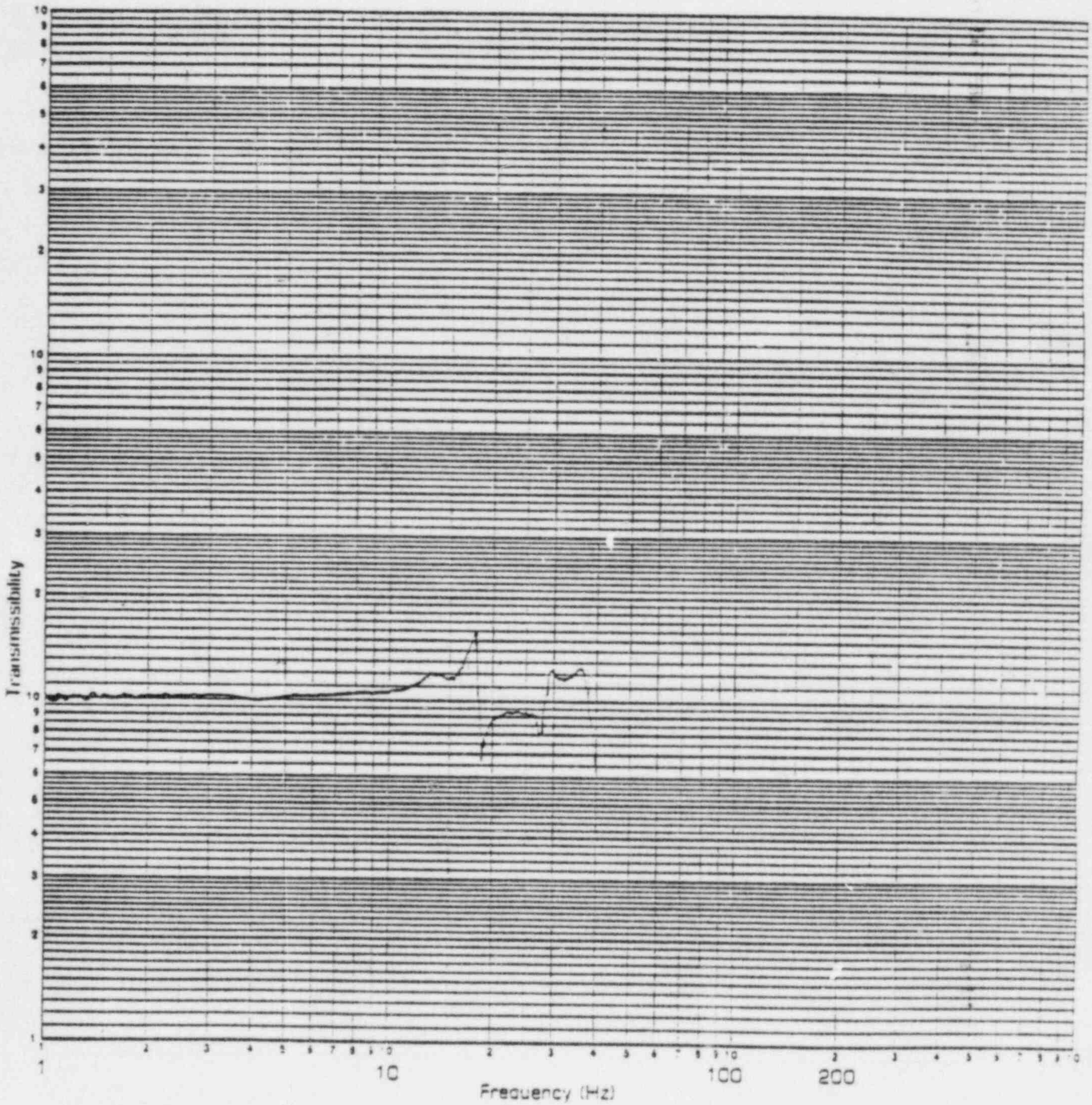
AXIS LAT/VERT

ACCEL NO 1LONG NO. HCA

TEST RUN NO. 87

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 30°

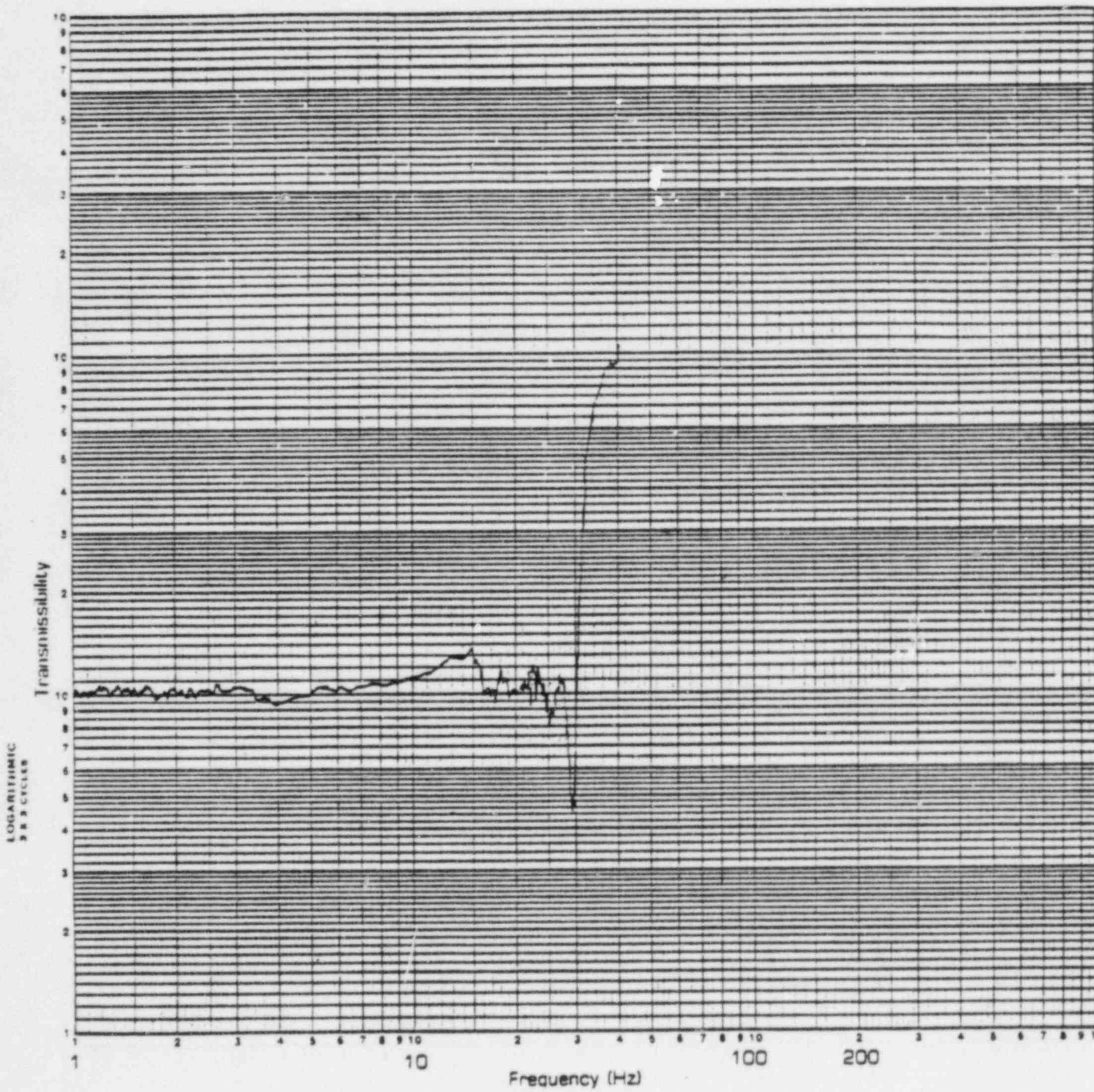
AXIS LAT/VERT

ACCEL NO. 2 LAT NO. 1ACA

TEST RUN NO. 37

FULL SCALE TRANSMISSIBILITY

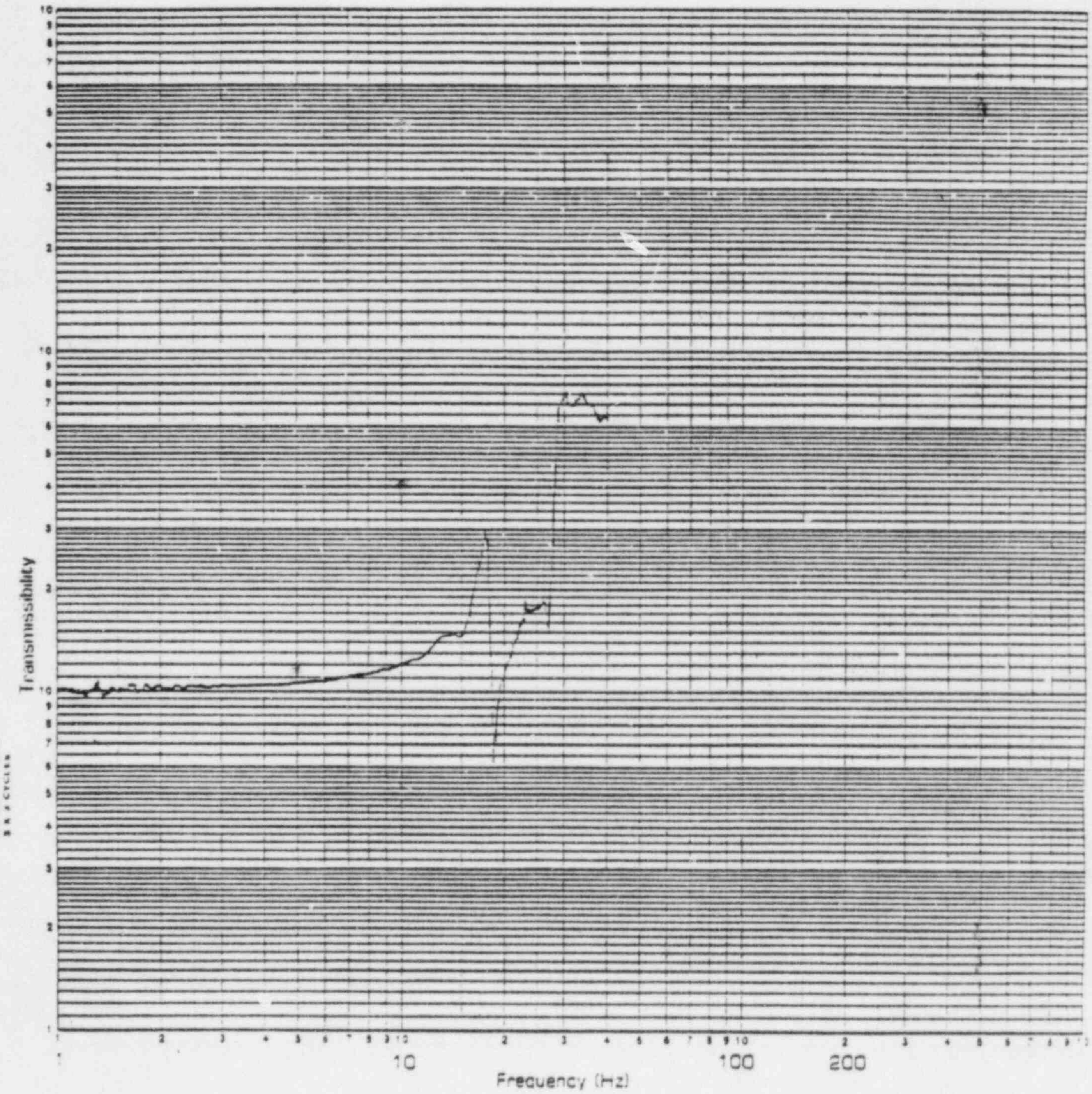
0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20°
AXIS LAT/VERT
ACCEL NO. 3V NO. VCA
TEST RUN NO. 87

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

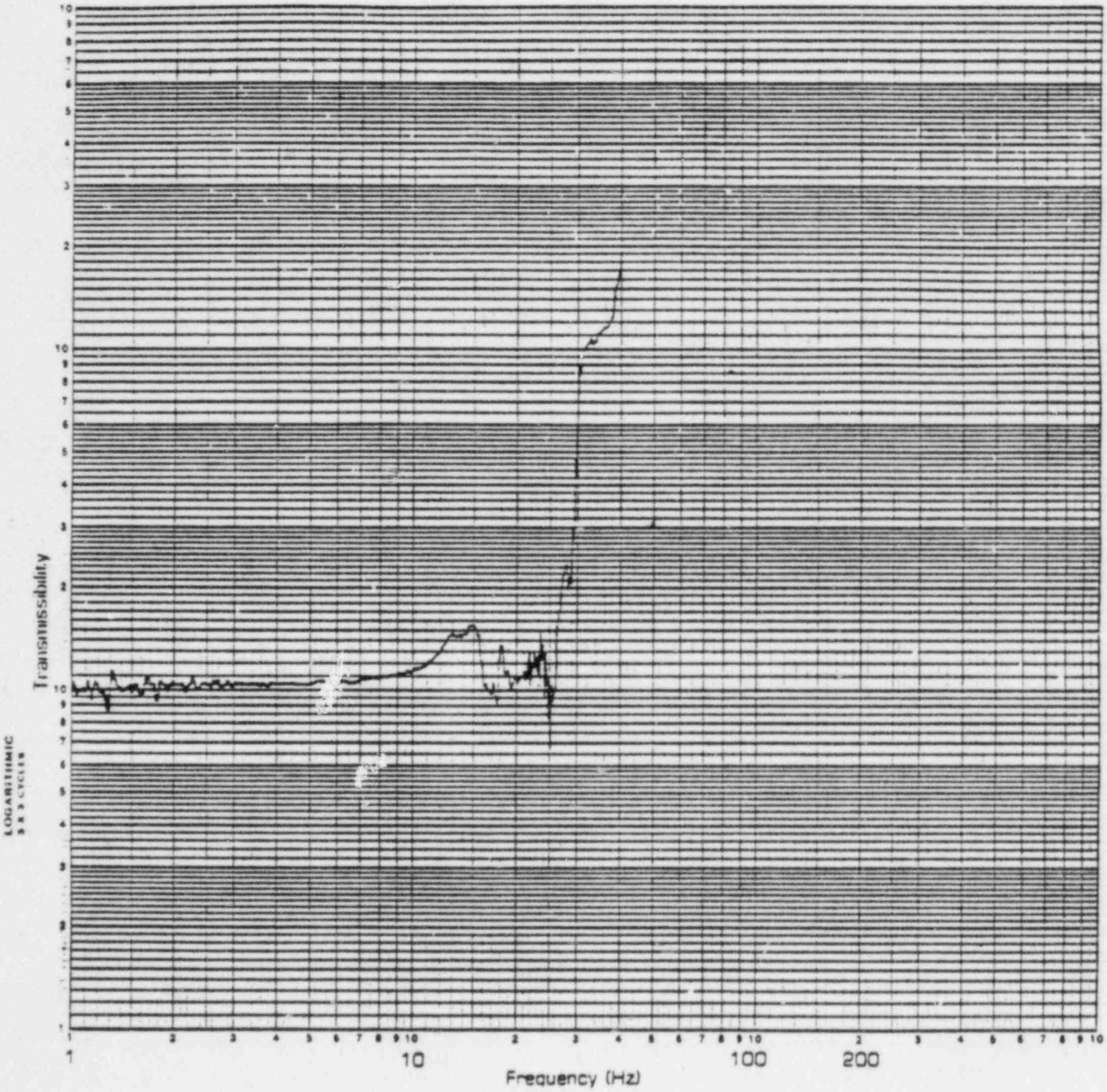
AXIS LAT/VERT

ACCEL NO. 4 LAT NO. HCA

TEST RUN NO. 87

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

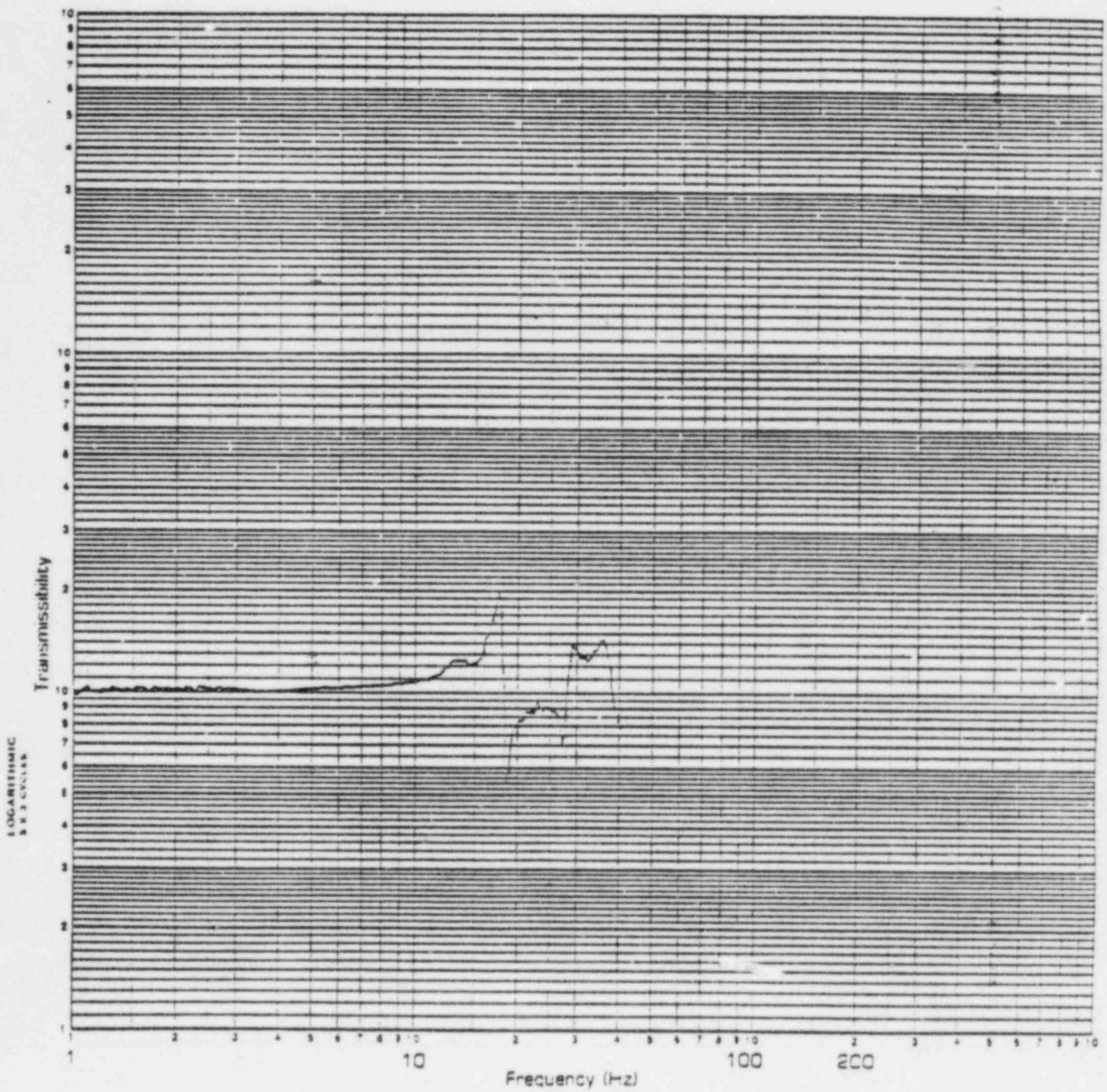


SPECIMEN 20"
AXIS LAT/VERT
ACCEL NO. 5V NO. VCA
TEST RUN NO. 87

Page No. IX-69
Report No. 45088-1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

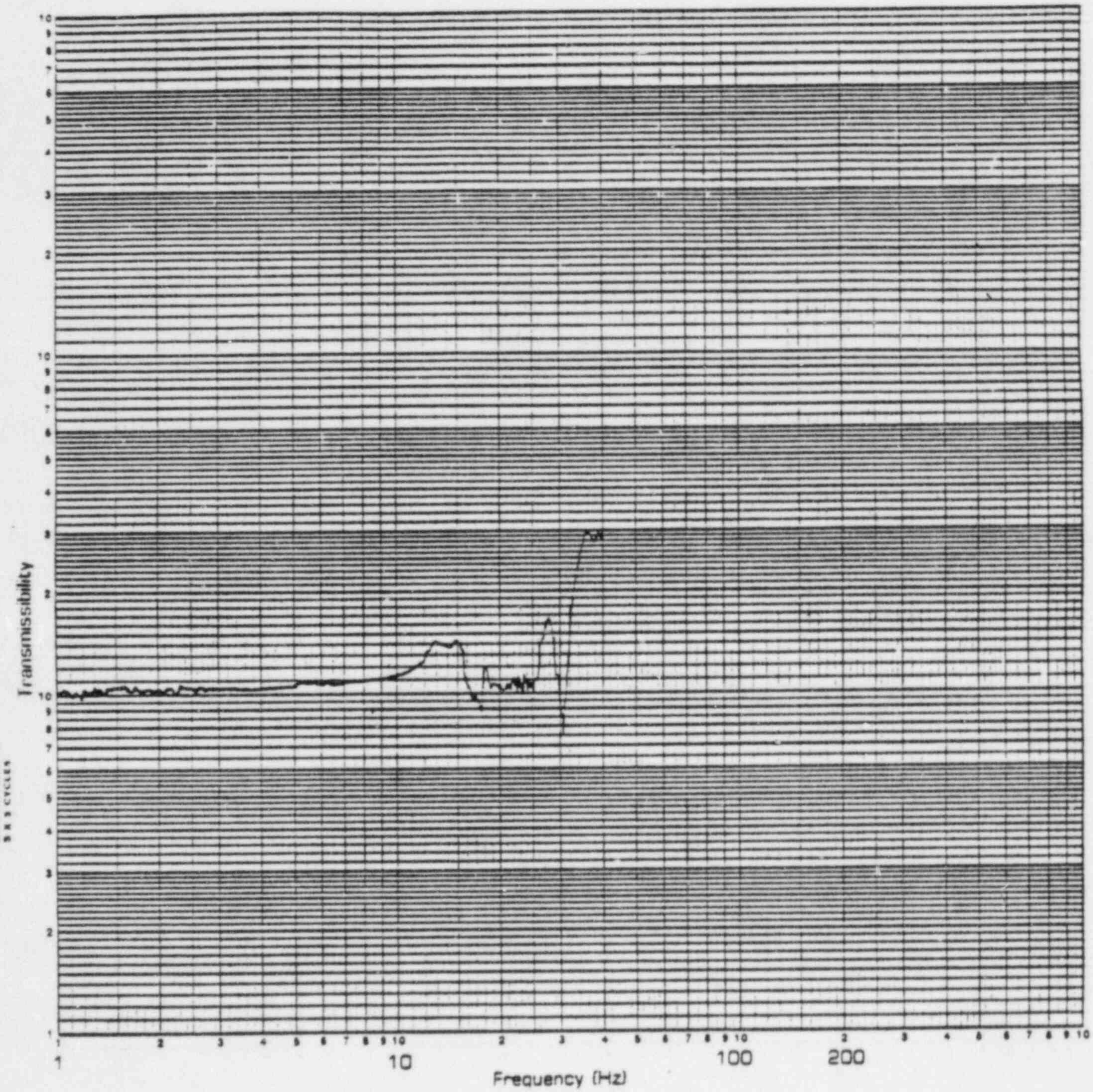
ACCEL NO. 6 LAT NO. HCA

AXIS LAT/VERT

TEST RUN NO. 87

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

AXIS LAT/VERT

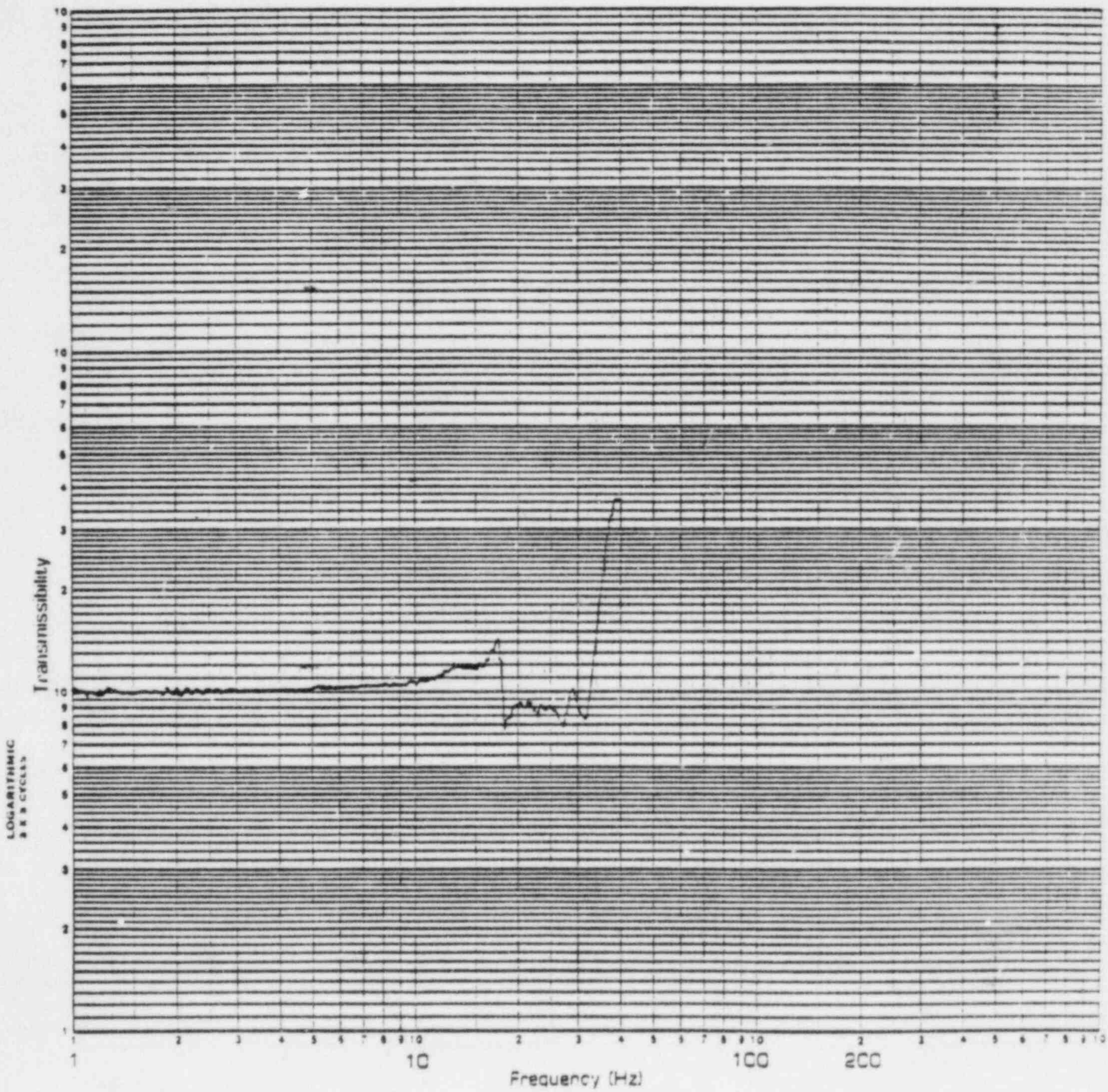
ACCEL NO. 7V NO. VCA

TEST RUN NO. 87

Page No. IX-71
Report No. 45088-1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

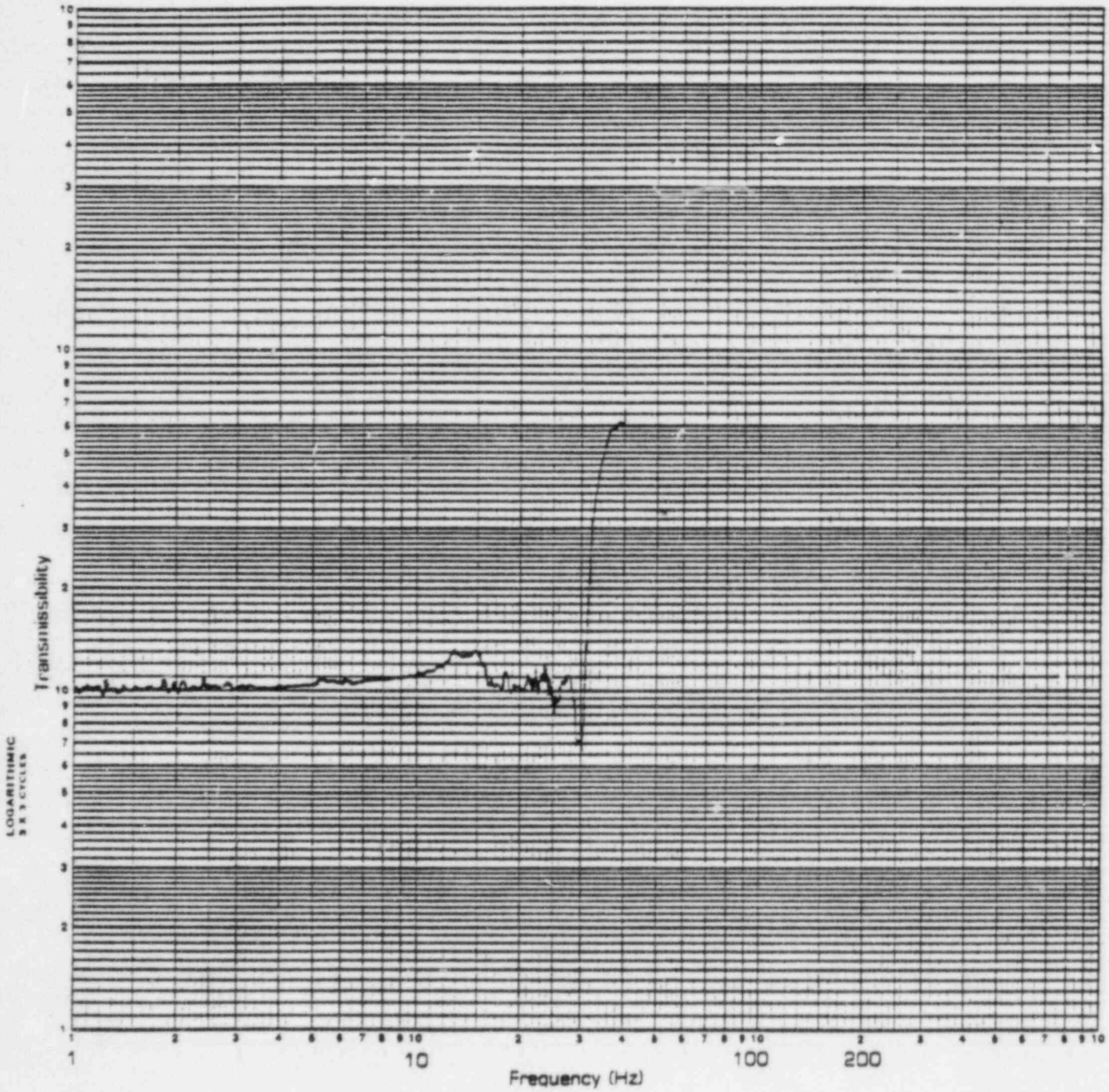
ACCEL NO. 8LAT NO. HCA

AXIS LAT/VERT

TEST RUN NO. 87

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☑ 1000 ☐



SPECIMEN 20"

AXIS LAT/VERT

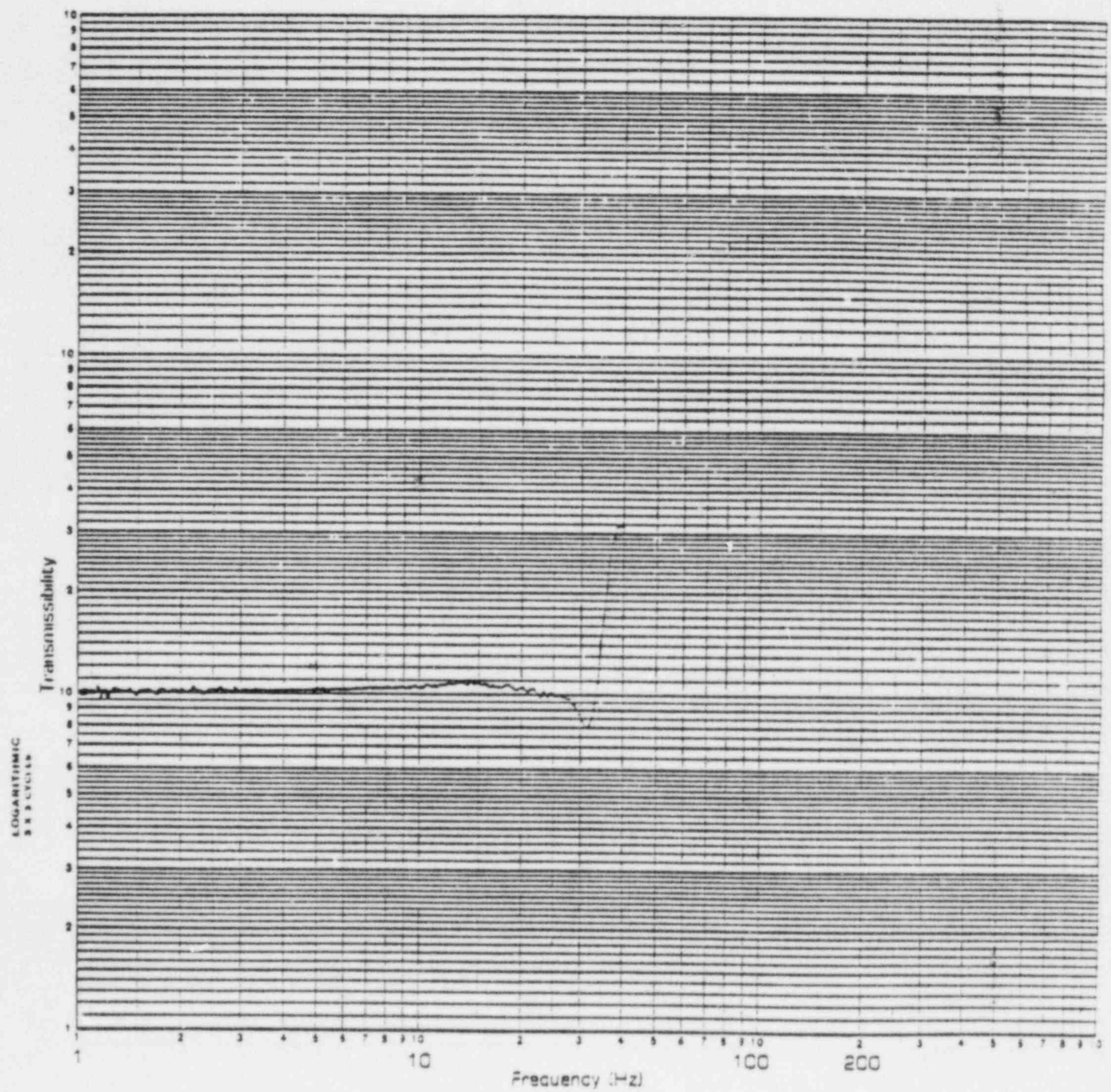
ACCEL NO. 9V NO. VCA

TEST RUN NO. 87

Page No. IX-73
Report No. 45088-1

FULL SCALE TRANSMISSIBILITY

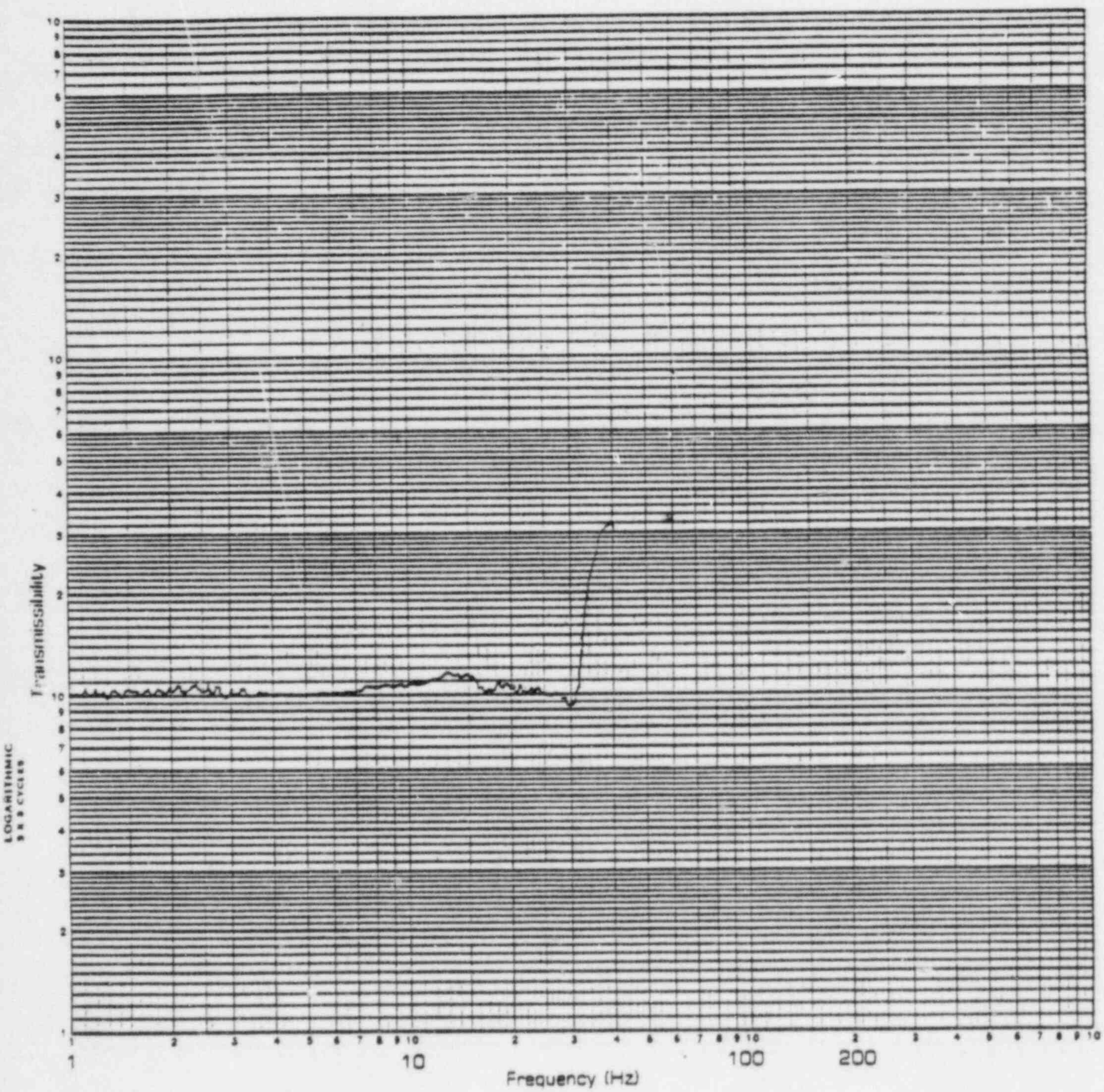
0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"
ACCEL NO 10 LAT NO. HGA
AXIS LAT/VERT
TEST RUN NO. 87

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

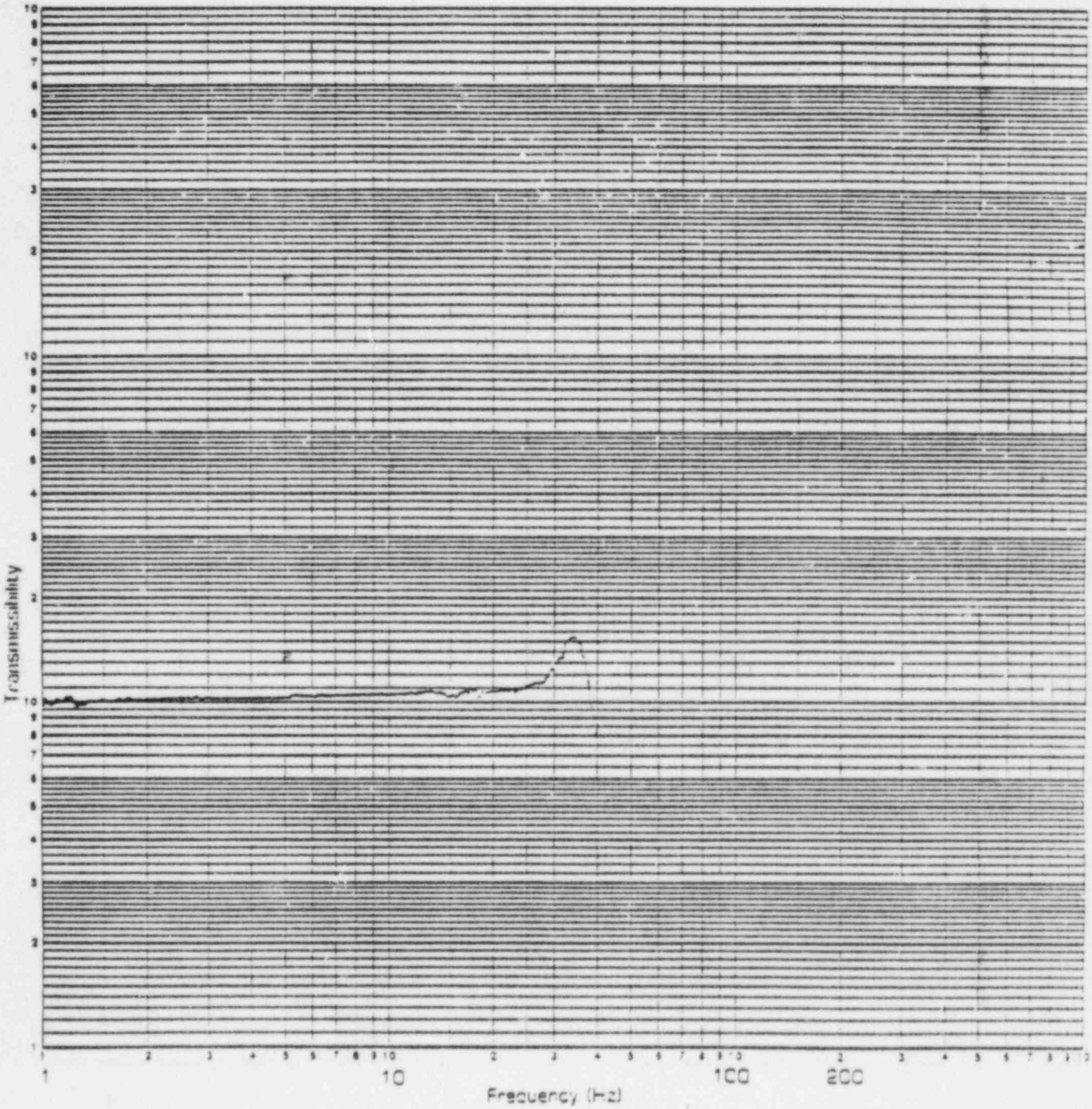


SPECIMEN 20"
AXIS L47/VERT
ACCEL NO. 11V NO. VCA
TEST RUN NO. 87

Page No. IX-75
Report No. 45088-1

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

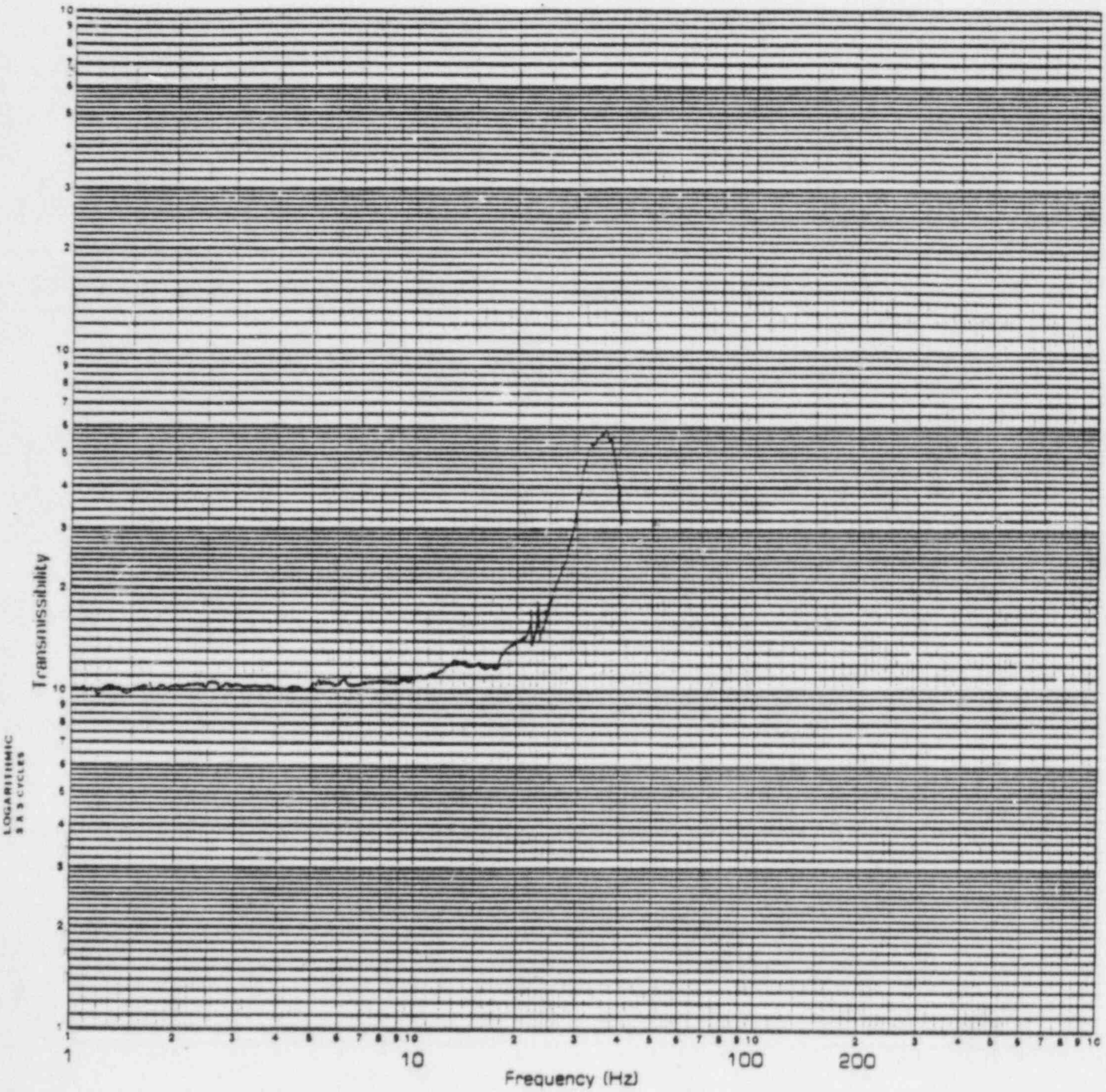
AXIS LAT/VERT

ACCEL NO. 12 LAT NO. HCA

TEST RUN NO. 87

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☑ 1000 ☐



SPECIMEN 20"

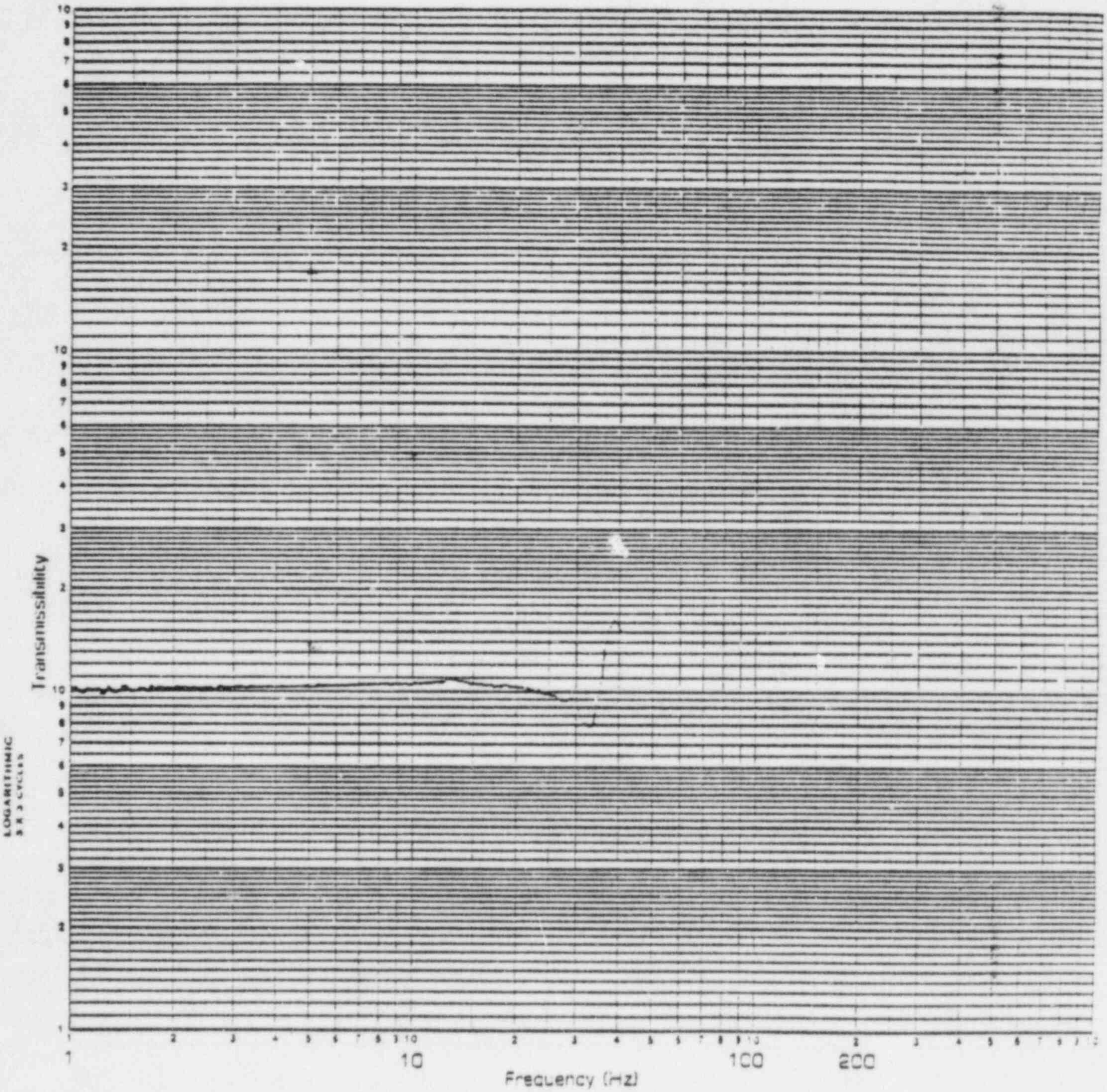
AXIS LAT/VERT

ACCEL NO. 13 V NO. VCA

TEST RUN NO. 87

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

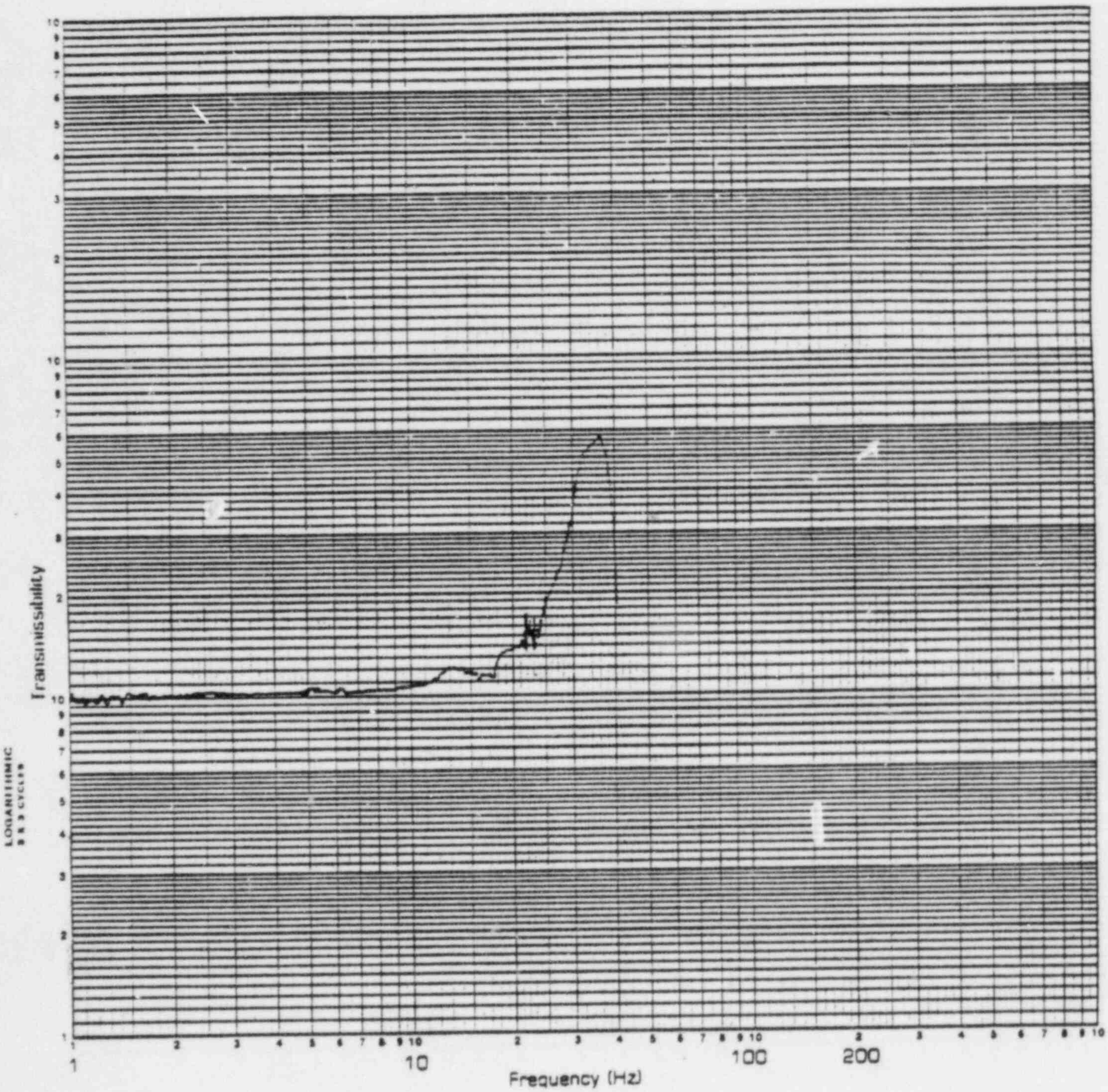
AXIS LAT/VERT

ACCEL NO. 14 LAT NO. HCA

TEST RUN NO. 27

FULL SCALE TRANSMISSIBILITY

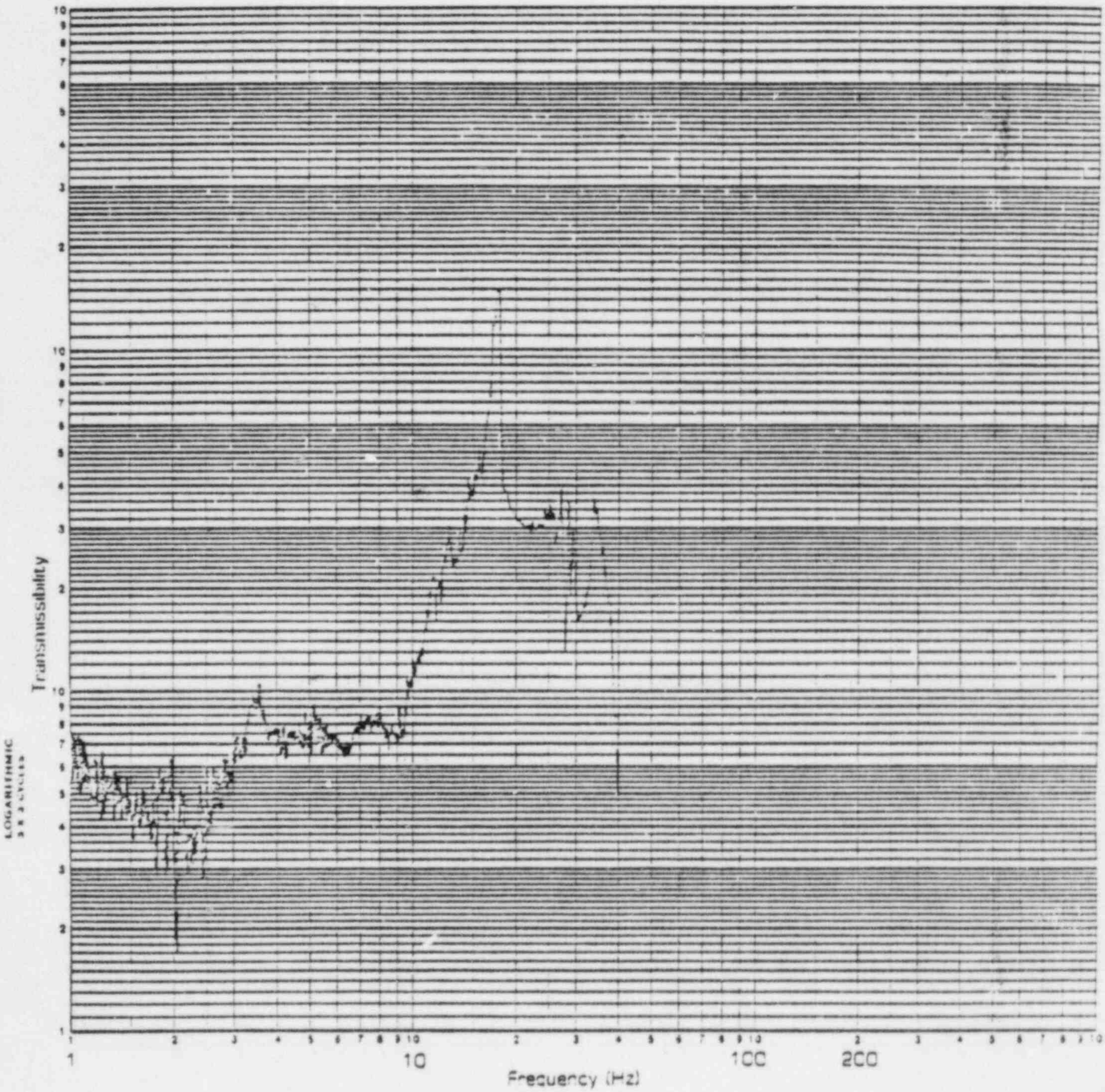
0.1 ☐ 1.0 ☐ 10 ☐ 100 ☑ 1000 ☐



SPECIMEN 20"
AXIS LAT/VERT
ACCEL NO. 15V NO. VCA
TEST RUN NO. 87

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☒ 100 ☐ 1000 ☐



SPECIMEN 20"

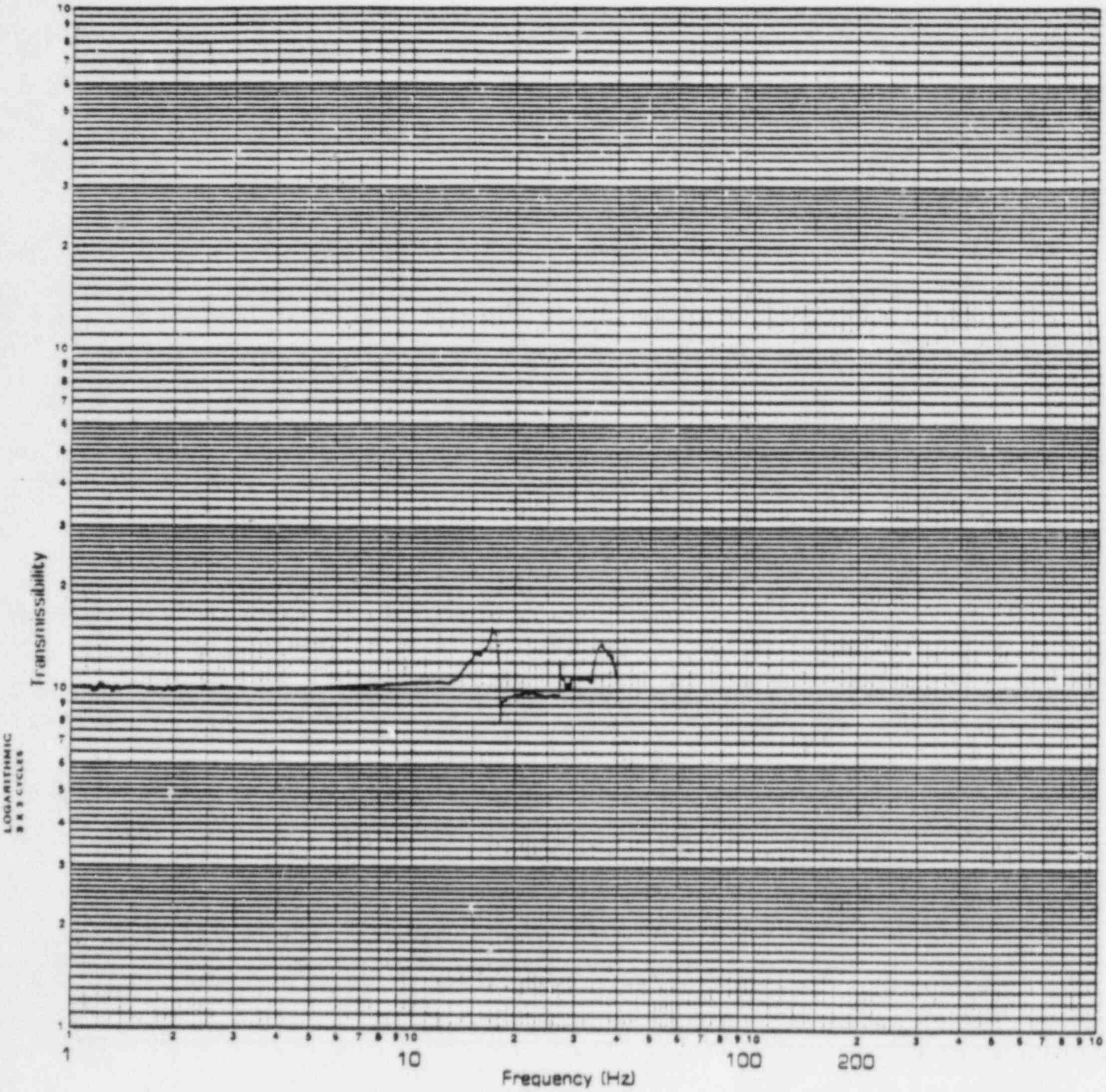
AXIS LAT/VERT

ACCEL NO. 1LONG NO. HCA

TEST RUN NO. 88

FULL SCALE TRANSMISSIBILITY

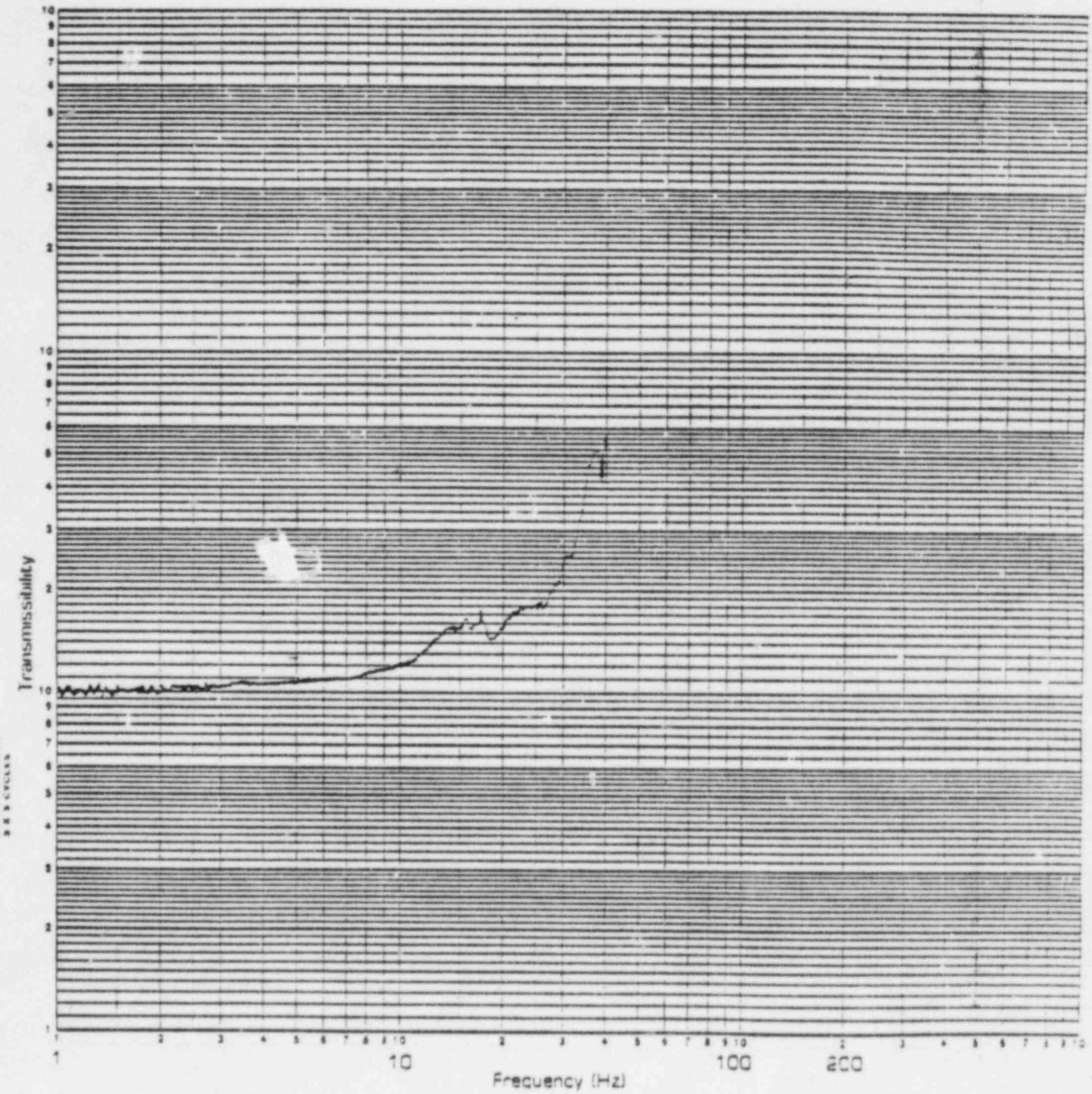
0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"
AXIS LAT/VERT
ACCEL NO. 2LAT NO. HCA
TEST RUN NO. 88

FULL SCALE TRANSMISSIBILITY

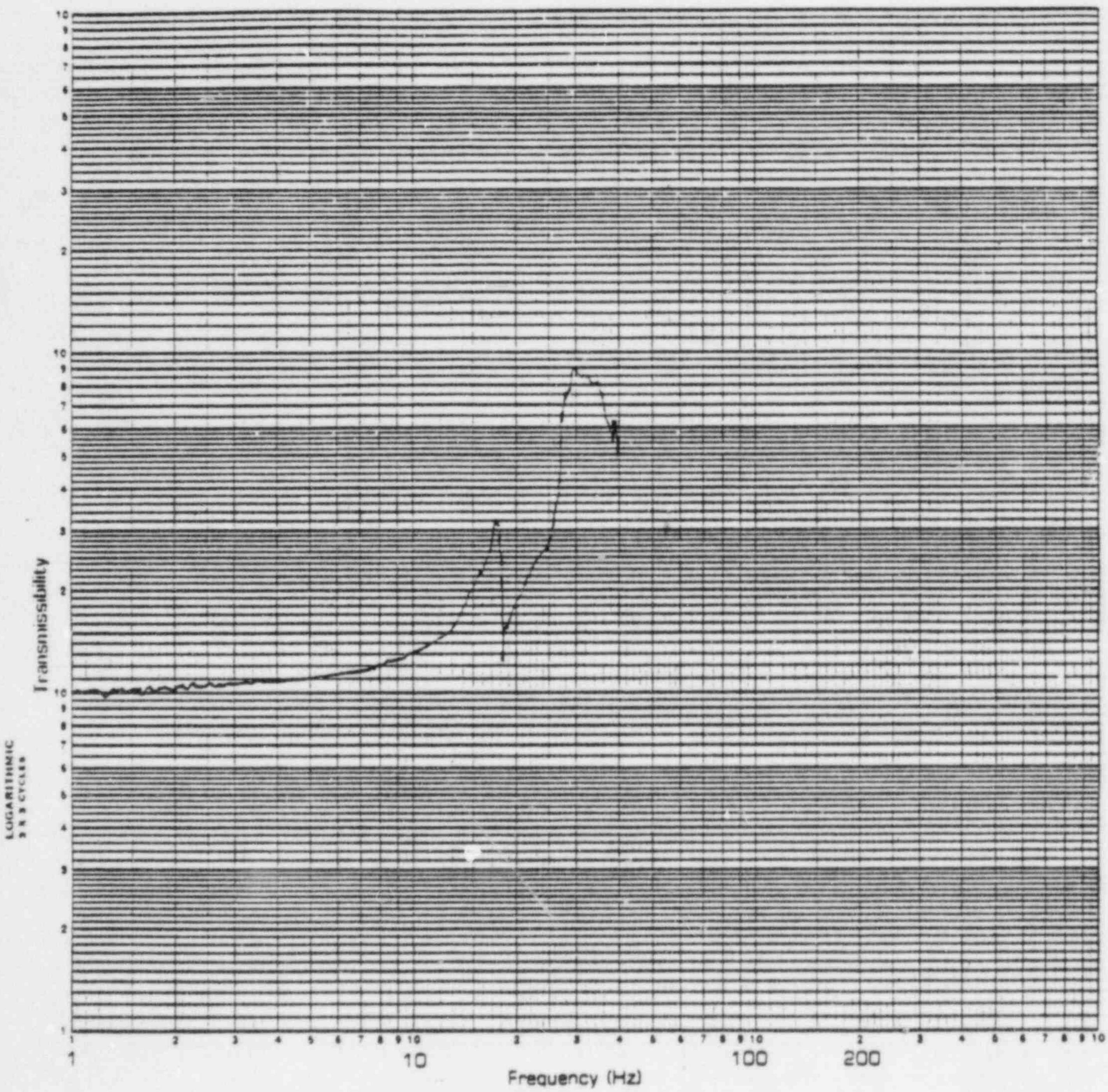
0.1 ☐ 1.0 ☐ 10 ☐ 100 ☑ 1000 ☐



SPECIMEN 20"
AXIS LAT/VERT
ACCEL NO 3V NO. VCA
TEST RUN NO 88

FULL SCALE TRANSMISSIBILITY

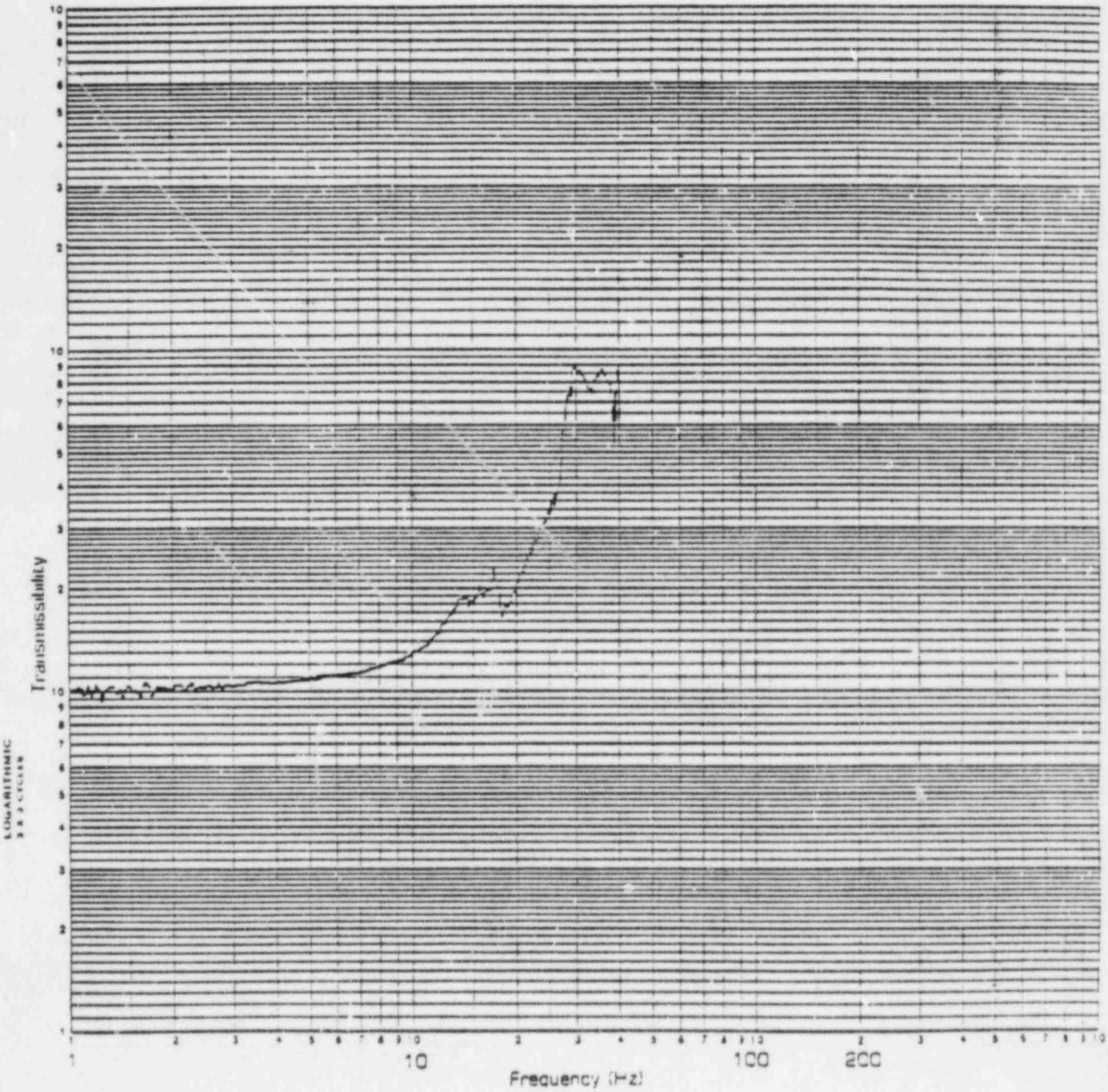
0.1 ☐ 1.0 ☐ 10 ☐ 100 ☑ 1000 ☐



SPECIMEN 20"
AXIS LAT/VERT
ACCEL NO. 4LAT NO. HCA
TEST RUN NO. 88

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

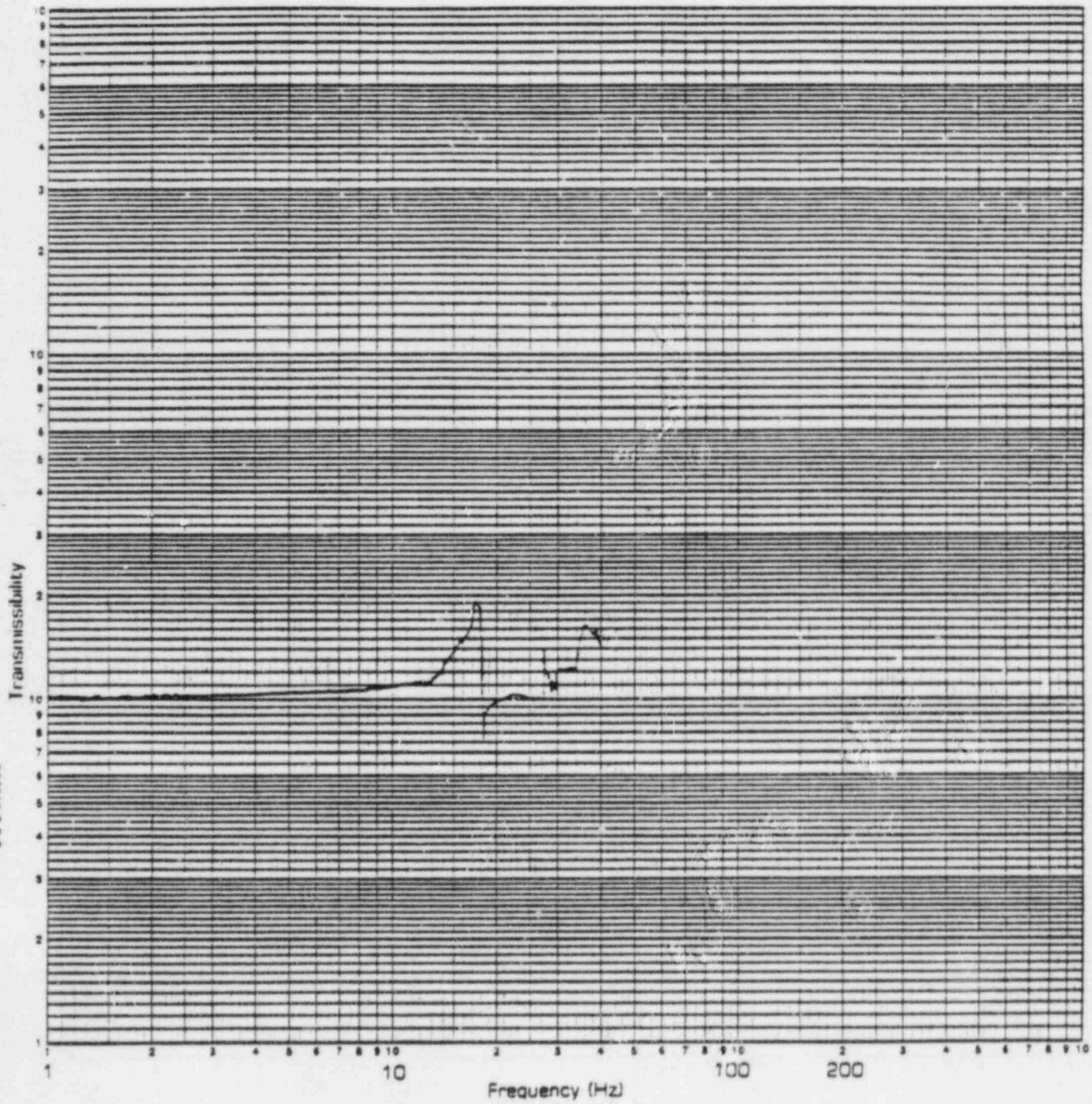
ACCEL NO. 5 V NO. VCA

AXIS LAT/VERT

TEST RUN NO. 28

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

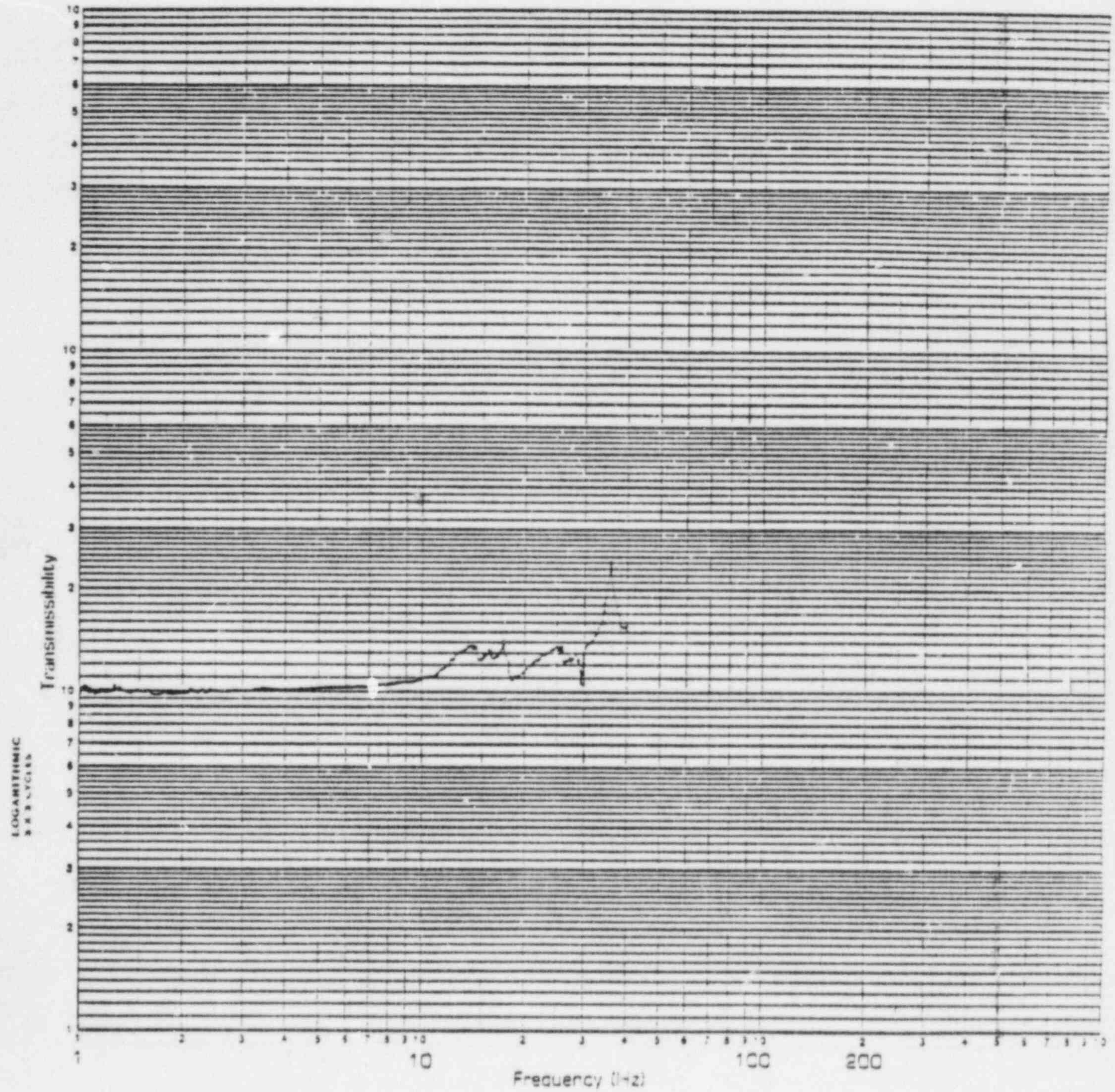
AXIS LAT/VERT

ACCEL NO. 6 LAT NO. HCA

TEST RUN NO. 88

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

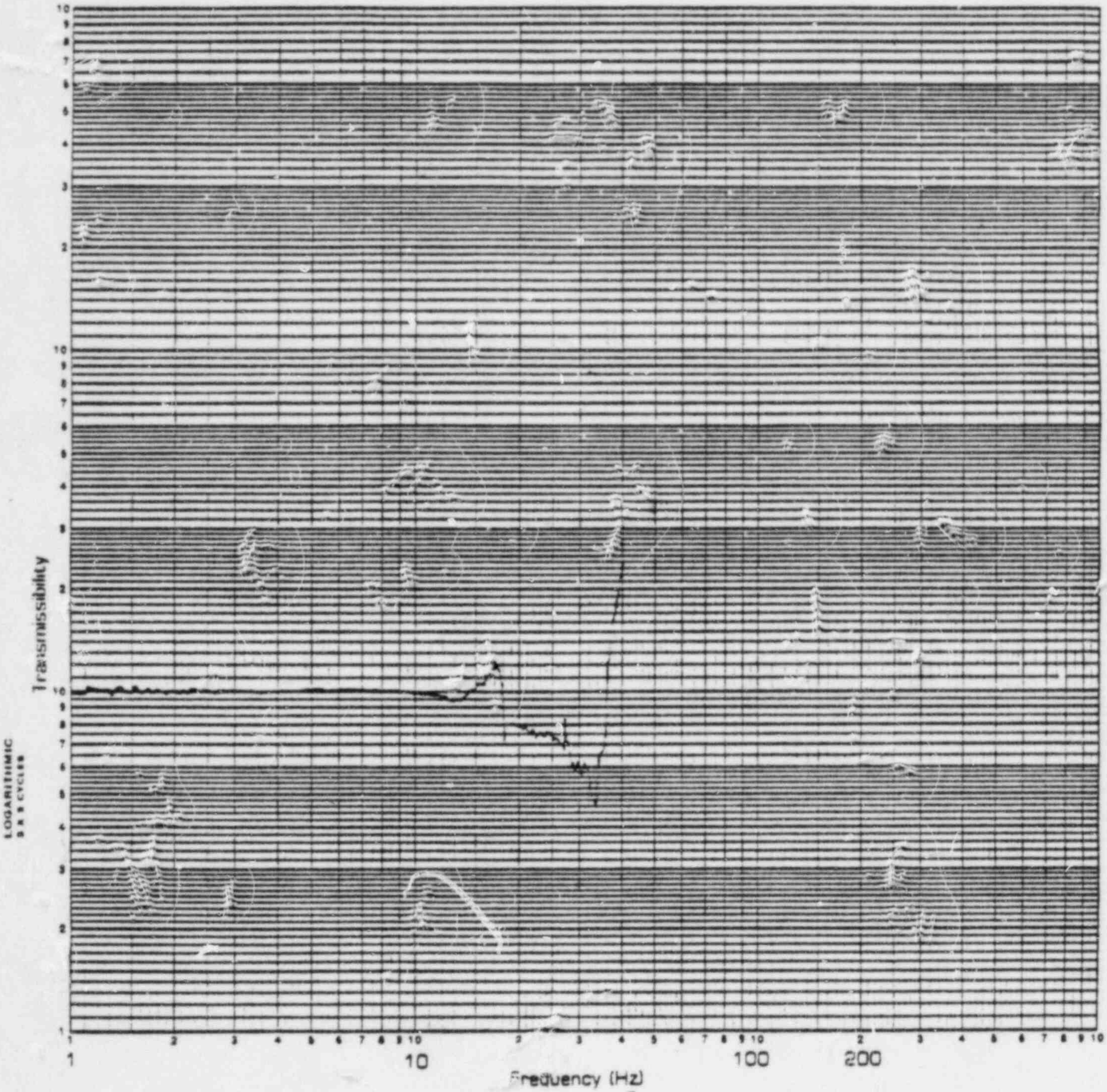
ACCEL NO. 7U NO. VCA

AXIS LAT/VERT

TEST RUN NO. 88

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☑ 1000 ☐



SPECIMEN 20"

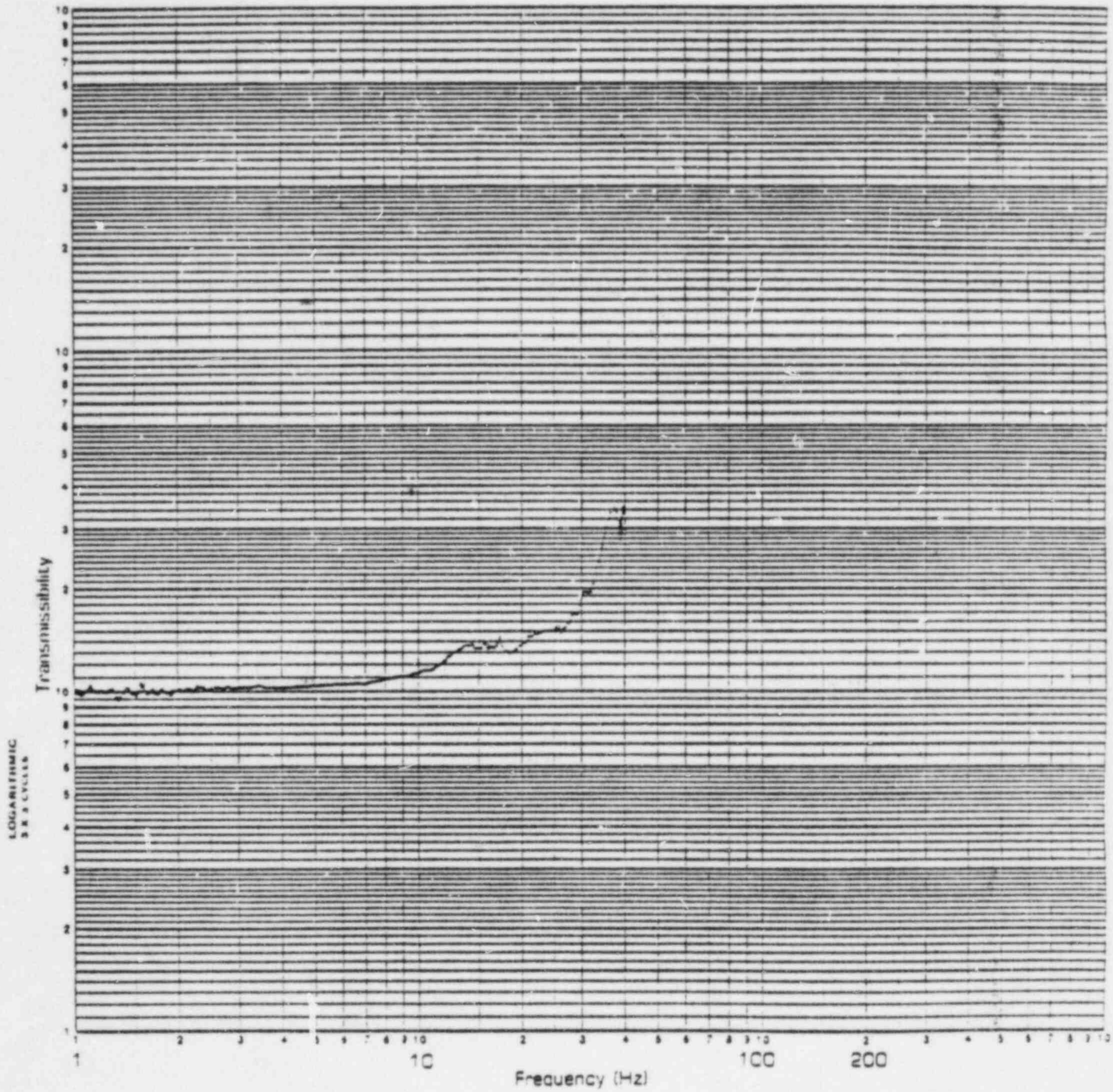
AXIS LAT/VERT

ACCEL NO. 8 LAT NO. HCA

TEST RUN NO. 88

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

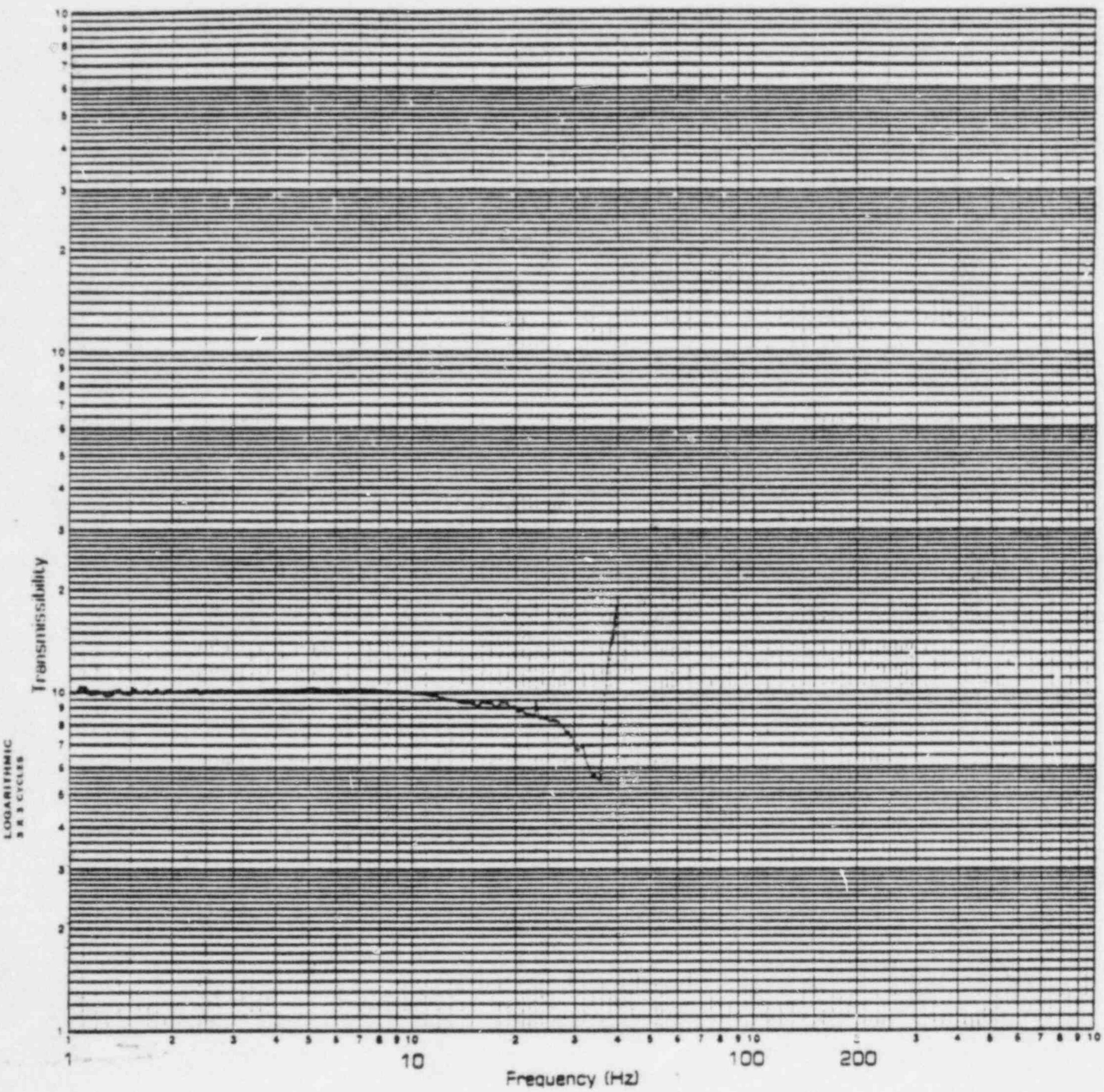
ACCEL NO. 9V NO. VCA

AXIS LAT/VERT

TEST RUN NO 88

FULL SCALE TRANSMISSIBILITY

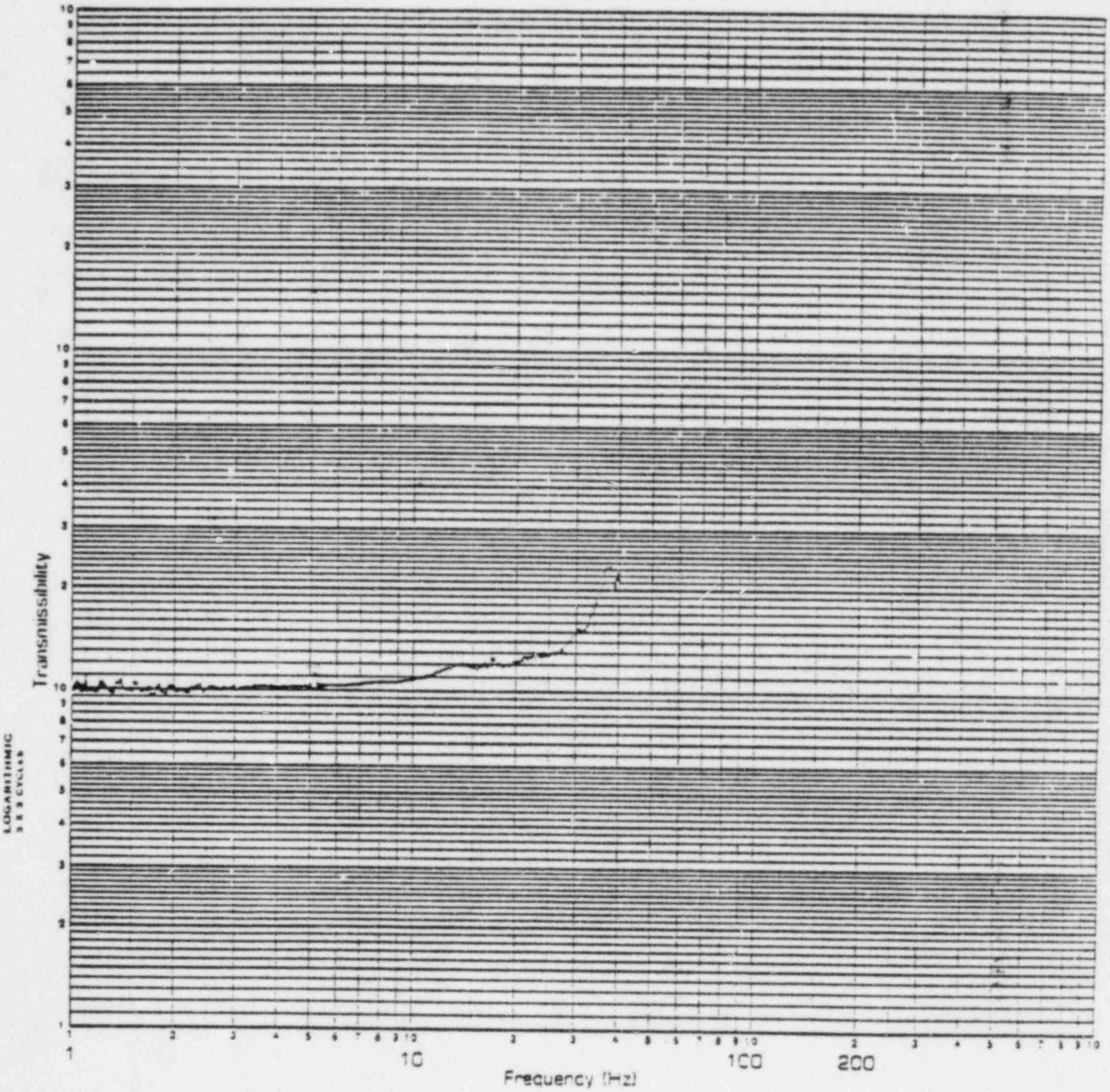
0.1 ☐ 1.0 ☐ 10 ☐ 100 ☑ 1000 ☐



SPECIMEN 20"
ACCEL NO. 10 LAT NO. HCA
AXIS LAT/VERT
TEST RUN NO. 8-8

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☑ 1000 ☐



SPECIMEN 20"

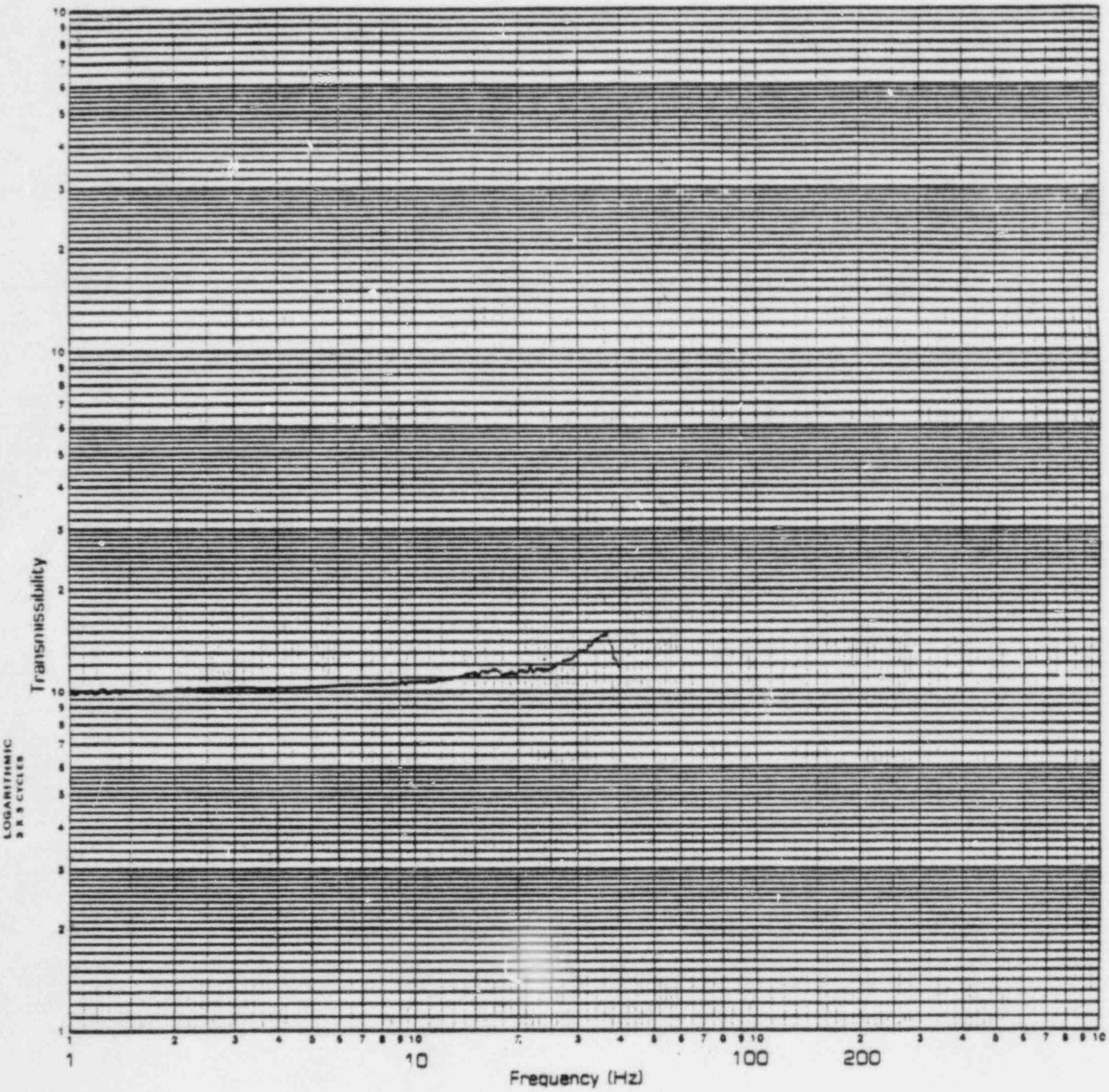
AXIS LAT/VERT

ACCEL NO. 11V NO. VCA

TEST RUN NO. 98

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

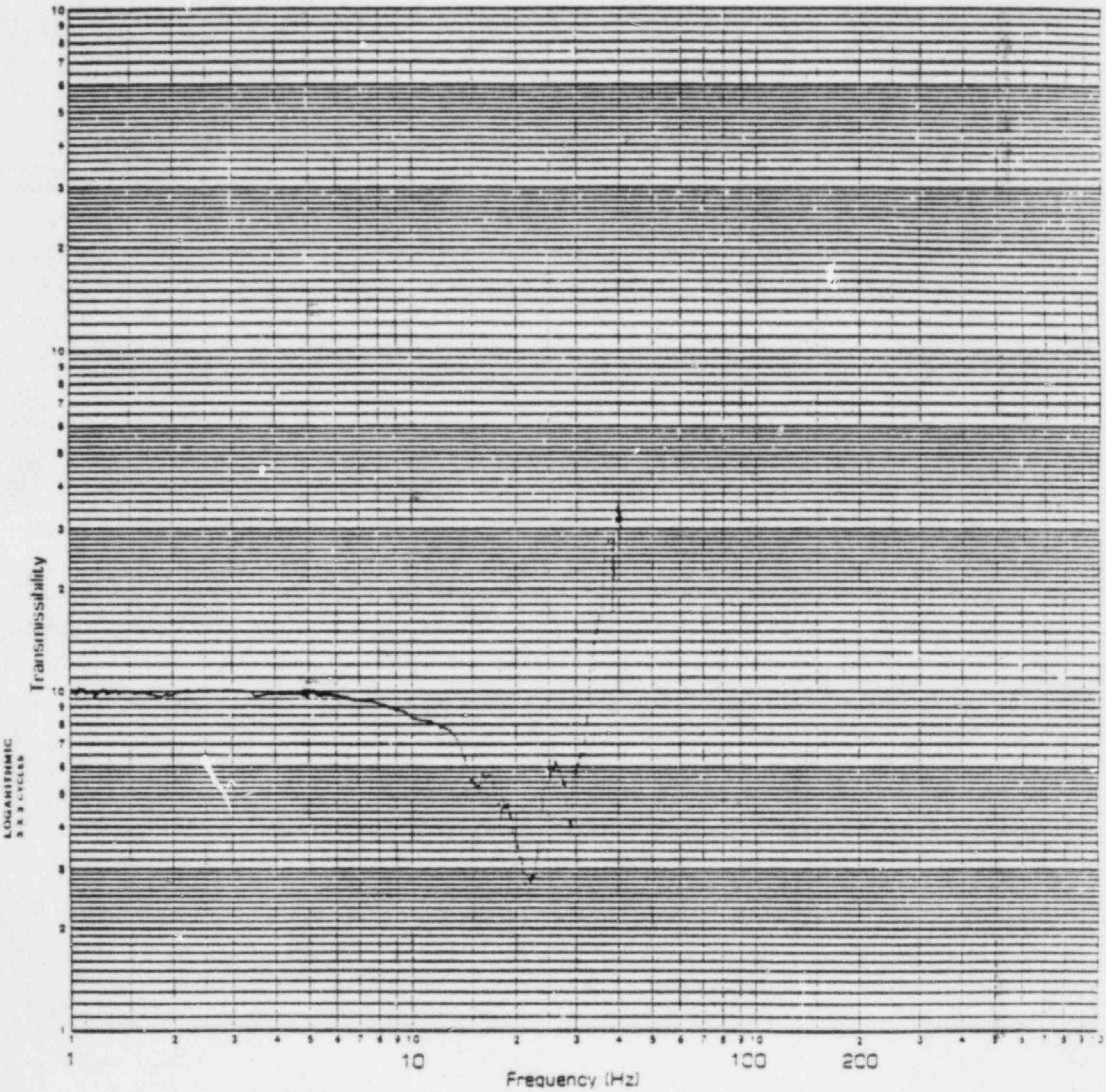
AXIS LAT/VERT

ACCEL NO. 12 LAT NO. HCA

TEST RUN NO. 88

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20°

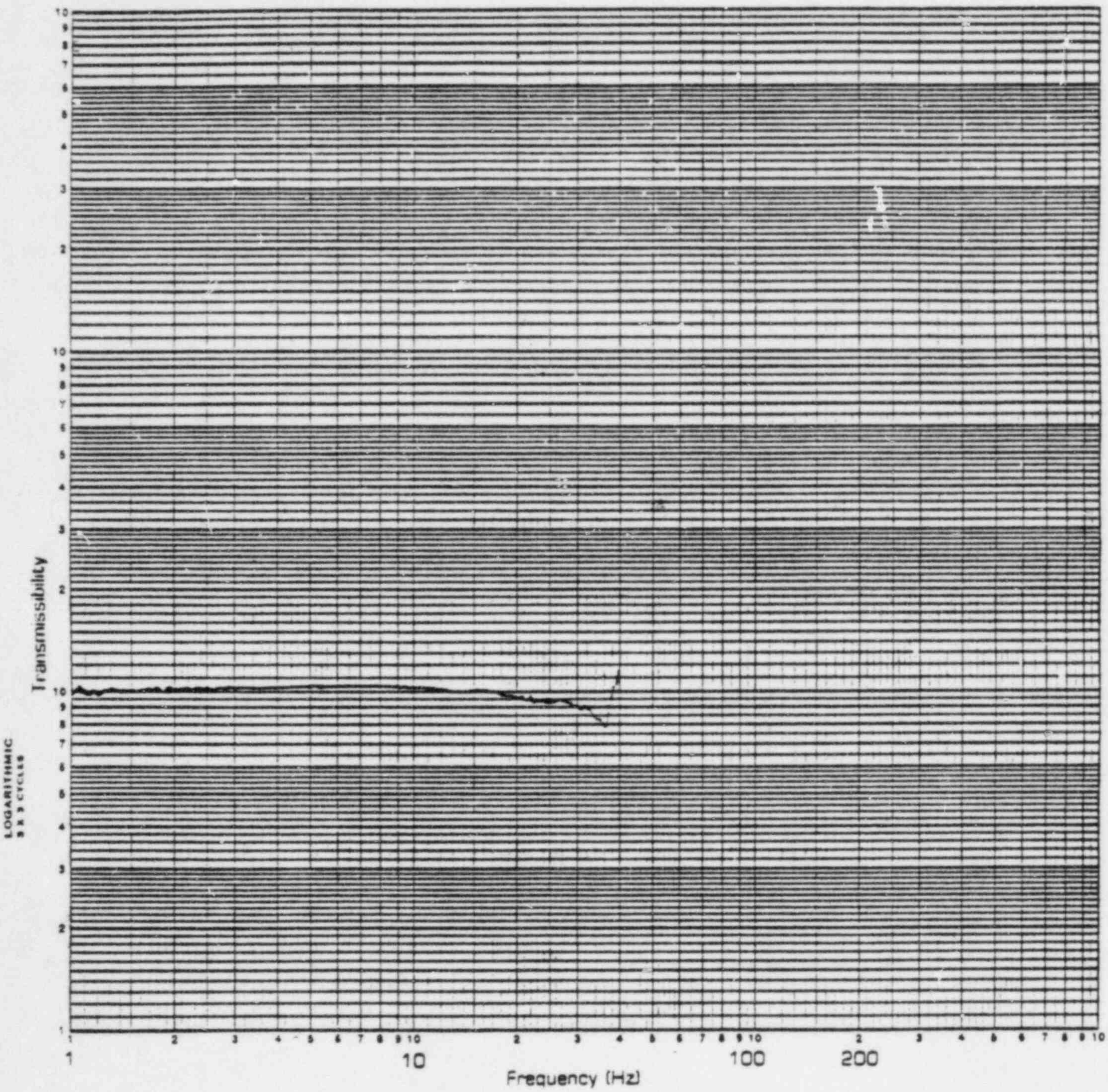
AXIS LAT/VERT

ACCEL NO. 13 V NO. VCA

TEST RUN NO. 88

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20"

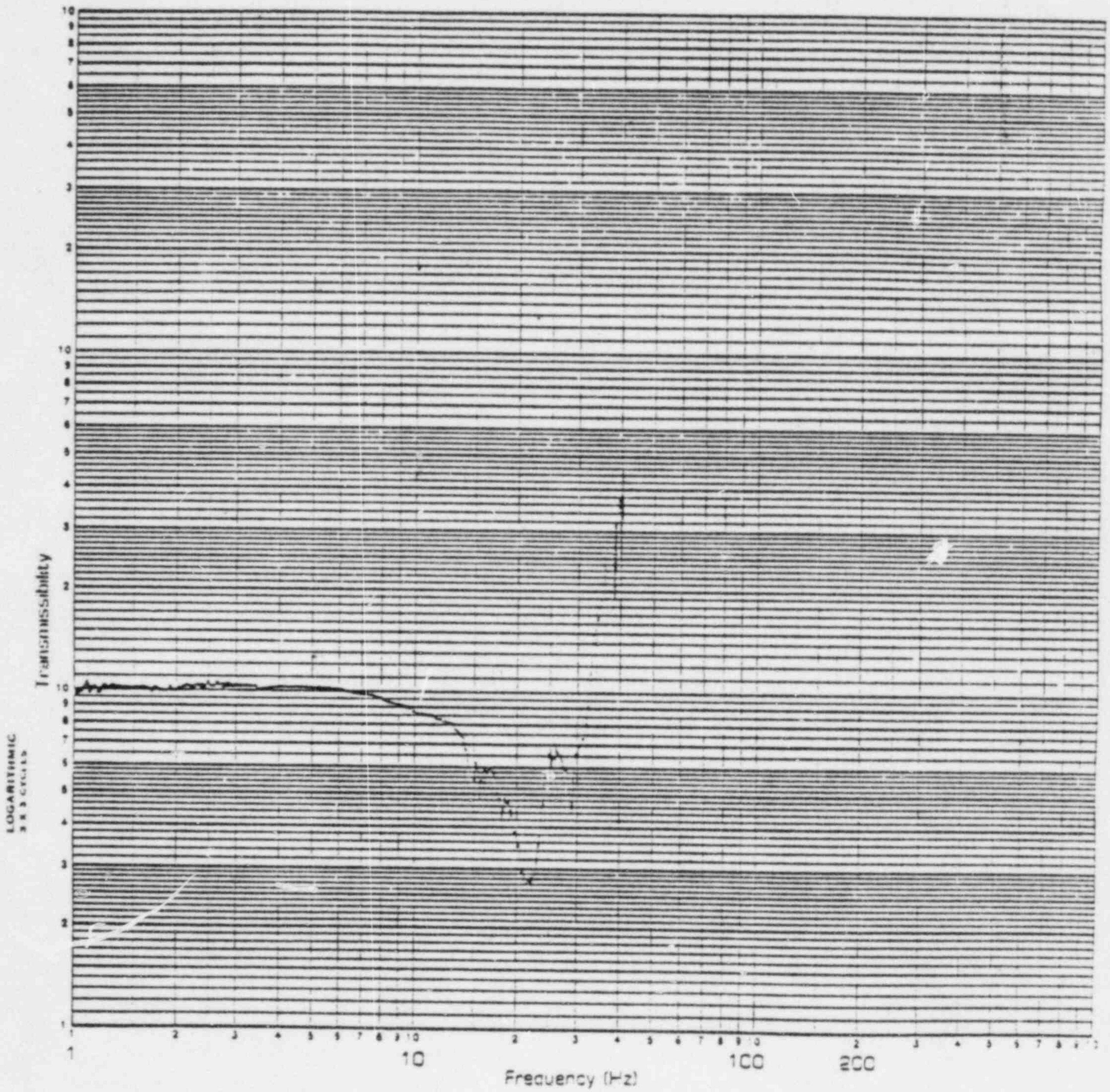
AXIS LAT/VERT

ACCEL NO. 14 LAT NO. HCA

TEST RUN NO. 8-8

FULL SCALE TRANSMISSIBILITY

0.1 ☐ 1.0 ☐ 10 ☐ 100 ☒ 1000 ☐



SPECIMEN 20°

AXIS LAT/VERT

ACCEL NO. 15 V NO. VCA

TEST RUN NO. 8-8

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APPENDIX II

DATA SHEETS
AND
INSTRUMENTATION EQUIPMENT SHEET
FOR
CONTACT RESISTANCE TESTS

DATA SHEET

WYLE LABORATORIES

Customer: Fisher Controls
Specimen: 20" Butterfly Valve
Part No.: -
Spec.: -
Para.: -
S. N: -
GSI: No
Amb. Temp.: 78°F
Photo: -
Test Med.: -
Specimen Temp.: Room Amb.
Job No.: 45088-04
Report No.: 45088-1
Start Date: 9.10.80

Test Title: Contact Resistance During Seismic Test 1

Terminals	Position	Reading
2 to 5	Closed	749 Milliohms @ 1 MA.
2 to 5	Open	>20 Megohms @ 1.4 vdc
3 to 4	Closed	15.1 ohms @ .01 MA.
3 to 4	Open	>20 Megohm @ 1.4 vdc
2 to 6	Closed	1.18 ohms @ .1 MA.
2 to 6	Open	>20 Megohms @ 1.4 vdc.

Wire No.	Position	Reading
1 to 2	Closed	4.28 ohms @ .1 MA.
1 to 2	Open	>20 Megohms @ 1.4 vdc
3 to 4	Closed	1.18 ohms @ .1 MA.
3 to 4	Open	>20 Megohms @ 1.4 vdc.

Tested By: Stephen Rice Date: 9.10.80
Witness: JON MILLIKEN
Sheet No. 1 of 2
Approved: [illegible]

WH-614A

DATA SHEET

Customer: Fisher Controls
Specimen: 20" Butterfly Valve
Part No.: –
Spec.: –
Para.: –
S/N: –
GSI: No

Amb. Temp.: 78°F
Photo: –
Test Med.: –
Specimen Temp.: Room Amb.

WYLE LABORATORIES
Job No.: 45088-04
Report No.: 45088-
Start Date: 9.10.80

Test Title: Contact Resistance During Seismic Test 2

Terminal	Position	Reading
2 to 5	Closed	356 Milliohms @ 1 M.A.
2 to 5	Open	>20 Megohms @ 1.4 vdc
3 to 4	Closed	29 ohms @ .01 M.A.
3 to 4	Open	>20 Megohms @ 1.4 vdc

Tested By: Stephen Rice Date: 9.10.80
Witness: JON MULLEN
Sheet No. 2 of 2
Approved: [illegible]

WH-614A

INSTRUMENTATION EQUIPMENT SHEET

Date 9·10·80 Job No. 45088-01 Test Area Pit#1

Technician S. Rice Customer Fisher Controls Type Test Contact Resistance During Seismic

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1.	DMM	Fluke	8012	—	11703	Multi	Mfg. Spec	8·20·80	11·20·80
2.	DMM	Keithley	164	48003A	11305	Multi	Mfg. Spec.	4·8·80	10·8·80

Instrument Test Engineer K Burkhart Checked & Received By Bobby L. Quinn

WH-1029

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APPENDIX III

INSTRUMENTATION LOG SHEETS
AND
IN TRUMENTATION EQUIPMENT SHEETS

All test equipmen and instrumentation used in the performance of this test proc am were calibrated in accordance with Wyle Laboratories' Qu lity Assurance Policies and Procedures Manual, which conforms t the applicable portions of ANSI N 45.2, 10 CFR 50/Appendix B, and Military Specification MIL-C-45662A. Standards used in performing all calibrations are traceable to the National Bureau of Standards.

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 1 OF 24

CUSTOMER FISHER TEST ENGINEER [signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
7/24/80		SET UP TO RECORD 2 CONTROL & 15 RESPONSE ACCELEROMETERS
		ON TAPE & OGRAPH
		SET UP TO RECORD 4 ELECTRICAL MONITORS & 3 PRESSURE
		TRANSDUCERS ON OGRAPH
		RECORDED CAL SIGNAL OF 1VRMS, 100HZ ON TAPE 1 & 2
		START 0000 STOP 0100'
		MOUNTED 20" VALVE IN THE LONG/VERT AXIS
	1405	RUN# 1 SINE SWEEP 1-40HZ 0.2g H,V 1/3 OCT/MIN LONG/V
		START 0100' STOP 0890' 0°
	1420	RUN# 2 SINE SWEEP 1-40HZ 0.2g H,V 1/3 OCT/MIN LONG/V
		START 0890' STOP 1150' 180°
	1945	RUN#3 SINE BEAT @ 1.0HZ 0.38G H&V IN PHASE LONG/V
		RUN#4 SINE BEAT @ 1.25HZ 0.47G H&V IN PHASE LONG/V

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 2 OF 24

CUSTOMER FISHER TEST ENGINEER [illegible signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
7-26-80		RUN#5 SINE BEAT @ 1.6HZ 0.6G H&V IN PHASE LONG/V
		RUN#6 SINE BEAT @ 2.0HZ 0.75G H&V
		RUN#7 SINE BEAT @ 2.5HZ 0.96G H&V
		RUN#8 SINE BEAT @ 3.15HZ 1.24G H&V
		RUN#9 SINE BEAT @ 4.0HZ 1.6G H&V
		RUN#10 SINE BEAT @ 5.0HZ 1.9G H&V
		RUN#11 SINE BEAT @ 6.0HZ 2.2G H&V
		RUN#12 SINE BEAT @ 7.0HZ 2.7G H&V
		RUN#13 SINE BEAT @ 8.0HZ 3.0G H&V IN PHASE LONG/V

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04

CUSTOMER FISHER

LOG PAGE NO. 3 OF 26

TEST ENGINEER [signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
7-26-80		RUN#14, SINE BEAT @ 9.0HZ 3.5G H&V IN PHASE LONG/V
		RUN#15, SINE BEAT @ 10.0HZ 3.75G H&V
		START 1685' STOP 1705
		RUN#16, SINE BEAT @ 11.0HZ 4.0G H&V
		START 1705 STOP 1730
		RUN#17, SINE BEAT @ 12.0HZ 4.5G H&V
		START 1730' STOP 1750
		RUN#18 SINE BEAT @ 13.0HZ 4.5G H&V
		START 1750' STOP 1770'
		RUN 19 SINE BEAT @ 14.0HZ 4.5G H&V
		START 1770' STOP 1790' IN PHASE LONG/V

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 4 OF 26

CUSTOMER FISHER TEST ENGINEER [illegible]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
2/26/80		RUN 20 SB @ 15.0 HZ 4.5G H & 4.35G V 1ɸ PHASE LONG/V
		START 1790' STOP 1820'
		RUN 21 SB @ 16.0 HZ 4.5G 4.4 V
		START 1820' STOP 1840'
	2245	RUN 22 SB @ 16.0 HZ 4.5G H & 4.2G V
		START 1840' STOP 1865'
		RUN 23 SB @ 17.0 HZ 4.5G H & 4.1 V
		START 1865' STOP 1900'
		RUN 24 SB @ 18.0 HZ 4.5G H & 4.1G V
		START 1900' STOP 1920'
		RUN 25 SB @ 19.0 HZ [illegible]
		START 1920' STOP 1940' 1ɸ PHASE LONG/V

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 5 OF 26

CUSTOMER FISHER TEST ENGINEER [illegible]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
2/26/80		RUN 26 SB @ 20.0 HZ 4.1GH/V IN PHASE LONG/V
		START 1940' STOP 1960'
		RUN 27 SB @ 21.0 HZ 4.25GH & 4.1GV
		START 1960' STOP 1980'
		RUN 28 SB @ 22.0 HZ 4.5GH / 4.0GV
		START 1980' STOP 2000'
		RUN 29 SB @ 23.0 HZ 4.25 GH/V
		START 2000' STOP 2020'
		RUN 30 SB @ 24.0 HZ 3.45 GH/V
		START 2020' STOP 2040'
		RUN 31 SB 25.0 HZ 3.25 GH/V
		START 2040' STOP 2060' IN PHASE LONG/V

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 6 OF 26

CUSTOMER FISHER TEST ENGINEER [signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
2/27/80		RUN 32 SB @ 26.0HZ 3.05 GH/U IN PHASE LONG/U
		START 2080' STOP 2100'
		RUN 33 SB @ 27.0HZ 2.95 GH/U
		START 2100' STOP 2120'
		RUN 34 SB @ 28.0HZ 2.75 GH/U
		START 2120' STOP 2140'
		RUN 35 SB @ 29.0HZ 2.6 GH/U
		START 2140' STOP 2160'
		RUN 36 SB @ 30.0HZ 2.4 GH/U
		START 2160' STOP 2180'
		RUN 37 SB @ 31.0HZ 2.3 GH/U
		START 2180' STOP 2200' IN PHASE LONG/U

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04

CUSTOMER FISHER

LOG PAGE NO. 7 OF 26

TEST ENGINEER [illegible]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
7/27/80		RUN 38 SB @ 32.0 HZ 2.1g H&V IN PHASE LONG/V
		START 2200' STOP 2220'
		RUN 39 SB @ 33.0 HZ 2.0g H&V
		START 2220' STOP 2240'
		RUN 40 SB @ 40.0 HZ 2.0g H&V
		START 2240' STOP 2260' IN PHASE LONG/V
		RUN 41 SB @ 1.0 HZ 0.38g H&V OUT PHASE LONG/V
		RUN 42 SB @ 1.25 HZ 0.47g H&V
		RUN 43 SB @ 1.6 HZ 0.6g H&V
		RUN 44 SB @ 2.0 HZ 0.25g H&V
		RUN 45 SB @ 2.5 HZ 0.96g H&V OUT PHASE LONG/V

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 8 OF 26

CUSTOMER FISHER TEST ENGINEER [illegible]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
7/27/80		RUN 46 SB @ 3.15 HZ 1.24g H/V OUT PHASE LONG/V
		RUN 47 SB @ 4.0 HZ 1.6g H/V
		RUN 48 SB @ 5.0 HZ 1.9g H/V
		RUN 49 SB @ 6.0 HZ 2.2g H/V
		RUN 50 SB @ 7.0 HZ 2.7g H/V
		RUN 51 SB @ 8.0 HZ 3.2g H/V
		RUN 52 SB @ 9.0 HZ 3.5g H/V
		RUN 53 SB @ 10.0 HZ 3.75g H/V
		RUN 54 SB @ 11.0 HZ 4.0g H/V OUT PHASE LONG/V

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 9 OF 26

CUSTOMER Fisher TEST ENGINEER [signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
7-27-80		Run 55 S.B. @ 12.0Hz 4.5g HEV Out Phase Long/V
		Run 56 S.B. @ 13.0Hz 4.5g HEV Out Phase Long/V
		Run 57 S.B.@ 14.0Hz 4.5g HEV Out Phase Long/V
		Run 58 S.B. @ 15.0Hz 4.5g HEV Out Phase Long/V
		THE 3/4" DIA. MOUNTING BOLTS WHICH ATTACH THE ACTUATOR MOUNTING BRACKET TO THE
		VALVE BODY WOULD NOT REMAIN TIGHTENED DURING THE CALIBRATION BEATS PRIOR TO
		TEST RUN 59. (SEE NOTICE OF ANOMALY NO. 4). THE TEST PROGRAM WAS INTERRUPTED;
		HIGHER STRENGTH MOUNTING BOLTS WERE INSTALLED; THE REQUIRED INPUT LEVELS WERE
		REDUCED FROM 4.5g TO 3.0g; AND THE TEST PROGRAM WAS RESUMED ON 9/9/80.
9-9-80	0818	Run 59 SB @ 16.0 Hz 3.0g HEV Out Phase Long/V
		Tape Start 0100' Stop 0120'
	0821	Run 60 SB @ 17.0Hz 3.0g HEV 2.1gV Out Phase Long/V
		Tape Start 0120' Stop 0140'
		Run 61 SB @ 18.0Hz 3.0g HEV Out Phase Long/V
		Tape Start 0140' Stop 0160'

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04

CUSTOMER FISHER

LOG PAGE NO. 12 OF 20

TEST ENGINEER [signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
9/9/80	1016	RUN #74 SINE BEAT @ 31.0 Hz 2.3g H/V 180° LONG/V
		START 0355' STOP 0370'
		RUN 75 SB @ 32.0 Hz 2.1g H/V
		START 0370' STOP 0385'
		RUN 76 SB @ 33.0 Hz 2.0g H/V
		START 0385' STOP 0400'
		RUN 77 SB @ 40.0 Hz 2.0g H/V
		START 0400 STOP 0415'
	1326	RUN 78 SB @ 31.5 Hz 2.2g H/V
		START 0415' STOP 0435
		RUN 79 SB @ 31.5 Hz 2.2g H/V 180° LONG/V
		START 0435 STOP 0470'

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04

CUSTOMER FISHER

LOG PAGE NO. 13 OF 22

TEST ENGINEER [illegible signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
9/9/80	1329	RUN 80 SINE BEAT @ 19.0 Hz 3.0g H&V 180° LONG/V
		START 0470' STOP 0505'
		RUN 81 SINE BEAT @ 15.5 Hz 3.0g H&V 180° LONG/V
		START 0505' STOP 0560'
		RUN 82 SINE BEAT @ 15.5 Hz 3.0g H&V 0° LONG/V
		START 0560' STOP 0605'
		RUN 83 SINE BEAT @ 22.5 Hz 3.25g H&V 0° LONG/V
		START 0605' STOP 0650'
		RUN 84 SINE BEAT @ 31.5 Hz 2.25g H&V 0° LONG/V
		START 0650' STOP 0690
		RUN 85 SINE BEAT @ 19.0 Hz 2.5g H & 3.5g V 180° LONG/V
		START 0690' STOP 0700

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04

CUSTOMER FISHER

LOG PAGE NO. 14 OF 26

TEST ENGINEER [illegible]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
9/5/80	1509	RUN 86 SINE BEAT @ 19.0 HZ 3.25g H&V 180° LONG/V
		START 0700' STOP 0720'
		Rotated Specimen 90° To The LAT/VERT AXIS
	1940	RUN 87 SINE SWEEP 1-40 HZ 0.2g input ½ oct/min 0° LAT/V
		START 0720' STOP 1345'
	2020	RUN 88 SINE SWEEP 1-40 HZ 0.2g INPUT ½ oct/min 180° LAT/V
		START 1380' STOP 2025'
9/10/80	0724	RUN 89 SINE BEAT @ 1.0 HZ 0.3g H&V 0° LAT/V
		RUN 90 SINE BEAT @ 1.25 HZ .47g H&V
		RUN 91 SINE BEAT @ 1.6 HZ 0.6g H&V
		RUN 92 SINE BEAT @ 2.0 HZ 0.75g H&V 0° LAT/V

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 15 OF 26

CUSTOMER FISHER TEST ENGINEER [signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
9/10/80	0852	Run# 93 SINE BEAT @ 2.5 Hz 0.96 g H/V 0° LAT/V
		Run# 94 SINE BEAT @ 3.15 Hz 1.24 g H/V
		Run 95 SINE BEAT @ 4.0 Hz 1.6 g H/V
		Run 96 SINE BEAT @ 5.0 Hz 1.9 g H/V
		Run 97 SINE BEAT @ 6.0 Hz 2.2 g H/V
		Run 98 SINE BEAT @ 7.0 Hz 2.7 g H/V
		Run 99 SINE BEAT @ 8.0 Hz 3.0 g H/V
		Run 100 SINE BEAT @ 9.0 Hz 3.1 g H / 3.25 g V
		Run 101 SINE BEAT @ 10.0 Hz 3.1 g H/V 0° LAT/V
		START 2025' STOP 2046

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04

CUSTOMER FISHER

LOG PAGE NO. 16 OF 20

TEST ENGINEER [illegible]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
9/10/80	0831	RUN 102 SINE BEAT @ 11.0 Hz 3.0g H/V 0° LAT/V
		START 2046 STOP 2065'
		RUN 103 SB @ 12.0 Hz 3.1g H/V
		START 2065' STOP 2087
		RUN 104 SB @ 13.0 Hz 3.1g H/V
		START 2087' STOP 2108'
		RUN 105 SB @ 14.0 Hz 3.0g H, 3.1g V
		START 2108 STOP 2128'
		RUN 106 SB @ 15.0 Hz 3.1g H, 3.25g V
		START 2128' STOP 2143'
	0907	RUN 107 SB @ 16.0 Hz 3.0g H/V 0° LAT/V
		START 2143 STOP 2160

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 17 OF 2e

CUSTOMER FISHER TEST ENGINEER [signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
9/10/80	0911	RUN 108 SINE BEAT @ 17.0Hz 3.0g H+V 0° LAT/V
		START 2160' STOP 2178'
		RUN 109 SB @ 18.0Hz 3.0g H+V
		START 2178' STOP 2196
		RUN 110 SB @ 19.0Hz 3.0g H+V
		START 2196 STOP 2214'
		RUN 111 SB @ 20.0Hz 3.25g H, 3.0g V
		START 2214' STOP 2228'
		RUN 112 SB @ 21.0 Hz 3.1g H, 3.0g V
		START 2228' STOP 2242
	0927	RUN 113 SB @ 22.0 Hz 3.1g H+V 0° LAT/V
		START 2242 STOP 2257

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 18 OF 26

CUSTOMER Fisher TEST ENGINEER [illegible]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)	
9/10/80	09:43	Run# 114 SINE BEAT @ 23.0 Hz 3.0g H/V	0° LAT/V
		START 2257' STOP 2273'	
		Run 115 SB @ 24.0 Hz 3.0g H/V	
		START 2273 STOP 2290	
		Run# 116 SB @ 25.0 Hz 3.25g H/V	
		START 2290' STOP 2306	
		Run 117 SB @ 26.0 Hz 3.25g H, 3.0g V	
		START 2306 STOP 2320	
		Run 118 SB @ 27.0 Hz 3.0g H/V	
		START 2320 STOP 2340	
	1206	Run 119 SB @ 28.0 Hz 2.75g H/V	0° LAT/V
		START 2340 STOP 2360	

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04   LOG PAGE NO. 19 OF 20

CUSTOMER FISHER   TEST ENGINEER [signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
9/10/80		RUN 120 SINE BEAT @ 29.0 Hz 2.4g H!V 0° LAT/V
		START 2360 STOP 2375'
		RUN 121 SB @ 30.0 Hz 2.4g H, 2.5g V
		START 2375 STOP 2390
	1215	RUN 122 SB @ 31.0 Hz 2.5g H, 2.4g V
		START 2390' STOP 2400'
		RUN 123 SB @ 32.0 Hz 2.1g H, 2.3g V
		START 2400 STOP 2415'
		RUN 124 SB @ 33.0 Hz 2.1g H!V
		START 2415 STOP 2430
	1348	RUN 125 SB @ 40.0 Hz 2.25g H; 2.5g V 0° LAT/V
		START 2430 STOP 2445'

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 4588-04

CUSTOMER FISHER

LOG PAGE NO. 20 OF 26

TEST ENGINEER [signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
9/10/80	1508	RUN 126 SINE BEAT @ 1.0 HZ 0.33g H&V 180° LAT/V
	1518	RUN 127 SB @ 1.25 HZ 0.47g H&V
	1529	RUN 128 SB @ 1.6 HZ 0.6g H&V
	1535	RUN 129 SB @ 2.0 HZ 0.75g H&V
	1540	RUN 130 SB @ 2.5 HZ 0.96g H&V
	1545	RUN 131 SB @ 3.15 HZ 1.24g H&V
	1550	RUN 132 SB @ 4.0 HZ 1.6g H&V
	1555	RUN 133 SB @ 5.0 HZ 1.9g H&V
	1605	RUN 134 SB @ 6.0 HZ 2.2g H&V 180° LAT/V

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 21 OF 26

CUSTOMER FISHER TEST ENGINEER [illegible signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
9/10/80	1608	RUN 135 SINE BEAT @ 7.0 HZ 2.7g H/V 180° LAT/V
	1612	RUN 136 SB @ 8.0 HZ 3.0g H/V
	1612	RUN 137 SB @ 9.0 HZ 3.0g H/V
	1622	RUN 138 SB @ 10.0 HZ 3.0g H/V
		START 0100' STOP 0120'
	1635	RUN 139 SB @ 11.0 HZ 3.0g H/V
		START 0125' STOP 0145'
	1640	RUN 140 SB @ 12.0 HZ 3.0g H/V
		START 0145' STOP 0160'
	1648	RUN 141 SB @ 13.0 HZ 3.0g H/V 180° LAT/V
		START 0160' STOP 0175'

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04
CUSTOMER FISHER

LOG PAGE NO. 22 OF 2[illegible]
TEST ENGINEER [illegible]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
9/10/80	1705	RUN 142 SINE BEAT @ 14.0 HZ 3.0g H/V 180° LAT/V
		START 0175' STOP 0190'
	1710	RUN 143 SB @ 15.0 HZ 3.0g H/V
		START 0190' STOP 0205'
	1715	RUN 144 SB @ 16.0 HZ 3.0g H/V
		START 0205' STOP 0220'
	1717	RUN 145 SB @ 17.0 HZ 3.0g H/V
		START 0220' STOP 0235'
	1725	RUN 146 SB @ 18.0 HZ 3.0g H/V
		START 0235' STOP 0250'
	1730	RUN 147 SB @ 19.0 HZ 3.0g H/V 180° LAT/VERT
		START 0250' STOP 0265'

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 23 OF 24

CUSTOMER FISHER TEST ENGINEER [illegible]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
9/10/80	1743	RUN 148 SINE BEAT @ 20.0 HZ 3.0g H/V 180° LAT/V
		START 0265' STOP 0280'
	1746	RUN 149 SB @ 21.0 HZ 3.0g H/V
		START 0280' STOP 0255'
	1749	RUN 150 SB @ 22.0 HZ 3.0g H/V
		START 0295' STOP 0310'
	1752	RUN 151 SB @ 23.0 HZ 3.0g H/V
		START 0310' STOP 0325'
	1755	RUN 152 SB @ 24.0 HZ 3.0g H/V
		START 0325' STOP 0340'
	558	RUN 153 SB @ 25.0 HZ 3.0g H/V 180° LAT/V
		START 0340' STOP 0355'

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 24 OF 26

CUSTOMER FISHER TEST ENGINEER [illegible signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
7/10/80	1805	RUN 154 SINE BEAT @ 26.0 HZ 3.0g H/V 180° LAT/V
		START 0355' STOP 0370'
	1810	RUN 155 SB @ 27.0 HZ 2.9g H/3.0g V,
		START 0370' STOP 0385'
	1813	RUN 156 SB @ 28.0 HZ 2.85g H/3.0g V
		START 0385' STOP 0400'
	1815	RUN 157 SB @ 29.0 HZ 2.65g H/V
		START 0400' STOP 0415'
	1818	RUN 158 SB @ 30.0 HZ 2.4g H/V
		START 0415' STOP 0430'
	1821	RUN 159 SB @ 31.0 HZ 2.3g H/V 180° LAT/V
		START 0430' STOP 0445'

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04 LOG PAGE NO. 25 OF 2a

CUSTOMER FISHER TEST ENGINEER [signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
9/10/80	1825	RUN 160 SINE BEAT @ 32.0 HZ 2.1g H/V 180° LAT/U
		START 0445' STOP 0460'
	1829	RUN 161 SB @ 33.0 HZ 2.0g H/V
		START 0460' STOP 0475'
	1840	RUN 162 SB @ 40.0 HZ 2.0g H/V
		START 0475' STOP 0495'
	1843	RUN 163 OPERATIONAL SB @ 33.0 HZ 2.0g H/V
		START 0495' STOP 0535'
	1850	RUN 164 OPERATIONAL SB @ 30.0 HZ 2.4g H/V
		START 0535' STOP 0560'
	1855	RUN 165 OPERATIONAL SB @ 17.5 HZ 3.0g H/V 180° LAT/U
		START 0560' STOP 0595'

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WYLE LABORATORIES
INSTRUMENTATION LOG SHEET

JOB NO. 45088-04

CUSTOMER FISHER

LOG PAGE NO. 26 OF 26

TEST ENGINEER [signature]

DATE	TIME	REMARKS (Include Run Number, Part Changes, Shift Changes and all other pertinent data)
9/10/80	1900	RUN 166 ~~OPERATIONAL~~ SB@ 30.0 HZ 2.4g H/V 0° LAT/V
		START 0595' STOP 0630'
	1920	RUN 167 OPERATIONAL SB@ 33.0 HZ 2.0g H/V 0° LAT/V
		START 0630' STOP 0665'
	2038	RUN 168 OPERATIONAL SB@ 31.0 HZ 2.3g H/V 0° LAT/V
		START 0665' STOP 0710'
	2045	RUN 169 OPERATIONAL SB@ 19.0 HZ 3.0g H/V 180° LAT/V
		START 0710' STOP 0755'

INSTRUMENTATION EQUIPMENT SHEET

TEST SERIES I

Date 7-26-80 Job No. 45088-04-3291 Test Area PIT 1

Technician W. BICE Customer FISHER Type Test SEISMIC

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	Press. Transducer	MB ELECT	151-HAC-118	—	92588	100PSI	± 2%	7-23-80	1-23-81
2	Press. Transducer	MB ELECT	151-HAC-118	—	92589	100PSI	± 2%	7-23-80	1-23-81
3	Press. Transducer	MB ELECT	151-HAC-118	—	92590	100PSI	± 2%	7-23-80	1-23-81
4	Press Transducer	Statham	2A48-500-[illegible]	86	92578	500PSIA	± 2%	7-16-80	1-16-81
5	Accelerometer	ENDEVCO	2272	NA45	51413	1000g	± 5%	5-12-80	8-12-80
6	Accelerometer	ENDEVCO	2272	NA49	51444	1000g	± 5%	6-4-80	9-4-80
7	Accelerometer	ENDEVCO	2272	RA05	95045	1000g	± 5%	5-5-80	8-5-80
8	Accelerometer	ENDEVCO	2272	NA28	51410	1000g	± 5%	5-5-80	8-5-80
9	Accelerometer	ENDEVCO	2272	EQ44	96152	1000g	± 5%	6-4-80	9-4-80
10	Accelerometer	ENDEVCO	2272	ES23	96268	1000g	± 5%	5-12-80	8-12-80
11	Accelerometer	ENDEVCO	2272	NK29	98048	1000g	± 5%	6-4-80	9-4-80
12	Accelerometer	ENDEVCO	2272	NA14	51407	1000g	± 5%	5-5-80	8-5-80
13	Accelerometer	ENDEVCO	7701-100	AE77	11643	1000g	± 5%	6-4-80	9-4-80
14	Accelerometer	ENDEVCO	7701-100	AD16	11335	1000g	± 5%	6-4-80	9-4-80
15	Accelerometer	ENDEVCO	7701-100	AG07	11813	1000g	± 5%	6-4-80	9-4-80
16	Accelerometer	ENDEVCO	2272	NA68	51406	1000g	± 5%	6-20-80	9-20-80
17	Accelerometer	ENDEVCO	7704-100	AE75	92425	1000g	± 5%	6-4-80	9-4-80
18	Accelerometer	ENDEVCO	7701-50	AH45	92493	1000g	± 5%	6-4-80	9-4-80

Instrument Test Engineer H Ellendland Checked & Received By Bobby L. Quinn

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INSTRUMENTATION EQUIPMENT SHEET
TEST SERIES I

Date 7-26-80 Job No. 45088-04-3291 Test Area PIT 1

Technician H. Bice Customer FISHER Type Test SEISMIC

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
19	Accelerometer	ENDEVCO	2272	6L39	11635	1000g	±5%	6-4-80	9-4-80
20	Accelerometer	ENDEVCO	2272	EQ73	96157	1000g	±5%	6-30-80	9-30-80
21	Accelerometer	ENDEVCO	2272	NA67	51432	1000g	±5%	6-20-80	9-20-80
22	SIGNAL CONDITIONER	Vishay	2120	—	96204	10V DC	±2%	7-16-80	10-16-80
23	SIGNAL CONDITIONER	Vishay	2120	—	96211	10VDC	±2%	7-16-80	10-16-80
24	SIGNAL CONDITIONER	Vishay	2120	—	11689	10VDC	±2%	7-16-80	10-16-80
25	SIGNAL CONDITIONER	Vishay	2120	—	96203	10VDC	±2%	7-16-80	10-16-80
26	SIGNAL CONDITIONER	Vishay	2120	—	96223	10VDC	±2%	7-16-80	10-16-80
27	VISICORDER	CEC	5-119	—	11075	DC TO 2.5KHZ	±2%	6-25-80	12-25-80
28	POWER SUPPLY	Vishay	2110	—	96227	±10VDC	±2%	6-5-80	9-5-80
29	VISICORDER	HONEYWELL	1508	—	11073	DC TO 2.5KHZ	±2%	3-14-80	9-14-80
30	VISICORDER	HONEYWELL	1508	—	11074	DC TO 2.5KHZ	±2%	4-29-80	10-29-80
31	GALVO AMP	HONEYWELL	T6GA-102	—	98057	1:1	±2%	7-18-80	1-18-81
32	GALVO AMP	HONEYWELL	T6GA-100	—	96255	1:1	±2%	7-18-80	1-18-81
33	GALVO AMP	HONEYWELL	T6GA-600	—	96285	1:1	±2%	7-9-80	1-9-81
34	GALVO AMP	HONEYWELL	T6GA 500	—	96275	1:1	±2%	2-26-80	8-26-80
35	GALVO AMP	HONEYWELL	T6GA 500	—	96258	1:1	±2%	2-25-80	8-25-80
36	GALVO AMP	HONEYWELL	T6GA-100	—	11175	1:1	±2%	6-24-80	12-24-80

Instrument Test Engineer H E Strickland

Checked & Received By Bobby L. Quinn

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INSTRUMENTATION EQUIPMENT SHEET

TEST SERIES I

Date 7-26-80 Job No. 45088-04-3291 Test Area PIT 1

Technician H. Bice Customer FISHER Type Test SEISMIC

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
36	TAPE RECORDER	BELL & HOWELL	CPR4010	—	11189	DC TO 2.5KHZ	± 2%	7-22-80	10-22-80
37	TAPE RECORDER	BELL & HOWELL	4020	—	96664	DC TO 2.5KHZ	± 2%	7-1-80	10-1-80
38	OSCILLOSCOPE	TEKTRONIX	RM561A	—	553	MULTI	± 3%	2-29-80	8-29-80
39	PLUG IN UNIT	TEKTRONIX	TYPE 3A74	—	537	MULTI	± 3%	2-29-80	8-29-80
40	PLUG IN UNIT	TEKTRONIX	TYPE 2B67	—	539	MULTI	± 3%	2-29-80	8-29-80
41	VOLTMETER	B&K	2416	—	80188	1000V	± 2%	7-1-80	10-1-80
42	CHARGE AMP	ENDEVCO	2721A	—	92358	10KHZ	± 5%	3-19-80	9-19-80
43	CHARGE AMP	ENDEVCO	2721A	—	92359	10KHZ	± 5%	3-19-80	9-19-80
44	CHARGE AMP	ENDEVCO	2721A	—	92360	10KHZ	± 5%	3-19-80	9-19-80
45	CHARGE AMP	ENDEVCO	2721A	—	92361	10KHZ	± 5%	3-19-80	9-19-80
46	CHARGE AMP	ENDEVCO	2721A	—	92362	10KHZ	± 5%	3-19-80	9-19-80
47	CHARGE AMP	ENDEVCO	2721A	—	92363	10KHZ	± 5%	3-19-80	9-19-80
48	CHARGE AMP	ENDEVCO	2721A	—	92364	10KHZ	± 5%	3-19-80	9-19-80
49	CHARGE AMP	ENDEVCO	2721A	—	92365	10KHZ	± 5%	3-19-80	9-19-80
50	CHARGE AMP	ENDEVCO	2721A	—	92366	10KHZ	± 5%	2-19-80	8-19-80
51	CHARGE AMP	ENDEVCO	2721A	—	92367	10KHZ	± 5%	2-19-80	8-19-80
52	CHARGE AMP	ENDEVCO	2721A	—	92367	10KHZ	± 5%	2-19-80	8-19-80
53	CHARGE AMP	ENDEVCO	2721A	—	92368	10KHZ	± 5%	2-19-80	8-19-80

Instrument Test Engineer H E Strickland Checked & Received By Bobby L. Quinn

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INSTRUMENTATION EQUIPMENT SHEET

TEST SERIES I

Date 7-26-80 Job No. 45088-04-3291 Test Area PIT 1

Technician H. BICE Customer FISHER Type Test SEISMIC

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
54	CHARGE AMP	ENDEVCO	2721A	—	92369	10KHZ	±5%	2-19-80	8-19-80
55	CHARGE AMP	ENDEVCO	2721A	—	92-370	10KHZ	±5%	2-19-80	8-19-80
56	CHARGE AMP	ENDEVCO	2721A	—	92371	10KHZ	±5%	2-19-80	8-19-80
57	CHARGE AMP	ENDEVCO	2721A	—	92372	10KHZ	±5%	2-19-80	8-19-80
58	ACCELEROMETER	ENDEVCO	7701-100	AC 45	11351	1000g	±5%	6-4-80	9-4-80
59	ACCELEROMETER	ENDEVCO	7701-100	AE 50	11754	1000g	±5%	6-4-80	9-4-80
60	SWEEP OSCILLATOR	SPEC. DYNAMICS	SD104	—	95360	50KHZ	±2%	4-29-80	7-29-80
61	SERVO MONITOR	SPEC. DYNAMICS	SD105	—	95296	1000g	±4%	4-29-80	7-29-80
62	SERVO MONITOR	SPEC. DYNAMICS	SD105	—	95359	1000g	±4%	7-22-80	10-22-80
63	XY RECORDER	H.P.	7044A	—	11207	10V/in	±2%	4-30-80	7-30-80
64	CHARGE AMP	ENDEVCO	2740B	—	11212	50KHZ	±1.5%	6-23-80	12-23-80
65	CHARGE AMP	ENDEVCO	2740B	—	11213	50KHZ	±1.5%	6-23-80	12-23-80
66	LOG.FREQ.CONV.	SPEC. DYNAMICS	SD116	—	95123	20KHZ	±2%	7-22-80	10-22-80
67	TRACKING FILTER	SPEC. DYNAMICS	SD131L	—	11242	40db	±0.5db	4-15-80	10-15-80
68	TRACKING FILTER	SPEC. DYNAMICS	SD131L	—	11243	40db	±0.5db	4-15-80	10-15-80
69	POWER SUPPLY	ENDEVCO	4222	—	92394	±15VDC	±5%	3-19-80	9-19-80
70	POWER SUPPLY	ENDEVCO	4222	—	92395	±15VDC	±5%	2-19-80	8-19-80
71	GALVO AMP	HONEYWELL	T6GA-500	—	11472	DC TO 2.5KHZ	±2%	7-23-80	1-23-81

Instrument Test Engineer H E Strickland Checked & Received By Bobby L. Quinn

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INSTRUMENTATION EQUIPMENT SHEET

TEST SERIES I

Date 7-26-80 Job No. 45088-04-3291 Test Area PIT 1

Technician H. Bice Customer FISHER Type Test SEISMIC

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
72	DMM	KEITHLEY	178	—	11313	1000V	± MFG SPEC	7-11-80	7-11-81
73	VISICORDER	HONEYWELL	1508	—	81026	DC TO 2.5KHZ	± 2%	6-18-80	12-18-80
74	POWER SUPPLY	NOBATRON	DCR150-5	—	11309	200V DC	± 0.12 Reg	2-25-80	8-25-80
75	POWER SUPPLY	[illegible] LAB	865	—	11393	40V DC	± 0.1%	5-9-80	11-9-80
76	GAGE	HEISE	—	—	95032	200 PSI	± 1% FS	6-10-80	9-10-80
77	VISICORDER	HONEYWELL	1508	—	96056	DC TO 2.5KHZ	± 2%	3-24-80	9-24-80
78	GALVO AMP	HONEYWELL	T66A-500	—	96280	1:1	± 2%	3-24-80	9-24-80
79	SINE BEAT GEN.	MCFADDEN ELEC. CO	209A	—	11027	99.9 HZ	± SYSTEM	7-26-80	PRIOR TO USE
80	GAGE	ROBERTSHAW	—	—	2035	200 PSI	± 1% FS	6-30-80	9-30-80
81	GAGE	ROBERTSHAW	—	—	2034	200 PSI	± 1% FS	6-30-80	9-30-80
82	GAGE	—	—	—	97751	100 PSI	± 1% FS	7-23-80	10-23-80
83	GAGE	ROBERTSHAW	—	—	98690	160 PSI	± 1% FS	7-23-80	10-23-80
84	GAGE	ROBERTSHAW	—	—	98092	200 PSI	± 1% FS	7-18-80	10-18-80
85	GAGE	MAXISAFE	1850	—	97746	600 PSI	± 1% FS	7-23-80	10-23-80

Instrument Test Engineer [illegible] Checked & Received By Bobby L. Quinn

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INSTRUMENTATION EQUIPMENT SHEET

TEST SERIES II

Date 7/8/80 Job No. 45088 Test Area Pit #1 D

Technician Coleman Customer Fisher Type Test SEISMIC

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	ACCELEROMETER	ENDEVCO	2272	NA41	F1439	1000G	± 5%	6-20-80	9-20-80
2	ACCELEROMETER	ENDEVCO	2272	CX03	95365	1000G	± 5%	6-30-80	9-30-80
3	ACCELEROMETER	ENDEVCO	2272	EP49	96146	1000G	± 5%	6-30-80	9-30-80
4	ACCELEROMETER	ENDEVCO	2272	NA74	F1426	1000G	± 5%	6-30-80	9-30-80
5	ACCELEROMETER	ENDEVCO	2272	AQ93	51405	1000G	± 5%	7-24-80	10-24-80
6	ACCELEROMETER	ENDEVCO	2272	EQ58	96155	1000G	± 5%	7-24-80	10-24-80
7	ACCELEROMETER	ENDEVCO	2272	NA66	51417	1000G	± 5%	6-30-80	9-30-80
8	ACCELEROMETER	ENDEVCO	2272	EQ21	96148	1000G	± 5%	7-23-80	10-23-80
9	ACCELEROMETER	ENDEVCO	2272	NA25	51430	1000G	± 5%	6-24-80	9-24-80
10	ACCELEROMETER	ENDEVCO	2272	EQ56	96154	1000G	± 5%	6-30-80	9-30-80
11	ACCELEROMETER	ENDEVCO	2272	NA67	F1432	1000G	± 5%	6-20-80	9-20-80
12	ACCELEROMETER	ENDEVCO	2272	EQ34	96149	1000G	± 5%	6-24-80	9-24-80
13	ACCELEROMETER	ENDEVCO	2272	NA92	F1445	1000G	± 5%	6-20-80	9-20-80
14	ACCELEROMETER	ENDEVCO	2272	NA97	51409	1000G	± 5%	6-24-80	9-24-80
15	ACCELEROMETER	ENDEVCO	2272	NA08	F1436	1000G	± 5%	6-20-80	9-20-80
16	ACCELEROMETER	ENDEVCO	2272	RA05	95045	1000G	± 5%	8-1-80	11-1-80
17	ACCELEROMETER	ENDEVCO	2272	EQ36	96150	1000G	± 5%	6-20-80	9-20-80
18	ACCELEROMETER	ENDEVCO	7701-100	AD06	11334	1000G	± 5%	7-15-80	10-15-80

Instrument Test Engineer Wayne Kilgore Checked & Received By Bobby L. Quinn

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INSTRUMENTATION EQUIPMENT SHEET

TEST SERIES II

Date 9/8/80 Job No. 45088 Test Area Pit #1 D

Technician Lohman Customer Fisher Type Test Seismic

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
19	ACCELEROMETER	ENDEVCO	7701-100	AE73	11640	1000G	± 5%	8-5-80	11-5-80
20	CHARGE AMP	ENDEVCO	2721AM4	—	92358	10KHZ	± 5%	3-19-80	9-19-80
21	CHARGE AMP	ENDEVCO	2721AM4	—	92359	10KHZ	± 5%	3-19-80	9-19-80
22	CHARGE AMP	ENDEVCO	2721AM4	—	92360	10KHZ	± 5%	3-19-80	9-19-80
23	CHARGE AMP	ENDEVCO	2721AM4	—	92361	10KHZ	± 5%	3-19-80	9-19-80
24	CHARGE AMP	ENDEVCO	2721AM4	—	92362	10KHZ	± 5%	3-19-80	9-19-80
25	CHARGE AMP	ENDEVCO	2721AM4	—	92363	10KHZ	± 5%	3-19-80	9-19-80
26	CHARGE AMP	ENDEVCO	2721AM4	—	92364	10KHZ	± 5%	3-19-80	9-19-80
27	CHARGE AMP	ENDEVCO	2721AM4	—	92365	10KHZ	± 5%	3-19-80	9-19-80
28	CHARGE AMP	ENDEVCO	2721AM4	—	92366	10KHZ	± 5%	8-18-80	2-18-81
29	CHARGE AMP	ENDEVCO	2721AM4	—	92367	10KHZ	± %	8-18-80	2-18-81
30	CHARGE AMP	ENDEVCO	2721AM4	—	92368	10KHZ	± 5%	8-18-80	2-18-81
31	CHARGE AMP	ENDEVCO	2721AM4	—	92369	10KHZ	± 5%	8-18-80	2-18-81
32	CHARGE AMP	ENDEVCO	2721AM4	—	92370	10KHZ	± 5%	8-18-80	2-18-81
33	CHARGE AMP	ENDEVCO	2721AM4	—	92371	10KHZ	± 5%	8-18-80	2-18-81
34	CHARGE AMP	ENDEVCO	2721AM4	—	92372	10KHZ	± 5%	8-18-80	2-18-81
35	CHARGE AMP	ENDEVCO	2721AM4	—	92373	10KHZ	± 5%	8-18-80	2-18-81
36	CHARGE AMP	ENDEVCO	2721AM4	—	92342	10KHZ	± 5%	4-9-80	10-9-80

Instrument Test Engineer Wayne Kilgore Checked & Received By Bobby L. Quinn

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INSTRUMENTATION EQUIPMENT SHEET

TEST SERIES II

Date 9/8/80 Job No. 45088 Test Area P.t #1 D

Technician Lohrman Customer fisher Type Test SEISMIC

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
37	CHARGE AMP	ENDEVCO	2740B	—	11212	50KHz	± 1.5%	6-23-80	12-23-80
38	CHARGE AMP	ENDEVCO	2740B	—	11213	50KHz	± 1.5%	6-23-80	12-23-80
39	Power supply	ENDEVCO	4222	—	92392	± 15VDC	± .1%	4-9-80	10-9-80
40	Power supply	ENDEVCO	4222	—	92395	± 15VDC	± .1%	8-18-80	2-18-81
41	Power supply	ENDEVCO	4222	—	92394	± 15VDC	± .1%	3-19-80	9-19-80
42	TAPE RECORDER	Bell & Howell	4020	—	96664	2.5KHz	± 2%	7-1-80	10-1-80
43	TAPE RECORDER	Bell & Howell	4010	—	11602	2.5KHz	± 2%	7-28-80	10-28-80
44	LOG FREQ CONVERTER	SPEC. DYNAMICS	SD116	—	95123	20KHz	± 2%	7-22-80	10-22-80
45	Tracking filter	SPEC. Dynamics	SD131	—	11243	40dB	± .5dB	4-15-80	10-15-80
46	Tracking filter	SPEC. Dynamics	SD131	—	11242	40dB	± .5dB	4-15-80	10-15-80
47	Volt METER	B&K	2416	—	80188	1000VDC	± 2%	7-1-80	10-1-80
48	SWEEP OSCILLATOR	SPEC. DYNAMICS	SD104	—	95360	.005-50KHz	± 2%	8-4-80	11-4-80
49	SERVO CONTROLER	SPEC. Dynamics	SD105	—	95296	1000G	± 4%	8-4-80	11-4-80
50	SERVO CONTROLER	SPEC. Dynamics	SD105	—	95359	1000G	± 4%	7-22-80	10-22-80
51	VISICORDER	CEC	5-119	—	11075	2.5KHz	± 2%	6-25-80	12-25-80
52	VISICORDER	HONEYWELL	1508	—	11074	2.5KHz	± 2%	4-29-80	10-29-80
53	VISICORDER	Honeywell	1508	—	11073	2.5KHz	± 2%	3-14-80	9-14-80
54	XY RECORDER	H.P.	7044A	—	95377	10V/in	± .2%	9-2-80	12-2-80

Instrument Test Engineer Wayne Kilgore Checked & Received By Bobby L. Quinn

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INSTRUMENTATION EQUIPMENT SHEET

TEST SERIES II

Date 9/8/80 Job No. 45088 Test Area Pit #1 D

Technician Lohrman Customer Fisher Type Test Seismic

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
55	Galvo amp	Honeywell	T6GA-500	—	96280	1:1	±2%	3-24-80	9-24-80
56	Galvo amp	Honeywell	T6GA-500	—	95397	1:1	±2%	7-18-80	1-18-81
57	Galvo amp	Honeywell	T6GA-500	—	96568	1:1	±2%	6-6-80	12-6-80
58	Galvo amp	Honeywell	T6GA-600	—	96295	1:1	±2%	7-9-80	1-9-81
59	Galvo amp	Honeywell	T6GA-100	—	96256	1:1	±2%	4-29-80	10-29-80
60	Galvo amp	Honeywell	T6GA-100	—	11175	1:1	±2%	6-24-80	12-24-80
61	Visicorder	Honeywell	1508	—	96056	2.5KHZ	±2%	3-24-80	9-24-80
62	Sine Beat Generator	McFadden Elec.	209A	—	1027	99.9HZ	±2%	9-8-80	Prior to use
63	Signal conditioner	Vishay	2120	—	96216	0-10VDC	±2%	7-30-80	10-30-80
64	Signal conditioner	Vishay	2120	—	96217	0-10VDC	±2%	7-30-80	10-30-80
65	Signal conditioner	Vishay	2120	—	96218	0-10VDC	±2%	7-30-80	10-30-80
66	Power supply	Vishay	2110	—	96299	0-10V DC	±2%	7-30-80	10-30-80
67	Pressur x ducer	MB elect	151-HAC-118	—	92585	100PSI	±2%	7-23-80	1-23-81
68	Pressur x ducer	MB elect	151-HAC-118	—	92586	100PSI	±2%	7-23-80	1-23-81
69	Pressur x ducer	MB elect	151-HAC-118	—	92587	100PSI	±2%	7-23-80	1-23-81
70	Pressur x ducer	MB elect	151-HAC-118	—	92588	100PSI	±2%	7-23-80	1-23-81
71	Pressur x ducer	MB elect	151-HAC-118	—	92589	100PSI	±2%	7-23-80	1-23-81
72	Pressur x ducer	MB elect	151-HAC-118	—	92590	100PSI	±2%	7-23-80	1-23-81

Instrument Test Engineer Wayne Kilgore Checked & Received By Bobby L. Quinn

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INSTRUMENTATION EQUIPMENT SHEET

TEST SERIES II

Date 9/8/80 Job No. 45088 Test Area Pit #1 D

Technician Lohrman Customer Fisher Type Test SEISMIC

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
73.	Presure-Xducer	Statham	PA418 500	86	92578	500PSIA	±2%	7-16-80	1-16-81
74.	Power supply	Electronic Mesur.	TR 212A	—	80247	0-28vDc	±1%	7-23-80	1-23-81
75	oscilloscope	H.P.	122AR	—	80604	mult:	±3%	9-2-80	12-2-80
76	Decade Resistor	General Radio	1432-L	37704	1136-8	100KΩ	±0.05%	8-7-80	8-7-81
77	Accelerometer	Endevco	2213	EC72	11340	1000G	±5%	8-4-80	11-4-80

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Instrument Test Engineer Wayne Kilgore

Checked & Received By Bobby L. Quinn

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INSTRUMENTATION EQUIPMENT SHEET

TEST SERIES II

Date 9-8-80 Job No. 45088-04 Test Area Pit 1

Technician Robert Coleman Customer Fisher Type Test Seismic

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	DMM	Keithley	178	—	11313	multi	MFG	7-11-80	7-11-81
2	GALVO AMP	H/W	T66A	—	11472	DC-8KHZ	±2%	7-23-80	1-23-81
3	VISCORder	H/W	T508	—	81026	24 channels	±2%	6-18-80	12-18-80
4	POWER SUPPLY	HARRISON	865C	—	11393	0-40V	±1%	5-9-80	11-9-80
5	POWER SUPPLY	KEPCO	KS36	—	98723	0-50V	±1%	7-21-80	1-21-81
6	POWER SUPPLY	SORENSEN	DCR-150B	—	11309	0-300V	±1%	9-8-80	12-8-80

Instrument Test Engineer K Burkhart Checked & Received By Bobby L Quinn

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APPENDIX IV

SPECIFIC INSTRUCTIONS
OF THE
FISHER CONTROLS COMPANY
TECHNICAL REPRESENTATIVE

9510-AX5AC03-5063-5 281

Jon Milliken
Fisher Controls Company
Technical Representative
July 25, 1980

Revision A
(Revised 9/8/80)

SPECIFIC INSTRUCTIONS FOR THE DYNAM'~ TEST PROCEDURE

SPECIMEN: Valve Body; I, Item No. 605A - 1.0; Actuator; XV, 237 - 1.02

BOM DRAWING: Special Configuration

DESCRIPTION: 20" 9220 with Bettis T-420B-SR2-12

1.0 PRE-TEST INSPECTION

1.1 Examine the valve for any evidence of shipping damage.

1.2 Ensure that the valve conforms to the proper construction.

1.3 Take photographs of any damage and note any discrepancies.

2.0 MOUNT VALVE TO TABLE

2.1 Valve should be mounted between two bookend fixtures that simulate in-service mounting as closely as is possible.

2.2 The fixtures must be rigid in the frequency range of interest so that indicated resonances will result from the characteristics of the valve alone and not from the interaction of the fixtures with the valve.

2.3 The valve should be mounted initially with the valve body (pipe-line) axis parallel to the horizontal axis of the table. This will be designated as the longitudinal axis.

3.0 PRE-TEST FUNCTIONALS

3.1 Instrumentation

3.1.1 The valve will stroke from 0° to 90° and a rotary potentiometer must be connected to monitor and record the valve position during this test.

3.1.2 A pressure gage that reads to 200 psi must be connected at the inlet of the valve.

3.1.3 An air supply of 140 psi should be connected to the 95H regulator.

3.1.4 Pressure transducers must be installed in the supply and output lines connected to the regulator. (The supply is 140 psi and the output is 70 psi.)

3.1.5 A pressure transducer is also required to measure the internal cylinder pressure (70 psi). A

A

3.1.6 The solenoid should be supplied with 125 V.D.C. A

3.2 Stroking Time Test

3.2.1 The valve should be stroked open and pressurized to 75 psi with air. The valve should then be stroked closed, then open, and then closed.

3.2.2 The valve should then be stroked open by energizing the solenoid and the valve position versus time recorded. The valve should then be stroked closed with the valve position versus time recorded.

3.3 Pressure Integrity Test

3.3.1 The valve should be stroked open and an internal pressure of 75 psi re-established. The packing area and retaining ring should be observed for three minutes and any leakage noted.

3.4 Seat Leakage Test

3.4.1 Stroke the valve closed using the solenoid.

3.4.2 Establish a pressure drop of 75 psi across the seat.

3.4.3 Wait approximately three minutes for the leakage to stabilize and then measure leakage for one minute at the valve outlet.

4.0 RESONANCE SEARCH

4.1 Instrumentation

4.1.1 Reference accelerometers for both the horizontal driving axis and the vertical axis will be installed at the point where the valve body is connected to the bookend fixture to measure actual input to the valve itself. The control accelerometers may be mounted on the table for safety reasons.

4.1.2 In addition, response accelerometers will be mounted at the actuator C.G. and at the regulator, solenoid, versa valve, and limit switches. Those at the C.G. will be triaxial and the balance will be biaxial. Their precise location will be specified by the Fisher Test Engineer on-site. The locations should be recorded. A

4.1.3 Up to five additional sites for investigation of triaxial response may be specified by the Fisher Test Engineer. These would be primarily used for investigation of fixture flexibility.

4.1.4 The readings of all accelerometers should be recorded simultaneously throughout the resonance search.

4.1.5 A reference accelerometer (input accelerometer) output shall be recorded on all oscillograph traces of the appurtenances.

4.2 Frequency Sweep - 0° Phase

4.2.1 A biaxial sweep at 0° phase between the horizontal and vertical inputs should be run with a minimum of .2 g's input in each axis.

4.2.2 The sweep should be from 1 to 40 Hz at a maximum sweep rate of 1/3 octave/minute.

4.2.3 The valve should be closed and pressured to 75 psi.

4.2.4 All three pressure transducers discussed in Sections 3.1.4 and 3.1.5 and valve position should be continuously monitored and recorded on 2" strip charts to allow resolution of data. A

4.3 Resonance Search - 180° Phase

4.3.1 Repeat the test from Section 4.2 but with 180° phase shift between the horizontal and vertical inputs.

5.0 DETERMINATION OF MAJOR RESONANCES

5.1 Major resonances are defined as any frequency where the response at the C.G. of the actuator or any of the appurtenances in a given axis exceeds the input in the same axis by a factor of 3.

6.0 SINE BEAT TESTING - 0° PHASE

6.1 Sine Beat

The input should be biaxial with 0° phase between horizontal and vertical inputs. It must also be a sine beat signal with five beats at each frequency and at least 10 cycles/beat. A

6.2 Test Frequencies: Hz and Inputs

Hz	G's	Hz	G's	Hz	G's
1.0	1.5	11.0	3.0	24.0	3.0
1.25	2.2	12.0	3.0	25.0	3.0
1.6	3.0	13.0	3.0	26.0	3.0
2.0	3.0	14.0	3.0	27.0	2.95
2.5	3.0	15.0	3.0	28.0	2.75
3.15	3.0	16.0	3.0	29.0	2.6
4.0	3.0	17.0	3.0	30.0	2.4
5.0	3.0	18.0	3.0	31.0	2.3
6.0	3.0	19.0	3.0	32.0	2.1
7.0	3.0	20.0	3.0	33.0	2.0
8.0	3.0	21.0	3.0	40.0	2.0
9.0	3.0	22.0	3.0		
10.0	3.0	23.0	3.0		

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Sine beats must also be run at any frequency between 33 and 40 Hz, where any deviations or malfunctions occurred in valve accessories during resonance search.

6.3 Tests should be run with the valve closed and at 75 psi, air.

6.4 Fastener Tightening During Sine Beats

The test specimen will be examined for possible fastener loosening or other physical damage following each violent test such as may occur at a severe structural resonance.

Any fastener loosening or other physical damage should be documented in the test log as it occurs; however, any physical tightening of loosened bolts or other fasteners shall conform to the following procedure.

Unless there is an observed loosening of the fasteners which in the opinion of the Fisher Test Engineer would result in damage to the test specimen upon continuance of the test, fastener tightening shall only be performed following tests at the frequencies of 5 Hz, 15 Hz, 25 Hz, and 33 Hz in the test frequency sequence for each axis and each phase.

Prior to any fastener tightening, the test valve will be operated through one complete cycle to show that the observed fastener loosening will adversely affect the operability of the valve. The test specimen performance, as well as the fastener tightening performed, shall be fully documented in the test report.

In addition to the above, it shall be the prerogative of the Fisher Test Engineer to stop the test at any frequency where, in his technical opinion, a physical tightening of fasteners is mandatory to prevent undue damage to the test specimen. In such a case, it shall be the responsibility of the Fisher Test Engineer to resolve the problem and develop a suitable course of action based upon the individual circumstances. In addition, he shall also be responsible for assuring that the test report will include a full description of the action taken along with all pertinent details concerning valve operability and fastener tightening.

6.5 All pressure transducers, limit switches and valve travel should be monitored and recorded during each test.

6.6 All accelerometers will be recorded during each test.

6.7 A reference accelerometer (input accelerometer) output shall be recorded on all oscillograph traces of the appurtenances.

6.8 The valve will be cycled from the closed to the open position and then stroked fully closed at the following frequencies:

(a) Each major resonance below 33 Hz detected during the resonance search.

(b) Any frequencies where deviations or malfunctions occurred during the search.

(c) The frequency of maximum response measured during the sine beat tests.

6.9 Opening and closing times should be recorded during all stroking tests.

6.10 Record any evidence of damage for inclusion into the report.

7.0 SINE BEAT TESTING - 180° PHASE

7.1 Repeat procedure outlined in Section 6.0, but with 180° phase shift between vertical and horizontal inputs.

8.0 SEISMIC TEST - LATERAL AXIS

8.1 The valve assembly and fixtures must now be rotated 90° about the vertical axis and the tests in Sections 3.2 through 7.0 repeated.

9.0 POST-TEST FUNCTIONALS

9.1 Repeat the tests from Section 3.0

9.2 Thoroughly inspect the valves for any signs of structural damage.

10.0 ACCEPTANCE CRITERIA

When any of the following acceptance criteria are not met, the specific deviation shall be submitted to the buyer for evaluation and acceptability for the specific application.

(1) Increase of cycle time above that required by the specification.

(2) Increase of leakage between Pre-test and Post-test Performance Test greater than 1 cc/hr/in. valve diameter water or 1×10^{-2} cc/sec/in. valve diameter air.

(3) Physical damage to any accessory will be cause for rejection of the accessory.

(4) Change of position of the valve exceeding 5° during all seismic testing. A

(5) Indicator lights controlled by limit switches function improperly for Bettis-operated valves only.*

(6) Loss of pressure-boundary integrity.

(7) Structural failure.

This meets the intent of Bechtel Specification 10466, Appendix I.

*The indicator light for "Open" may flutter, flicker, or dim, but must return to its fully-illuminated condition. The indicator light for "Closed" may flicker or flutter, but must return to its fully-unilluminated condition.

11.0 REPORT

A certification-type report will be issued subsequent to completion of testing. This report will be signed by a Registered Professional Engineer and will summarize the maximum "g" levels, natural frequencies, details and recommendations concerning deficiencies and repairs, and photographs of test setups, accelerometers, failures, etc. The report will also contain a list of test equipment used and calibrations, and instrumentation log sheets, and a copy of these specific instructions.

APPENDIX IV

SPECIFIC INSTRUCTIONS
OF THE
FISHER CONTROLS COMPANY
TECHNICAL REPRESENTATIVE

Jon Milliken
Fisher Controls Company
Technical Representative
July 25, 1980

Revision A
(Revised 9/8/80)

SPECIFIC INSTRUCTIONS FOR THE DYNAMIC TEST PROCEDURE

SPECIMEN: Valve Body: I, Item No. 605A - 1.0; Actuator: XV, 237 - 1.02

BOM DRAWING: Special Configuration

DESCRIPTION: 20" 9220 with Bettis T-420B-SR2-12

1.0 PRE-TEST INSPECTION

1.1 Examine the valve for any evidence of shipping damage.

1.2 Ensure that the valve conforms to the proper construction.

1.3 Take photographs of any damage and note any discrepancies.

2.0 MOUNT VALVE TO TABLE

2.1 Valve should be mounted between two bookend fixtures that simulate in-service mounting as closely as is possible.

2.2 The fixtures must be rigid in the frequency range of interest so that indicated resonances will result from the characteristics of the valve alone and not from the interaction of the fixtures with the valve.

2.3 The valve should be mounted initially with the valve body (pipe-line) axis parallel to the horizontal axis of the table. This will be designated as the longitudinal axis.

3.0 PRE-TEST FUNCTIONALS

3.1 Instrumentation

3.1.1 The valve will stroke from 0° to 90° and a rotary potentiometer must be connected to monitor and record the valve position during this test.

3.1.2 A pressure gage that reads to 200 psi must be connected at the inlet of the valve.

3.1.3 An air supply of 140 psi should be connected to the 95H regulator.

3.1.4 Pressure transducers must be installed in the supply and output lines connected to the regulator. (The supply is 140 psi and the output is 70 psi.)

3.1.5 A pressure transducer is also required to measure the internal cylinder pressure (70 psi). A

3.1.6 The solenoid should be supplied with 125 V.D.C. A A

3.2 Stroking Time Test

3.2.1 The valve should be stroked open and pressurized to 75 psi with air. The valve should then be stroked closed, then open, and then closed.

3.2.2 The valve should then be stroked open by energizing the solenoid and the valve position versus time recorded. The valve should then be stroked closed with the valve position versus time recorded.

3.3 Pressure Integrity Test

3.3.1 The valve should be stroked open and an internal pressure of 75 psi re-established. The packing area and retaining ring should be observed for three minutes and any leakage noted.

3.4 Seat Leakage Test

3.4.1 Stroke the valve closed using the solenoid.

3.4.2 Establish a pressure drop of 75 psi across the seat.

3.4.3 Wait approximately three minutes for the leakage to stabilize and then measure leakage for one minute at the valve outlet.

4.0 RESONANCE SEARCH

4.1 Instrumentation

4.1.1 Reference accelerometers for both the horizontal driving axis and the vertical axis will be installed at the point where the valve body is connected to the bookend fixture to measure actual input to the valve itself. The control accelerometers may be mounted on the table for safety reasons.

4.1.2 In addition, response accelerometers will be mounted at the actuator C.G. and at the regulator, solenoid, versa valve, and limit switches. Those at the C.G. will be triaxial and the balance will be biaxial. Their precise location will be specified by the Fisher Test Engineer on-site. The locations should be recorded. A

4.1.3 Up to five additional sites for investigation of triaxial response may be specified by the Fisher Test Engineer. These would be primarily used for investigation of fixture flexibility.

4.1.4 The readings of all accelerometers should be recorded simultaneously throughout the resonance search.

4.1.5 A reference accelerometer (input accelerometer) output shall be recorded on all oscillograph traces of the appurtenances.

4.2 Frequency Sweep - 0° Phase

4.2.1 A biaxial sweep at 0° phase between the horizontal and vertical inputs should be run with a minimum of .2 g's input in each axis.

4.2.2 The sweep should be from 1 to 40 Hz at a maximum sweep rate of 1/3 octave/minute.

4.2.3 The valve should be closed and pressured to 75 psi.

4.2.4 All three pressure transducers discussed in Sections 3.1.4 and 3.1.5 and valve position should be continuously monitored and recorded on 2" strip charts to allow resolution of data. A

4.3 Resonance Search - 180° Phase

4.3.1 Repeat the test from Section 4.2 but with 180° phase shift between the horizontal and vertical inputs.

5.0 DETERMINATION OF MAJOR RESONANCES

5.1 Major resonances are defined as any frequency where the response at the C.G. of the actuator or any of the appurtenances in a given axis exceeds the input in the same axis by a factor of 3.

6.0 SINE BEAT TESTING - 0° PHASE

6.1 Sine Beat

The input should be biaxial with 0° phase between horizontal and vertical inputs. It must also be a sine beat signal with five beats at each frequency and at least 10 cycles/beat. A

6.2 Test Frequencies: Hz and Inputs

Hz	G's	Hz	G's	Hz	G's
1.0	1.5	11.0	3.0	24.0	3.0
1.25	2.2	12.0	3.0	25.0	3.0
1.6	3.0	13.0	3.0	26.0	3.0
2.0	3.0	14.0	3.0	27.0	2.95
2.5	3.0	15.0	3.0	28.0	2.75
3.15	3.0	16.0	3.0	29.0	2.6
4.0	3.0	17.0	3.0	30.0	2.4
5.0	3.0	18.0	3.0	31.0	2.3
6.0	3.0	19.0	3.0	32.0	2.1
7.0	3.0	20.0	3.0	33.0	2.0
8.0	3.0	21.0	3.0	40.0	2.0
9.0	3.0	22.0	3.0		
10.0	3.0	23.0	3.0		

A

Sine beats must also be run at any frequency between 33 and 40 Hz, where any deviations or malfunctions occurred in valve accessories during resonance search.

6.3 Tests should be run with the valve closed and at 75 psi, air.

6.4 Fastener Tightening During Sine Beats

The test specimen will be examined for possible fastener loosening or other physical damage following each violent test such as may occur at a severe structural resonance.

Any fastener loosening or other physical damage should be documented in the test log as it occurs; however, any physical tightening of loosened bolts or other fasteners shall conform to the following procedure.

Unless there is an observed loosening of the fasteners which in the opinion of the Fisher Test Engineer would result in damage to the test specimen upon continuance of the test, fastener tightening shall only be performed following tests at the frequencies of 5 Hz, 15 Hz, 25 Hz, and 33 Hz in the test frequency sequence for each axis and each phase.

Prior to any fastener tightening, the test valve will be operated through one complete cycle to show that the observed fastener loosening will adversely affect the operability of the valve. The test specimen performance, as well as the fastener tightening performed, shall be fully documented in the test report.

In addition to the above, it shall be the prerogative of the Fisher Test Engineer to stop the test at any frequency where, in his technical opinion, a physical tightening of fasteners is mandatory to prevent undue damage to the test specimen. In such a case, it shall be the responsibility of the Fisher Test Engineer to resolve the problem and develop a suitable course of action based upon the individual circumstances. In addition, he shall also be responsible for assuring that the test report will include a full description of the action taken along with all pertinent details concerning valve operability and fastener tightening.

6.5 All pressure transducers, limit switches and valve travel should be monitored and recorded during each test.

6.6 All accelerometers will be recorded during each test.

6.7 A reference accelerometer (input accelerometer) output shall be recorded on all oscillograph traces of the appurtenances.

6.8 The valve will be cycled from the closed to the open position and then stroked fully closed at the following frequencies:

(a) Each major resonance below 33 Hz detected during the resonance search.

(b) Any frequencies where deviations or malfunctions occurred during the search.

(c) The frequency of maximum response measured during the sine beat tests.

6.9 Opening and closing times should be recorded during all stroking tests.

6.10 Record any evidence of damage for inclusion into the report.

7.0 SINE BEAT TESTING - 180° PHASE

7.1 Repeat procedure outlined in Section 6.0, but with 180° phase shift between vertical and horizontal inputs.

8.0 SEISMIC TEST - LATERAL AXIS

8.1 The valve assembly and fixtures must now be rotated 90° about the vertical axis and the tests in Sections 3.2 through 7.0 repeated.

9.0 POST-TEST FUNCTIONALS

9.1 Repeat the tests from Section 3.0

9.2 Thoroughly inspect the valves for any signs of structural damage.

10.0 ACCEPTANCE CRITERIA

When any of the following acceptance criteria are not met, the specific deviation shall be submitted to the buyer for evaluation and acceptability for the specific application.

(1) Increase of cycle time above that required by the specification.

(2) Increase of leakage between Pre-test and Post-test Performance Test greater than 1 cc/hr/in. valve diameter water or 1×10^{-2} cc/sec/in. valve diameter air.

(3) Physical damage to any accessory will be cause for rejection of the accessory.

(4) Change of position of the valve exceeding 5° during all seismic testing. A

(5) Indicator lights controlled by limit switches function improperly for Bettis-operated valves only.*

(6) Loss of pressure-boundary integrity.

(7) Structural failure.

This meets the intent of Bechtel Specification 10466, Appendix I.

*The indicator light for "Open" may flutter, flicker, or dim, but must return to its fully-illuminated condition. The indicator light for "Closed" may flicker or flutter, but must return to its fully-unilluminated condition.

11.0 REPORT

A certification-type report will be issued subsequent to completion of testing. This report will be signed by a Registered Professional Engineer and will summarize the maximum "g" levels, natural frequencies, details and recommendations concerning deficiencies and repairs, and photographs of test setups, accelerometers, failures, etc. The report will also contain a list of test equipment used and calibrations, and instrumentation log sheets, and a copy of these specific instructions.

SECTION X

POST-SEISMIC FUNCTIONAL TESTS

1.0 REQUIREMENTS

The requirements for these tests are outlined in Section II, Paragraph 1.0, of this report.

2.0 PROCEDURES

The procedures for these tests are described in Section II, Paragraph 2.0, of this report.

3.0 RESULTS

The test item was subjected to the tests required by Paragraph 1.0. The tests were conducted as outlined in Paragraph 2.0 above. The test item complied with all specified test requirements, although two (2) anomalies were noted (reference Notices of Anomaly Nos. 5 and 6, Appendix I of this Section). These anomalies are described below:

NCA #5: It was noted that the green light on the valve control box was inoperative. Subsequent inspection showed that both terminal strips in the junction box had vibrated loose and that Wire No. 1 in the junction box was broken from its terminal lug. Wire No. 1 supplies power to the green light on the control box. A condulet containing the wiring to the control box had rotated approximately 70° clockwise.

The condulet was returned to its original position. The terminal strips were bolted back into place and a new terminal lug was installed on Wire No. 1 in the junction box (reference NCA #4, Appendix I, Section IX, of this report).

NCA #6: During performance of the Post-Seismic Functional Tests, it was noted that there was a hairline crack in the junction box adjacent to the 1-1/2" condulet.

The Customer was notified of this anomaly. The Customer requested that the crack be heliarc-welded to prevent leakage during LOCA testing.

3.0 RESULTS (Continued)

The test item's stroke times are shown below:

Voltage to Solenoid	Pressure to Solenoid	Stroke Times Closed to Open	Stroke Times Open to Closed
90 VDC	70 psig	25.5 sec	19.85 sec
125 VDC	70 psig	22.5 sec	20.00 sec
140 VDC	70 psig	22.0 sec	19.75 sec

There was zero leakage across the valve disc at 75 psid for 15 minutes.

Notices of Anomaly Nos. 5 and 6 are presented in Appendix I. A typical oscillograph recording showing stroke time is presented in Appendix II. Photographs of the test setup and cracked junction box appear in Appendix III. Data obtained is presented on Data Sheets in Appendix IV, and an Instrumentation Equipment Sheet is presented in Appendix V of this Section.

APPENDIX I

NOTICES OF ANOMALY

NOTICE OF ANOMALY

NOTICE NO. 5 P. O. NUMBER: H-217770 WYLE JOB NO. 45088

CONTRACT NUMBER: N/A

CATEGORY: [X] SPECIMEN ☐ PROCEDURE ☐ TEST EQUIPMENT DATE: 9/16/80

TO: Fisher Controls ATTN: Bill Haslett

PART NAME: 20" Butterfly Valve PART NO. Type 9200

TEST: Post-Seismic Functional Test I. D. NO. -------

SPECIFICATION: Fisher Document FOP-19 Rev. F PARA. NO. 2.0

NOTIFICATION MADE TO: Bill Haslett DATE: 9/16/80

NOTIFICATION MADE BY: Earl Campbell VIA: Verbal

REQUIREMENTS:

The functional tests will be performed to ensure that all components perform without malfunction prior to any condition simulation.

DESCRIPTION OF ANOMALY:

Following the seismic testing it was noted that the green light on the valve control box was inoperative. Subsequent inspection showed that both terminal strips in the junction box had vibrated loose and that wire No. 1 in the junction box was broken from its terminal lug. Wire No. 1 supplies power to the green light on the control box. A condulet containing the wiring to the control box had rotated approximately 70° clockwise.

DISPOSITION – COMMENTS – RECOMMENDATIONS:

The condulet was returned to its original position. The terminal strips were bolted back into place and a new terminal lug was installed on wire No. 1 in the junction box, per the customers request. Photographs were made.

Testing is to continue.

DISTRIBUTION:
Original: Dept.
1 Copies: Customer
2 Copies: Q. C.
2 Copies Project Office
1 Copy: Contracts
1 Copy: Operations Director

TEST WITNESS ____________

____

REPRESENTING ____________

ENGINEER Earl R Campbell

QUALITY CONTROL [signature]

PROJECT MANAGER Robert C. Hall

NOTICE OF ANOMALY

NOTICE NO. 5 P. O. NUMBER: H-217770 WYLE JOB NO. 45068

CONTRACT NUMBER: N/A

CATEGORY: ☒ SPECIMEN ☐ PROCEDURE ☐ TEST EQUIPMENT DATE: 9/17/80

TO: Fisher Controls ATTN: Bill Haslett

PART NAME: 20" Butterfly Valve PART NO. Type 9200

TEST: Post-Seismic Functional Test I. D. NO. ---------

SPECIFICATION: Fisher Document FQP-19 Rev.F PARA. NO. 2.0

NOTIFICATION MADE TO: Bill Haslett DATE: 9/17/80

NOTIFICATION MADE BY: Earl Campbell VIA: Verbal

REQUIREMENTS:

The functional test will be performed to ensure that all components perform without malfunction prior to any condition simulation.

DESCRIPTION OF ANOMALY:

During performance of the Post-Seismic Functional Tests, it was noted that there was a hairline crack in the junction box adjacent to the 1 1/2" condulet.

DISPOSITION – COMMENTS – RECOMMENDATIONS:

The customer was notified of this anomaly. The customer requested that the crack be heliarc welded to prevent leakage during LOCA Testing.

DISTRIBUTION:
Original: Dept.
( ) Copies: Customer
2 Copies: Q. C.
2 Copies Project Office
1 Copy: Contracts
1 Copy: Operations Director

TEST WITNESS ________

REPRESENTING ________

ENGINEER Earl R Campbell

QUALITY CONTROL [illegible signature]

PROJECT MANAGER Robert A. Hall

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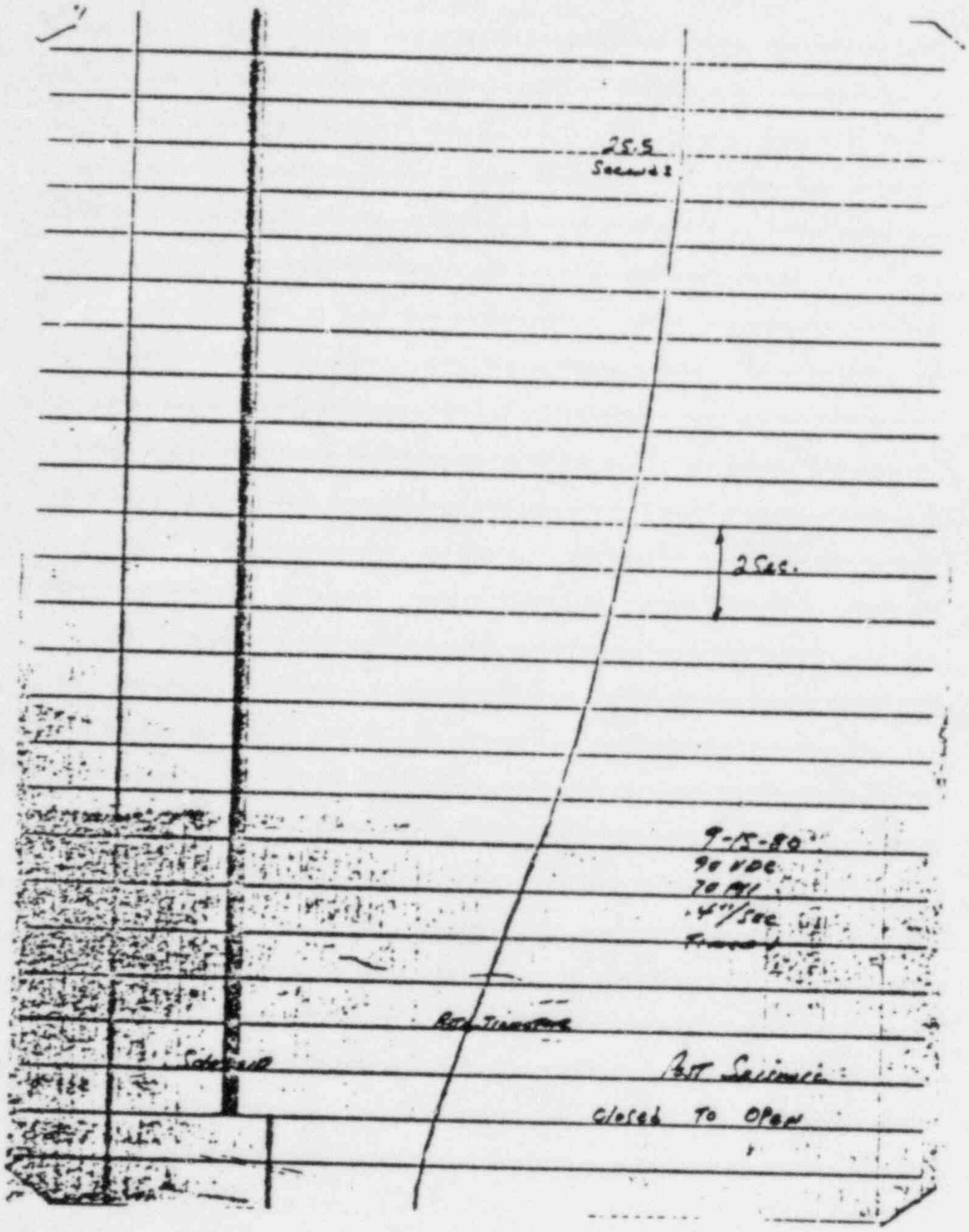
APPENDIX II

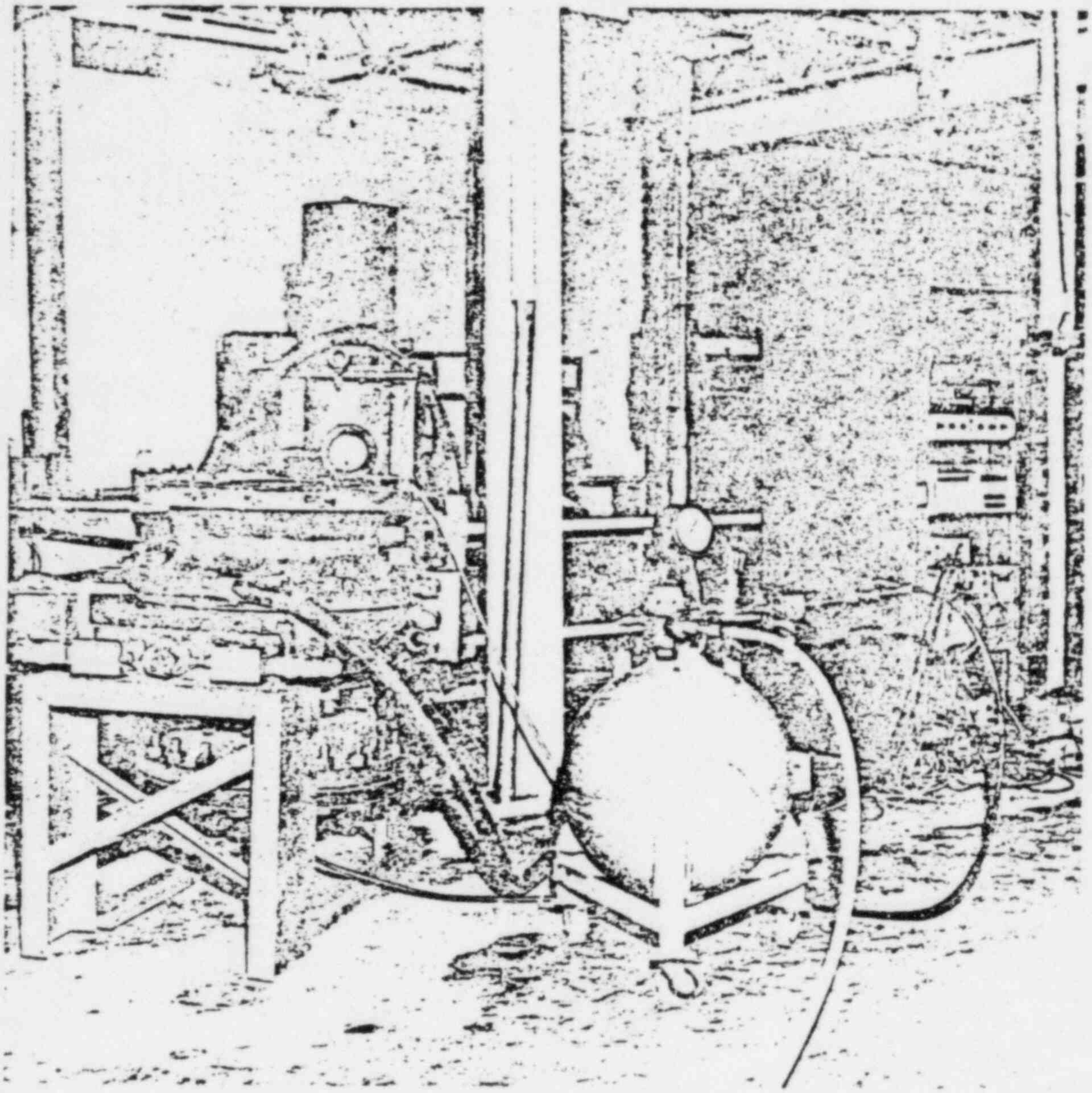
TYPICAL OSCILLOGRAPH RECORDING



TYPICAL OSCILLOGRAPH RECORDING

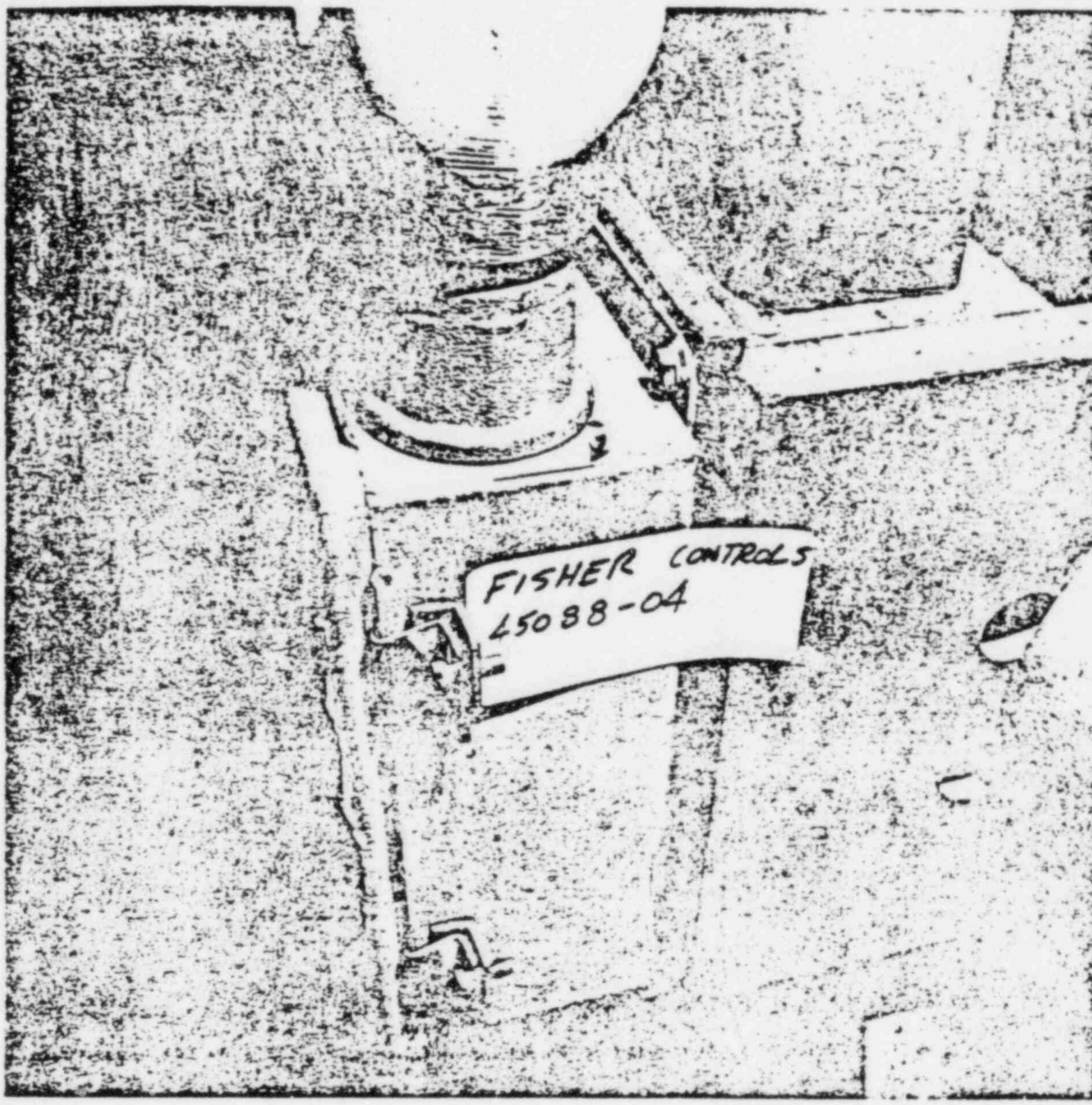
APPENDIX III

PHOTOGRAPHS



PHOTOGRAPH X-1

TEST SETUP
POST-SEISMIC FUNCTIONAL



PHOTOGRAPH X-2

JUNCTION BOX WITH HAIRLINE CRACK
AND
CONDULET ROTATED APPROXIMATELY 70°

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APPENDIX IV

DATA SHEETS

DATA SHEET

Customer Fisher Controls Company

Specimen 20" Butterfly Valve

Part No. Type 9200

Spec. Fisher Document, FOP-19

Para. 2.0

S/N ---

GSI ---

Amb. Temp. 72°F

Photo Yes

Test Med. GN_2

Specimen Temp. AmB.

WYLE LABORATORIES

Job No. 45088

Report No. —

Start Date 9-15-80

Test Title BASELINE FUNCTIONAL Post Seismic

	90 VDC	125 VDC	140 VDC
Type of Gas	GN_2	GN_2	GN_2
Pressure of Gas to Solenoid	70 PSI	70 PSI	70 PSI
Regulator Pressure Inlet:	140 PSI	140 PSI	140 PSI
Outlet:	70 PSI	70 PSI	70 PSI
Time duration of Operating Cycle: (sec)			
Closed to Open:	25.5 sec	22.5 sec	22.0 sec
Open to Closed:	19.85 sec	20.0 sec	19.75 sec
Indicator Light Function	GREEN Light out	GREEN Light out	GREEN Light out
Voltage to Solenoid	90 VDC	125 VDC	140 VDC
Voltage to Limit Switch	90 VDC	125 VDC	140 VDC
Seat Leakage @ ~~50~~ psig for 15 minutes 25 PSIG	NO LEAKAGE		

INSTRUMENT	Model No.	Wyle No. or S/N	Calibration Date	Calibration Due
1.				
2.				
3.				
4.				
5.				

Specimen Failed —

Specimen Passed ✓

NOA Written —

Tested By Robert Calem Date: 9-15-80

Witness — Date: —

Sheet No. 1 of 2

Approved Earl R Campbell

WH-614A

Page No. X-15 Report No. 45088-1

DATA SHEET

Customer FISHER CONTROLS
Specimen 20" BUTTERFLY VALVE
Part No. TYPE 9205
Spec. EQP-19 REV E
Para. 20
S.N ---
GSI ---

Amb. Temp. 72°F
Photo Yes
Test Med. AIR
Specimen Temp. ROOM Amb

WYLE LABORATORIES
Job No. 45088-04
Report No. —
Start Date 9-15-80

Test Title POST SEISMIC

A. SOLENOID RESISTANCE 939.7 Ω
TERMINALS 2-3

B. CONTACT RESISTANCE SWITCH #2 150 milliohms
WIRE 1-2 CONTACTS A-B @ 1mA

C. CONTACT RESISTANCE SWITCH #2
WIRE 3/4 CONTACTS G&H 148 milliohms
@ 1mA

D SOLENOID to GROUND .64X10^4 MΩ @ 500V

E CONTACT RESISTANCE 1.0 X 10^5 MΩ @ 500V
WIRE 1-2 SWITCH OPEN

F. CONTACT RESISTANCE .9X10^5 MΩ @ 500V

Amb Temp 72°
Rel Hum 50%
Lights - GREEN Light OUT *

Specimen Failed —
Specimen Passed ✓
NOA Written —

Tested By Robert R Coleman Date: 9-15-80
Witness — Date: —
Sheet No. 2 of 2
Approved Earl R Campbell

WH-614A

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APPENDIX V

INSTRUMENTATION EQUIPMENT SHEET

INSTRUMENTATION EQUIPMENT SHEET

Date 9-15-80 Job No. 45088-04 Test Area SCHAUL CHAMBER

Technician Robert Coleman Customer FISHER CONTROL Type Test POST SEISMIC

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	DMM	KEITHLEY	178	--	11313	MULTI	MFG	7-11-80	7-11-81
2	O GRAPH	HONEYWELL	1508	--	81026	0-1KHZ	±2%	6-18-80	12-18-80
3	GALVO AMP	HONEYWELL	T6GA	---	11472	1-1	±2%	7-23-80	1-23-81
4	DC POWER SUPPLY	SORENSEN	DCR-150-R	--	11309	0-150V 0-5A	±.1% R	9-8-80	3-8-81
5	POWER SUPPLY	HARRISON LAB	865C	---	11393	0-40V	±1%	5-9-80	11-9-80
6	DMM	KEITHLEY	164	--	11305	MULTI	MFG	4-8-80	10-8-80
7	PRESSURE GAGE	Robert SHAW	400	--	98071	0-400PSI	±1% FS	9-15-80	12-15-80
8	PRESSURE GAGE	Robert SHAW	200	--	2034	0-200PSI	±1% FS	9-12-80	12-12-80
9	PRESSURE GAGE	Robert SHAW	100	--	2010	0-100PSI	±1% FS	9-4-80	12-4-80
10	MEGOMETER	G/R	1862-C	--	97812	MULTI	±3%	5-7-80	11-7-80

Page No. X-18
Report No. 45088-1

Instrument Test Engineer [signature] Checked & Received By Earl R Campbell

WH-1029

SECTION XI

DESIGN BASIS EVENT LOAD TEST

1.0 REQUIREMENTS

A blind flange shall be secured to the outlet side of the valve assembly test fixture while the inlet side of the valve fixture shall remain open and exposed to the test chamber pressure.

The valve assembly shall be installed in the test chamber and the chamber environment stabilized for one hour at 120°F and approximately 55 percent relative humidity.

The valve shall be stroked through one complete operational cycle and the stroking time measured in both directions. This stroking time measurement shall utilize the same RVDT or other stem motion detection device utilized in the functional tests.

The test valve assembly shall be subjected to a steam exposure profile, depicted in Figure 1 (reference Appendix II of this Section), and a chemical spray for the DBE event environment simulation for in-containment service with either a BWR or a PWR plant. The DBE simulation shall be accomplished using superheated steam for the first 8 hours and saturated steam for the remainder of the 30 days.

The temperature, pressure, and humidity shall be recorded continuously during the DBE simulation along with disc position, operating air pressure, voltage to solenoid valve, and voltage to limit switches.

Seat leakage shall be monitored continuously during the entire DBE simulation. The seat leakage shall be monitored with the test chamber pressure applied directly to the inlet side of the valve.

The test valve assembly shall not be stroked open during the DBE simulation. It shall be stroked closed when the test chamber pressure is 6 psig and shall remain in the fully-closed position throughout the DBE simulation. The closure stroking time measured here is the final stroking time factor (T_f), and shall be recorded as such in the final test report. This stroking time measurement shall utilize the same RVDT or other stem motion detection device utilized in the functional tests.

At the start of the DBE simulation, initiate a chemical spray with the chemical composition and spray rate per IEEE 323-1974 and maintain throughout the entire DBE simulation. The pH level of the spray shall be maintained as follows:

11.0 (maximum) from 0 to 7,200 seconds, and

8.5 to 9.0 from 7,200 seconds to 30 days.

2.0 PROCEDURES

The test item was placed in the test vessel with the outlet side of the valve down. The outlet side was equipped with a blind flange for leak check purposes. The inlet side of the valve was equipped with a blind flange mounted on stand-offs so the chemical spray would not impinge directly upon the T-ring, although the T-ring was exposed to the chamber environment.

The electrical leads from the control box to the junction box on the test item were routed through a 1" conduit and potted with Scotchcast "9" epoxy.

The pneumatic feedthroughs for the solenoid and leak check lines were routed through the vessel wall by stainless steel fittings. The solenoid pneumatic line was 3/8" copper tubing. The leak check line was 1/4" copper tubing.

The test vessel temperature was measured using three (3) Type "T" (copper/Constantan) thermocouples hooked up in parallel and read out on a datalogger. There was also a visual readout for temperature. The chamber pressure was measured using a calibrated pressure transducer and pressure gage.

The test item seat leakage was monitored continuously for the entire 30-day test.

The chemical spray flow rate was calculated using the manufacturer's (Spraying Systems, Inc.) published flow rate for spray nozzle Model #1/4GG10W at a given pressure. The flow rate was .15 gpm/ft^2 of the test vessel horizontal cross-sectional area. The chemical spray pH was 9.5 to 10 for the first 7200 seconds and maintained at 8.5 to 9 for the remainder of the 30-day test.

The chamber temperature was increased to 120°F using saturated steam. This temperature was maintained for 1 hour. The test item was stroked through one complete "closed" to "open" to "closed" cycle and the stroke times in both directions measured. The pressure to the solenoid valve was 70 psig. The voltage to the solenoid valve was 125 VDC. This pressure and voltage was maintained to the test item for the full 30-day test.

The test chamber temperature was increased to 140°F and stabilized for 1 hour. The chamber temperature was then increased to 340°F. The test item was closed when the chamber pressure was 6 psig. The test item remained closed for the test duration. The required time from 140°F to 340°F was not met (reference NOA #7, Appendix I of this Section). The actual ramp time was 13 minutes and 37 seconds. The chemical spray at a rate of .15 gpm/ft^2 of the chamber cross-sectional area was initiated at the 340°F temperature and maintained for the entire first

2.0 PROCEDURES (Continued)

temperature transient. The chamber pressure was 70 psig at the 340°F plateau. The 340° plateau was maintained for three hours. The steam to the test chamber was shut off and the chamber allowed to cool.

The second time/temperature/pressure transient was initiated. The test was aborted at 35 minutes and 50 seconds due to excessive steam leakage at the test chamber's top flange. The highest temperature observed was 356.7°F (reference NCA #8, Appendix I of this Section).

The top flange gasket was replaced and the chamber temperature was stabilized at 140°F for 1 hour. The chamber temperature was increased to 341°F in 17 minutes and 41 seconds. The time from 341°F to the maximum chamber temperature (365°F) was an additional 18 minutes and 50 seconds. The required 381°F spike was not accomplished (reference NCA #9, Appendix I of this Section). The chemical spray at a rate of .15 gpm/ft^2 was initiated at the 365°F point and maintained for the test duration. The 365°F plateau was maintained for the required 2 minutes. The chamber pressure was 75 psig. The chamber temperature was decreased to 340°F and maintained for the required 2 hours and 56 minutes. The chamber pressure was 74 psig. The chamber temperature was decreased to 320°F and maintained for the required 3 hours. The chamber pressure was 75 psig.

The chamber temperature was decreased to 250°F and maintained for the required 85 hours (3.54 days). The chamber pressure was 16 psig. The chamber temperature was out-of-tolerance for a total of 2 hours and 2 minutes on the high temperature side (reference NCA #9, Appendix I of this Section). The chamber temperature was decreased to 200°F and maintained for the required 26 days. The chamber temperature was out-of-tolerance on the low temperautre side for a total of 9 hours and 30 minutes. The low temperature observed was 140°F. The chamber temperature was out-of-tolerance on the high temperature side for 4 hours and 30 minutes. The high temperature observed was 230°F (reference NCA #10, Appendix I of this Section). The total test time at 200°F was increased 9 hours and 30 minutes to allow full exposure to the 200°F temperature to the test item.

The chamber was pressurized with gaseous nitrogen at the 200°F plateau to meet the required 5 psig pressure. The average pressure at the 200°F plateau was 8 psig. The test was terminated after a total of 30 days test time. The test item was photographed and removed from the chamber.

3.0 RESULTS

The test item was subjected to the tests required by Paragraph 1.0. The tests were conducted as described in Paragraph 2.0. The test item complied with all specified requirements although four (4) anomalies were noted. These anomalies pertain to slow ramp times on the temperature transients, a steam leak that caused the second temperature transient to be aborted, and out-of-tolerance temperatures (reference NOA's 7 through 10, Appendix I of this Section).

The test item was closed at the 6 psig chamber pressure and remained closed for the duration of the test.

There was zero leakage past the valve disc for the duration of the test.

The pressure to the solenoid valve was 70 psig for the duration of the test.

The voltage to the solenoid was 125 VDC continuously.

The adjusted stroking time factor ($^{T_f}/_{T_1}$) is:

	Closed to Open	Open to Closed
Initial Stroke Time (T_1)	21.60 sec	20.05 sec
Final Stroke Time (T_f)	21.25 sec	16.75 sec
Adjusted Stroke Time	.9838	.8354

(Reference Section IV of this report.)

Notices of Anomaly Nos. 7 through 10 are presented in Appendix I. Figures showing the required test profile and the actual test profile are presented in Appendix II. This data was reduced from datalogger tapes. A sketch of the test setup is presented in Appendix III. Typical oscillograph recordings are presented in Appendix IV. Photographs pertaining to this test are presented in Appendix V. Instrumentation Equipment Sheets are presented in Appendix VI of this Section.

APPENDIX I

NOTICES OF ANOMALY

NOTICE OF ANOMALY

NOTICE NO. 7 P. O NUMBER: H-217770 WYLE JOB NO. 45088

CONTRACT NUMBER: N/A

CATEGORY: ☐ SPECIMEN ☒ PROCEDURE ☒ TEST EQUIPMENT DATE: 9/22/80

TO: Fisher Controls ATTN: Bill Haslett

PART NAME: 20" Butterfly Valve PART NO. Type 9200

TEST: Design Basis Event I. D. NO. -----------

SPECIFICATION: Fisher Document FQP-19 Rev. F PARA. NO. 7.0

NOTIFICATION MADE TO: Bill Haslett DATE: 9/23/80

NOTIFICATION MADE BY: Earl Campbell VIA: Verbal

REQUIREMENTS:

The test valve assembly will be subjected to a steam exposure profile, and a chemical spray for the design basis event environment simulation for in-containment service with either a BWR or a PWR plant. The DBE simulation will be accomplished using superheated steam for the first 8 hours and saturated steam for the remainder of the 30 days.

DESCRIPTION OF ANOMALY:

During the first temperature and pressure transient, the required time from 120°F to 340°F in three minutes was not accomplished. The time required to reach 340°F was 13 minutes and 37 seconds.

DISPOSITION — COMMENTS — RECOMMENDATIONS:

Following the initial temperature and pressure transient, the test was shut down to re-charge the steam accumulators for the second transient. Testing is to continue.

DISTRIBUTION:
Original: Dept.
1 Copies: Customer
2 Copies: Q. C.
2 Copies Project Office
1 Copy: Contracts
1 Copy: Operations Director

TEST WITNESS William B. Haslett ENGINEER Earl R Campbell

QUALITY CONTROL [signature]

REPRESENTING Fisher Controls PROJECT MANAGER Robert B Hall

NOTICE OF ANOMALY

NOTICE NO. 8 P. O. NUMBER: H-217770 WYLE JOB NO. 45088

CONTRACT NUMBER: N/A

CATEGORY: ☐ SPECIMEN ☐ PROCEDURE ☒ TEST EQUIPMENT DATE: 9/23/80

TO: Fisher Controls ATTN: Bill Haslett

PART NAME: 20" Butterfly Valve PART NO. Type 9200

TEST: Design Basis Event I. D. NO. ----------

SPECIFICATION: Fisher Document FQP-19 Rev. F PARA. NO. 7.0

NOTIFICATION MADE TO: Bill Haslett DATE: 9/23/80

NOTIFICATION MADE BY: Earl Campbell VIA: Verbal

REQUIREMENTS:

The test valve assembly will be subjected to a steam exposure profile, and a chemical spray for the design basis event environment simulation for in-containment service with either a BWR or a PWR plant. The DBE simulation will be accomplished using superheated steam for the first 8 hours and saturated steam for the remainder of the 30 days.

DESCRIPTION OF ANOMALY:

The second temperature and pressure transient was aborted at 35 minutes and 50 seconds into the test, due to excessive steam leakage at the top flange of the LOCA chamber. The highest temperature observed was 356.7°F.

DISPOSITION — COMMENTS — RECOMMENDATIONS:

Wyle Laboratories is to repair or replace the LOCA chamber flange gasket and resume testing per agreement with the customer.

DISTRIBUTION:
Original: Dept.
( ) Copies: Customer
2 Copies: Q. C.
2 Copies Project Office
1 Copy: Contracts
1 Copy: Operations Director

TEST WITNESS William V. Haslett

REPRESENTING Fisher Controls

ENGINEER Earl L Campbell

QUALITY CONTROL [signature]

PROJECT MANAGER Robert A. Hall

NOTICE OF ANOMALY

NOTICE NO. 9 P. O. NUMBER: H-217770 WYLE JOB NO. 45088 PAGE NO. ______

CONTRACT NUMBER: N/A REPORT NO. ______

CATEGORY: ☐ SPECIMEN ☒ PROCEDURE ☒ TEST EQUIPMENT DATE: 9-30-80

TO: Fisher Contro's ATTN: Bill Haslett

PART NAME: 20" Butterfly Valve PART NO. Type 9200

TEST: Design Basis Event I. D. NO. N/A

SPECIFICATION: Fisher Document FQP-19, Rev. F PARA. NO. 7.0

NOTIFICATION MADE TO: Bill Haslett DATE: 9-30-80

NOTIFICATION MADE BY: E. Campbell VIA: Telephone

REQUIREMENTS:

The test valve assembly will be subjected to a steam exposure profile, and a chemical spray for the design basis event environment simulation for in-containment service with either a BWR or a PWR plant. The DBE simulation will be accomplished using superheated steam for the first 8 hours and saturated steam for the remainder of the 30 days.

DESCRIPTION OF ANOMALY:

During the second temperature and pressure transient, the required time from 140°F to 381°F in ≈3 minutes was not accomplished. The time from 140°F to 341°F was 17 minutes, 41 seconds. The time from 341°F to the maximum chamber temperature (365°F) was an additional 18 minutes, 50 seconds. The 381°F was not accomplished.

The test chamber was out-of-tolerance on the high temperature side during the 250°F plateau on two occasions, as shown below:

9/27/80 - 42 minutes, the high temperature observed was 260°F.
9/28/80 - 1 hour, 20 minutes, the high temperature observed was 300°F.

DISPOSITION — COMMENTS — RECOMMENDATIONS:

Copies of the circular charts showing the second temperature and pressure transient, along with the circular charts showing the two out-of-tolerance conditions, were forwarded to the Customer.

Testing is to continue by agreement with the Customer.

LCB

DISTRIBUTION:
Original: Dept.
1 Copies: Customer
2 Copies: Q. C.
2 Copies Project Office
1 Copy: Contracts
1 Copy: Operations Director

TEST WITNESS ——

——

REPRESENTING ——

ENGINEER Earl R Campbell

QUALITY CONTROL [signature]

PROJECT MANAGER Herschel D. Jordan

NOTICE OF ANOMALY

NOTICE NO. 10 P. O. NUMBER: H-217770 WYLE JOB NO 45088

CONTRACT NUMBER: N/A

CATEGORY: ☐ SPECIMEN ☐ PROCEDURE ☒ TEST EQUIPMENT DATE: 10-6-80

TO: Fisher Controls Company ATTN: Bill Haslett

PART NAME: 20" Butterfly Valve PART NO. Type 9200

TEST: Design Basis Event I. D. NO. N/A

SPECIFICATION: Fisher Document FQP-19, Rev. F PARA. NO. 7.0

NOTIFICATION MADE TO: Bill Haslett DATE: 10-6-80

NOTIFICATION MADE BY: E. Campbell VIA: Telephone

REQUIREMENTS:

The test valve assembly will be subjected to a steam exposure profile, and a chemical spray for the design basis event environment simulation for in-containment service with either a BWR or a PWR plant. The DBE simulation will be accomplished using superheated steam for the first 8 hours and saturated steam for the remainder of the 30 days. The required temperature after the first four days is 200 ± 5°F.

DESCRIPTION OF ANOMALY:

The test chamber temperature was out-of-tolerance on the low temperature side for a total of 1 hour and 30 minutes on 10/4/80 and for 8 hours on 10/5/80. The test chamber was out-of-tolerance on the high temperature side on 10/4/80 for a total of 4 hours and 30 minutes. The out-of-tolerance conditions are shown in summary below:

Date	Time	Max. Temp.	Min. Temp.
10/4/80	1 hour, 30 minutes	---	180°F
10/4/80	4 hours, 30 minutes	230°F	---
10/5/80	8 hours	---	140°F

DISPOSITION – COMMENTS – RECOMMENDATIONS:

The Customer stated that he could justify the out-of-tolerance time on the high temperature side as being a worst-case test. The out-of-tolerance time on the low temperature side (9 hours, 30 minutes) will be added to the overall test time at the end of the 30-day test.

DISTRIBUTION:
Original: Dept.
1 Copies: Customer
2 Copies: Q. C.
2 Copies Project Office
1 Copy: Contracts
1 Copy: Operations Director

TEST WITNESS —

—

REPRESENTING —

ENGINEER Earl R Campbell

QUALITY CONTROL [signature]

PROJECT MANAGER [signature]

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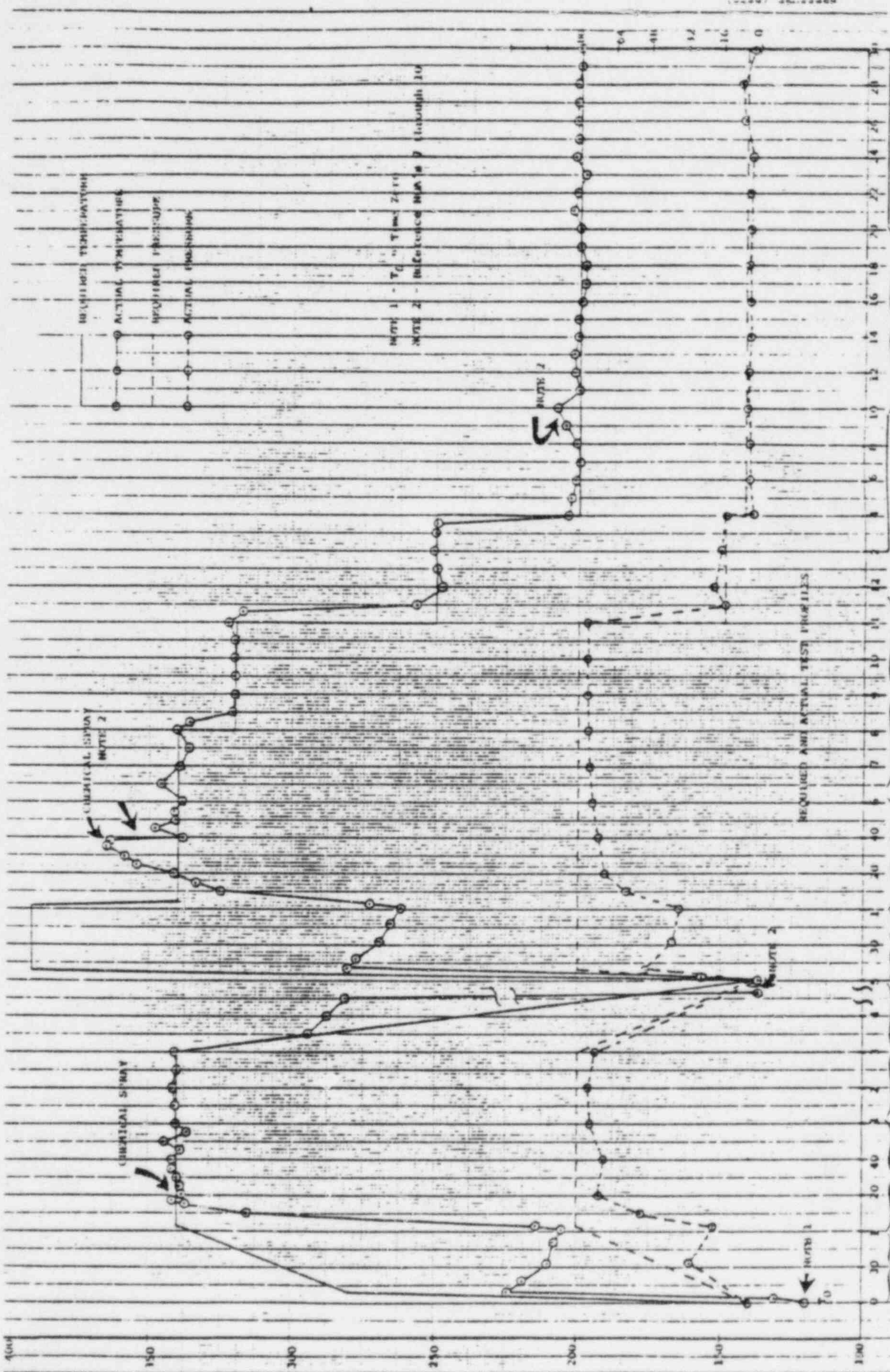
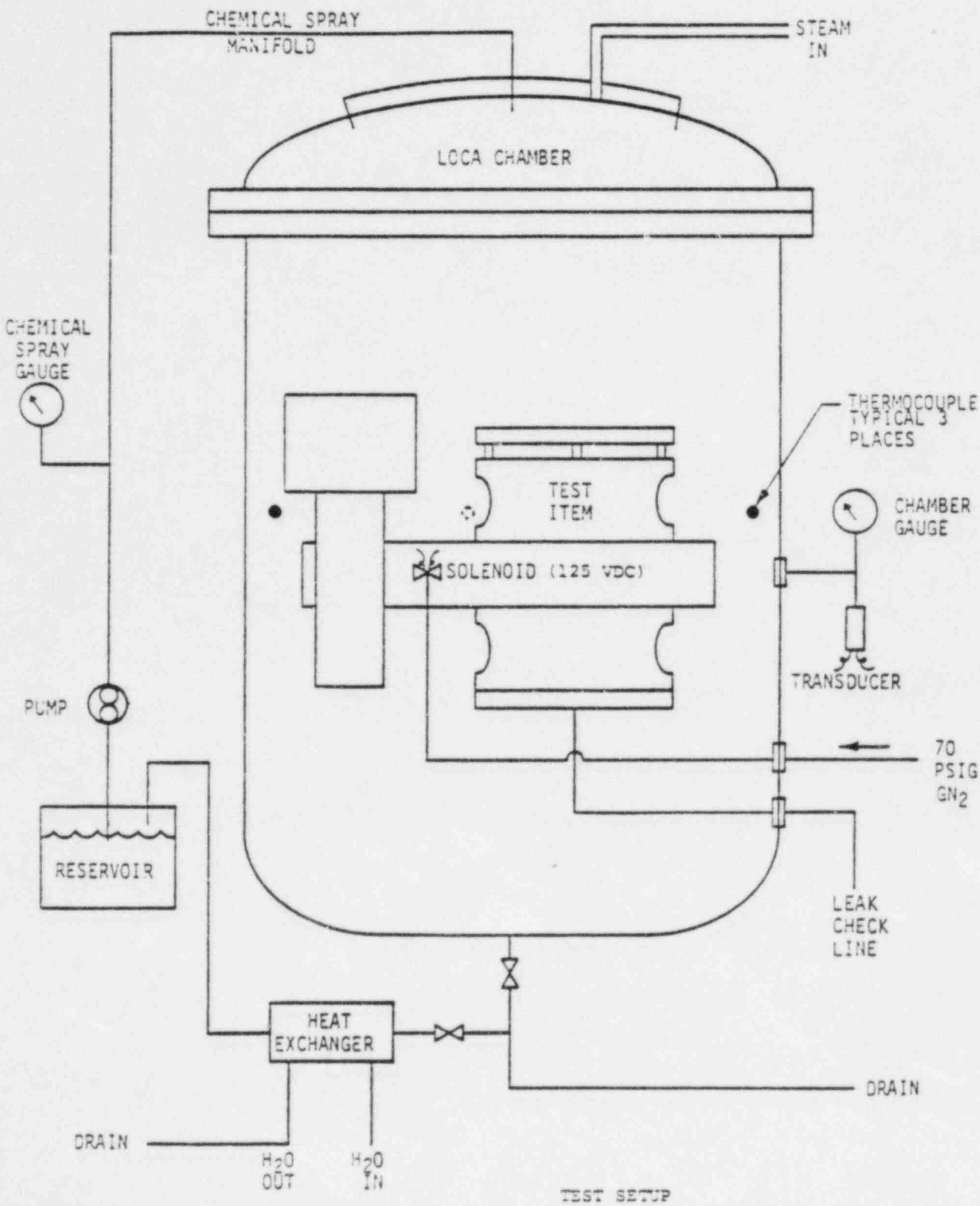
APPENDIX II

REQUIRED AND ACTUAL
TEST PROFILES


PRESSURE (PSIG)
TEMPERATURE (°F)
REQUIRED TEMPERATURE
ACTUAL TEMPERATURE
REQUIRED PRESSURE
ACTUAL PRESSURE
NOTE 1 - T0 = Time Zero
CHEMICAL SPRAY
NOTE 2
NOTE 1
SECONDS
MINUTES
HOURS
DAYS
TIME
REQUIRED AND ACTUAL TEST PROFILES

APPENDIX III

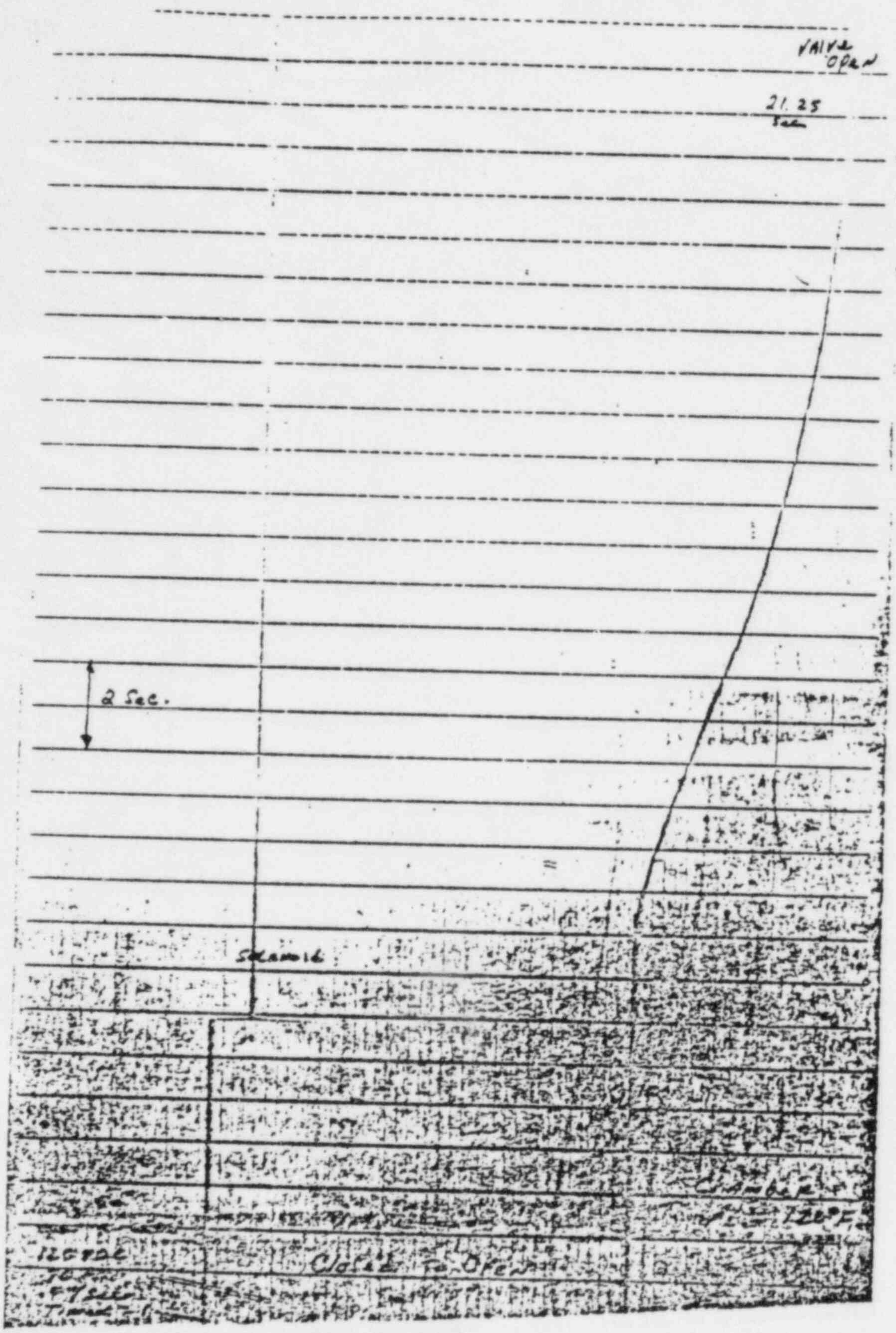
TEST SETUP
DESIGN BASIS EVENT

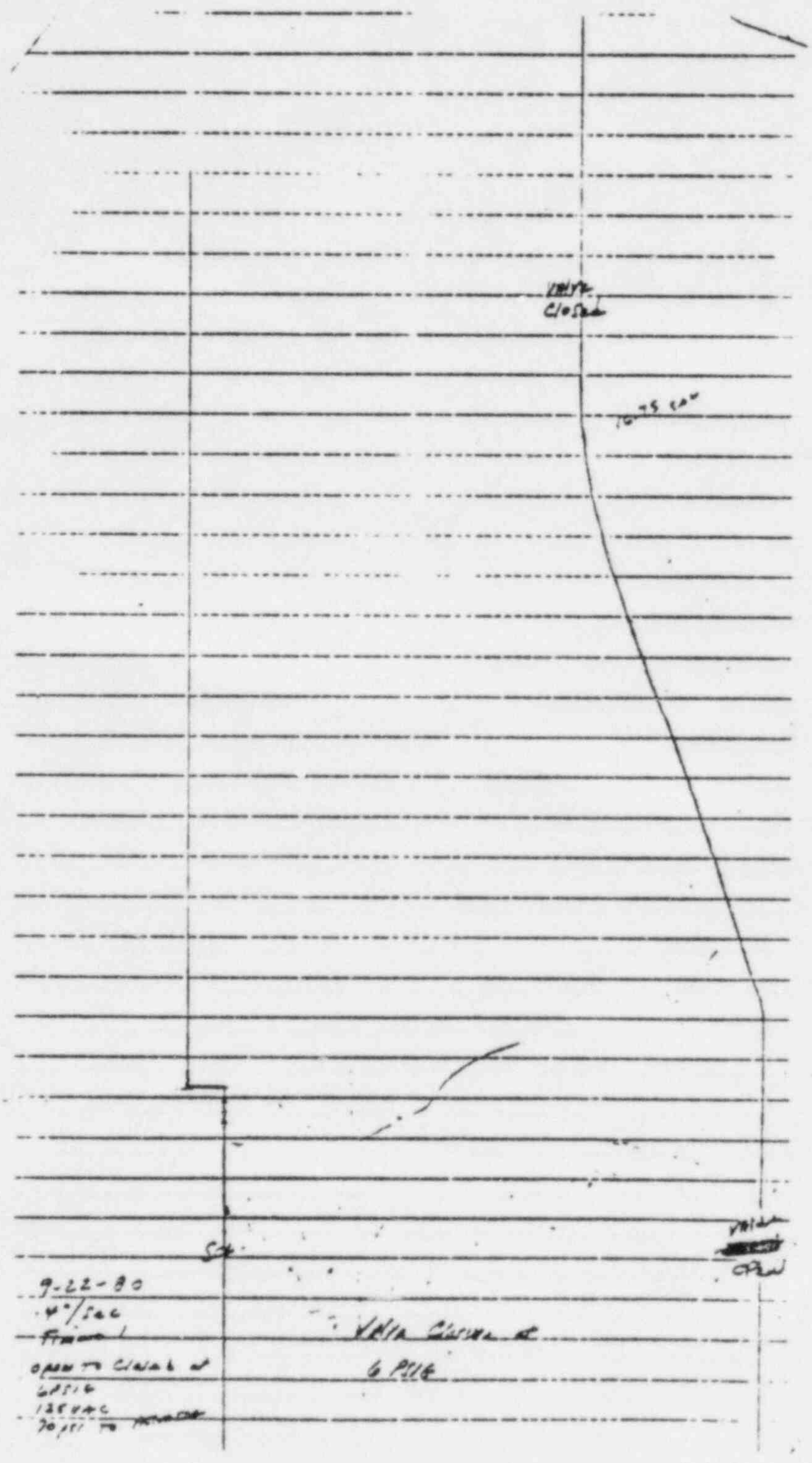


TEST SETUP
DESIGN BASIS EVENT

APPENDIX IV

OSCILLOGRAPH RECORDINGS


Valve Open
21.25 Sec
2 Sec.
Solenoid
Chamber
120°F
Closed To Open


Closed
Open
9-22-80
.4"/sec
Open to Closed at
6PSIG
125VAC
Valve Closure at
6 PSIG

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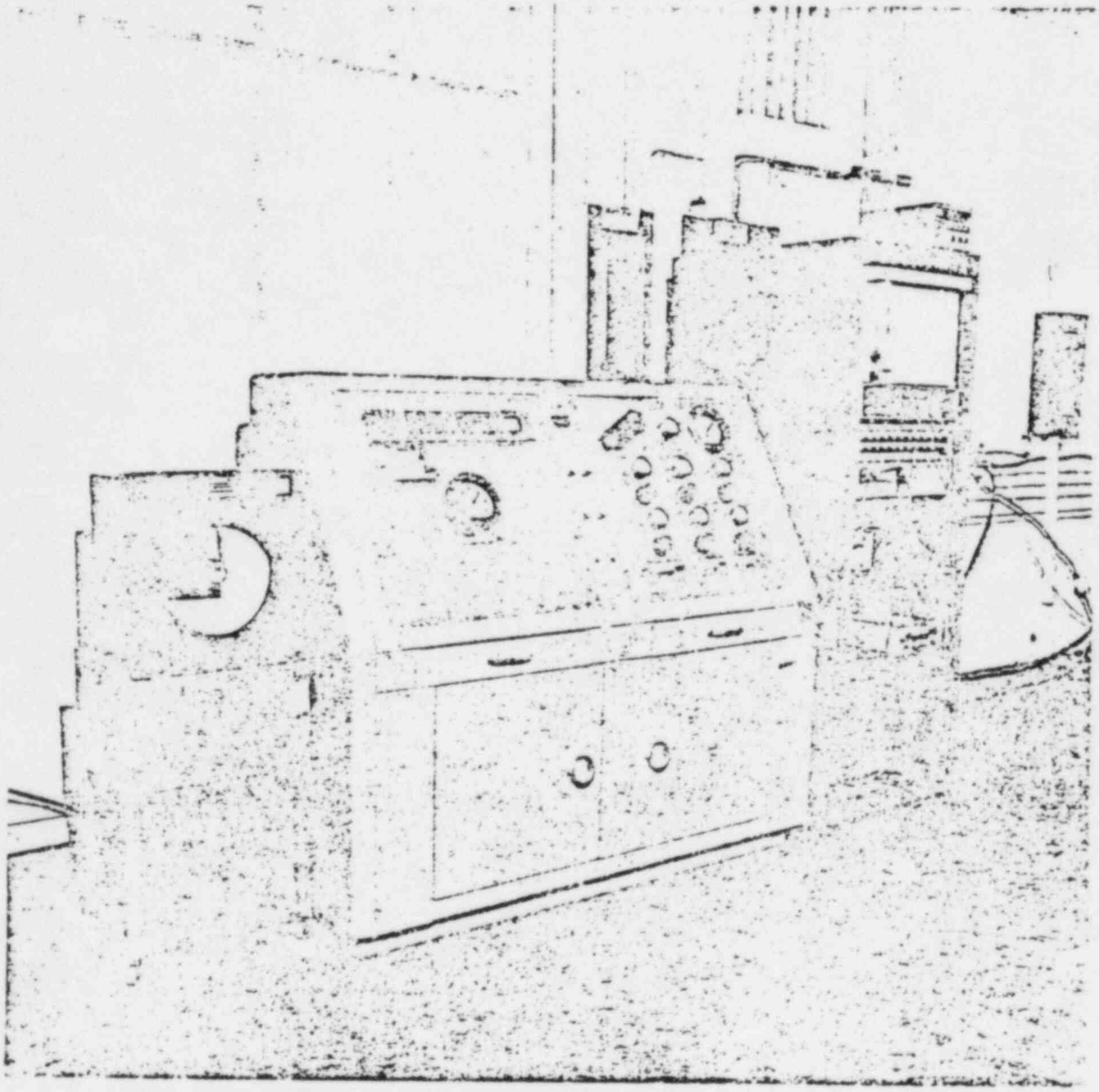
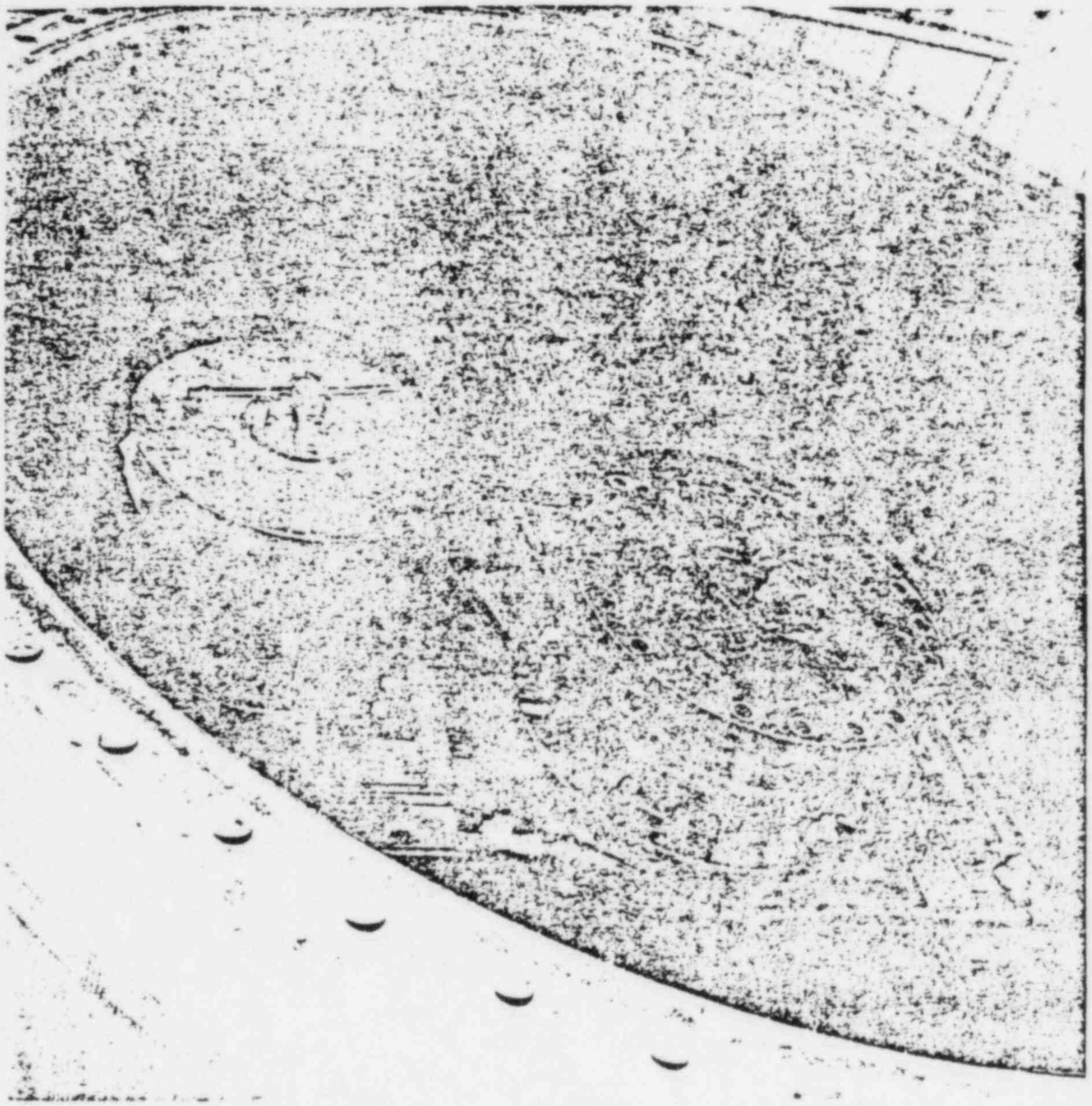
APPENDIX V

PHOTOGRAPHS



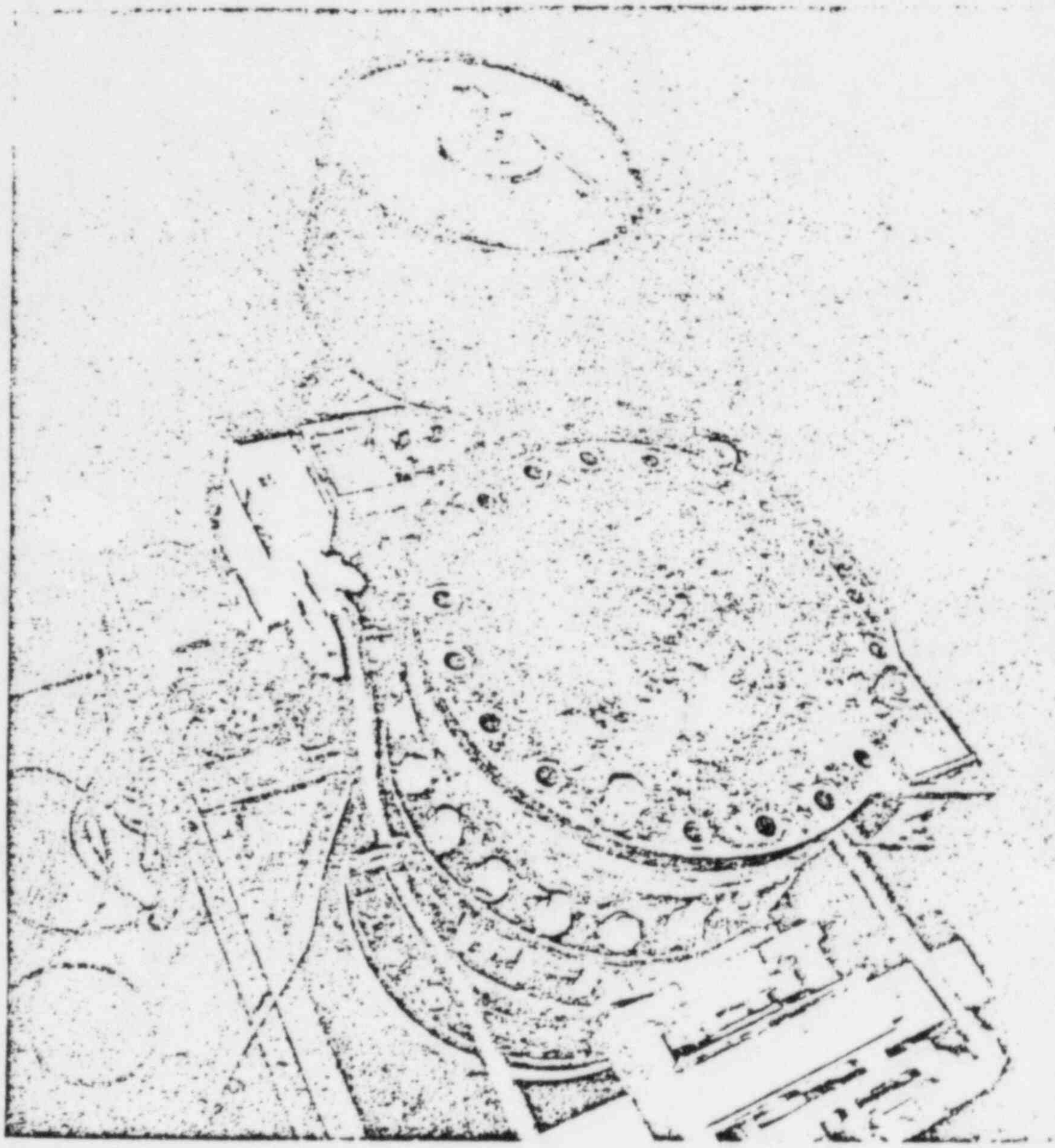
PHOTOGRAPH XI-1

LOCA INSTRUMENTATION
AND
STEAM CONTROL CONSOLE



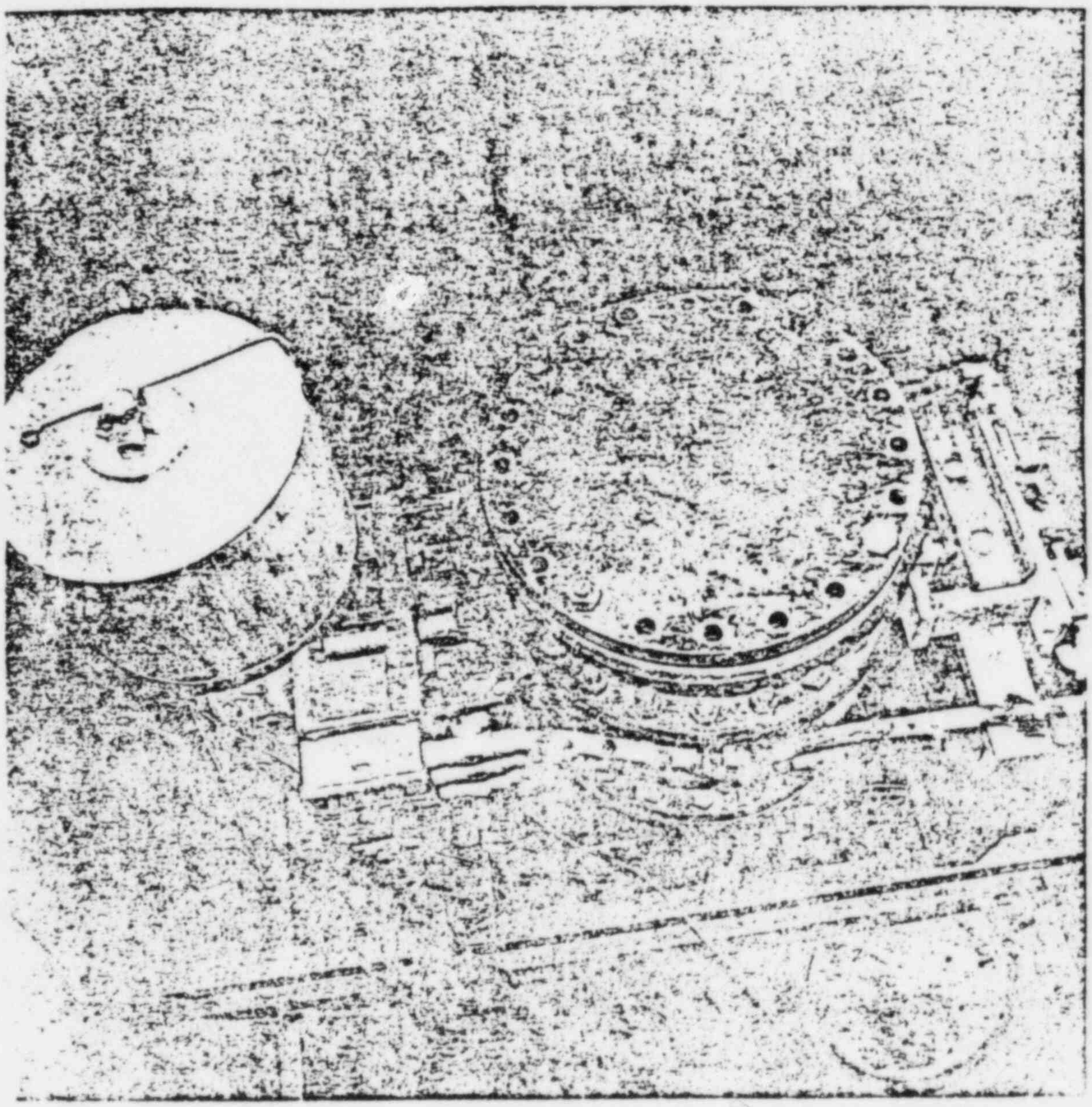
PHOTOGRAPH XI-2

PRIOR TO LOCA



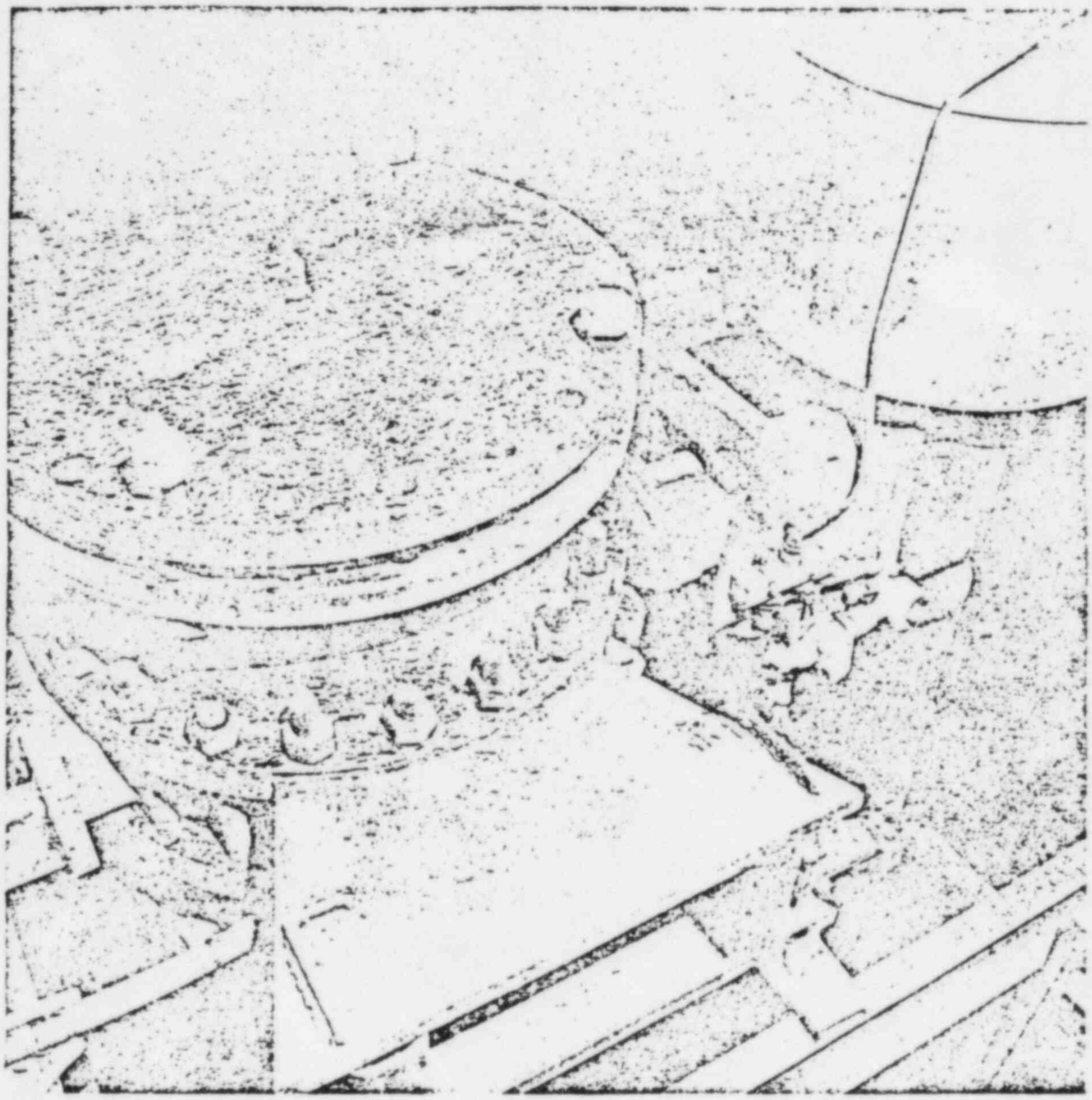
PHOTOGRAPH XI-3

PRIOR TO LOCA



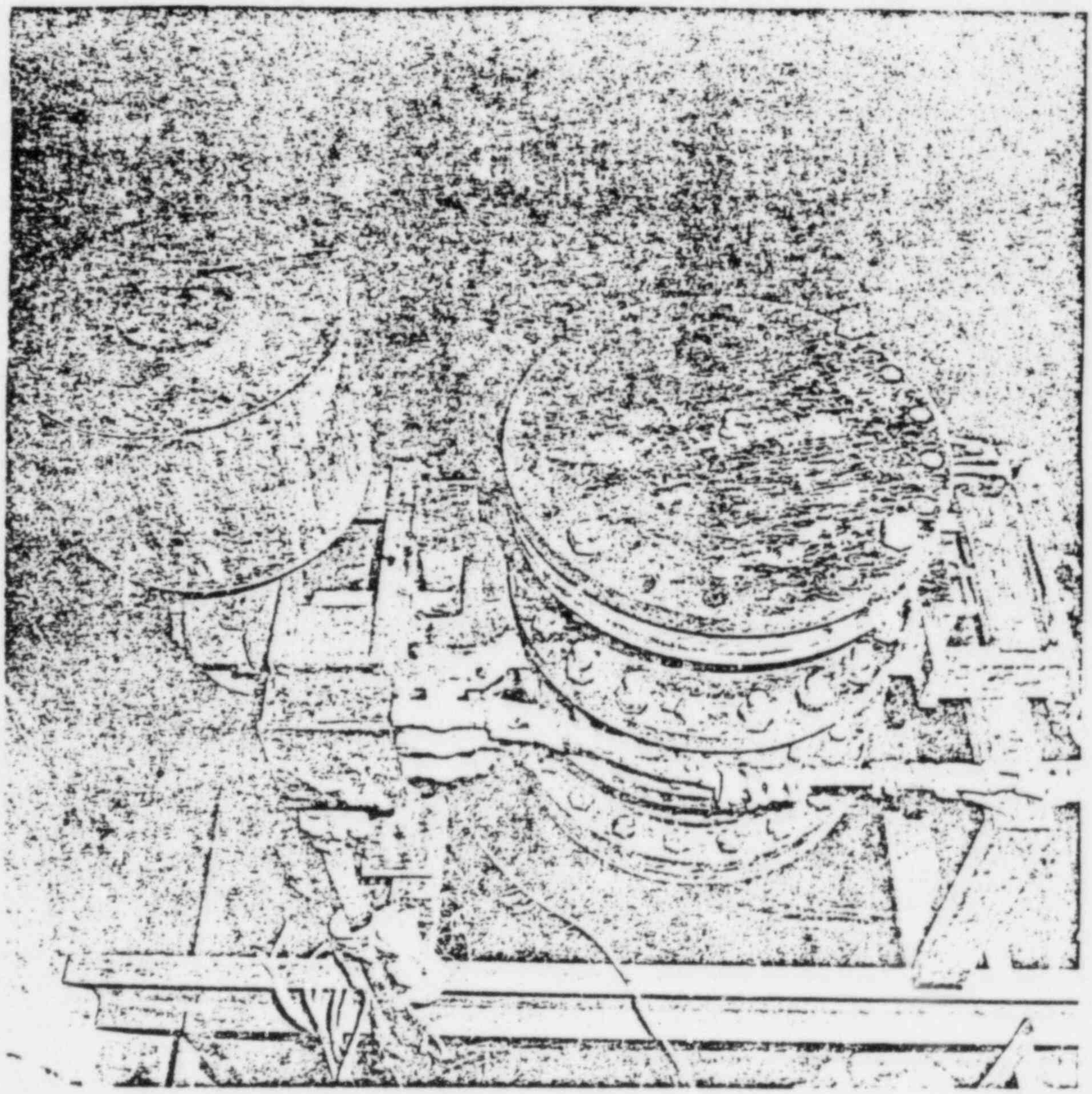
PHOTOGRAPH XI-4

TEST ITEM AFTER LOCA



PHOTOGRAPH XI-5

TEST ITEM AFTER LOCA

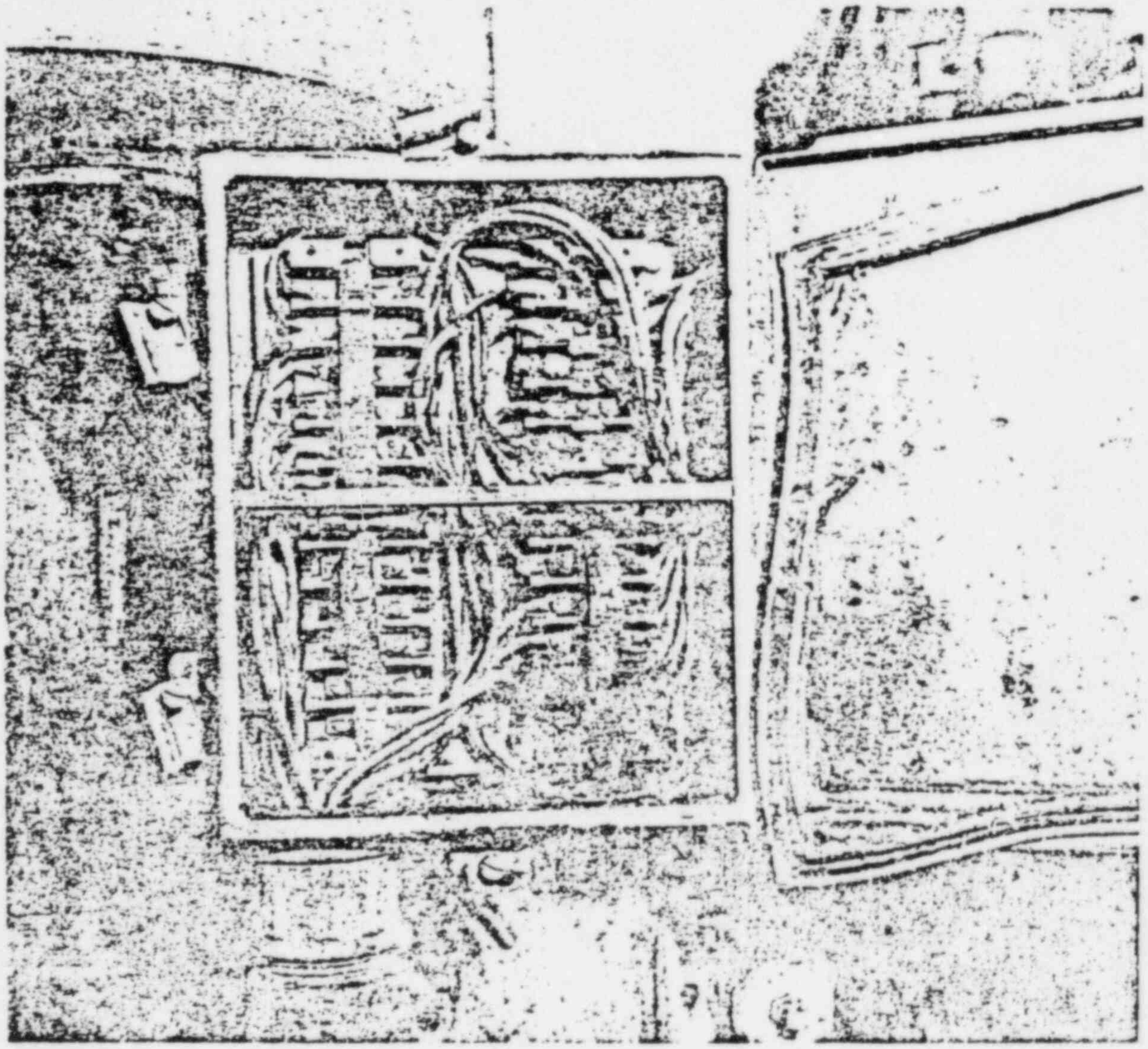


PHOTOGRAPH XI-6

TEST ITEM AFTER LOCA

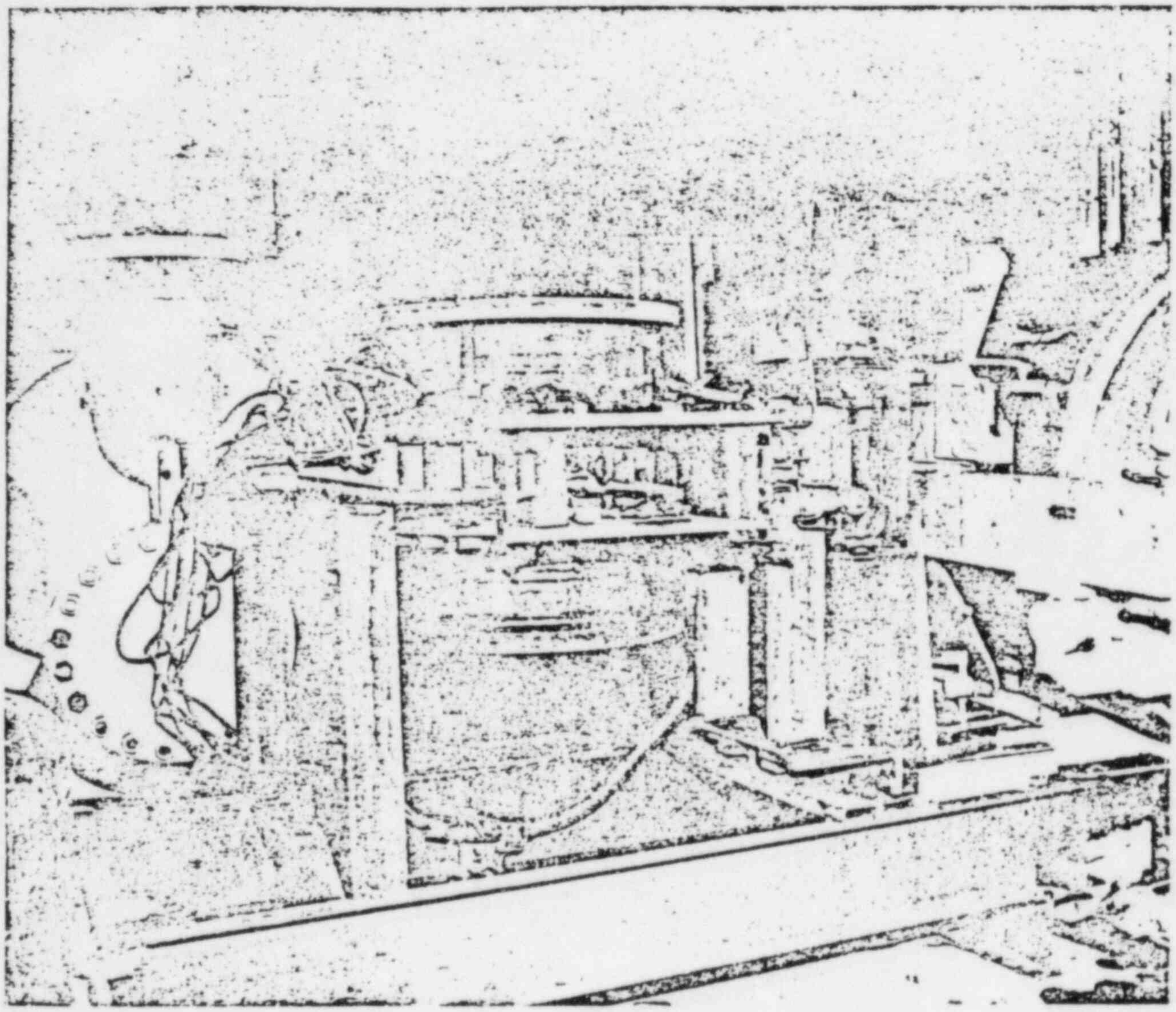
PHOTOGRAPH XI-7

TEST ITEM AFTER LOCA



PHOTOGRAPH XI-8

JUNCTION BOX AFTER LOCA



PHOTOGRAPH 9

TEST ITEM POST-LOCA

APPENDIX VI

INSTRUMENTATION EQUIPMENT SHEETS

INSTRUMENTATION EQUIPMENT SHEET

Date 10/17/80 Job No. 45088-05-5488 Test Area ENV LAB

Technician B Bolyn Customer Fisher Type Test LOCA

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	Redundant	R/I	6391LP	N/A	11798	-125°F to +375°F	±.5%	10-16-80	4-16-81
2	Recorder & Controller	Honeywell	152C15-PLY [illegible]	N/A	92567	-150° to 600°F	±2°F	7-25-80	10-25-80
3	Temperature gauge	Doric	400A Type T/°F	N/A	11221	-125 to +375°F	±1°F	6-19-80	12-19-80
4	Pressure gauge	MAXISAFE	NA	NA	100	0 to 300 PSI	±1%	8-14-80	11-14-80
5	Pressure gauge	Robertshaw	NA	NA	92593	0 to 200	±1% FS	7-29-80	10-29-80

Instrument Test Engineer B. Gorrett

Checked & Received By Earl R Campbell

WH 1029

INSTRUMENTATION EQUIPMENT SHEET

Date 9-22-80 Job No. 45088-05 Test Area ENV. LAB

Technician G. Gray Customer Fisher Type Test LOCA

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	Pressure Trans.	Statham	PA416-100-3	1906	21906	0-100PSIA	± 5%	9-22-80	3-22-81
2	Power Supply	Electronic Measurement	TR036-5	—	80246	0-36VDC	± .12R	5-6-80	11-6-80
3	Data Logger	Fluke	2200B	—	92846	-400°F to +200°F	± MFG Spec	4-7-80	10-7-80
4	DMM	Hewlett Packard	3465A	—	11150	Multi	MFG spec	5-12-80	11-12-80
5	Power Supply	Harrison Labs	865C	—	11393	0-40VDC	± 0.1 %R	5-9-80	11-9-80
6	Oscillograph	Honeywell	1508	—	81026	DC-2KHz	± 2. %	6-18-80	12-18-80
7	Galvo. Amp	Honeywell	T66A-500	—	11472	1:1 Gain	± 2. %	7-23-80	1-23-81
8	DMM	Keithley	178	—	11313	Multi.	MFG Spec	7-11-80	7-11-81
9	Power Supply	Sorensen	DCR-150-5	—	11309	0-200V DC	± 0.1 % R	9-8-80	3-8-81
10	Temp. Indicator	Doric	400A	—	11221	-350 to +750°F	± 1°F	6-19-80	12-19-80
11	Pressure Gage	Maxisafe	4½-1377	—	100	0-3000 psi	± 1 %	8-14-80	11-14-80
12	Pressure Gage	Robershaw	600-D1851-1	—	92593	0-200 psi	± 1% F.S.	7-29-80	10-29-80
13	Pressure Gage	Maxisafe	7327	—	97745	0-600 psi	± 1% F.S.	7-23-80	10-23-80
14	Pressure Gage	U.S. Gauge	1902C	—	92595	0-300 psi	± 2% F.S.	9-3-80	12-3-80

Instrument Test Engineer H. E. Strickland Checked & Received By Earl R Campbell

WH-1029

INSTRUMENTATION EQUIPMENT SHEET

Date 9.22.80 Job No. 45088-05 Test Area Environmental

Technician S. Rice Customer Fisher Controls Type Test LOCA

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	DMM	Keithley	178	—	11313	Multi	Mfg Spec	7.11.80	7.11.81
2.	Power Supply	Sorensen	DCR150-5	—	11309	0-150vdc	±0.1% Reg	5.8.80	3.8.81
3.	Power Supply	Harrison Labs	865C	—	11393	0-40vdc	±.01% Reg	5.8.80	11.9.80
4	Visicorder	Honeywell	1508	—	81026	2.5kHz	±2%	6.18.80	12.18.80
5.	Galvo Amp	Honeywell	T6GA500	—	11472	1-1	±2%	7.23.80	1.23.81

Instrument Test Engineer [signature] Checked & Received By Earl R. Campbell

WH 1029

SECTION XII

THERMAL TRANSIENTS AND SEAT LEAKAGE TESTS (ADDENDUM TO LOCA TEST)

1.0 REQUIREMENTS

The following tests shall be performed to simulate, with a dry oven atmosphere, the 381° temperature transient that was not accomplished during the LOCA Test (reference Section XI of this report).

The valve assembly shall be placed in a preheated 200°F oven for 8 hours and the temperature allowed to stabilize. The valve assembly shall be oriented in the oven with the inlet side up and the disc horizontal. The blind flange on the inlet side of the valve shall be secured in such a fashion as to let the oven environment be in contact with the T-ring. The outlet side of the valve shall have a blind flange and spool piece secured to it and vented to the atmosphere.

When the stabilization is completed, the test valve assembly shall be removed from the 200°F oven and placed as rapidly as possible in a second oven preheated to 381°F in the same orientation. After the valve assembly has been placed in the oven, the oven temperature shall be brought back to 381°F as rapidly as possible and held for 2 minutes.

Upon completion of the 381°F temperature spike, the blind flange on the valve assembly inlet shall be made air-tight. The oven temperature shall be reduced to 125°F and stabilized for 1 hour. Once temperature has been stabilized, the inlet spool piece and blind flange assembly shall be pressurized with air to 2.5 psig for 15 minutes. The seat leakage shall be measured and recorded.

Following the tests outlined above, the oven temperature shall be reduced to 100°F and stabilized for 1 hour. Once the temperature has been stabilized, the inlet spool piece and blind flange assembly shall be pressurized with air to 2.5 psig for 15 minutes. The seat leakage shall be measured and recorded.

The oven temperature shall be stabilized for 1/2 hour at 120°F. Upon stabilization of the temperature, seat leak tests with air at pressure differentials of 10, 20, 30, 40, 50, 60, and 75 psid shall be performed.

Exercise the test valve through one complete stroking cycle, then time the duration of the operating stroke. Opening and closing times shall be recorded.

2.0 PROCEDURES (Continued)

The test item was placed in a temperature-controlled oven and the oven temperature stabilized at 200°F ± 3°F for 24 hours. The valve temperature stabilized at 198.4°F.

The test item was removed from the oven and placed in another oven, which was pre-conditioned to 381°F ± 3°F. The oven temperature was re-established at 381°F ± 3°F and maintained for 2 minutes. The test item was positioned such that the inlet side was up, the disc horizontal, and the T-ring seal exposed to the oven environment. The test item temperature at the end of the 2-minute test was 165.6°F.

The test item was removed from the oven and the inlet blind flange was secured for leak checks. The test item was placed in the original oven and the temperature established and controlled at 125°F ± 3°F. The oven temperature was maintained for 1 hour and a leak check performed with air. The 2.5 psig pressure was maintained for 15 minutes and the leakage was monitored using the bubble-pan method. The test item's temperature was 147°F at the completion of this test.

The oven temperature was reduced to 100°F ± 3°F and maintained for 1 hour. The test item was again leak-checked at 2.5 psig for 15 minutes. The test item's temperature was 127°F at the completion of this test.

The oven temperature was stabilized at 120°F ± 3°F for 30 minutes and leak checks performed at 10, 20, 30, 40, 50, 60, and 75 psid across the valve disc. The leakage was measured by the bubble-pan method.

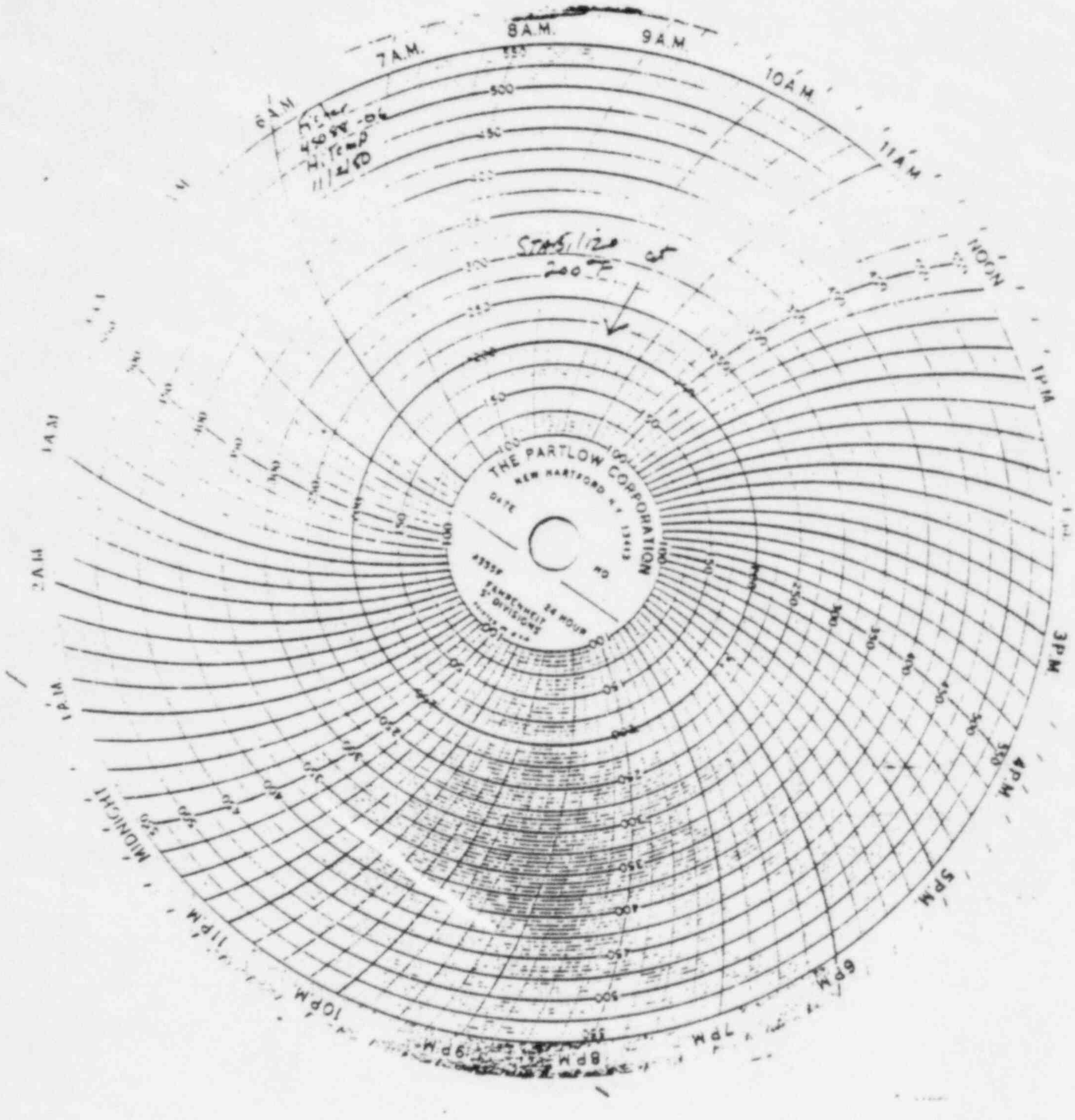
3.0 RESULTS

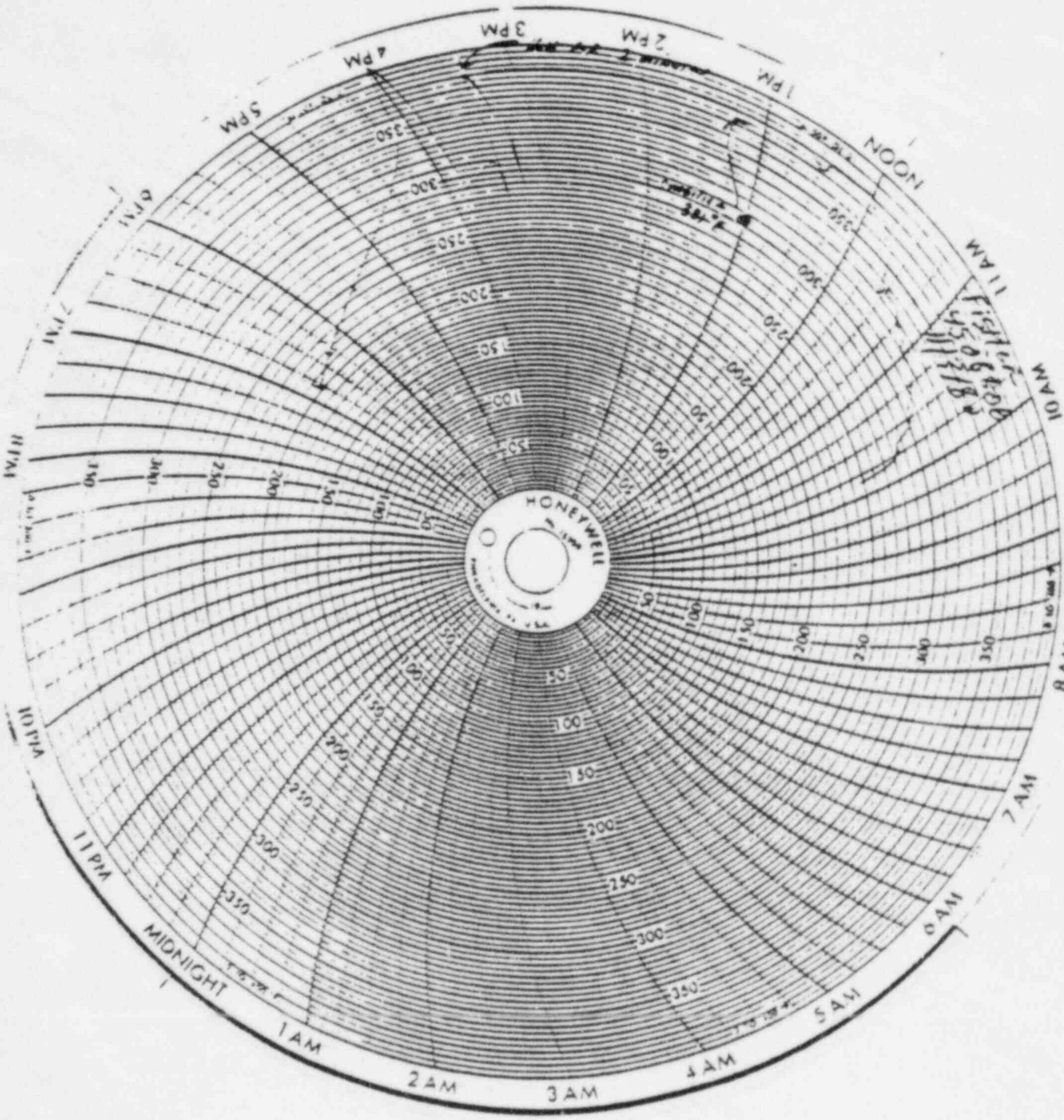
The test item was subjected to the tests required by Paragraph 1.0 above. The tests were performed as described in Paragraph 2.0 above. There was zero leakage past the valve disc during both leak-check tests at 2.5 psid. The leakage past the valve disc at 10, 20 and 30 psid was zero. The leakage at 40 psid was 1 bubble/minute. At 50 psid the leakage was 350 cc/minute. At 60 psid the leakage was 618 cc/minute, and at 75 psid the leakage was 1167 cc/minute.

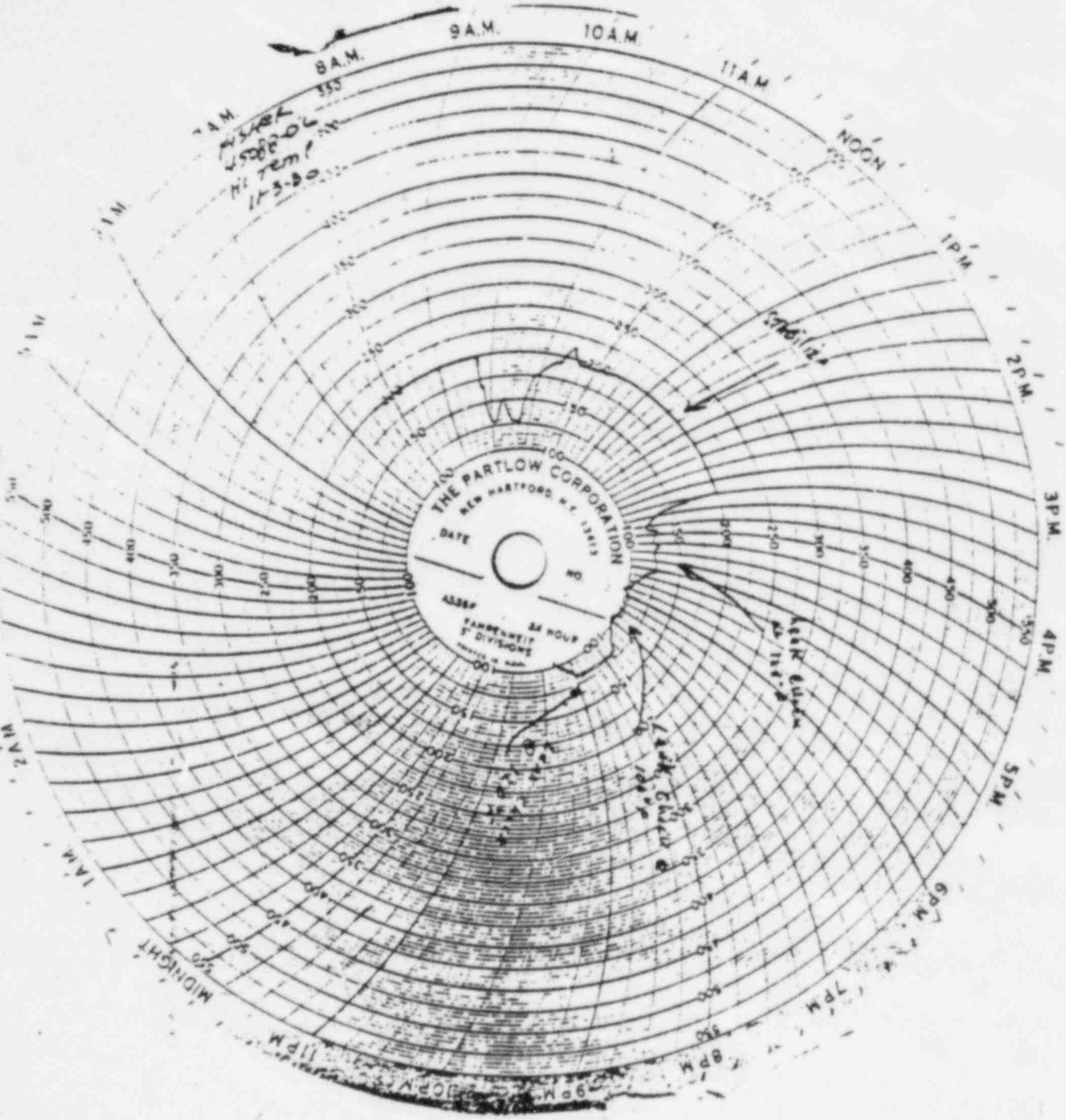
Circular chart recordings showing the test oven temperatures are presented in Appendix I. Photographs pertaining to these tests are presented in Appendix II. A Data Sheet showing data obtained is presented in Appendix III, and an Instrumentation Equipment Sheet is presented in Appendix IV.

APPENDIX I

CIRCULAR CHART RECORDINGS

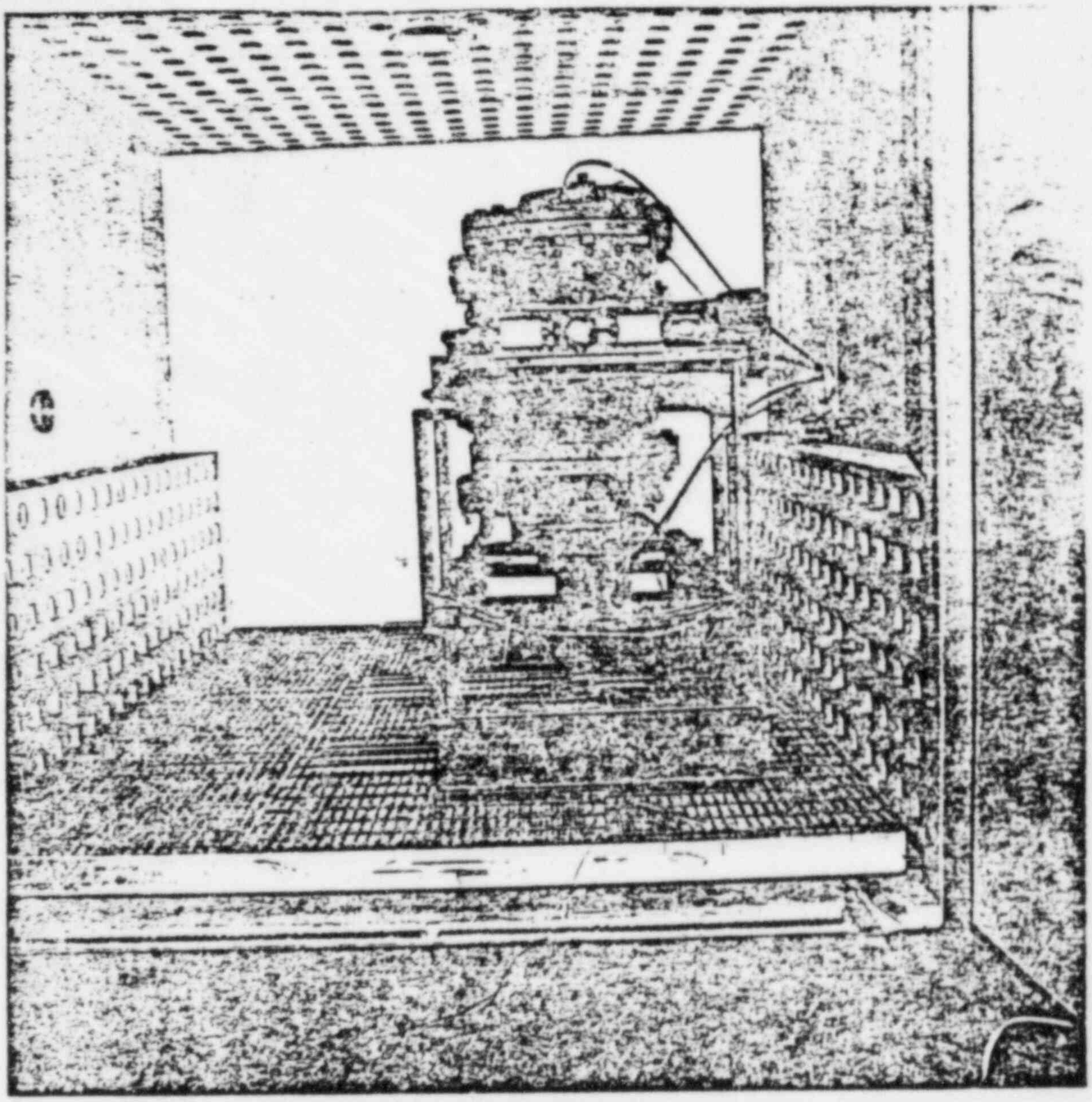

THE PARTLOW CORPORATION
NEW HARTFORD, N.Y.
DATE
Stabilize @ 200°F
NOON
1 P.M.
3 P.M.
4 P.M.
5 P.M.
6 P.M.
7 P.M.
8 P.M.
9 P.M.
10 P.M.
11 P.M.
MIDNIGHT
1 A.M.
2 A.M.
7 A.M.
8 A.M.
9 A.M.
10 A.M.
11 A.M.


HONEYWELL
NOON
1 PM
2 PM
3 PM
4 PM
5 PM
6 PM
7 PM
8 PM
10 PM
11 PM
MIDNIGHT
1 AM
2 AM
3 AM
4 AM
5 AM
6 AM
7 AM
8 AM
9 AM
10 AM
11 AM


THE PARTLOW CORPORATION
NEW HARTFORD, N.Y.
DATE
NO.
24 HOUR
FAHRENHEIT
8 A.M.
9 A.M.
10 A.M.
11 A.M.
NOON
1 P.M.
2 P.M.
3 P.M.
4 P.M.
5 P.M.
6 P.M.
7 P.M.
8 P.M.
11 P.M.
MIDNIGHT
1 A.M.
2 A.M.
3 A.M.
Stabilize

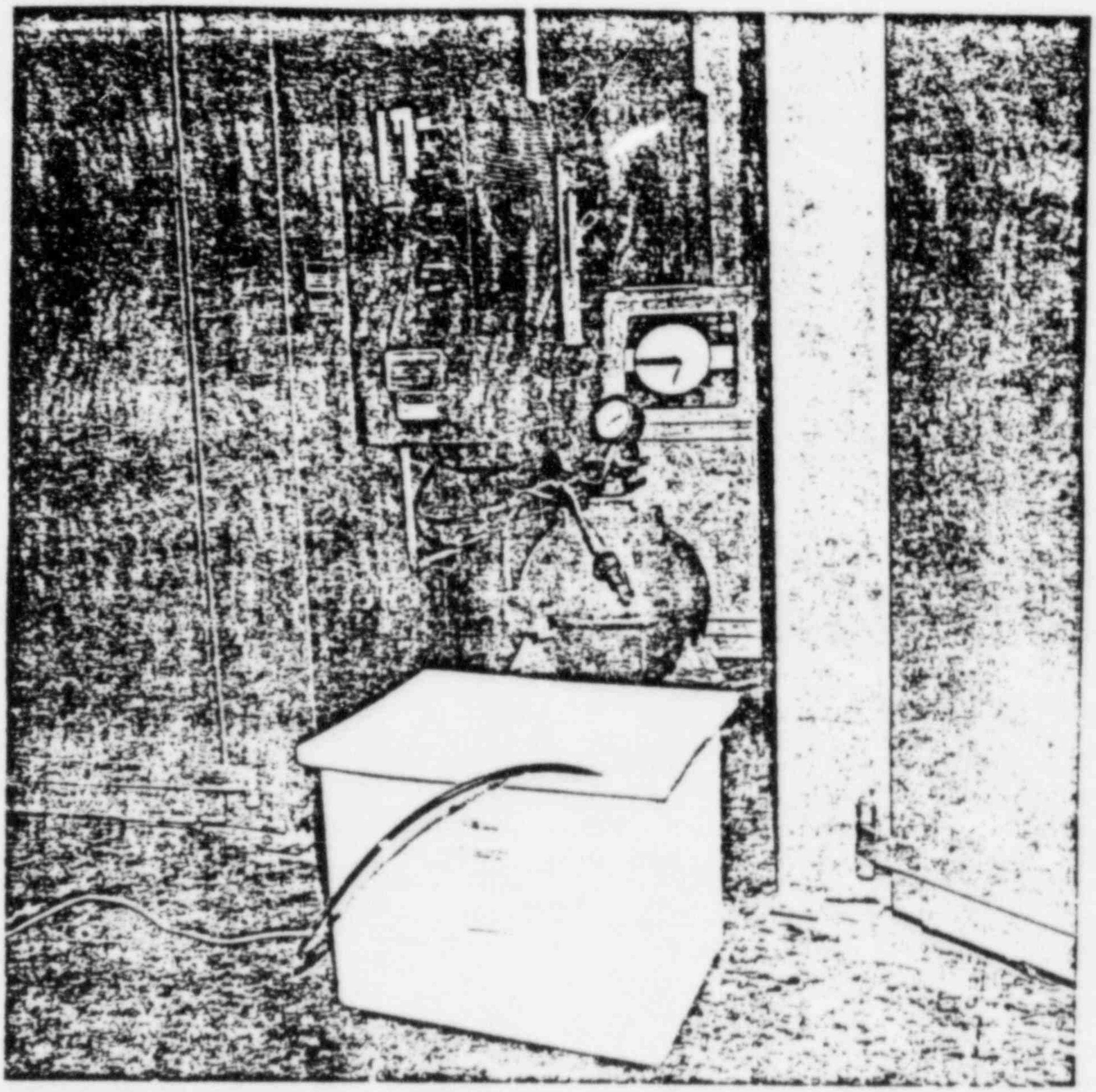
APPENDIX II

PHOTOGRAPHS



PHOTOGRAPH XII-1

TEST ITEM IN OVEN AFTER LEAK CHECKS



PHOTOGRAPH XII-2

INSTRUMENTATION AND LEAK CHECK EQUIPMENT

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APPENDIX III

DATA SHEET

DATA SHEET

Customer Fisher Controls
Specimen 20" Butterfly Valve
Part No. Type 9200
Spec. COS to P.O. 217770
Para. 1 thru 6
S/N N/A
GSI —

Amb. Temp. ≈ 74°F
Photo Yes
Test Med. Air
Specimen Temp. Various

WYLE LABORATORIES
Job No. 45088
Report No. —
Start Date 11-2-80

Test Title Thermal Tests & Leak Checks (Information Only)

*Chamber #	Temp. °F	Valve Temp.	Test Time	Seat Leakage @ 2.5 PSID
1	200°F	195.4°F	Soaked for 24 hours	N/A
2	381°F	165.6°F	2 minutes	N/A
1	125°F	147°F	1 hour	Zero @ 2.5 PSID
1	100°F	127°F	1 hour	Zero @ 2.5 PSID
1	120°F	122°F	30 minutes	Zero @ 10 PSID
				Zero @ 20 PSID
				Zero @ 30 PSID
				1 Bubble per min. @ 40 PSID
				350 cc per min. @ 50 PSID
				618 cc per min. @ 60 PSID
				1167 cc per min. @ 75 PSID

*Chamber #1 is Low Temp. (100°F to 200°F)
*Chamber #2 is High Temp. (381°F)

Specimen Failed —
Specimen Passed ✓
NCA Written —

Tested By M. Luttrell Date 11-4-80
Witness — Date —
Sheet No. 1 of 1
Approved Earl R Campbell

APPENDIX IV

INSTRUMENTATION EQUIPMENT SHEET

INSTRUMENTATION EQUIPMENT SHEET

Date 11/4/80 Job No. 45088-06 Test Area EV. LAB
Technician M. LUTTRELL Customer FISHER Type Test THERMAL & LEAK CHECK

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1.	RECORDER	PARTLOW	RFC15	—	11462	100° to 550°	±.5%	10-1-80	4-1-81
2.	CONTROLLER	R/I	639	—	11292	0° to 1000°	±.5%	5-8-80	11-8-80
3.	REDUNDANT	R/I	—	—	11282	0° to 1000°	±.5%	6-25-80	12-5-80
4.	GAGE	ROBERTSHAW	54	—	54	0 to 5.0 PSI	±1	11-3-80	2-3-81
5.	GAGE	ROBERTSHAW	ACRA	—	98648	0 to 200	±1	9-22-80	12-22-80
6.	RECORDER	HONEYWELL	45	—	92812	0° to 400°	±.5%	9-2-80	12-2-80
7.	REDUNDANT	R/I	—	—	11284	0° to 1000°	±.5%	7-10-80	1-10-81
8.	CONTROLLER	R/I	639	—	11293	0° to 1000°	±.5%	7-1-80	1-1-81

Instrument Test Engineer B. Jewett Checked & Received By Earl R Campbell

WL 1039

SECTION XIII

POST-LOCA FUNCTIONAL TESTS

1.0 REQUIREMENTS

The requirements for these tests are as described in Section II, Paragraph 1.0 of this report.

These tests are for "Information Only".

2.0 PROCEDURES

The procedures for these tests are as outlined in Section II, Paragraph 2.0 of this report.

3.0 RESULTS

The test item was subjected to the tests required by Paragraph 1.0.

The valve was stroked "closed" to "open" to "closed" two (2) full cycles, but would not remain in the "open" position.

The red light on the control box was inoperative.

The green light on the control box was operational.

The Versa valve leaked at 70 psig at the end cap nearest the Bettis Actuator.

The regulator was operational.

The relief valve was operational.

The junction box showed evidence of moisture and corrosion internally. The door gasket was loose and hardened.

The electrical measurements were performed.

No Notice of Anomaly was written since these tests were for "Information Only".

The test item was shipped to Isomedix, Inc., Parsippany, New Jersey, along with both spool pieces and blind flanges per the request of the Fisher Technical Representative.

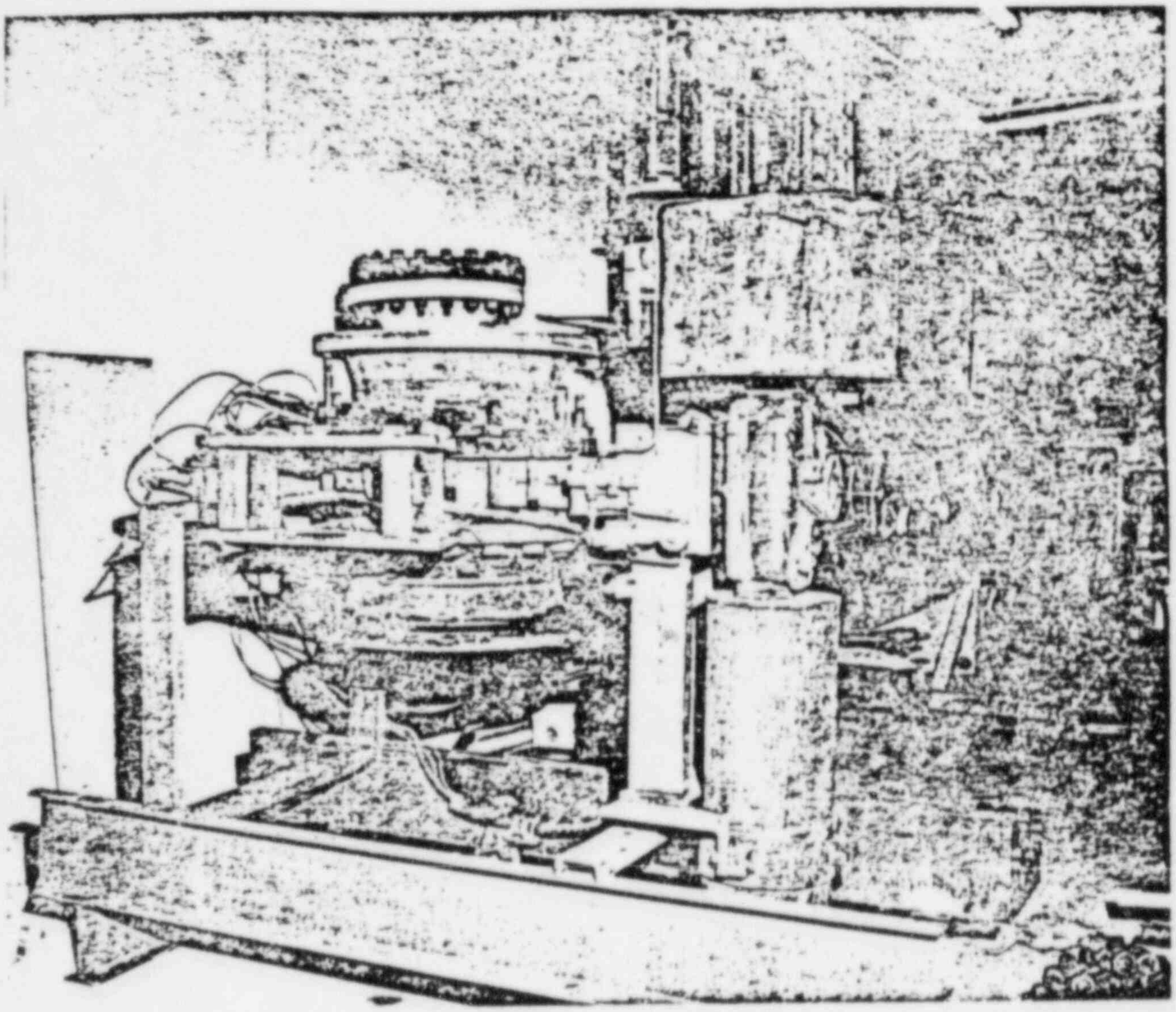
Photographs pertaining to this test are presented in Appendix I.

3.0 RESULTS (Continued)

A Data Sheet showing the results of the electrical measurements is presented in Appendix II, and an Instrumentation Equipment Sheet is presented in Appendix III of this Section.

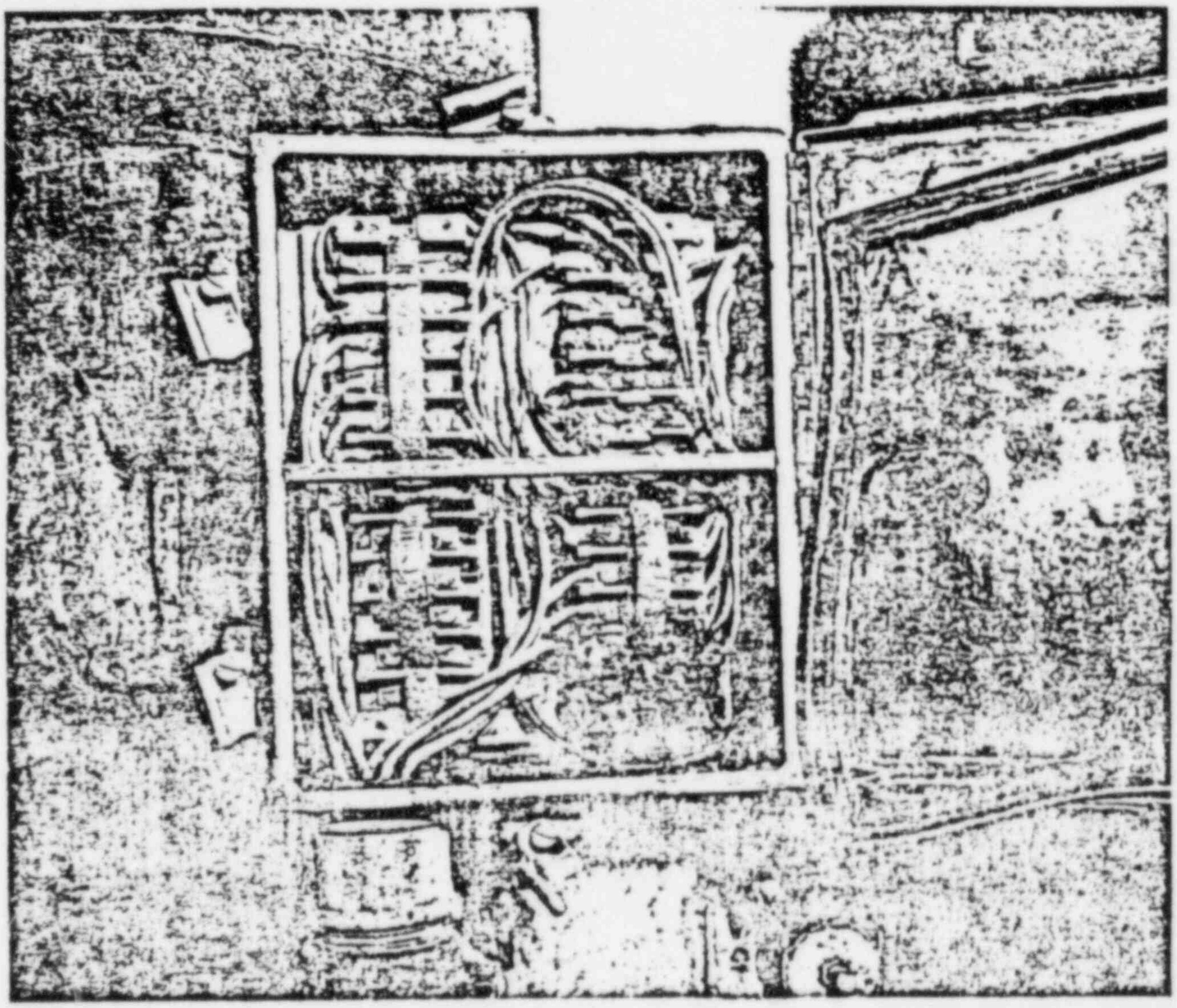
APPENDIX I

PHOTOGRAPHS



PHOTOGRAPH XIII-1

TEST ITEM AFTER LOCA



PHOTOGRAPH XIII-2

JUNCTION BOX AFTER LOCA

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APPENDIX II

DATA SHEET

DATA SHEET

WYLE LABORATORIES

Customer: Fisher Controls
Specimen: 20" Butterfly Valve
Part No.: Type 9200
Spec.: FCP-19 Rev E
Para.: 3.0
S.N: —
GSI: —

Amb. Temp.: 71°F
Photo: None
Test Med.: —
Specimen Temp.: 106.4°F

Job No.: 45088-06
Report No.: —
Start Date: 11-6-80

Test Title: Post Loca Functional

Solenoid Resistance - 272 Ω
- Terminals 2 to 3 In The Box

Wire - 285 Milliohms @ 1 ma
* Two wires from the specimen have no markings

Wire - 302 Milliohms @ 1 ma
* Two wires from the specimen have no markings.

Solenoid Resistance to Ground - 37 KΩ
** This readings was taken with a DMM.

Specimen Failed: —
Specimen Passed: INFORMATION ONLY
NOA Written: —

Tested By: [signature] Date: 11-6-80
Witness: — Date: —
Sheet No.: 1 of 1
Approved: Earl R. Campbell

WH-614A

APPENDIX III

INSTRUMENTATION EQUIPMENT SHEET

INSTRUMENTATION EQUIPMENT SHEET

Date 11-4-80 Job No. 45088-06 Test Area Environmental

Technician S. Rice Customer Fisher Controls Type Test Post-Loca Functional

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1.	Gauge	Robertshaw	—	—	54	0-5psi	±1 Div	11-3-80	2-3-81
2.	Gauge	Robertshaw	—	—	98071	0-400 PSI	±1% FS	9-15-80	12-15-80
3.	Gauge	Robershaw	—	—	98648	0-700 PSI	±1% FS	9-22-80	12-22-80
4	Temp. Indicator	Doric	400A	—	11221	Variable	±1% F	6-19-80	12-19-80
5.	Temp. Recorder	Partlow	—	—	11462	100 To 550° F	±5° F	10-1-80	4-1-81
6.	Power Supply	Sorensen	DCR 150-5	—	11309	0-150 VDC	±1%	9-8-80	3-8-81
7.	DMM	Keithley	179	—	11312	Multi.	Mfg. Spec	6-19-80	6-19-81
8.	DMM	Keithley	164	—	11305	Multi.	Mfg. Spec	10-9-80	4-9-81
9.	DMM	Hewlett Packard	3465A	—	96293	Multi	Mfg. Spec	7-29-80	1-29-81
10.	Megohmmeter	General Radio	1862-C	2374	97892	5 to 20000 Meg	±3%	5-7-80	11-7-80

Instrument Test Engineer K Burkhart Checked & Received By Earl R Campbell

WH-1029

Page No. XIII-10
Report No. 45088-1

SECTION XIV

ADDENDUM I

FISHER DOCUMENT
FQP-19 - REV. F

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FQP-19

FISHER CONTROLS ENVIRONMENTAL

QUALIFICATION PLAN

STANDARDS AND SPECIFICATIONS COVER SHEET

FISHER Controls

MARSHALLTOWN, IOWA

FISHER CONTROLS ENVIRONMENTL QUALIFICATION PLAN

NO. FQP-19 F
BY 9-22-79
APVD 9-23-79
PAGE 0.1 OF
REV K 2-18-80

THIS PAGE IS THE COVER SHEET OF ALL STANDARDS AND SPECIFICATIONS DOCUMENTS CONTAINING 3 OR MORE PAGES OF SPECIFICATIONS.

THE TABLE BELOW SHOWS THE REVISION LEVEL OF EACH PAGE OF THIS DOCUMENT. A REVISION OF THIS PAGE WILL BE MADE WHEN ANY PAGE OF THIS DOCUMENT IS REVISED.

WHEN REFERRING TO THIS DOCUMENT SPECIFY THE REVISION LEVEL OF THIS PAGE.

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0.2	F
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1.2	A
2	C
2.1	A
3	C
4	A
5	B
6	B
7	D
7.1	A
8	C
9	D
10	D
10.1	A
11	A
12	C

PAGE NUMBER	REVISION LEVEL
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14	D
14.1	A
15	D
16	B
17	C
18	A
19	E
19.1	A
20	C
20.1	A
21	C
21.1	A
21.2	A
22	C
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23.2	B
24	C
24.1	A

PAGE NUMBER	REVISION LEVEL
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26	A
27	C
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28	C
28.1	C
29	B
30	D
31	A
32	D
33	B
34	D
35	B
36	C
37	B
37.1	B
38	A
39	C
39.1	B
40	A

FISHER Controls
MARSHALLTOWN, IOWA

STANDARDS AND SPECIFICATIONS COVER SHEET

NO. FOP-19 B

BY C.K. 2-12-90
APV'D C.C. 2-12-90
PAGE OF
REV

FISHER CONTROLS ENVIRONMENTAL QUALIFICATION PLAN

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THE TABLE BELOW SHOWS THE REVISION LEVEL OF EACH PAGE OF THIS DOCUMENT. A REVISION OF THIS PAGE WILL BE MADE WHEN ANY PAGE OF THIS DOCUMENT IS REVISED.

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43	A
43.1	C
44	B
45	B
46	B
47	B
48	B
49	C
49.1	B
50	B
51	C

PAGE NUMBER	REVISION LEVEL

PAGE NUMBER	REVISION LEVEL

FISHER CONTROLS COMPANY
CONTINENTAL DIVISION

FQP-19 (B)

ENVIRONMENTAL QUALIFICATION PLAN

FOR

FISHER CONTROLS COMPANY

BUTTERFLY CONTROL VALVES

FOR

BECHTEL POWER CORPORATION

STANDARDIZED NUCLEAR UNIT POWER PLANT SYSTEMS

BECHTEL SPECIFICATION NO. 10466-M-237, M-236, AND J605A

			Revision F April 14, 1980 (F)
	Revision D February 12, 1980		Revision E February 26, 1980 (E)
	Revision B April 23, 1979		Revision C November 15, 1979 (C)
DATE:	Revision 0 December 13, 1978	Revision:	Revision A February 19, 1979 (B)

PREPARED BY: Richard C. Sekerchak
Richard C. Sekerchak, Project Engineer

REVIEWED BY: Carl D. Wilson
Carl D. Wilson, Manager, Testing and Analysis

APPROVED BY: Robert E. Kessler
Robert E. Kessler, Manager, Design and Development

INTRODUCTION

This document delineates a specific procedure to qualify Fisher Controls Company Butterfly Control Valves suitable for 4 years of normal environmental conditions and the environment exhibited by a design basis event.

The method of environmental qualification to be used is that of radiation exposure, artificial aging, seismic vibration, and exposure to a design basis event environment.

With the valve T-ring seal adjusted for a shut-off pressure differential of 150 psid, the test valve assembly will undergo a preliminary functional test to establish the initial condition of the valve. This will be followed by a series of normal condition load tests designed to show functionality at several normal and off-normal load conditions.

Following the normal condition load tests, the valve T-ring seal may be replaced at the discretion of the Fisher Test Engineer. In any event, the T-ring seal will then be readjusted for a shut-off pressure differential of 75 psid, after which, the baseline functional tests will be performed. C

The test valve assembly will then be subjected to an aging process consisting of alternating exposure to high temperature and high humidity with concurrent stroking of the valve to ultimately simulate 5 years of aging. Since the high temperature, accelerated aging process causes an unrealistic temperature set condition to occur in the elastomeric T-ring seal with a resultant potential for seat leakage, the T-ring seal will be readjusted at this point to compensate for this artificial condition which would not occur during a real-time, 5-year aging period at 120°F. The Fisher Environmental Qualification Report will include supplementary field service information supporting the justification for this procedure.

Following the post-aging readjustment of the T-ring seal, the valve assembly will then be exposed to radiation, utilizing a source such as Cobalt-60, for a total exposure of 1×10^7 RAD equivalent air dose in order to bring the valve assembly to its end-of-life condition prior to the seismic test.

Following the irradiation, the test valve assembly will be subjected to a seismic test per Fisher Controls Company Seismic Qualification Plan, FQP-23. The valve assembly will then experience a steam and chemical exposure profile to simulate the environment of a design basis event. Duration of the steam exposure profile will be 30 days.. After completion of the 30 day DBE simulation, the valve will undergo a series of post-DBE leakage tests to simulate the long-term, post-DBE shut-off capability of the valve.

Finally fo..owing the complete qualification sequence described above, the valve assembly will again be exposed to radiation bringing the total cumulative exposure level to 1×10^8 Rad equivalent air dose. Then, for informational purposes only, the valve will be subjected to a series of functional tests at 120°F, including seat leakage tests at various incremental pressures up to 75 psid.

Periodically throughout the previously mentioned tests, functional tests will be performed to ensure that the test valve assembly is performing properly (e.g., maintains design seat leakage, open and closing times within specified limits, etc.).

TESTING:

The purpose of these specific tests and the sequence in which they will be performed is to simulate a design basis event after the Equipment has been in service for a number of years. Following is an explanation of what each phase of the testing will accomplish:

The valve will initially undergo a series of normal condition load tests to demonstrate functionality of the valve at several normal and off-normal load conditions.

Following the normal condition load tests, the test valve assembly will be artificially aged by being subjected to alternating high temperature and high humidity cycles along with concurrent stroking of the valve during the humidity cycle. The intent of artificial aging is to bring the valve to a condition representative of a specific length of operating service in excess of the qualified life. In this case, the qualified life is 4 years and the valve will be artificially aged to simulate 5 years to ensure valve operability for a period of up to one (1) year after a DBE.

C

During normal operation, a valve in containment may be exposed to radiation which may cause degradation of nonmetallic components and electrical circuits. Also, during a design basis event, the valve may be exposed to a large dose of radiation. Fisher Controls plans to expose the test valve assembly to one single dose of radiation which will equal or exceed the combined radiation level experienced during normal service and the radiation level during a design basis event. In all, the total exposure will be 1×10^7 RADS equivalent air dose. This radiation exposure combined with the prior accelerated heat aging sequence will bring the valve assembly to its end-of-life condition prior to the seismic test.

Past history verified by field service experience indicates no deleterious effects to any hardware due to normal plant vibration; therefore, vibration aging will not be performed.

As demonstrated by previous testing, (Continental Report No. 92-395), the Type 9200 butterfly valve, excluding elastomers, is suitable for more than 50,000 full operating cycles with satisfactory operation. Based upon the previous testing results, mechanical aging will not be performed on parts subject to wear due to mechanical motion and not subject to environmental degradation. Refer to the environmental-qualification reports for Limitorque, ASCO, and Namco for details on mechanical aging on the respective equipment. B

A seismic test will then be performed per Fisher Controls Seismic Qualification Plan, FQP-23, to simulate the seismic loading during a design basis event. C

Upon completion of the seismic test, the environment will be stabilized at the conditions representative of the normal operating conditions. The reasoning behind this portion of the test is that prior to a design basis event (during normal service), the control valve assembly is experiencing some "normal" service temperature, pressure, and relative humidity. The "normal" service conditions upon which qualification is based are 120°F, atmospheric pressure, and 5 - 100% relative humidity. C

Following stabilization of the normal operating conditions, the test valve assembly will be subjected to a steam and chemical exposure profile which will approximately simulate the conditions of a design basis event. B

Following completion of the 30 day DBE simulation, the valve will undergo a series of post-DBE leakage tests to simulate the long-term, post-DBE shut-off capability of the valve. C

The purpose of this environmental qualification is to demonstrate that after being *in service for an extended period of time, the control valve assembly will perform its intended function during and after a design basis event. The test procedure depicted above is considered by Fisher Controls Company, Continental Division, to be a satisfactory method of establishing a 4-year qualified life for the valve and associated components that are not qualified by other qualification tests or methods.*

GENERAL DISCUSSION OF AGING TECHNIQUE AND SUPPORTING DOCUMENTATION:

Many different approaches were considered in the search for an acceptable method for artificially aging our (Fisher Controls Company) butterfly control valves. It is Fisher Controls' opinion that artificial aging, by accelerated heat aging, exposure to radiation, valve cycling, and seismic vibration, is the most viable procedure based upon current technology. Fisher Controls believes that the Arrhenius Relationship for determining test temperature and duration, the 10°C Rule of Aging, is a valid technique for accelerated heat aging for the valve assembly and accessories.

Additionally, during testing, the test conditions can be accurately simulated and recorded, the effects of aging noted throughout the test, and the time required for testing is of a reasonable duration.

The 10° C Rule of Aging states that the life of the specimen is reduced one-half for each 10°C rise in temperature. Tests performed by the Bureau of Standards on various elastomers yielded results which demonstrate that when elastomers are heat aged in air, the rate of degradation of the elastomers was approximately twice as rapid for each 10°C rise in test temperature.[1]

AGING AND QUALIFIED LIFE:

As stated previously, the test valve assembly will be subjected to an aging process consisting of alternating exposure to high temperature and high humidity with concurrent stroking of the valve during the humidity cycle to ultimately simulate 5 years of aging and environmentally qualify the valve assembly for a 4-year qualified life. 5

The 5 years of aging is representative of 4 years of normal service plus 1 year of service after a design basis event, should a design-basis event occur at the end of the fourth year of service. This is the maximum time period for which the control valve will be environmentally qualified.

REINSTATING THE QUALIFIED LIFE:

After 4 years, the qualified life can be reinstated by replacement of the valve T-ring (elastomeric seat ring) and all other nonmetallic components, thus reinstating the life for an additional 4 years. This type of maintenance program can be continued up to a maximum of 40 years. The specific parts and components which must be replaced to reinstate the qualified life for the valve and accessories will be listed in the Fisher Controls Equipment Instruction Manual.

APPURTENANCE QUALIFICATION:

Environmental qualification of appurtenances is the responsibility of the appurtenance manufacturer and only those appurtenances involved in the safety/failure mode function require environmental qualification. The environmental qualification of the appurtenances will be demonstrated by the test program and supplemented in the appurtenance manufacturers' report. The appurtenance qualification reports will be submitted for Bechtel approval. The Fisher Environmental Qualification Report will include all appurtenance qualification reports as applicable with supplements as necessary to satisfy the Bechtel "SNUPPS" specification requirements.

All appurtenances will be mounted on the test valve during environmental qualification testing and Fisher Controls will document the performance of each appurtenance and certify that they were exposed to the conditions delineated in Section 3 of this document. Fisher Controls will not certify that appurtenances manufactured by others are qualified to environmental conditions above and beyond those delineated in the appurtenance manufacturers' qualification report. Fisher will certify the ability of the equipment (valve and appurtenances) to perform its safety function as demonstrated by test and supplemented by the appurtenance manufacturers' qualification reports of ASCO and Namco. Fisher will certify the ability of the Bettis to perform its safety-related function as demonstrated by test. Fisher will also establish a qualified life and instructions for reinstating the life. These parts will be listed in the instruction manual. 6

During environmental testing, the conduit connections of all appurtenances will be sealed to exclude the environment from their interior. All conduit connections will be run to a junction box and will be sealed. Fisher will certify that the junction box, conduit, terminal blocks, seals, and wiring will not impair the safety-related function of the valve as demonstrated by test. We will provide a qualified life and instructions with parts list to reinstate the qualified life.

In the event of a malfunction or failure of an appurtenance of the control valve assembly, the deviation or failure will be recorded, the component replaced, if necessary, and the qualification test continued. The appurtenance manufacturer will be informed of the anomaly and be requested to retest/requalify or provide justification for the anomaly.

APPURTENANCE QUALIFIED LIFE OR MAINTENANCE INTERVAL:

The qualified life for Namco EA180 Series Limit Switches will be determined by aging information presently available, testing per this procedure, aging to be performed by Namco, or an on-going qualification program. The procedure for reinstating qualified life will be included in the Fisher Controls Instruction Manual. The qualified life will be supplied in the Fisher Environmental Qualification Report.

The installed life for ASCO solenoid valves is 40 years and 40,000 cycles. Coils and elastomeric components shall be replaced every 4 years per ASCO Seismic and Environmental Qualification Report - Test Report AQS21678/TR. The procedure for reinstating qualified life will be included in the Fisher Controls Instruction Manual.

Fisher Controls will certify the ability of the Versa 3-way valve to perform its safety-related function as demonstrated by the tests outlined in this procedure. Fisher will establish a qualified life for the Versa valve which will be listed in the Environmental Qualification report. The procedure for reinstating the qualified life will be included in the Fisher Controls Instruction Manual.

TEST LOCATION AND VALVE ADJUSTMENTS:

If the test valve assembly must be transported from one facility to another, a functional test will be performed per Fisher Controls Environmental Qualification Plan, Section A, Paragraph 2.0, and adjustments will be made as required prior to any testing to place the valve in its pre-transit condition. The functional test will be performed to ensure that there have been no adverse effects to the assembly or to correct any caused by the transfer. Following testing, a functional test will be performed.

The necessity of adjustments will be determined by the Fisher Controls Project Engineer, and Bechtel will be advised prior to performance of the adjustment. If adjustments are made, the reason(s) for requiring adjustment will be documented and justification provided in the environmental qualification report.

EXTRAPOLATION OF ENVIRONMENTAL QUALIFICATION TEST RESULTS:

(1) The test valve (10466-J605-1.0 with appurtenances from 10466-M237-1.02) is a Type 9200 and all valves on this order are Type 9200's of various sizes larger and smaller than the test valve. The qualification test will qualify all valves on this order since they are of the same general construction and composed of the same materials but of different size. All of the components of the Type 9200 required to perform the safety-related function such as disc seal, bearings, disc, body, etc., utilize the same design principles.

(2) The test valve utilizes a Bettis T420B-SR2-12 rotary pneumatic actuator. Fisher Controls will certify the ability of the Bettis to perform its safety-related function as demonstrated by this test. This test is considered applicable to all Bettis operators on this order since they are of the same general construction and composed of the same general materials but of different size. All of the components of the Bettis actuator required to perform the safety-related function utilize the same design principles.

(3) The Type 1073 manual actuators are composed of metallic components only and there should not be adverse effects due to the environment.

(4) Limitorque actuators have been environmentally and seismically qualified and the report will be submitted for Bechtel approval. The Limitorque qualification report will be included as part of the environmental qualification report.

(5) All Namco Limit switches are Type EA180 Series and are of identical construction. The EA180 limit switches have been environmentally and seismically qualified

by Namco and the qualification will be extended to meet the Bechtel "SNUPPS" specification requirements by Namco based upon the Fisher Controls Environmental Qualification Test as mounted on the valve assembly. The Namco Environmental Qualification Report with supplements as necessary, will be submitted for Bechtel approval as part of the Fisher Controls Environmental Qualification Report.

(6) The ASCO NP8320A185V solenoid valves have been environmentally and seismically qualified by ASCO and the qualification will be extended to meet the Bechtel "SNUPPS" Specification requirements by ASCO based upon the Fisher Controls Environmental Qualification Test as mounted on the valve assembly. The ASCO Environmental Qualification Report, with supplements as necessary, will be submitted for Bechtel approval as part of the Fisher Controls Environmental Qualification Report. C

(7) Fisher P595 Filters, Bailey AP 2-1-2-1-0 Positioners, Tescom 35 R Relief Valves, Fisher 546 Transducers do not require environmental qualification since they are not involved in the safety function of the valve assemblies. However, if any of the aforementioned appurtenances are on the environmental qualification test valve, their performance will be monitored. D

(8) The seals for the junction box and all appurtenances are identical and Fisher will certify that the performance of the seals will not impair the safety-related function of the valve as demonstrated by this test.

(9) All junction boxes, terminal blocks, and wiring materials between the junction box and appurtenances are identical. Fisher will certify that this equipment will not impair the safety-related function of the valve based upon this test. 3

(10) The Fisher 95H regulators are identical and will be qualified by this test. Fisher will certify that this equipment will not impair the safety-related function of the valve based upon this test.

(11) The test valve utilizes a Versa VSP-3501-15-155 pneumatic 3-way valve which is identical to all Versa valves used on this order. Fisher Controls will certify the ability of the Versa valve to perform its safety-related function as demonstrated by this test. Fisher will establish a qualified life for the Versa valve which will be listed in the Fisher Environmental Qualification Report. The procedure for reinstating the qualified life will be included in the Fisher Controls Instruction Manual.

ADJUSTED STROKING TIME:

To assure that all Bettis-operated valves will stroke in the time period as required by Bechtel Specification, an adjusted stroking time factor will be calculated per the following equation and applied to the actual stroking time of each Bettis-operated production valve:

Adjusted Stroking Time Factor = T_f/T_i

T_f = Final stroking time (measured at start of DBE simulation as described in Section 7.3)

T_i = Initial stroking time (measured during the pre-aging functional tests described in Section 4.05)

The actual stroking time for the production valves will be multiplied by the adjusted stroking time factor or 1; whichever is greater. If the adjusted stroking time is equal to or less than that required by Bechtel Specification, the equipment selection will be considered satisfactory.

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REFERENCES

(1) Tener, R.F., Smith, W.H., and Holt, W.L., "Aging of Soft Rubber Goods", Technologic Papers of the Bureau of Standards, No. 342, Bureau of Standards, Department of Commerce, 1927.

FIGURE 1 - Valve Assembly Test Sequence

Functional Test
↓
Normal Condition Load Test
↓
Functional Test
↓
Aging Simulation
↓
Functional Test
↓
Radiation
↓
Functional Test
↓
Seismic
↓
Functional Test
↓ → Valve Assemblies Qualified for Orders 10466-M-236 and 10466-J605A
↓
Design Basis Event Test
↓
Post-DBE Leakage Tests
↓ → Valve Assemblies Qualified for Order 10466-M-237
↓
(The following tests are for information only)
↓
Post-DBE Functional Tests
↓
Post-DBE Radiation
↓
Post Radiation Functional Tests

NOTE: In the event of a malfunction or failure of an appurtenance of the valve assembly, the deviation or failure will be recorded, the component replaced, if necessary, and the qualification test continued. The appurtenance manufacturer will be informed of the anomaly and be requested to retest/requalify or provide justification for the anomaly.

C

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SECTION A

GENERAL TYPE TEST PROCEDURE FOR THE ENVIRONMENTAL QUALIFICATION OF FISHER CONTROLS COMPANY BUTTERFLY CONTROL VALVES TO CONDITIONS SIMULATING NUCLEAR POWER GENERATING STATION IN-CONTAINMENT SERVICE FOR EITHER A BWR OR A PWR PLANT.

1.0 SCOPE:

This test plan delineates the steps to be used by Wyle Laboratories to perform a type test of a Fisher Controls Company Butterfly Control Valve in accordance with the intent of IEEE Standard 323-1974, IEEE Standard for Qualifying Class IE Equipment for Nuclear Power Generating Stations; IEEE Standard 344-1975, IEEE Recommended Practices for Seismic Qualification of Class IE Equipment for Nuclear Power Generating Stations; IEEE Standard 382-1972, Trial-Use Guide for Type Test of Class 1 Electric Valve Operators for Nuclear Power Generating Stations; and Bechtel Power Corporation Specifications 10466-M-236, M-237, and J605, Appendix L. The type test will consist of the individual tests in the order listed below:

(a) Functional Test
(b) Normal Condition Load TEst
(c) Functional Tst
(d) Aging Simulation
(e) Functional Test
(f) Nuclear Radiation Exposure
(g) Functional Test

D

(h) Seismic Testing*

(i) Functional Test

(j) Design Basis Event Load Test

(k) Post-DBE Leakage Tests

(l) Post-DBE Functional Test (for information only)

(m) Post-DBE Radiation Exposure

(n) Post-Radiation Functional Test (for information only)

(o) Inspection

*Seismic Test will be presented in the Seismic Qualification Plan, FQP-23.

1.1 ACCEPTANCE CRITERIA:

Qualified acceptance will require that the following malfunctions do not occur. Whenever any of these malfunctions occur, the specified deviation data will be formally submitted to Bechtel for evaluation of acceptability for the specific application:

VALVE:

(A) Loss of performance characteristics; e.g., ability to change position (from open to closed or closed to open).

(B) For leakage acceptance criteria, see Table 5, page 39.

ACTUATOR:

(A) Failure to perform its safety-related function.

SOLENOID AND VERSA VALVE:

(A) Valve does not traverse to fail-safe position upon loss of electric power.

LIMIT SWITCH:

(A) Valve does not remain in proper position.

(B) Indicator lights function improperly. (*, **)

* The circuit which will be used to monitor limit switch function which includes the indicator lights is per Bechtel Drawing E-03GT03(Q), Revision 0. (See Section D).

** The indicator light for "Open" may flicker, flutter, or dim, but must return to its fully illuminated condition. The indicator light for "Closed" may flicker or flutter but must return to its fully un-illuminated condition.

JUNCTION BOX, TERMINAL BLOCKS, SEALS, WIRING:

(A) Performance impairs safety-related function of solenoid valve and/or limit switches.

PRESSURE REGULATOR:

(A) Supply pressure exceeds 125% of regulator setting.

Nonoccurrence of any of the above is necessary qualification for the test valve assembly.

1.0 TEST FIXTURES:

Prior to beginning the test sequence described in this procedure (FCP-19), the test valve will be outfitted with a special spool-piece flange assembly on both the inlet and outlet sides of the valve. Each spool-piece flange will consist of two (2) ANSI Class 150 weld neck flanges welded together.

The purpose of these special spool-piece flanges is to allow the installation or removal of a bell-flange housing on either the inlet or outlet side of the valve without disturbing the flange bolting on the valve body itself. B

These special spool-piece flanges are to be installed on the valve prior to initiation of the test sequence described in section 1.0 and are not to be removed or readjusted throughout the entire sequence except as required to replace or readjust the T-ring seal at the points specified in the test sequence.

2.0 FUNCTIONAL TEST:

The functional test will be performed to ensure that all components perform without malfunction prior to any condition simulation. Base line measurements will be taken on various parameters as noted per Items 2.1 thru 2.8 below:

A regulated gas supply will be connected to the solenoid valve of the test valve assembly. Nominal flow, as received from the gas supply when the solenoid valve is actuated, will be used. The functional tests will be performed with a voltage to the electrical appurtenances of 90 V DC, 125 V DC, and 140 V DC.

The parameters will be measured at times specified at select points in the test procedure. The functional test parameters to be measured are as follows:

2.1 Time duration of the operating stroke: Opening and closing times will be recorded. (A cycle is defined as going from the full-closed to the full-open and back to the full-closed position). B

2.2 Seat leakage per Fisher Controls Continental Test Specification, CTS 1.21, with Appendix included in Section C. See Table 5, page 33, for seat leak test pressures and allowable leakages. C

2.3 Pressure of regulated gas supply to solenoid valve will be 70 PSIG.

2.4 Regulator inlet and outlet pressure.

2.5 Type of gas being used.

2.6 Voltage to solenoid.

2.7 Voltage to limit switch.

2.8 Functionability of indicator lights and proper indication.

3.0 NUCLEAR RADIATION EXPOSURE:

3.1 The radiation exposures for normal operation and a Design Basis Event will be combined into a single exposure. The test valve assembly will be uniformly exposed to a source of Cobalt-60 for a period that will yield an exposure of 1.0×10^7 RAD equivalent air dose. Following the exposure to radiation, a functional test will be performed.

The radiation dose rate shall be low enough to limit the temperature rise of the valve to 20°C. In no event will the radiation dose rate exceed 1.0 Megarad per hour. E D

Following the radiation exposure outlined above, functional tests will be performed per Section 2.0. The seat leakage test at this point will be performed for information only. Since the bulk of this radiation exposure represents the DBE radiation simulation, the shut-off capability of the valve must be judged in conjunction with the high temperature simulation of the DBE, i.e. the high temperature expansion of the T-ring during the DBE will have a beneficial effect in helping the valve to maintain its shut-off capability despite any concurrent radiation damage. Thus, leakage following the radiation-only sequence is not significant providing that the valve can demonstrate effective shut-off against the DBE pressure and temperature profile specified in Section 7.04. D

3.2 The post-DBE radiation exposure described in Section 9.3, page 28, is for information only and will not affect the qualification of the test valve assembly. The test valve will be uniformly exposed to a source of Cobalt-60 for a period that will yield an exposure of 90 Megarads. This will bring the total radiation exposure of the valve to 100 Megarads (10^8 Rads).

The radiation dose rate during this final exposure shall be low enough to limit the temperature rise of the valve to 20°C. In no event will the radiation dose rate exceed 1.0 Megarad per hour.

3.3 During both of the radiation exposures described above, the special spool-piece test fixture flanges will be installed on the valve; however, there will be no bell flanges or other attachments so that both ends of the test fixture remain open to the radiation.

4.0 AGING SIMULATION

In order to simulate exposure to temperature, humidity, and operating cycles in excess of the 4-year qualified life, a procedure compatible with IEEE 382-1972, Trial-Use Guide for Type Test of Class 1 Electric Valve Operators for Nuclear Power Generating Stations, and IEEE 323-1974, IEEE Standard for Qualifying Class IE Equipment for Nuclear Power Generating Stations, will be employed.

4.05 After completion of the Normal Condition Load Tests (Section 6.0) and prior to beginning the aging simulation described below, the valve T-ring seal will be examined and may be replaced if necessary at the descretion of the Fisher Test Engineer. Following this examination and possible replacement, the T-ring seal will be adjusted for a shut-off pressure differential of 75 psid, after which a series of baseline functional tests will be performed as outlined in Section 2.0. C

The closure stroking time measured during these functional tests is the initial stroking time factor (T_i) described on page 10 and shall be recorded as such in the final test report. This stroking time measurement must utilize the same RVDT or other stem motion detection device that will be utilized in the DBE tests described in Sections 7.03 and 7.3. C

4.1 The test valve assembly will be subjected to alternate cycles of temperature and humidity with concurrent stroking of the valve during the humidity cycle. The valve will be stroked using a pressure of 90 PSIG to the actuator (during aging simulation only) which represents the maximum allowable working pressure for the actuator on the test valve. Pressures in excess of the maximum allowable working pressure may result in damage to the torque-producing mechanisms of the actuator.

4.2 Each temperature cycle will be 2.85 days at 227.8°F (108.8°C). Total exposure at temperature will be 28.5 days (10 cycles). The temperature of 227.8°F (108.8°C) was chosen to simulate temperature aging since it yielded a reasonable test duration. Based on the 10°C Rule, this temperature and test duration should age the valve assembly equivalent to 5 years at 120°F. This is in excess of the qualified life of 4 years. It was determined arithmetically as follows:

NORMAL CONDITION DESIGN TEMPERATURE = 120°F (48.8°C)

TEST DURATION	TEST TEMPERATURE	
5 yrs.	@ 120°F	(48.8°C)
2-1/2 yrs.	@ 137.8°F	(58.8°C)
1-1/4 yrs.	@ 155.8°F	(68.8°C)
5/8 yrs. (228-1/8 days)	@ 173.8°F	(78.8°C)
5/16 yrs. (114-1/16 days)	@ 191.8°F	(88.8°C)
5/32 yrs. (57-1/3 days)	@ 209.8°F	(98.8°C)
5/64 yrs. (28-1/2 days)	@ 227.8°F	(108.8°C)

Humidity will not be controlled during the temperature cycle. It will, however, be recorded.

4.3 Each humidity cycle will be 48 hours at 140°F (60°C) and 95 $^{+5}_{-0}$ per cent humidity. Total exposure to humidity will be 20 days (10 cycles).

4.4 The test valve will be actuated for 1,000 operating cycles which will be evenly divided between the ten humidity cycles. The voltage to the electrical appurtenances for operating the valve will be 125 V DC. When not stroking, the valve will remain in the closed position. Both the opening and closing stroke times, as measured from the change in solenoid energization to the limit switch contact at the opposite end of travel, will be measured and recorded during the first full cycle stroking operation of each humidity cycle. C

4.5 Throughout the aging simulation sequence, the special test fixture spool-pieces will remain in place on the valve. A bell flange will be attached to the inlet side of the valve test fixture and will remain in place throughout the aging simulation so that the inlet side of the valve can be pressurized when required. The outlet side of the valve fixture will remain open so as to fully expose the T-ring seal to the test chamber environment.

In order to provide a realistic evaluation of any seat leakage change which might occur during the heat aging simulation, the inlet bell flange will be pressurized periodically and the seat leakage observed while the valve is experiencing one of the high temperature (227.8°F) cycles. If any leakage is observed during this inspection, a bell flange will be installed on the outlet side of the valve test fixture so that the leakage can be collected and measured. This test is to be performed at the end of the first, fourth, seventh, and last high temperature cycles of the sequence. The test fluid, test pressure, and allowable leakages are specified in Table 5, page 39.

4.6 At the conclusion of the entire aging simulation sequence, the valve assembly will be stabilized at ambient temperature and functional tests performed per Section 2.0. The seat leakage test at this point will be performed for information only because of the unrealistic nature of the compression set which is expected to occur during the high temperature phase of the aging simulation.

4.7 Following the functional tests described above, the T-ring seal will be readjusted for a shut-off pressure differential of 75 psid. This is to compensate for the unrealistic temperature set which will occur in the elastomeric T-ring seal during the high temperature accelerated aging tests.

4.8 Following readjustment of the T-ring seal, functional tests will again be performed per Section 2.0.

5.0 SEISMIC VIBRATION TESTING:

Once the radiation exposure and post-radiation functional tests have been completed, the test valve assembly will undergo seismic testing per the procedure delineated in the Fisher Seismic Qualification Plan, FQP-23, with the exceptions noted below. Following the seismic testing, functional tests will be performed per Section 2.0 of this procedure (FQP-19).

Performance criteria during both the seismic test and post-seismic functional tests will be as outlined in FQP-23 with the exception of the seat leakage criteria which will be as specified in Table 5, page 39, FQP-19.

The seismic test parameters normally specified in Table 3, page 12, FQP-23 will be as listed below:

a. Valve position during seismic testing - closed
b. Seat leak test pressure - 75 psi
c. Body pressure and fluid during seismic testing - 75 psi air
d. Max closing time - unspecified
e. The RIM input required in Section 2.3, FQP-23 will be as specified in Figure 2, page 6.0, FQP-23.

6.0 NORMAL CONDITION LOAD TEST:

A series of Normal Condition Load Tests will be conducted following the initial baseline functional tests. These tests are designed to show functionality of the valve assembly at various normal and off-normal load conditions.

With the T-ring seal adjusted to a shut-off pressure differential of 150 psid and the special test fixture spool-pieces installed on the valve, the valve assembly will be subjected to the various tests as specified in the procedures below. A bell flange will be installed on the inlet side of the valve test fixture to allow pressurization of the valve inlet with either air or water.

6.1 After the valve assembly has been installed in a test chamber and the test chamber temperature has been stabilized for 24 hours at 120°F, the valve will be operated through 10 complete stroking cycles.

The test chamber temperature will then be reduced to ambient temperature and stabilized for a period of 24 hours. A seat leakage test will then be performed per CTS 1.21, Rev. 0, using air at a differential test pressure of 75 psid. The seat leakage criteria will be as specified in Table 5, page 39.

Upon completion of the above, the same test, as outlined above in Section 6.1,will be repeated. Both seat leakage measurements will be recorded and any measurable increase in seat leakage must be reported immediately to the Fisher Test Engineer for evaluation. Fisher will then be responsible for immediately notifying Bechtel of this increase.

6.2 After completion of the above, the test chamber will be stabilized for 24 hours at 140°F after which the valve will be operated through 5 complete stroking cycles.

The test chamber temperature will then be reduced to ambient temperature and stabilized for a period of 24 hours. A seat leak test will then be performed per CTS 1.21, Rev. 0, using water at a differential test pressure of 150 psid. The seat leakage will be collected and measured and the leakage criteria will be as specified in Table 5, page 39.

Upon completion of the above, the same test, as outlined above in Section 6.2, will be repeated. Both seat leakage measurements will be recorded and any measurable increase in seat leakage must be reported immediately to the Fisher Test Engineer for evaluation. Fisher will then be responsible for immediately notifying Bechtel of this increase. B

6.3 After completion of the above, the test chamber temperature will be stabilized for 24 hours at 170°F, after which the valve will be operated through 2 complete stroking cycles.

The test chamber will then be reduced to ambient temperature and stabilized for a period of 24 hours. A seat leak test will then be performed per CTS 1.21, Rev. 0, using water at a differential test pressure of 150 psid. The seat leakage will be collected and measured and the leakage criteria will be as specified in Table 5, page 39.

Upon completion of the above, the same test, as outlined above in Section 6.3, will be repeated. Both seat leakage measurements will be recorded and any measurable increase in seat leakage must be reported immediately to the Fisher Test Engineer for evaluation. Fisher will then be responsible for immediately notifying Bechtel of this increase.

B

7.0 DESIGN BASIS EVENT LOAD TEST:

7.01 A bell flange will be secured to the outlet side of the valve assembly test fixture while the inlet side of the valve fixture will remain open and exposed to the test chamber pressure.

7.02 Prior to beginning the DBE sequence outlined below, the valve assembly will be installed in the test chamber and the chamber environment stabilized for one hour at 120°F and approximately 55 percent relative humidity.

7.03 Upon stabilization of the temperature and relative humidity, the valve will be stroked through one complete operational cycle and the stroking time measured in both directions. This stroking time measurement must utilize the same RVDT or other stem motion detection device utilized in the functional tests described in Section 4.05.

7.04 The test valve assembly will then be subjected to a steam exposure profile, depicted in Figure 1, and a chemical spray for the design basis event environment simulation for in-containment service with either a BWR or a PWR plant. The DBE simulation will be accomplished using superheated steam for the first 8 hours and saturated steam for the remainder of the 30 days.

7.1 The temperature, pressure, and humidity will be recorded continuously during the DBE simulation along with disc position, operating air pressure, voltage to solenoid valve, and voltage to limit switches.

7.2 Seat leakage will be monitored continuously during the entire DBE simulation. The seat leakage will be monitored with the test chamber pressure applied directly to the inlet side of the valve. (Refer to CTS 1.21, Revision 0, with appendix in Section C).

7.3 The test valve assembly will not be stroked open during the DBE simulation. It will be stroked closed when the test chamber pressure is 6 psig and will remain in the fully-closed position throughout the DBE simulation and the post-DBE leakage tests. The closure stroking time measured here is the final stroking time factor (T_f) described on page 10 and shall be recorded as such in the final test report. This stroking time measurement must utilize the same RVDT or other stem motion detection device utilized in the functional tests described in Section 4.05.

7.4 At the start of the DBE simulation, initiate a chemical spray with the chemical composition and spray rate per IEEE 323-1974 and maintain throughout the entire DBE simulation. The PH level of the spray shall be maintained as follows:

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PH	DURATION
11.0 (Maximum)	0 to 7,200 Seconds
8.5 to 9.0	7,200 seconds to 30 days

6

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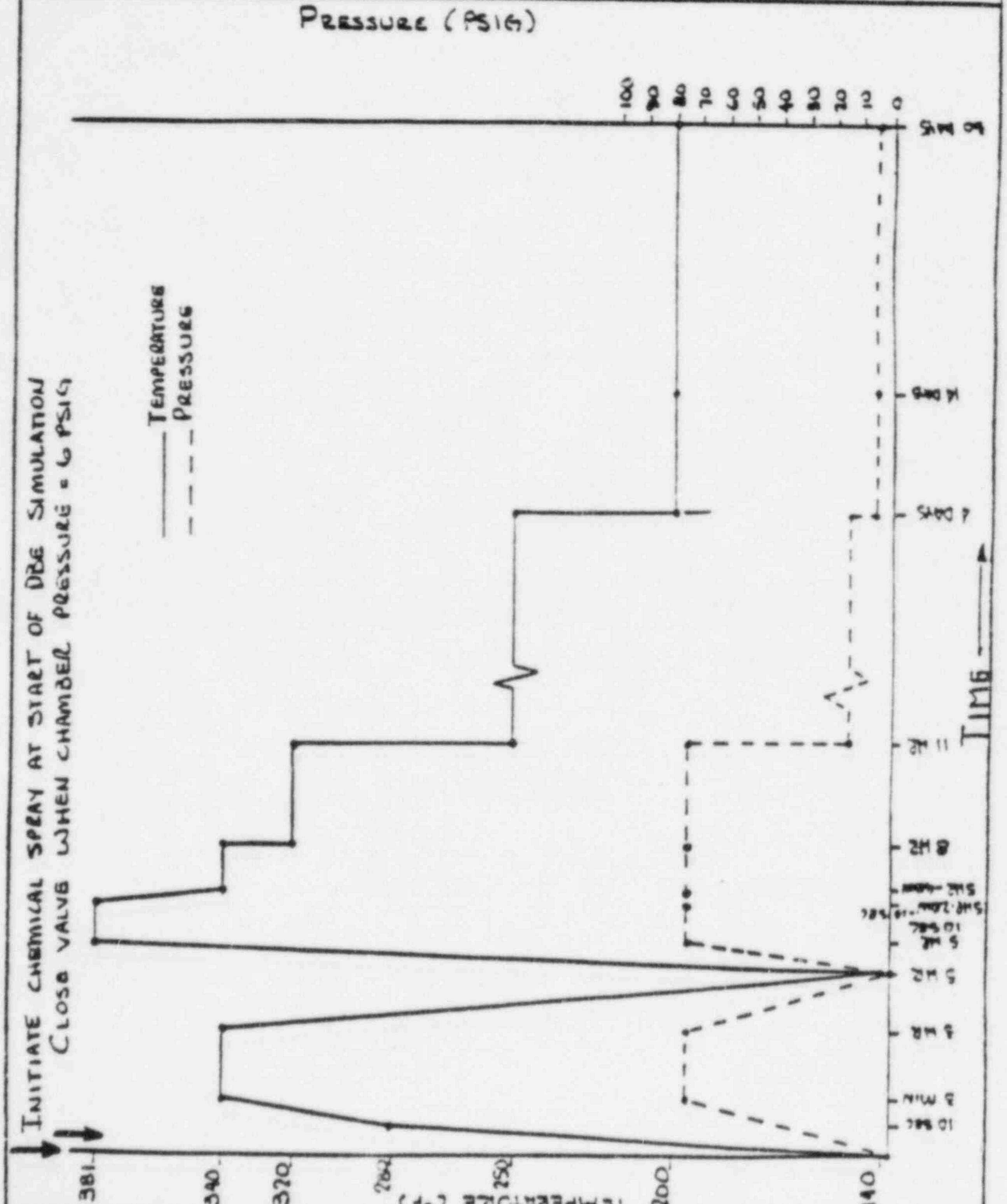
FISHER CONTROLS COMPANY
CONTINENTAL DIVISION
Coraopolis, Pennsylvania 15108

ENGINEERING DATA



SUBJECT Temp / Press Profile for DBE Simulation

BY R.C. Sevcik DATE 11-6-78

FIGURE 1

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8.0 DBE AND POST-DBE LEAK TESTS:

8.1 During the DBE test, the outlet side of the valve will be equipped with a bell flange utilizing a pressure line which connects the valve outlet to a leakage measurement device located outside the test chamber. The inlet side of the valve test fixture will be left open to allow free access of the test chamber pressure to the valve inlet.

Using the procedures outlined in Fisher Controls Continental Test Specification CTS 1.21 with Appendix CCN 6F133-01, the test valve seat leakage shall be monitored continuously throughout the DBE test. The leak test pressure shall be the DBE test chamber pressure as defined in Figure 1, "Temperature/Pressure Profile for DBE Simulation".

DBE qualification acceptance criteria shall consist solely of proof that the valve failed closed at the appropriate time and remained closed throughout the remainder of the DBE test with measured seat leakage less than or equal to that specified in Table 5, page 39, as well as satisfactory completion of the post-DBE seat leakage tests as specified in Sections 8.2 and 8.3 below.

8.2 Upon completion of the DBE test outlined in Section 7.0, the test chamber temperature shall be reduced to 125°F and stabilized at this temperature for one hour. Once the temperature has stabilized, the test chamber pressure shall be maintained at 2.5 psig for 15 minutes and the seat leakage measured and recorded. The seat leakage criteria will be as specified in Table 5, page 39.

8.3 Following the test outlined above in Section 8.2, the test chamber temperature shall be reduced to 100°F and stabilized at this temperature for one hour. Once the temperature has stabilized, the test chamber pressure shall be maintained at 2.5 psig for 15 minutes and the seat leakage measured and recorded. The seat leakage criteria will be as specified in Table 5, page 39.

9.0 POST DBE FUNCTIONAL TEST - "FOR INFORMATION ONLY"

Upon completion of the DBE simulation and post-DBE leakage checks, the following tests are to be performed for information only and are not subject to the acceptance criteria of Section A, paragraph 1.1.

9.1 The temperature in the test chamber will be stabilized for 1/2 hour at 120°F. The relative humidity will be monitored but not controlled. Upon stabilization of the temperature, perform seat leak tests with air at pressure differentials of 10, 20, 30, 40, 50, 60, and 75 psid per Fisher Controls Continental Test Specification CTS 1.21 with Appendix CCN 6F133-01. Record any leakage that occurs.

9.2 Exercise the test valve through one complete stroking cycle, then time the duration of the operating stroke. Opening and closing times will be recorded. (A stroking cycle is defined as going from the full-closed to the full-open and back to the full-closed position).

9.3 Remove the valve from the test chamber. Then with the valve in the closed position, the test valve assembly will be uniformly exposed to a source of Cobalt-60 radiation for a period that will yield an exposure of 90 Megarads. This will bring the total radiation exposure of the valve to 100 Megarads (1×10^8 rads). The performance of this test will conform to the requirements of Section 3.0.

9.4 Following the radiation, take care to maintain the valve in the closed position. Then, place the valve assembly in a test chamber where the valve temperature can be raised to 120°F. The relative humidity will be monitored but not controlled. Upon stabilization of the valve temperature at 120°F, perform seat leak tests with air at pressure differentials of 10, 20, 30, 40, 50, 60, and 75 psid per Fisher Controls Continental Test Specification CTS 1.21 with Appendix CCN 6F133-01. Record any leakage that occurs. C B

9.5 Exercise the test valve through one complete stroking cycle, then time the duration of the operating stroke. Opening and closing times will be recorded.

FISHER CONTROLS COMPANY
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10.0 INSPECTION:

Upon completion of the test, the test valve assembly will be disassembled and visually inspected. The condition of the test valve assembly components will be recorded with sufficient photographs taken to adequately show the post-test condition of the valve assembly including all appurtenances. 8

FISHER CONTROLS COMPANY
CONTINENTAL DIVISION

SECTION B

TYPE TEST OF 20" TYPE 9220 FISHER CONTROLS COMPANY BUTTERFLY CONTROL VALVE FOR BECHTEL POWER CORPORATION TO CONDITIONS SIMULATING NUCLEAR POWER PLANT GENERATING STATION IN-CONTAINMENT SERVICE FOR EITHER A BWR OR A PWR PLANT PER BECHTEL POWER CORPORATION SPECIFICATIONS 10466-M236, M237, AND J605A, APPENDIX L.

1.0 SCOPE:

This test plan delineates the steps to be used by Wyle Laboratories to perform a type test of a 20" Type 9220 Fisher Controls Company Butterfly Control Valve, with the following appurtenances, in accordance with Section B:

Bettis T-420B-SR2- 12 Pneumatic Actuator
ASCO NP8320A135V 3-Way Solenoid Valve
Namco EA18031302 and EA18032302 Limit Switches
Fisher P536 Filter with Brass Element
Fisher 95R Regulator
Tarstack 35R Pressure Relief Valve
Hoffman Junction Box W/G.E. #EB-25 Terminal Strips
Versa VSP-3501-155E Pneumatic 3-way Valve

1.1 Index of Tables & Graphs:

FISHER CONTROLS COMPANY
CONTINENTAL DIVISION

TABLE I

VALVE CATEGORIES

VALVE CATEGORY	P.O. ITEM NO.	BODY ENDS SHAFT DIAMETER	ACTUATOR	APPURTENANCES
I	605A-1.0	20" - 9220 ANSI B16.5 Class 150 1-3/4" ø Shaft	Bettis T-316B-SR2-M3-12	(1) Bailey Positioner #AP2-1-2-1- 0 (1) National ACME Limit Switch #EA18031302 (1) Fisher P595 Filter with Brass Element (1) Fisher 95H Regulator (1) ASCO #NP8320A185V 3-Way Solenoid Valve (1) Texsteam 35R Pressure Relief Valve (1) Versa VSP-3501-155H 3-way Valve
II	605A-2.0	14" - 9220 ANSI B16.5 Class 150 2" ø Shaft	Bettis T-416B-SR3-M3-12	(1) Texsteam 35R Pressure Relief Valve (1) ASCO NP8320A185V 3-Way Solenoid Valve (1) National ACME Limit Switch #EA18032302 (1) Fisher 95H Regulator (1) Fisher P595 Filter with Brass Element (1) National ACME Limit Switch #EA18031302 (1) Versa VSP-3501-155H 3-way Valve
III	605A-3.0	6" - 9220 ANSI B16.5 Class 150 3/4" ø Shaft	Bettis N 521C-SR80-12	(1) Bailey Positioner #AP2-1-2-1- 0 (2) Fisher 95H Regulator (2) Fisher P595 Filter with Brass Element (1) Fisher Transducer #546 (1) National ACME Limit Switch #EA18032302 (2) Texsteam 35R Pressure Relief Valve (1) National ACME Limit Switch EA18031302
IV	236-1.01	20" - 9270 ANSI B16.5 Class 150 1-3/4" ø Shaft	Limitorque H2BC Handwheel	
V	236-1.02	18" - 9270 ANSI B16.5 Class 150 1-1/2" ø Shaft	Fisher 1073 Handwheel (18"ø)	

TABLE I (Continued)

VALVE CATEGORIES

VALVE CATEGORY	P.O.-ITEM NO.	BODY ENDS SHAFT DIAMETER	ACTUATOR	APPURTENANCES
VI	236-1.03	16" - 9220 ANSI B16.5 Class 150 1-1/2" ∅ Shaft	Fisher 1073 Handwheel (12" ∅)	
VII	236-1.05	12" - 9220 ANSI B16.5 Class 150 1-1/4" ∅ Shaft	Fisher 1073 Handwheel (12" ∅)	
VIII	236-1.06	10" - 9220 ANSI B16.5 Class 150 1" ∅ Shaft	Fisher 1073 Handwheel (8" ∅)	
IX	236-1.07	8" - 9220 ANSI B16.5 Class 150 1" ∅ Shaft	Fisher 1073 Handwheel (8" ∅)	
X	236-2.01	24" - 9220 ANSI B16.5 Class 150 2" ∅ Shaft	Limitorque SMB 00/10-H3BC	
XI	236-2.02	18" - 9220 ANSI B16.5 Class 150 1-1/2" ∅ Shaft	Limitorque SMB 000/5-H2BC	

TABLE 1 (Continued)

VALVE CATEGORIES

VALVE CATEGORY	P.O.-ITEM NO.	BODY ENDS SHAFT DIAMETER	ACTUATOR	APPURTENANCES
XII	236-2.03	12" - 9220 ANSI B16.5 Class 150 1-1/4" ϕ Shaft	Limitorque SMB 000/2-H1BC	
XIII	236-2.04	8" - 9220 ANSI B16.5 Class 150 1" ϕ Shaft	Limitorque SMB 00/5- H1BC	
XIV	236-2.05	6" - 9220 ANSI B16.5 Class 150 3/4" ϕ Shaft	Limitorque SMB 00/5- H1BC	
XV	237-1.02	36" - 9220 API - 605 Class 150 BWE/Flange 2-1/2" ϕ Shaft	Bettis T-420B-SR2-12	(1) Versa VSP-3501-155H 3-way Valve (1) Texsteam 35R Pressure Relief Valve (1) Fisher 95H Regulator (1) Fisher P595 Filter with Brass Element (1) ASCO NPB320A185V 3-Way Solenoid Valve (1) National ACME Limitswitches #EA180032302 (1) Hoffman Junction Box W/G.E. #EB-25 Terminal Strips and assorted unilet seals (1) National ACME Limit Switch EA18031302
XVI	237-1.06	18" - 9220 ANSI B16.5 Class 150 BWE/Flange 2" ϕ Shaft	Bettis T-416B-SR3-12	(1) Versa VSP-3601-155H 3-way Valve (1) Fisher 95H Regulator (1) Fisher P595 Filter with Brass Element (1) ASCO NPB320A185V 3-Way Solenoid Valve (1) National ACME Limitswitch #EA18032302 (1) Hoffman Junction Box W/G.E. #EB-25 Terminal Strips and assorted unilet seals (1) Texsteam 35R Pressure Relief Valve (1) National ACME Limit Switch EA18031302

TABLE I (Continued)

VALVE CATEGORIES

VALVE CATEGORY	P.O.-ITEM NO.	BODY ENDS SHAFT DIAMETER	ACTUATOR	APPURTENANCES
XVII	237-2.02	14" - 9220 ANSI B16.5 Class 150 BWE/Flange 1-1/2" ∅ Shaft	Limitorque SMB 000/5-H2BC	
XVIII	237-2.05	10" - 9220 ANSI B16.5 Class 150 BWE/Flange 1-1/4" ∅ Shaft	Limitorque SMB 000/2-H1BC	
XIX	237-2.07	6" - 9220 ANSI B16.5 Class 150 BWE/Flange 3/4" ∅ Shaft	Limitorque SMB000/2-H0BC	
XX	236-2.07	20" - 9220 ANSI B16.5 Class 150 2" ∅ Shaft	Limitorque SMB 000/5-H1BC	
XXI	236-1.01	8" - 9220 ANSI B16.5 Class 150 1" ∅ Shaft	Fisher 1071 Handwheel (8" ∅)	

TABLE 8

FUNCTIONAL TEST ALLOWABLE PARAMETERS AND TEST RESULTS

VALVE: 10466-J605-ITEM 1.9 WITH
ACCESSORIES FROM 10466-M237-ITEM 1.08

	Allowable Value	Initial Functional Test Results	Post Radiation Exposure Functional Test Results	Functional Test Results at Each Stage of Aging: 1st	2nd	3rd	4th		Normal Conditions Load Test Functional Test Results	Post DBE Functional Test Results (For Information Only)	Post DBE/Radiation Functional Test Results (For Information Only)
Type of Gas	Air or Nitrogen										
Pressure of Gas to Solenoid	70 PSIG										
Regulator Pressure Inlet: Outlet:	150 PSIG 70 PSIG										
Time duration of operating cycle: OPEN: CLOSE:	--------- As measured										
Seat Leakage	Table 5										
Voltage to Solenoid											
Voltage to Limit Switch											
Indicator Light Function											

FISHER CONTROLS COMPANY
CONTINENTAL DIVISION

TABLE 3a

DBE RADIATION EXPOSURE TEST

VALVE: 10466-J605-ITEM 1.0 WITH
ACCESSORIES FROM 10466-M237-ITEM 1.02

SOURCE OF RADIATION: ______________________

RATE OF RADIATION EXPOSURE: ______________________

TOTAL RADIATION EXPOSURE: ______________________

NOTE:

Wyle Laboratories to supply Certificate of Compliance with the required radiation exposure.

TABLE 3b

SUPPLEMENTAL RADIATION EXPOSURE TEST
(For Information Only)

VALVE: 10466-J605-ITEM 1.0 WITH
ACCESSORIES FROM 10466-M237-ITEM 1.02

B

SOURCE OF RADIATION: ____________________

RATE OF RADIATION EXPOSURE: ____________________

TOTAL RADIATION EXPOSURE: ____________________

NOTE:

Wyle Laboratories to supply Certificate of Compliance with the required radiation exposure.

FISHER CONTROLS COMPANY
CONTINENTAL DIVISION

TABLE 4

TEMPERATURE, HUMIDITY, CYCLE TESTING FOR AGING SIMULATION

VALVE: 10466-J605-ITEM 1.0 WITH
ACCESSORIES FROM 10466-M237-ITEM 1.02

AGING CYCLE	START DATE	FINISH DATE	TEMPERATURE	HUMIDITY	NO. OF ELAPSED OPERATING CYCLES

TABLE 5

SEAT LEAKAGE TEST CRITERIA, ALLOWABLE LEAKAGE, AND TEST RESULTS

Test Description	Test Fluid	Test Pressure	Allowable Leakage	Measured Leakage
1. Initial Functional tests (Sect. 2.0)	Air	75 psid	1472 cc/min.†	
2. Normal Condition Load Tests:				
120°F (Sect. 6.1)				
Initial	Air	75 psid	1472 cc/min.	$
Final	Air	75 psid	No Increase	
140°F (Sect. 6.2)				
Initial	Water	150 psid	5 ml/min.	
Final	Water	150 psid	No Increase	
170°F (Sect. 6.3)				
Initial	Water	150 psid	5 GPM	
Final	Water	150 psid	No Increase	
3. Pre-Aging Baseline Functional Tests (Sect. 4.05)	Air	75 psid	1472 cc/min.	
4. Aging Simulation High Temperature Cycles (Sect. 4.5)				
First Cycle	Air	75 psid	1472 cc/min.	
Fourth Cycle	Air	75 psid	1472 cc/min.	
Seventh Cycle	Air	75 psid	1472 cc/min.	
Last Cycle	Air	75 psid	1472 cc/min.	
5. Post-Aging Functional Air Tests (Sect. 4.6)	Air	75 psid	Information Only	
6. Pre-Radiation Functional Tests Following T-ring Adjustment (Sect. 4.8)	Air	75 psid	1472 cc/min.	
7. Post-Radiation Functional Tests (Sect. 3.1)	Air	75 psid	Information Only	

TABLE 5
(Continued)

Description	Test Fluid	Test Pressure	Allowable Leakage	Measured Leakage
8. Post-Seismic Functional Tests (Sect. 5.0	Air	75 psid	*Note 1	
9. DBE Test (Sect. 8.1)	Steam	DBE Profile Fig. 1	1472 cc/min.	
10. Post-DBE Leakage Tests:				
125°F (Sect. 8.2)	(Air or	2.5 psid	1472 cc/min.	
100°F (Sect. 8.3)	Steam)	2.5 psid	2944 cc/min.	
11. Post-DBE Functional Tests (Sect. 9.1)	Air	10 psid	Information Only	
	Air	20 psig		
	Air	30 psid		
	Air	40 psid		
	Air	50 psid		
	Air	60 psid		
	Air	75 psid		
12. Post-Radiation Functional Tests (Sect. 9.4)	Air	10 psid	Information Only	
	Air	20 psid		
	Air	30 psid		
	Air	40 psid		
	Air	50 psid		
	Air	60 psid		
	Air	75 psid		

*Note 1: The post-seismic allowable leakage = (post-radiation leakage per Sect. 3.1: indicated by # in the measured leakage column) + (1472 cc/min.) - (Normal condition load test data taken after the 120°F test per Section 6.1: indicated by $ in the measured leakage column).

†Note 2: 1472 cc/min. of air is equivalent to 3.12 SCFH.

FISHER CONTROLS COMPANY
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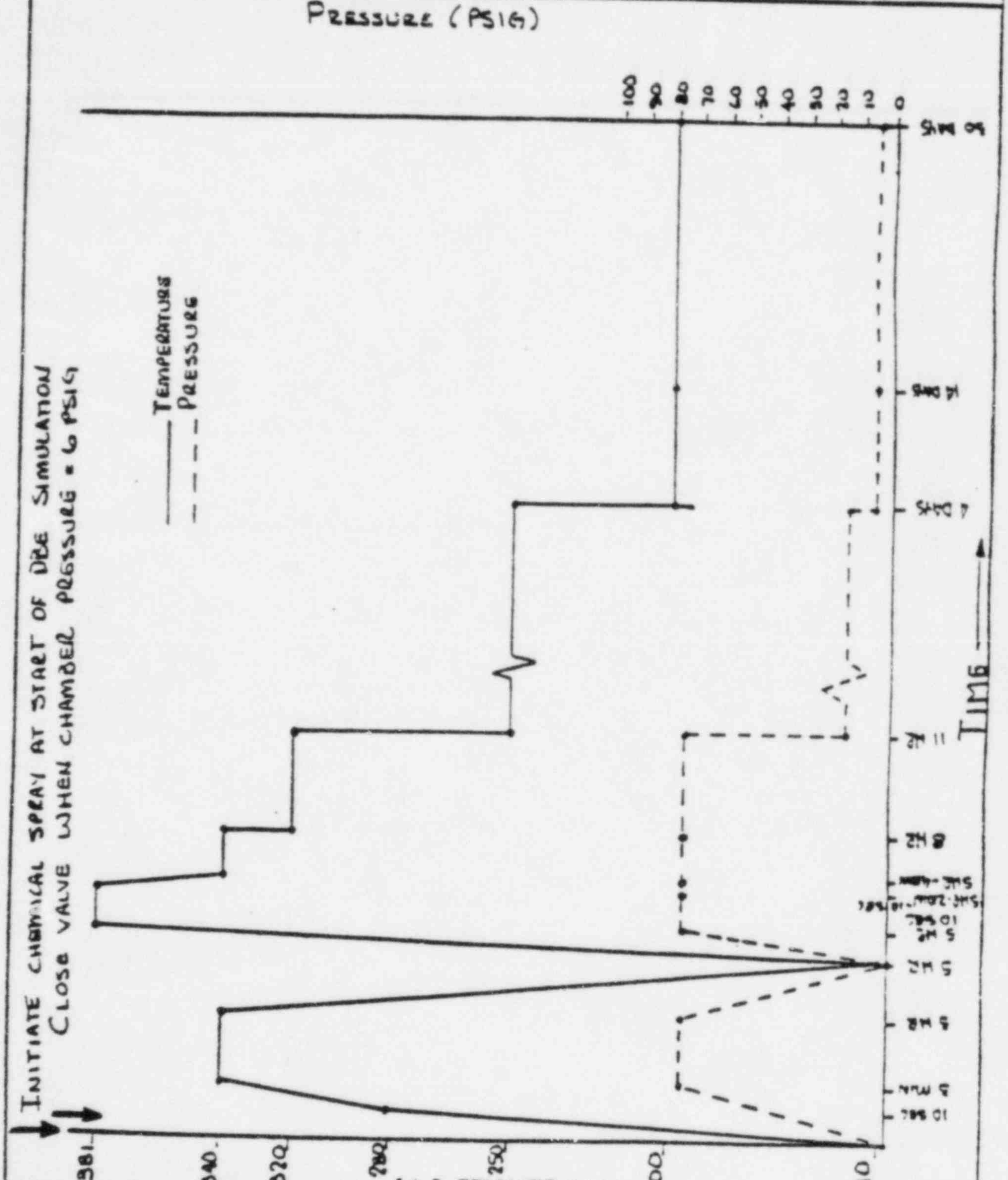
Coraopolis, Pennsylvania 15108

ENGINEERING DATA



SUBJECT Temp / Press Profile for DBE Simulation

BY R.C. Seyczuk DATE 11-6-78

FIGURE 1

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FISHER CONTROLS COMPANY
CONTINENTAL DIVISION

FIGURE 1A

ACTUAL DBE TEST TEMPERATURE/PRESSURE
PROFILE (as maintained by Wyle Laboratories)

VALVE: 10466-J605-ITEM 1.0 WITH
ACCESSORIES FROM 10466-M237-ITEM 1.02

Figure 1A will be inserted at this point by Wyle Laboratories and will show the following:

(1) Actual temperature/pressure profile.

(2) Actual closing time.

(3) A record of the disc position during DBE test.

(4) Record of indicator light performance during DBE.

(5) A record of valve seat leakage throughout the DBE test. 8

(6) Composition of chemical spray and spray rate.

(7) PH level of chemical spray throughout DBE simulation.

FISHER CONTROLS COMPANY
CONTINENTAL DIVISION

TABLE 6

DEVIATIONS FROM STANDARD PERFORMANCE CHARACTERISTICS

VALVE: 10466-J605-ITEM 1.0 WITH
ACCESSORIES FROM 10466-H237-ITEM 1.02

FISHER CONTROLS COMPANY
CONTINENTAL DIVISION

TABLE 7

(Page 1 of)

VALVE AND ACCESSORY COMPONENTS SUBJECT TO DEGRADATION - INSPECTION RESULTS.

VALVE CATEGORY: ____________________

____________ P.O. ITEM NO. ____________________

FISHER CON NO.: ____________________

VALVE SIZE & TYPE: ____________________

ACTUATOR: ____________________

APPURTENANCE: ____________________

PART SUBJECT TO ENVIRONMENTAL DEGRADATION:

____

MATERIAL: ____________________

PART NO.: ____________________

INSPECTION RESULTS AND PHOTOGRAPH:

____

____

____

____

____

____

SECTION C

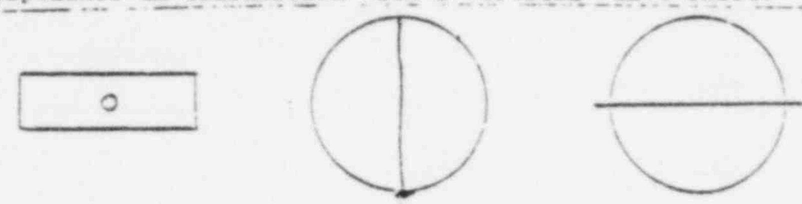
Contents

- *Continental Test Specification, CTS-1.21 Rev 0*
- *Specification/Procedure Appendix Number CCN 6F133-01 Rev 3*

C B

FISHER Controls CONTINENTAL DIV.	CONTINENTAL TEST SPECIFICATION	NO. CTS-1.21	REV: 0
	UNIDIRECTIONAL SEAT LEAK TEST PROCEDURE FOR ELASTOMER AND TEFLON SEATED, ADJUSTABLE TYPE 9200 T-RING VALVES (all valves 20" or less, & larger valves for use in vertical pipelines, or in horizontal pipelines with shafts vertical	DATE 9/10/75	
		DIST. EDL-17	
JOB NO. CD73-168		PAGE 1 OF 5	

1. SCOPE: This specification covers standard unidirectional leak testing of both elastomer and Teflon adjustable Type 9200 T-ring valves. Specifically, it is directed at all valves sizes 20" or less, & larger valves which are intended for installation in vertical pipelines or in horizontal pipelines in combination with a vertical valve shaft.



YES YES NO

2. PURPOSE: The purpose of this specification is to ensure seat leakage rates within those specified in section 8 below, with the valve mounted such as to simulate its intended service position.

3. DEFINITIONS:

Vertical Pipeline - For purposes of definition, a pipeline is considered to be vertical if its axis is less than 30° from true vertical.
Horizontal Pipeline - For purposes of definition, a pipeline is considered to be horizontal if its axis is 60° or less from true horizontal.
Vertical Valve Shaft - For purposes of definition, a valve shaft is considered to be vertical if its axis is less than 30° from true vertical when the valve body is rotated to the true vertical position.

4. APPLICABLE CODES & STANDARDS:

CGS 92-1 Type 9200 T-ring Adjustment Procedure
CTS 1.22 Bidirectional Seat Leak Test Procedure for Elastomer Seated, Adjustable Type 9200 T-Ring Valves (all valves size 20" or less & larger valves for use in vertical pipelines, or in horizontal pipelines with shafts vertical)
CTS 1.23 Unidirectional Seat Leak Test Procedure for Elastomer & Teflon Seated, Adjustable Type 9200 T-Ring Valves (Sizes greater than 20" which are for installation in horizontal pipelines with shafts horizontal)
CTS 1.24 Bidirectional Seat Leak Test Procedure for Elastomer Seated Adjustable Type 9200 T-Ring Valves (Sizes greater than 20" which are for installation in horizontal pipelines with shafts horizontal)

APPROVED BY:		WRITTEN BY:
Manager, Quality Assurance C. L. Reckin	Manager, Sales & Marketing	EH:sb E. Hoffmeier
Manager, Materials NOT REQUIRED	Manager, Manufacturing Dan A. Beale	Manager, Engineering E. Hoffmeier

FISHER Controls CONTINENTAL DIV.	CONTINENTAL TEST SPECIFICATION	NO. CTS-1.21	REV: 0
	UNIDIRECTIONAL SEAT LEAK TEST PROCEDURE FOR ELASTOMER AND TEFLON SEATED, ADJUSTABLE TYPE 9200 T-RING VALVES (all valves 20" or less, & larger valves for use in vertical pipelines, or in horizontal pipelines with shafts vertical)	DATE 9/10/75	
		DIST. EDL-17	
JOB NO. CD73-168		PAGE 2 OF 5	

5. POLICY:
   - Order entry documents shall reference this test specification and shall describe position of valve and actuator when in service.
   - Type 9200 T-ring valves covered by this specification are tested with the valve body and shaft horizontal.
   - Thrust collars are provided on the valve shaft to prevent disc and shaft movement along the shaft axis.
   - Seat leak testing follows any body or disc hydrostatic testing that may be required.
   - Provision for liquid leak testing of Teflon seated valves is included. Liquid leak testing is performed however only as provided by appendices to this specification and as a substitute to the air leak test.
   - Seat leak testing is unidirectional with pressure applied to the shaft side of the seal.
   - It is not necessary to verify disc material and taper pin leak tightness on valves which have previously passed a disc hydrostatic test.
   - Neolube lubricant is placed on adjusting set screw threads and the threaded holes for these set screws prior to initial adjustment.

6. TEST CONDITIONS:

6.1 Valve Assembly - The valve shall be fully assembled, except that the actuator need not be mounted.

SPECIAL PROVISIONS TO ENSURE PERSONNEL SAFETY MAY BE EMPLOYED TO PREVENT ACCIDENTAL DISC OPENING WHILE UNDER PRESSURE.

APPROVED BY:		WRITTEN BY:
Manager, Quality Assurance E. L. Becchion	Manager, Sales & Marketing	EH:sb Ed Hoffgaaren
Manager, Materials NOT REQUIRED	Manager, Manufacturing Dan O Brole	Manager, Engineering Ed Hoffgaaren

FISHER Controls CONTINENTAL DIV.	CONTINENTAL TEST SPECIFICATION	NO. CTS-1.21	REV: 0
	UNIDIRECTIONAL SEAT LEAK TEST PROCEDURE FOR ELASTOMER AND TEFLON SEATED, ADJUSTABLE TYPE 9200 T-RING VALVES (all valves 20" or less, & larger valves for use in vertical pipelines, or in horizontal pipelines with shafts vertical)	DATE 9/10/75	
		DIST. EDL-17	
JOB NO. CD73-168		PAGE 3 OF 5	

6.2 **Test Fluids - Clean, dry, filtered plant air is employed as the pressurizing media except that clean tap water is used to determine liquid leak rates for Teflon seated valves.**

6.3 Test Pressure - Test pressure is the service pressure differential or 10 psi, whichever is greater.

7. TEST PROCEDURE:

a. Test Flanges - The valve shall be bolted between flanges during the seat leak test. A blind flange shall be used on the valve face opposite the T-ring retaining plate and a welding end or a slip-on flange of sufficient inside diameter to expose the T-ring adjusting screws shall be used on the other face.

b. Position - The valve is tested with the body and disc horizontal. Pressure is applied from the underside.

c. Disc Stop Adjustment - The disc stop is adjusted to stop the disc in the center of the seat.

d. T-Ring Adjustment - All T-ring adjustments are performed with the valve between flanges. The adjusting screws are backed off until no contact with the compression ring occurs. The T-ring is then adjusted for the required leakage rate at the specified pressure using the procedure described in CGS 92-1.

e. Air Leak Detection - With the valve disc in the fully closed position, the packing area is coated with a soap solution or commercial leak detector and pressure is applied to the sealed side of the valve. The disc is fully covered with clean tap water to a maximum depth of one inch.

f. Liquid Leak Detection - For liquid leak detection, clean tap water is substituted for air as the pressurizing media. Leak rate is determined by collection and measurement of leakage during a time interval not less than one nor more than 10 minutes.

8. DURATION AND ACCEPTANCE CRITERIA:

8.1 Air Test

a. Elastomer T-ring

APPROVED BY:		WRITTEN BY:
Manager, Quality Assurance E. L. Peachen	Manager, Sales & Marketing	EH:sb E. Hoffgarner
Manager, Materials NOT REQUIRED	Manager, Manufacturing Dave A. Ruler	Manager, Engineering E. Hoffgarner

FISHER Controls CONTINENTAL DIV.	CONTINENTAL TEST SPECIFICATION	NO. CTS-1.21	REV
	UNIDIRECTIONAL SEAT LEAK TEST PROCEDURE FOR ELASTOMER AND TEFLON SEATED, ADJUSTABLE TYPE 9200 T-RING VALVES (all valves 20" or less, & larger valves for use in vertical pipelines, or in horizontal pipelines with shafts vertical)	DATE 9/10/75	
		DIST. EDL-17	
JOB NO. CD73-168		PAGE 4 OF 5	

Packing Seal - No visible leakage in the form of bubbles or spray is permitted upon application of the leak detecting fluid. Two applications of leak detecting fluid are required with the second following the first by a period no less than 5 minutes.

Taper Pins and Disc Material - No visible leakage in the form of bubbles or spray is permitted for a period not less than 2 minutes.

Seat - No visible leakage in the form of bubbles or spray is permitted for a period not less than 10 minutes.

b. Teflon T-Ring

Packing Seal - Same as elastomer T-ring air test

Taper Pins and Disc Material - Test not required

Seat - Leakage past the disc may not exceed the amounts shown in Table I. Interpolation for intermediate pressures is permitted.

VALVE SIZE	TEST PRESSURE (PSI) 10	20	40	60	80	100
2-6	5.00	7.00	11.00	15.00	19.00	23.00
8-12	12.50	17.50	27.50	37.50	47.50	57.50
14-18	20.00	28.00	44.00	60.00	76.00	92.00
20-24	27.50	38.50	60.50	82.50	104.50	126.50
30-36	42.50	59.50	93.50	127.50	161.50	195.50
42-48	57.50	80.50	126.50	172.50	218.50	264.50

TABLE I - MAXIMUM ACCEPTABLE AIR LEAK RATES FOR TEFLON T-RING, SCFH

APPROVED BY:		WRITTEN BY:
Manager, Quality Assurance E. L. Reclini	Manager, Sales & Marketing	EH:sb
Manager, Materials NOT REQUIRED	Manager, Manufacturing	Manager, Engineering

FISHER Controls CONTINENTAL DIV.	CONTINENTAL TEST SPECIFICATION	NO. CTS-1.21	REV: 0
	UNIDIRECTIONAL SEAT LEAK TEST PROCEDURE FOR ELASTOMER AND TEFLON SEATED, ADJUSTABLE TYPE 9200 T-RING VALVES (all valves 20" or less, & larger valves for use in vertical pipelines, or in horizontal pipelines with shafts vertical)	DATE 9/10/75	
		DIST. EDL-17	
JOB NO. CD73-168		PAGE 5 OF 5	

Continental Stand.

8.2 Liquid Test

a. Elastomer T-Ring - Not applicable

b. Teflon T-Ring

<u>Packing Seal</u> - No visible leakage is permitted

<u>Taper Pins and Disc Material</u> - Test not required

<u>Seat</u> - Leakage past the disc may not exceed the amounts shown in Table II. Interpolation for intermediate pressures is permitted.

VALVE SIZE	TEST PRESSURE (PSI) 10	20	40	60	80	100
2-6	.12	.17	.25	.30	.35	.40
8-12	.31	.44	.63	.77	.39	1.00
14-13	.50	.71	1.01	1.23	1.43	1.60
20-24	.69	.98	1.39	1.70	1.96	2.20
30-36	1.07	1.52	2.15	2.63	3.04	3.40
42-48	1.45	2.05	2.90	3.56	4.11	4.60

TABLE II - MAXIMUM ACCEPTABLE WATER LEAK RATES FOR TEFLON T-RING, GPM

9. <u>REPAIR</u>: For any repairs other than T-ring adjustment, the Engineering and Quality Assurance Departments shall be consulted for details.

10. <u>POST TEST CLEANING</u>:

Any valve that must be cleaned for special service shall be cleaned in accordance with the applicable specification, except that removal of T-ring retaining plate following the leak test is prohibited without retesting.

11. <u>RECORDS</u>: The test personnel shall make a complete record of the test procedure, conditions and results.

FQP-19 Rev B (B)

-48-

APPROVED BY:		WRITTEN BY:
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FISHER Controls
CONTINENTAL DIVISION

SPECIFICATION/PROCEDURE APPENDIX NUMBER CCN 6F133-01

UNIDIRECTIONAL SEAT LEAK TEST PROCEDURE FOR ELASTOMER AND TEFLON SEATED, ADJUSTABLE TYPE 9200 T-RING VALVES (All valves 20" or less, & larger valves for use in vertical pipelines, or in horizontal pipelines with shafts vertical).

Nuclear Class 2
Quality Level 2
Revision 3
Date 2-18-80
Page 1 of 1

I. SCOPE:

This appendix modifies and shall only be used with CTS 1.21, Rev. 0 in order to conform to the applicable Bechtel Power Corporation specifications.

II. REFERENCE DOCUMENTS:

A. Bechtel Specification No. 10466-M-237, M-236, J605A
B.
C.

III. MODIFICATIONS TO CTS 1.21 :

A. Test pressure differential is to be 75 PSI, except as noted in Section A, paragraph 9.0, modification C below, or Table 5, page 39.

B. Duration of seat leak test is to be 15 minutes (continuous during the DBE simulation).

C. The test valve fixture will be completely enclosed in bell flanges during the seismic test to allow for monitoring seat leakage as required. During the DBE simulation a bell flange will be secured on the outlet side of the valve only. Seat leakage will be measured throughout the entire DBE simulation with the test chamber pressure applied directly to the inlet side of the valve. A line will be run from the outlet bell flange to the outside of the test chamber for measurement of the seat leakage. C

Test flange configurations for seat leakage measurements during the various test sequences will be as specified in the sections identified below:

Heat aging (Section 4.5)
Radiation (Section 3.3)
Normal condition load tests (Section 6.0)
DBE Tests (Section 7.01)

FCP-13 Rev C 49

WRITTEN BY: Richard C. Sikerelsh

APPROVED BY: John Weekley

PROJECT ENGINEER	MANAGER, ENGINEERING	MANAGER, MANUFACTURING	MANAGER, QUALITY ASSURANCE
[signature]	[signature]	[signature]	[signature]

FORM CO 217—1/73

FISHER CONTROLS COMPANY
CONTINENTAL DIVISION

SECTION D

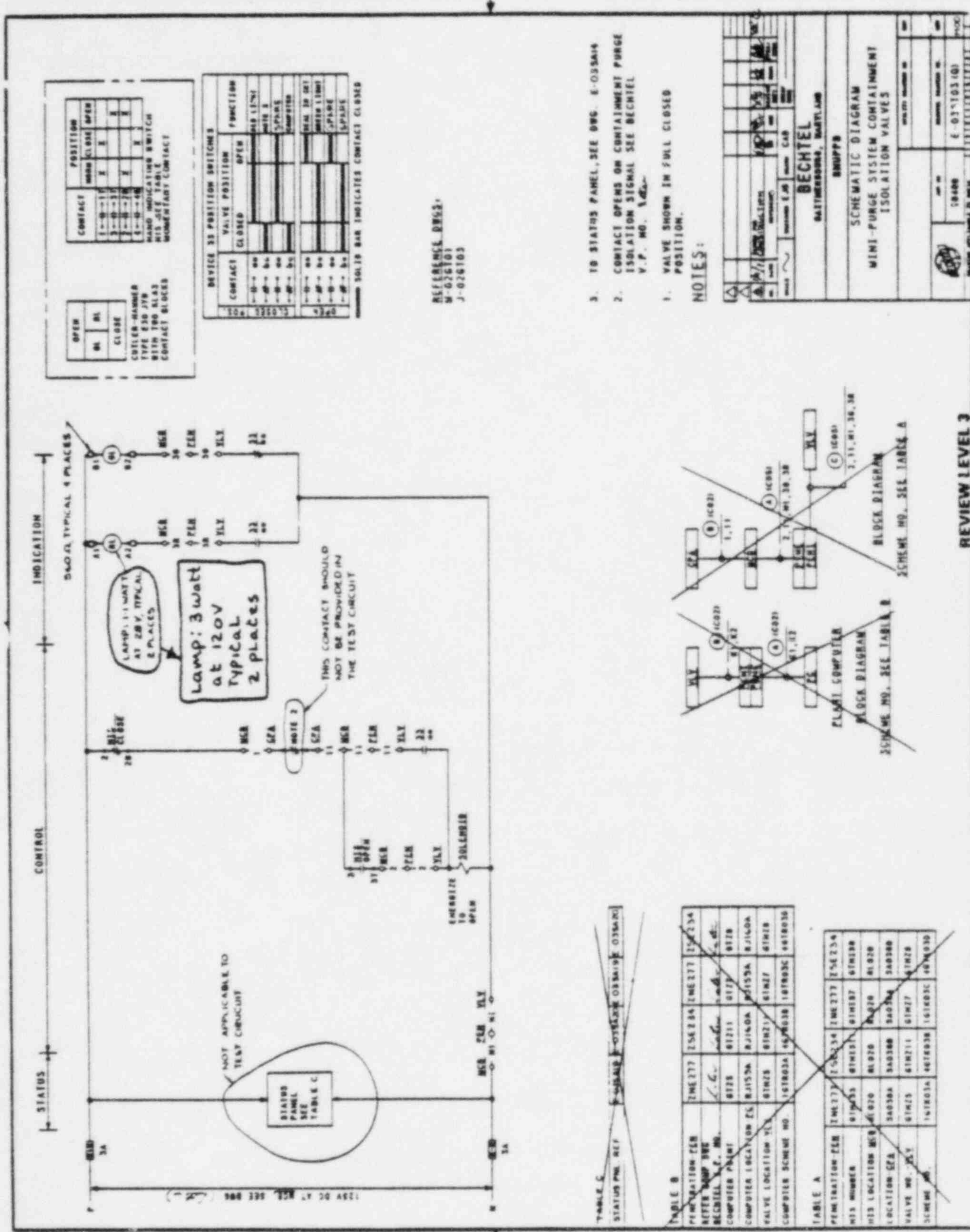
Contents

- Schematic Diagram, Mini-Purge System, Containment Isolation Valves.

  Bechtel Dwg E-03C703 (Q) Rev MOD

- Control Circuit, FQP-19 Rev B p 81

B


BECHTEL
GAITHERSBURG, MARYLAND
SCHEMATIC DIAGRAM
MINI-PURGE SYSTEM CONTAINMENT ISOLATION VALVES
NOTES:
1. VALVE SHOWN IN FULL CLOSED POSITION.
2. CONTACT OPENS ON CONTAINMENT PURGE ISOLATION SIGNAL SEE BECHTEL V.P. NO.
3. TO STATUS PANEL, SEE DWG. E-035A16
STATUS
CONTROL
INDICATION
Lamp: 3 watt at 120V Typical 2 places
THIS CONTACT SHOULD NOT BE PROVIDED IN THE TEST CIRCUIT
NOT APPLICABLE TO TEST CIRCUIT
ENERGIZE TO OPEN
SOLENOID
TABLE A
TABLE B
TABLE C
BLOCK DIAGRAM
PLANT COMPUTER BLOCK DIAGRAM
REVIEW LEVEL 3

443

9510 - ... 068-5

FISHER CONTROLS COMPANY
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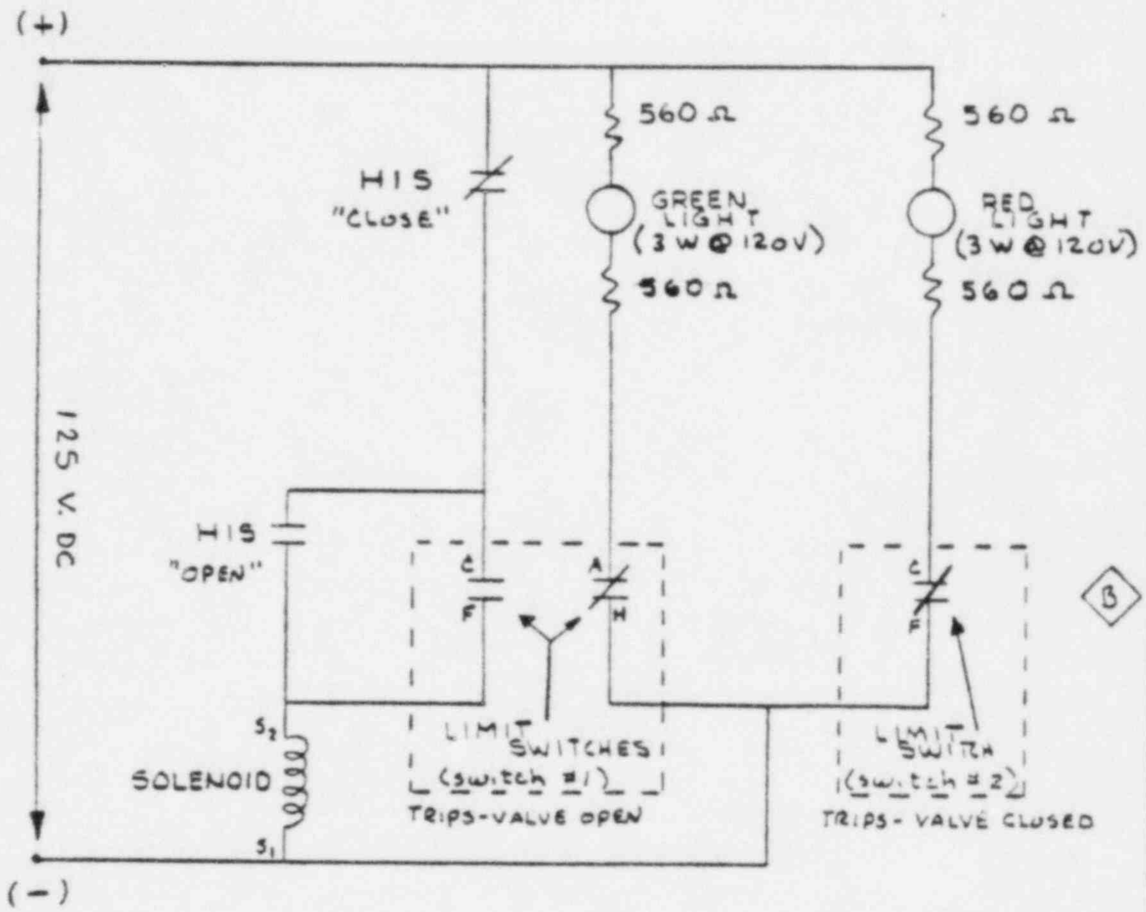
Coraopolis, Pennsylvania 15108

ENGINEERING DATA



HIS - HAND INDICATING SWITCH

GREEN LIGHT - INDICATES VALVE CLOSED

RED LIGHT - INDICATES VALVE OPEN

BOTH LIGHTS - INDICATES VALVE STROKING

THIS SKETCH IS A SIMPLIFIED REPRESENTATION OF THE CIRCUIT DEPICTED ON BECHTEL DWG. E-03GT03 (Q) REV. 0 AND IS INCLUDED TO AID IN PROPER WIRING OF THE TEST CIRCUIT.

FCP-13 Rev C

SUBJECT CONTROL CIRCUIT	BECHTEL POWER CORP — SNUPPS —	PAGE
BY RICK SELEZCHAK DATE 11-1-78		51

SECTION XV

ADDENDUM II

FISHER DOCUMENT
FQP-23 - REV. 9

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FQP-23

FISHER CONTROLS COMPANY

SEISMIC QUALIFICATION PLAN

FISHER Controls MARSHALLTOWN, IOWA	STANDARDS AND SPECIFICATIONS COVER SHEET	NO. FOP-23
	FISHER CONTROLS COMPANY SEISMIC QUALIFICATION PLAN	BY 5-31-79
		APVD 5-31-79
		PAGE 0.1 OF 12
		REV

THIS PAGE IS THE COVER SHEET OF ALL STANDARDS AND SPECIFICATIONS DOCUMENTS CONTAINING 3 OR MORE PAGES OF SPECIFICATIONS.

THE TABLE BELOW SHOWS THE REVISION LEVEL OF EACH PAGE OF THIS DOCUMENT. A REVISION OF THIS PAGE WILL BE MADE WHEN ANY PAGE OF THIS DOCUMENT IS REVISED.

WHEN REFERRING TO THIS DOCUMENT SPECIFY THE REVISION LEVEL OF THIS PAGE.

PAGE NUMBER	REVISION LEVEL
0.1	9
0.2	9
0.3	3
0.4	3
0.5	3
0.6	4
0.7	3
1	4
2	3
3	4
4	3
5	3
6.0	4
6.1	4
7	7
8	4

PAGE NUMBER	REVISION LEVEL
9	6
10	4
11	3
12	3
12.1	1

FISHER CONTROLS COMPANY
CONTINENTAL DIVISION

SEISMIC QUALIFICATION PLAN

FOR

BUTTERFLY VALVE ASSEMBLIES

FOR

BECHTEL POWER CORPORATION

STANDARDIZED NUCLEAR UNIT POWER PLANT SYSTEMS
(SNUPPS)

BECHTEL PURCHASE ORDER NO. 104466-J605A; M236; M237

Rev. 9: April 14, 1980
Rev. 8: February 26, 1980
Rev. 7: February 13, 1980
Rev. 6: November 15, 1979
Rev. 5: July 9, 1979
Rev. 4: May 31, 1979
Rev. 3: December 29, 1978

DATE: March 10, 1978 Rev. 1: June 22, 1978 Rev. 2: July 21, 1978

PREPARED BY: Richard C. Sekerchak
Richard C. Sekerchak, Project Engineer

REVIEWED BY: Carl D. Wilson
Carl D. Wilson, Senior Engineer

APPROVED BY: Richard Hoober
Richard E. Hoober, Manager of Engineering

INTRODUCTION

In order to meet the seismic qualification requirements of Bechtel Power Corporation, Standardized Nuclear Unit Power Plant Systems, Specifications 10466-J605A, M236, and M237 for active valves, Fisher Controls Company, Continental Divison, will utilize the following procedure:

.) Perform dynamic tests on the following nine (9) valves:

(A) J605A-1.0

(B) J605A-3.0

(C) M236-2.02

(D) M236-2.03

(E) M236-2.04

(F) M237-1.02

(G) M237-1.06

(H) M236-2.01 (I) M236-2.07

(2) Perform a geometric comparison between the tested valves and the remaining five (5) untested valve categories. The geometric comparison shall include:

(A) Comparison of bolt pattern and bolt size for body to actuator bracket bolt plane.

(B) Comparison of actuator bracket section (component size and section modulus).

(C) Comparison of actuator type, size and weight.

(D) Comparison of appurtenances.

(E) Seismic stress analysis for the tested and nontested valves using Fisher Controls Engineering Standard, ES 117, "Seismic Analysis of Rotary Valve Assemblies for Nuclear Service", with seismic inertial loadings of 4.5 g's for all active valves to verify that the stresses in the extended structure of the valves not tested are less than or equal to the stresses in the test valve.

The intent of the geometric comparison is to demonstrate that the extended structure of the valves not tested is equal or greater in strength than the extended structure of the tested valves. Valves which will be qualified by the geometric comparison are as follows:

(A) J605A-2.0

(B) M236-2.05

(C) M237-2.02

(D) M237-2.05

(E) M237-2.07

(3) Perform stress calculations for pressure retaining parts per the format submitted for Bechtel information. The stress calculations will be performed for the following components:

(A) Body

(B) Retaining Ring

(C) Disc

(D) Shaft

(E) Blank-off Plate

(F) Blank-off Plate Bolting

The calculations will utilize seismic inertial loadings as measured in the dynamic tests.

Seismic qualification of inactive valves will be accomplished by seismic stress analysis using Fisher Controls Engineering Standard, ES 117, "Seismic Analysis of Rotary Valve Assemblies for Nuclear Service." The intent is to demonstrate that the inactive valve assemblies have a first resonant frequency greater than 33 Hertz and that vertical and horizontal loadings of 4.5 g's per the RIM (Figure 2) will not produce stresses greater than allowed by Bechtel Specifications 10466-J605A, M236, and M237. Additionally, stress calculations will be performed for pressure retaining parts per the format submitted for Bechtel information. The stress calculations will be performed for the following components:

(A) Body

(B) Retaining Ring

(C) Disc

(D) Shaft

(E) Blank-off Plate

(F) Blank-off Plate Bolting

The calculations will utilize seismic inertial loadings of 4.5 g's.

Table 1 lists the valve categories with a description of the valves, actuators, and appurtenances. Table 2 shows the proposed qualification procedure for each category.

Active valves will be qualified by dynamic test with an input inertial load of 4.5 g (Ref. Figure 2) except for the 36" valve (10466-M-237-1.02) which will be qualified by dynamic test with an input inertial load of 3 g's (Ref. Figure 3) because of facility limitations.

Additionally, all active valves will be tested with their respective appurtenances mounted on the extended structure.

4

The environmental test valve will be dynamically tested per the procedure delineated in this qualification plan. The valve assembly will be constructed using the valve body and internal components from 10466-J605A-Item 1.0 and the actuator, bracket and appurtenances from 10466-M237-Item 1.02.

MC3830

FISHER CONTROLS COMPANY
CONTINENTAL DIVISION

TABLE OF CONTENTS

FISHER CONTROLS COMPANY
CONTINENTAL DIVISION

SEISMIC TEST PLAN
OF
NINE VALVE ASSEMBLIES
FOR
BECHTEL POWER, INC.
AT
WYLE LABORATORIES

4

1.0 MOUNTING

1.1 Nine Valve Assemblies, (line items not prototypes), described as Categories I, III, X, XI, XII, XIII, XV, XVI & XX in Table 1, hereinafter called the specimens, will be attached to a mounting fixture and the fixture, in turn, will be placed on the Wyle Biaxial High Force Simulator Table such that the base of the test fixture will be flush with the top of the test table. The specimen will be oriented such that its longitudinal axis will be colinear with the longitudinal axis of the table. For the second axis of test, the specimen will be rotated 90° in the horizontal plane. The tests will be performed in three test series due to the size and number of assemblies.

1.2 Specimen Tie Down

The specimens will be bolted in place between two bell flanges with gaskets. In the event the specimen is a flanged by butt weld end valve, the specimen will be sent to Wyle Laboratories with the butt weld end semi-machined, i.e., without the final weld end preparation. This will facilitiate mounting of the valve without endangering the weld prep integrity during seismic excitation. The specimen will be installed in the test fixture and the test fixture, in turn, will be fastened to the test table. The assemblies will simulate the in-service mounting configuration as closely as practical.

2.0 EXCITATION

2.1 Simultaneous Biaxial Excitation

Each horizontal axis will be excited separately, but each one will be excited simultaneously with the vertical axis (Longitudinal simultaneous with vertical, then lateral simultaneous with vertical). The test sequence will be performed with the horizontal and vertical inputs in phase and then repeated with the inputs 180° out of phase.

2.2 Resonant Search

A low level (0.2g minimum horizontal and vertical) biaxial continuous sinusoidal test will be performed over the frequency range of 1 to 40 Hertz at a sweep rate of 1/3 octave per minute maximum to determine major resonances. A major resonance is defined as a response order of magnitude three (3) or more times the input measured at the approximate centers of gravity (Ref. Paragraph 3.2). Responses exceeding three on the transmissibility plot due to superposition of a minor response on the rise of a major resonance will not be considered to be major resonances (See Figure 1, attached). Input and output of all analog accessories must be continuously recorded during the resonant search. Digital accessories must be continuously monitored during the resonant search. The valve position during the resonant search will be as noted in Table 3.

2.3 Sine Beat Testing

The specimens will be subjected to a sine beat test consisting of five (5) beats at each frequency with a minimum of ten (10) cycles per beat. Tests will be performed at the following frequencies plus any major resonant frequencies below 33 Hertz, including those of valve accessories, determined during the resonant search. Tests will also be run at points where valve accessories show a malfunction or where output variations are greater than published accuracy during the resonant search.

1.0, 1.25, 1.6, 2.0, 2.5, 3.15, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0,

11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0,

22.0, 23.0, 24.0, 25.0, 26.0, 27.0, 28.0, 29.0, 30.0, 31.0, 32.0,

33.0 and 40.0 HZ

The amplitude of each test will be independently adjusted in each axis until the input acceleration equals the required input motion (RIM) as shown in Figure 2 within the limits of the test machine. Figure 2, also, shows the expected capabilities of the test machine. Figure 3, will be used for the test of item 10466-M-237-1.02.

3.0 INSTRUMENTATION

3.1 Excitation Control

Control accelerometers will be mounted on the table at the valve mounting points to insure correct input to the valve.

3.2 Specimen Acceleration Response

Accelerometers will be located at the center of gravity of the actuator and each accessory (positioners, solenoids, switches, etc.). FM tape and oscillograph recorders will be used to record the response of each accelerometer.

4.0 FUNCTIONAL OPERATION

4.1 Pretest Performance Test

Prior to dynamic testing, the valves shall be cycled and cycle time recorded. Shut-off shall be checked and any leakage recorded. See Table 3 for seat leak test pressure. Log the input and output of all analog accessories at the 25, 50, 75 and 100 percent open positions.

4.2 Performance During Seismic Test

Performance testing of the valves during seismic simulation discussed in Paragraph 2.3 will consist of application of air or water pressure of 70 to 225 PSI (See Table 3) at no flow. Operation will be recorded by use of rotary displacement gauges mounted on each assembly. Positioner, transducer, and airset input and output will be continuously recorded during seismic simulation. Limit switches will be monitored continuously to detect contact bounce, etc. The position of the valve during the testing will be as shown in Table 3. The valve will be cycled once at maximum g level as measured at the actuator center of gravity and once at each major resonance below 33 Hertz and where accessories show a malfunction of where output variations are greater than published accuracy.

4.3 Post-Test Performance Test

The pretest performance test shall be repeated after all tests are complete.

5.0 IN-PROCESS INSPECTION

The records will be checked for equality of performance after each test. The specimen will be examined for possible damage following all violent tests such as at a severe structural resonance. A physical tightening of hardware will be performed according to the schedule outlined in Addendum A, page 12.1. 4

All important vibration effects will be logged including any tightening of fasteners on the accessories and actuator mounting hardware. Loosening of fasteners will be evaluated for the specific application and the individual component.

Photographs will be taken of any noticeable physical damage that may occur.

6.0 ACCEPTANCE CRITERIA

When any of the following acceptance criteria are not met, the specific deviation shall be submitted to the buyer for evaluation and acceptability for the specific application.

(1) Increase of cycle time above that required by the specification.

(2) Increase of leakage between Pretest and Post-test Performance Test greater than 1 cc/hr/in. valve diameter water or 1×10^{-2} cc/sec/in. valve diameter air.

(3) Physical damage to any accessory will be cause for rejection of the accessory.

(4) Change of position of the valve exceeding 5° during all seismic testing.

(5) Contact "bounce" on limit switches exceeding 10 millisecond duration for Limitorque-operated valves only.

(6) Indicator lights controlled by limit switches function improperly for Bettis-operated valves only.*

(7) Loss of pressure-boundary integrity.

(8) Structural failure.

This meets the intent of Bechtel Specification 10466, Appendix L.

7.0 REPORT

A certification-type report will be issued subsequent to completion of testing. This report will be signed by a Registered Professional Engineer and will summarize the maximum 'g' levels, natural frequencies, details and recommendations concerning deficiencies and repairs, photographs of test setups, accelerometers, failures, etc. The report will also contain a list of test equipment used and calibrations, and instrumentation log sheets.

*The indicator light for "Open" may flicker, flutter, or dim, but must return to its fully illuminated condition The indicator light for "Closed" may flicker or flutter, but must return to its fully un-illuminated condition.

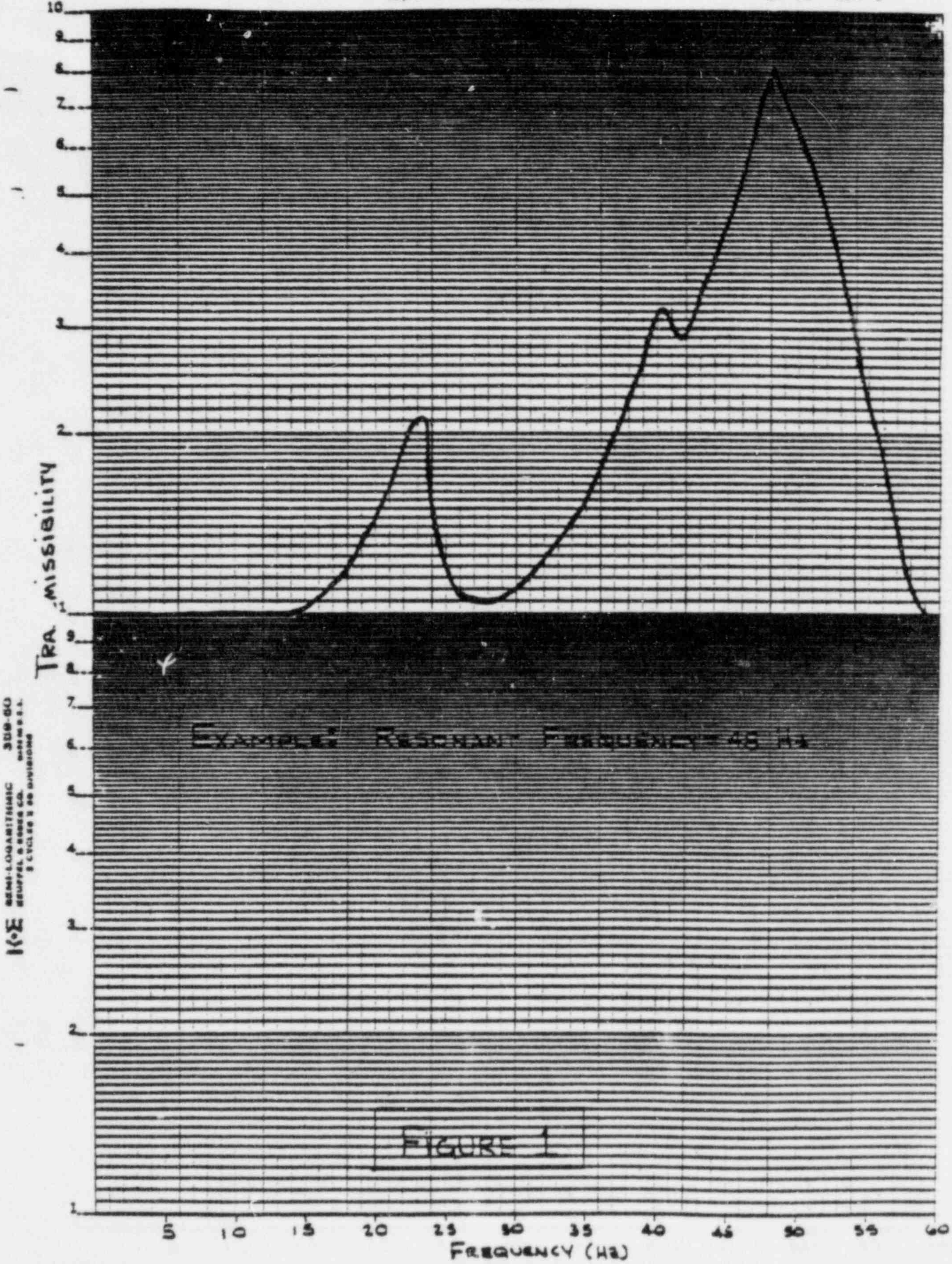
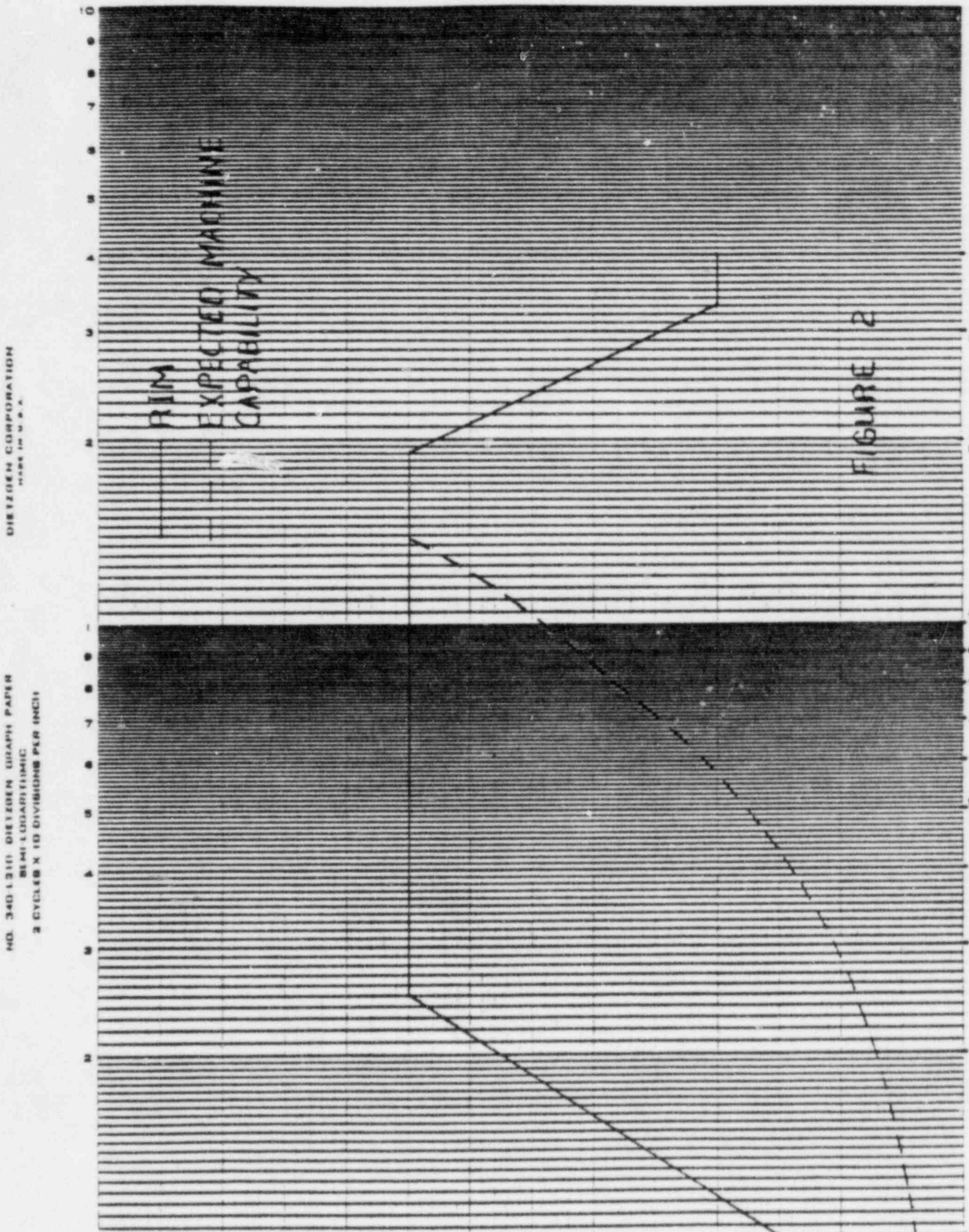

TRANSMISSIBILITY
EXAMPLE: RESONANT FREQUENCY = 48 Hz
FREQUENCY (Hz)
5
10
15
20
25
30
35
40
45
50
55
60
K&E SEMI-LOGARITHMIC 359-60

FIGURE 1


RIM
EXPECTED MACHINE CAPABILITY
FIGURE 2
FREQUENCY (Hz)
ACCELERATION (g's)
DIETZGEN CORPORATION
NO. 340-L210 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
2 CYCLES X 10 DIVISIONS PER INCH

6.0

TABLE I

VALVE CATEGORIES

VALVE CATEGORY	P.O. ITEM NO.	BODY ENDS SHAFT DIAMETER	ACTUATOR	APPURTENANCES
I	605A-1.0	20" - 9220 ANSI B16.5 Class 150 1-3/4" ∅ Shaft	Bettis T-316B-SR2-M3-12	(1) Bailey Positioner #AP2-1-2-1-0 (1) National ACME Limit Switch #EA18081302 (1) Fisher P598 Filter with Brass Element (1) Fisher 95H Regulator (1) ASCO #NP8320A185V 3-Way Solenoid Valve (1) Texsteam 35R Pressure Relief Valve (1) VERSA VSP-3501-155H 3-way valve
II	605A-2.0	14" - 9220 ANSI B16.5 Class 150 2" ∅ Shaft	Bettis T-416B-SR3-M3-12	(1) Texsteam 35R Pressure Relief Valve (1) ASCO #NP8320A185V (1) National ACME Limit Switch #EA18012302 (1) Fisher 95H Regulator (1) Fisher P596 Filter with Brass Element (1) National ACME Limit Switch #EA18031302 (1) VERSA VSP-3501-155H 3-way valve
III	605A-3.0	6" - 9220 ANSI B16.5 Class 150 3/4" ∅ Shaft	Bettis N 521C-SR80-12	(1) Bailey Positioner #AP2-1-2-1-0 (2) Fisher 95H Regulator (2) Fisher P595 Filter with Brass Element (1) Fisher Transducer #546 (1) National ACME Limit Switch #EA18032302 (2) Texsteam 35R Pressure Relief Valve (1) National ACME Limit Switch #EA18031302
IV	216-1.01	20" - 9270 ANSI B16.5 Class 150 1-3/4" ∅ Shaft	Limitorque H2BC Handwheel	
V	216-1.02	18" - 9270 ANSI B16.5 Class 150 1-1/2" ∅ Shaft	Fisher 1073 Handwheel (18"∅)	

7 5 6

TABLE I (Continued)

VALVE CATEGORIES

VALVE CATEGORY	P.O.-ITEM NO.	BODY ENDS SHAFT DIAMETER	ACTUATOR	APPURTENANCES
VI	236-1.03	16" - 9270 ANSI B16.5 Class 150 1-1/2" ø Shaft	Fisher 1073 Handwheel (12" ø)	
VII	236-1.05	12" - 9270 ANSI B16.5 Class 150 1-1/4" ø Shaft	Fisher 1073 Handwheel (12" ø)	
VIII	236-1.06	10" - 9270 ANSI B16.5 Class 150 1" ø Shaft	Fisher 1073 Handwheel (8" ø)	
IX	236-1.07	8" - 9270 ANSI B16.5 Class 150 1" ø Shaft	Fisher 1073 Handwheel (8" ø)	
X	236-2.01	24" - 9220 ANSI B16.5 Class 150 2" ø Shaft	Limitorque SMB 00/10-H3BC	
XI	236-2.02	18" - 9220 ANSI B16.5 Class 150 1-1/2" ø Shaft	Limitorque SMB 000/5-H2BC	

TABLE 1 (Continued)

VALVE CATEGORIES

VALVE CATEGORY	P.O.-ITEM NO.	BODY ENDS SHAFT DIAMETER	ACTUATOR	APPURTENANCES
XII	236-2.03	12" - 9220 ANSI B16.5 Class 150 1-1/4" ϕ Shaft	Limitorque SMB 000/2-H1BC	
XIII	236-2.04	8" - 9220 ANSI B16.5 Class 150 1" ϕ Shaft	Limitorque SMB 00/5-H1BC	
XIV	236-2.05	6" - 9220 ANSI B16.5 Class 150 3/4" ϕ Shaft	Limitorque SMB 00/5- H1BC	
XV	237-1.02	36" - 9220 API - 605 Class 150 BWE/Flange 2-1/2" ϕ Shaft	Bettis T-420B-SR2-12	(1) VERSA VSP-3501-155H 3-way Valve (1) Texsteam 35R Pressure Relief Valve (1) Fisher 95H Regulator (1) Fisher P595 Filter with Brass Element (1) ASCO #NP8320A185V 3-way Solenoid Valve (1) National ACME Limitswitch #EA18032302 (1) Hoffman Junction Box W/G.E. #EB-25 Term. Strips (1) National ACME Limit Switch #EA18031302
XVI	237-1.06	18" - 9220 ANSI B16.5 Class 150 BWE/Flange 2" ϕ Shaft	Bettis T-416B-SR3-12	(1) VERSA VSP-3601-155H 3-way Valve (1) Fisher 95H Regulator (1) Fisher P595 Filter with Brass Element (1) ASCO #NP8316A75E 3-Way Solenoid Valve (1) National ACME Limitswitch #EA18032302 (1) Hoffman Junction Box W/G.E. #EB-25 Terminal Strips (1) Texsteam 35R Pressure Relief Valve (1) National ACME Limit Switch #EA18031302

A A VI 0

TABLE I (Continued)

VALVE CATEGORIES

VALVE CATEGORY	P.O.-ITEM NO.	BODY ENDS SHAFT DIAMETER	ACTUATOR	APPURTENANCES
XVII	237-2.02	14" - 9220 ANSI B16.5 Class 150 BWE/Flange 1-1/2" ∅ Shaft	Limitorque SMB 000/5-H2BC	
XVIII	237-2.05	10" - 9220 ANSI B16.5 Class 150 BWE/Flange 1-1/4" ∅ Shaft	Limitorque SMB 000/2-H1BC	
XIX	237-2.07	6" - 9220 ANSI B16.5 Class 150 BWE/Flange 3/4" ∅ Shaft	Limitorque SMB 000/2-H0BC	
XX	236-2.07	20" - 9220 ANSI B16.5 Class 150 2" ∅ Shaft	Limitorque SMB 000/5-H3BC	
XXI	236-1.01	8" - 9220 ANSI B16.5 Class 150 1" ∅ Shaft	Fisher 1073 Handwheel (8" ∅)	

TABLE 2

VALVE CATEGORY	P.O.-ITEM NO.	ACTIVE	QUALIFICATION METHOD
I	J605A - 1.0	YES	TEST
II	J605A - 2.0	YES	Qualified Test Results of Category XVI
III	J605A - 3.0	YES	TEST
IV	M236 - 1.01	NO	ANALYSIS
V	M236 - 1.02	NO	ANALYSIS
VI	M236 - 1.03	NO	ANALYSIS
VII	M236 - 1.05	NO	ANALYSIS
VIII	M236 - 1.06	NO	ANALYSIS
IX	M236 - 1.07	NO	ANALYSIS
X	M236 - 2.01	YES	TEST
XI	M236 - 2.02	YES	TEST
XII	M236 - 2.03	YES	TEST
XIII	M236 - 2.04	YES	TEST
XIV	M236 - 2.05	YES	Qualified by Test Results of Category XIII
XV	M237 - 1.02	YES	TEST
XVI	M237 - 1.06	YES	TEST
XVII	M237 - 2.02	YES	Qualified by Test Results of Category XI
XVIII	M237 - 2.05	YES	Qualified by Test Results of Category XII
XIX	M237 - 2.07	YES	Qualified by Test Results of Category XIII
XX	M236 - 2.07	YES	TEST
XXI	M236 - 3.01	NO	ANALYSIS

TABLE 3

VALVE CATEGORY	VALVE POSITION	SEAT LEAK TEST PRESSURE	BODY PRESSURE DURING SEISMIC TESTING AND FLUID	MAXIMUM CLOSING TIME PER BECHTEL SPECIFICATION
I	50% OPEN	95 PSI	165 PSI WATER	50 SECONDS
III	50% OPEN	90 PSI	165 PSI WATER	MANUF. STD. (FAIL OPEN)
X	CLOSED	150 PSI	200 PSI WATER	60 SECONDS
XI	CLOSED	150 PSI	150 PSI AIR	60 SECONDS
XII	CLOSED	150 PSI	150 PSI AIR	60 SECONDS
XIII	CLOSED	200 PSI	200 PSI WATER	15 SECONDS
XV	CLOSED	60 PSI	70 PSI AIR	10 SECONDS
XVI	CLOSED	60 PSI	70 PSI AIR	3 SECONDS
XX	CLOSED	188 PSI	200 PSI AIR	60 SECONDS

FISHER CONTROLS COMPANY
CONTINENTAL DIVISION

ADDENDUM A

FASTENER TIGHTENING SCHEDULE FOR SEISMIC TESTING

The test specimen will be examined for possible fastener loosening or other physical damage following each violent test such as may occur at a severe structural resonance.

Any fastener loosening or other physical damage shall be documented in the test log as it occurs; however, any physical tightening of loosened bolts or other fasteners shall conform to the following procedure.

Unless there is an observed loosening of the fasteners which in the opinion of the Fisher Test Engineer would result in damage to the test specimen upon continuance of the test, fastener tightening shall only be performed following tests at the frequencies of 5 Hz, 15 Hz, 25 Hz, and 33 Hz in the test frequency sequence for each axis and each phase.

Prior to any fastener tightening, the test valve will be operated through one complete cycle to show that the observed fastener loosening will not adversely affect the operability of the valve. The test specimen performance as well as the fastener tightening performed shall be fully documented in the test report.

In addition to the above, it shall be the prerogative of the Fisher Test Engineer to stop the test at any frequency where, in his technical opinion, a physcial tightening of fasteners is mandatory to prevent undue damage to the test specimen. In such a case, it shall be the responsibility of the Fisher Test Engineer to resolve the problem and develop a suitable course of action based upon the individual circumstances. In addition, he shall also be responsible for assuring that the test report will include a full description of the action taken along with all pertinent details concerning valve operability and fastener tightening.

FQP-23 Rev 4

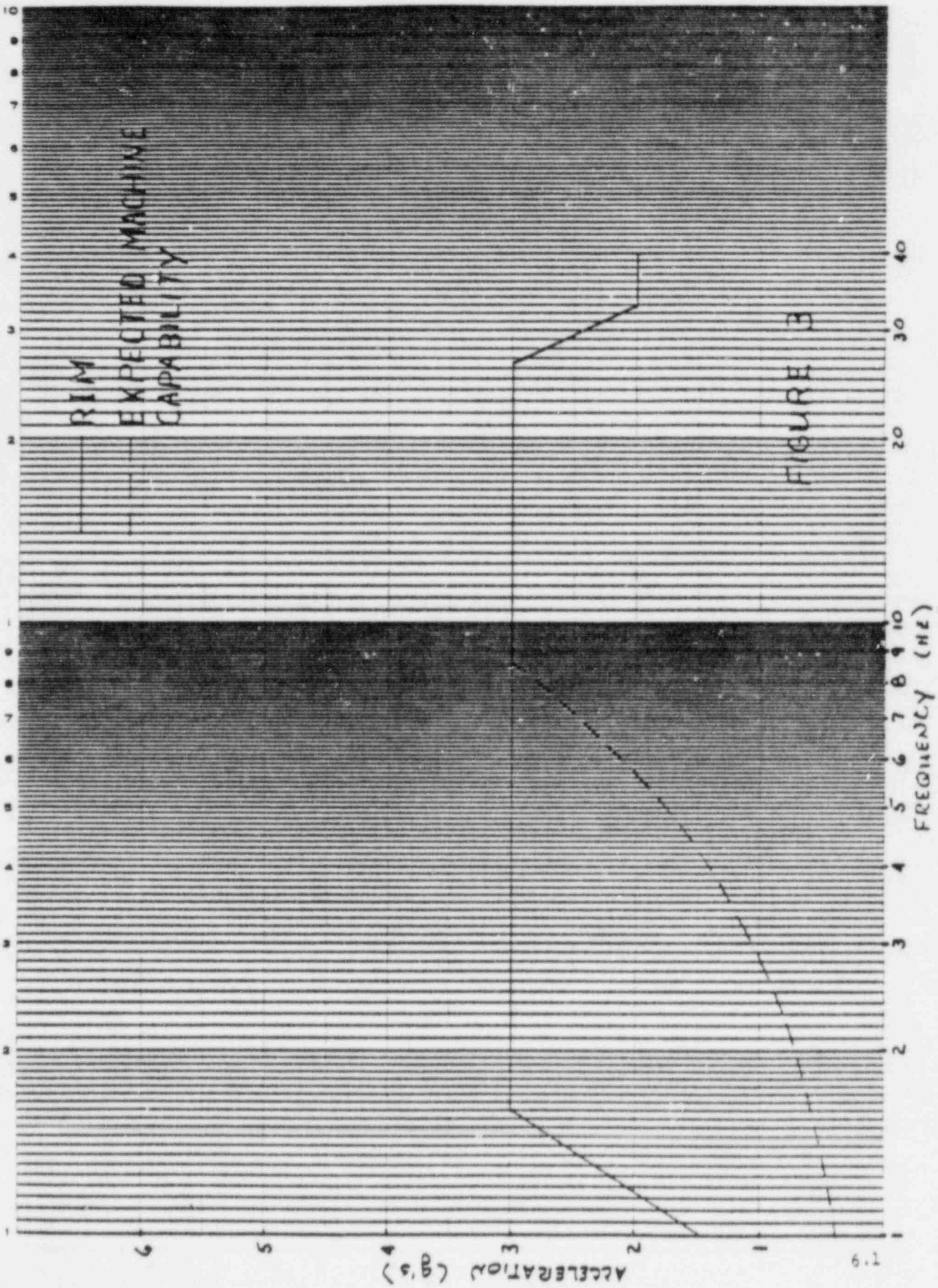


FIGURE 3

Rev. A

Attachment A-2

to

Vogtle Qualification Report FQP-11A

NA-29

Discussion of Anomalies
Noted During Environmental Test

FISHER Controls MARSHALLTOWN, IOWA	Resolution of Anomalies Noted During the SNUPPS Environmental Test Program	NO. NA-29
		BY SEH 8-25-81
		APVD 8-25-81
		PAGE 0.1 OF
		REV

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This document contains a description of the problems noted as anomalies during the SNUPPS environmental testing program. The anomalies are discussed and resolved in the sequence that they occurred and are referenced by the sequential numbers used on the Notice-of-Anomaly (NOA) sheets that are included in the Wyle Environmental Test Report No. 45088-1.

The anomalies are discussed because they represent changes in intended test procedure, shortcomings in test facility capability, or malfunction of equipment under test. However, it should be noted that the anomalies observed do not deter or preclude proper safety-function operation of the Fisher valve assembly.

*****

NOA #1

PROBLEM: Temperature was to be kept at 227.8°F for the thermal aging sequence. A power outage, lasting 30 minutes, caused the temperature within the aging chamber to fall to 210°F.

RESOLUTION: The duration of the tests was extended by 30 minutes at 227.8°F.

*****

NOA #2

1. PROBLEM: Flexible conduit from the junction box to the control box was split.

   RESOLUTION: Fisher is responsible for connection up to and including the junction box. The flexible conduit which split was supplied by Bechtel and is a connection for which Fisher has no responsiblity.

2. PROBLEM: One pint of lubricant leaked from the Bettis actuator.

   RESOLUTION: A portion of the grease within the Bettis actuator liquified due to the temperatures encountered during heat aging. During normal operation, the temperature will be 100°F lower. Hence, liquification is not expected. It should be noted that the lost lubricant did not affect actuator function.

3. PROBLEM: The "Normally-Open" set of contacts on the Number 1 Type EA 180 NAMCO limit switch were sticking and operationally intermittent.

   RESOLUTION: The contacts were thought to be sticking because the green light on the control box, which indicated when the valve was open, was lighted only intermittently. In reality, the intermittent operation of the light was due to wire number 1 being loose in the junction box. (See Page X-1 of Wyle Report No. 45088-1, "Qualification Test Program on a Type 9200, 20" Butterfly Valve with a G.H. Bettis Actuator".)

*****

NOA #3

PROBLEM: The 1/4-in. copper tubing connecting the solenoid valve to the Versa valve was bent during shipment. There was GN_2 leakage past the piston of the pneumatic actuator at a rate of 314.3 cc/sec.

RESOLUTION: Neither the leakage past the piston nor the bent copper tubing affected the ability of the actuator to perform its safety-related function.

*****

NOA #4

1. PROBLEM: The actuator-to-bracket mounting bolts loosened due to yielding during the seismic aging sequence.

   RESOLUTION: This seismic test was only to put the valve in the end-of-life condition. This particular actuator valve combination was selected for testing purposes only. Limitations in the test chamber size prevented the testing of the 36" valve body associated with this actuator on the SNUPPS project. This smaller valve body (20" 9200) was arbitrarily mated with the larger actuator (G.H. Bettis T420B-SR2) in order to simulate a complete valve assembly during the environmental test program. This valve-actuator combination was n't part of the SNUPPS project and does not represent a normal configuration. Both the 20" valve body and the T420B-SR2 actuator were tested separately with their respective valve bodies and actuators to verify seismic qualifi ation of each configuration (See Wyle seismic test reports for SNUPPS valve groups I and XV presented in FQP-23-B1 and FQP-23-B15 respectively.)

2. PROBLEM: Post seismic test inspection revealed a severe leakage at the Swagelock fitting at the air inlet of the Bettis actuator.

   RESOLUTION: This actuator had been previously seismically qualified. (See Wyle Rpt. No. 44500-11.) The tubing fatigued at the end of the second seismic test during environmental aging. The leakage had no effect on the capability of the valve to perform the safety-mode function.

*****

NOA #5

1. PROBLEM: Following the seismic testing, it was noted that the green light (indicates when the valve was open) was inoperative. Inspection showed that the terminal strips had vibrated loose. As a result, wire No. 1, which supplied power to the green light, had broken from its terminal lug.

   RESOLUTION: The valve being tested had the old style of fastening for the terminal strips. The new style incorporates a nut and lock washer arrangement to prevent the strips from loosening.

2. PROBLEM: Condulet containing the wiring to the control box had rotated approximately 70° clockwise.

   RESOLUTION: Fisher does not have responsibility for connections beyond the junction box. The rotation of the Condulet connector was due to an unsupported length of cable, which, when accelerated during the seismic testing, unduly loaded the connector, causing it to loosen.

   When the valve is in service, the cable should be supported as closely as possible to the junction box.

*****

NOA #6

PROBLEM: During the post-seismic functional, it was noted that there was a hairline crack in the junction box in the corner adjacent to the 1 1/2" Condulet.

RESOLUTION: The crack was due to the unsupported cable from the control box to the Hoffman junction box. The unsupported cable mass, when accelerated during the seismic aging tests, cyclically loaded the junction box, fatiguing the junction box wall.

When this valve is in service, the cable should be supported as closely as possible to the junction box.

*****

NOA #7

PROBLEM: The temperature transient from 120°F to 340°F in three minutes was not accomplished. Time required to reach 340°F was 13 minutes and 37 seconds.

RESOLUTION: Fourier's Law of Conductive Heat Transfer dictates that the change in temperature of the valve is directly a function of time. Because the time to reach the required 340°F was nearly four times longer than the required time, the valve was considerably hotter than if the transient had been met. Thus the test performed was much more severe than the required test, making the results conservative.

Test facility limitations would not permit performance of the required transient.

*****

NOA #8

PROBLEM: The second temperature and pressure transient was aborted at 35 minutes and 50 seconds into the test, due to excessive steam leakage at the top flange of the test chamber. The highest observed temperature was 356.7°F.

RESOLUTION: The temperature peak was later reached in a dry oven test. (See Wyle Test Report 45088-1, Section XII, and correspondence relating test results, Attachment A-12 of FQP-23-A.)

*****

NOA #9

PROBLEM: Second temperature and pressure transient again was not met.

RESOLUTION: See NOA #8.

*****

NOA #10

PROBLEM: The test chamber temperature was out of tolerance

1. On the low side for a total of 9 hr 30 min
2. On the high side 4 hr 30 min

RESOLUTION: The time out-of-tolerance on the low side was added to the total test time at the end of the test.

The time out-of-tolerance on the high side simply represents extra conservatism in the test.

Attachment A-3

to

Vogtle Qualification Report FQP-11A

NA-47

Modifications and Exceptions
to FQP-19, FQP-23, and NA-29
for Application to the Vogtle Project

FISHER Controls MARSHALLTOWN, IOWA	MODIFICATION AND EXCEPTIONS TO FQP-19, FQP-23 and NA29 FOR APPLICATION TO THE VOGTLE PROJECT	NO. NA-47 A
		BY 8/25/81
		APVD 8-25-81
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1.0 Purpose

This document modifies FQP-19, FQP-23 and NA-29 as they apply to the Vogtle project.

2.0 FQP-19

Disregard all references to SNUPPS, Bechtel Specification, Bechtel purchase order numbers and Bechtel tag numbers.

2.1 Page 1.1; paragraph 4: The total radiation exposure to the test valve was 2 x 10^8 rads. The functional tests, following the final radiation exposure, are for qualification purposes, not informational only. The seat leak tests were performed at incremental pressures up to 60 psid. The higher radiation levels were used to satisfy a Vogtle requirement. Seat leak tests above 60 psid are not required for Vogtle.

2.2 Page 2; paragraph 4: The radiation exposure to the test valve was in 3 doses, not a single dose. This was done partially to simulate normal end-of-life conditions and post DBE conditions and partially to obtain intermediate data. The number of doses of radiation does not affect qualification.

2.3 Page 4; paragraph 4: Activation energy testing was done to clarify the 10°C rule.

2.4 Pages 5, 6 & 7: Bechtel will be responsible for qualification of all buyout items. Disregard sections entitled, "Appurtenance Qualification", and "Appurtenance Qualified Life or Maintenance Interval".

2.5 Page 8; paragraph 1: The valve body material, of the test body, is SA 515-70. The Vogtle valve body materials are SA 182-316, SA 351-CF8M, and SA 515-70. Valve body material does not affect environmental qualification.

2.6 Page 8; paragraph 2: Fisher will not certify the ability of the Bettis to perform its safety-related function. Qualification of the Vogtle Bettis actuators is the responsibility of Bechtel Corp.

2.7 Page 8; paragraph 3: Disregard paragraph 3.

2.8 Page 8 and 9, paragraph 4, 5 and 6: Disregard paragraphs 4, 5 and 6. Qualification of ASCO's and NAMCO's and Limitorques will be the responsiblity of Bechtel Corp.

2.9 Page 9 and 10; paragraphs 7, 8, 9, 10, 11: Disregard paragraphs 7 through 11. These paragraphs are not applicable to the Vogtle project.

2.10 Page 15; paragraph 1.1: Actuator, solenoid and limit switch qualification is the responsibility of Bechtel. There are no versa valves on the Vogtle project.

2.11 Page 19; paragraph 1: The valve was exposed to 3 doses of radiation. The first exposure brought the total to 1×10^7 rads. See paragraph 2.2 of this document.

2.12 Page 19.1; paragraph 1: Post-DBE radiation exposure is for qualification purposes. The last radiation exposure brought the total integrated dose to 2×10^8 rads. (See paragraph 2.11 and 2.2 of this document.)

2.13 Page 24; paragraph 7.04: The steam exposure profile shows a 381°F temperature spike. This was supplemented with a 400°F oven temperature spike for satisfying the Vogtle requirements.

2.14 Page 28 - Post-DBE functional test is for qualification purposes.

2.15 Page 28; paragraph 9.3: The radiation exposure was 190 megarads which brought the total cumulative exposure to 2×10^8 rads. (See paragraphs 2.2, 2.11 and 2.12 of this document.)

2.16 Page 28; prargraph 9.4: Seat leak tests were performed at pressure differentials up to 60 psid. (See paragraph 2.1 above.)

3.0 FQP-23

Disregard all references to SNUPPS, Bechtel Specification, Bechtel purchase order numbers and Bechtel tag numbers.

4.0 NA-29

4.1 NOA #2, problem 1 - This problem does not apply to Vogtle qualification since no junction boxes are used.

4.2 NOA #2, problem 2 and 3 - Bechtel is responsible for appurtenance qualification.

4.3 NOA #5 and #6 - Terminal strips and junction boxes are not used on Vogtle valves.

9200 TEST SUMMARY
(SNUPPS)

- Heat aging
  Re-adjust T-Ring
- 1×10^7 Rads
  no Leakage
- Seismic
  no Leakage
- DBE pressure-Temp profile (see attached)
  no Leakage
- 381°F (15 minutes)
  no Leakage below 30 psid
  1167 cc/min at 75 psid (1472 cc/min allowed)
- 400°F (15 minutes)
  no Leakage at 2.5 psid
- 1×10^8 Rads
  Leakage increase to:
  875 cc/min (1.85 SCFH) at 2.5 psid
  76,900 cc/min (163 SCFH) at 60 psid
- 2×10^8 Rads
  Leakage increase to:
  4315 cc/min (9.1 SCFH) at 2.5 psid
  76,900 cc/min (163 SCFH) at 60 psid

Rev. A

Attachment A-4

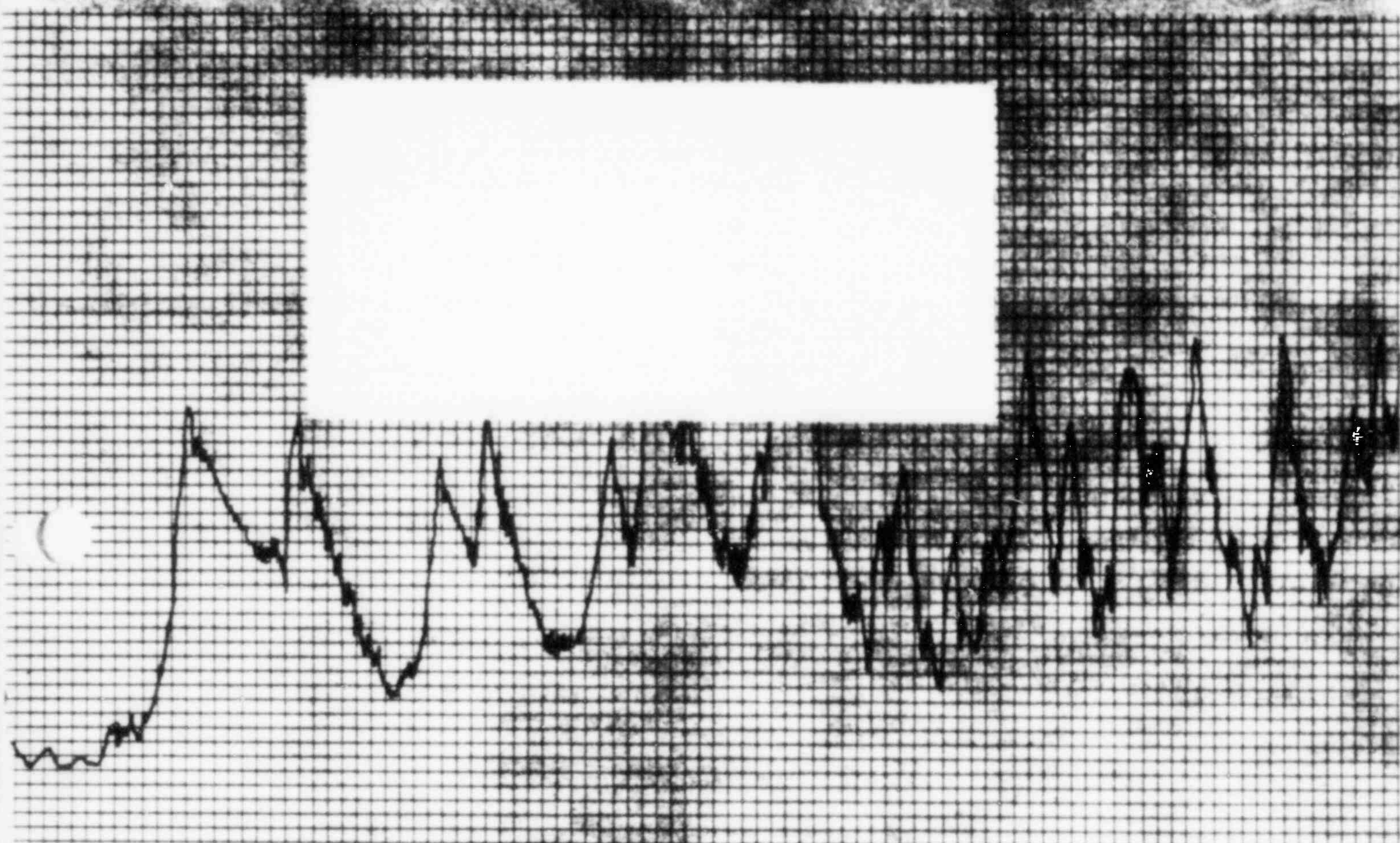
to

Vogtle Qualification Report, FQP-11A

Wyle Lab Report No. 45390-1,
Dated November 7, 1980

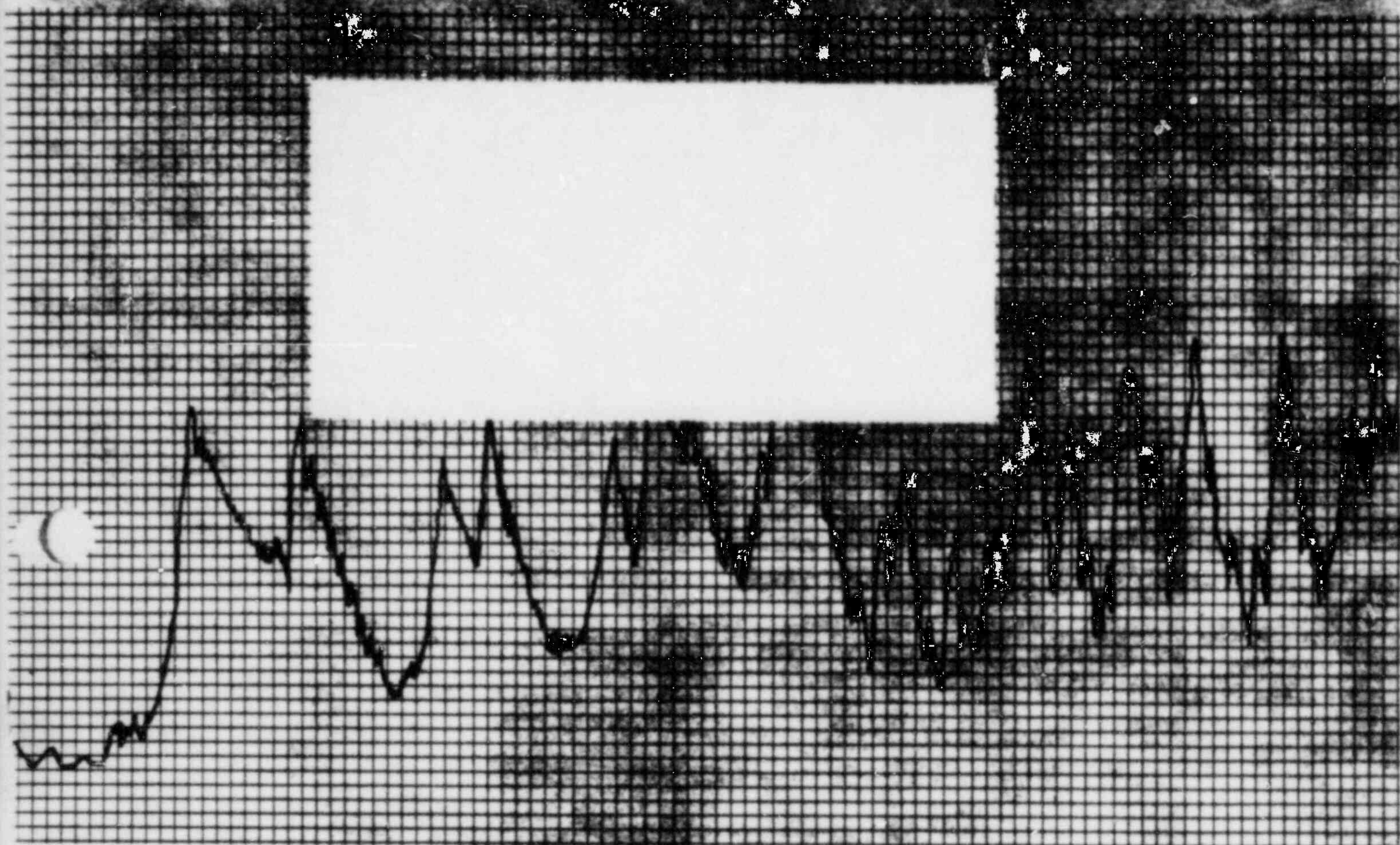
Temperature Transients and Seat Leakage Tests

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP



NEQ
NUCLEAR ENVIRONMENTAL QUALIFICATION

test REPORT



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