QDR-5437-241-01

QUALIFICATION REVIEW PACKAGE

ROSEMOUNT TRANSMITTERS

MODEL NO. 1152DP&AP

(PT-LM-201A,PT-LM-201B)

SURRY UNIT 2

NUS CORPORATION
910 CLOPPER ROAD
GAITHERSBURG, MARYLAND 20878
(301) 258-6000

N08.1-V01-290
April 30, 1982
File 4.1

Mr. A. L. Parrish, III
Manager, Multiple Power Projects
Virginia Electric & Power Co.
P.O. Box 564
Richmond, VA 23204

Attention: J. E. Wroniewicz

Subject: Surry Unit 2 Transmittal of Qualification Review Package No. QDR-5437-241-01 for TMI Item, Rosemount Transmitters

Dear Mr. Parrish:

Transmitted herewith is one (1) copy of the qualification document review package QDR-5437-241-01 for Rosemount Transmitters PT-LM-201A & PT-LM-201B for your review and acceptance.

In this package because sufficient justification for aging is not provided we recommend including these transmitters in an Ongoing Aging Surveillance Program.

Upon your review and acceptance of this, a final revised signed off copy of the complete package will be transmitted for your permanent files.

Very truly yours,

R. C. Wilson
Project Manager

cc: N. Garg, w/enc.
R. Bell, w/enc.
B. J. Reckman, w/o enc.
J. L. Renehan, w/o enc.
S. B. Gerges, w/o enc.

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ROSEMOUNT TRANSMITTERS
MODEL NO. 1152DP&AP
(PT-LM-201A,PT-LM-201B)
Surry Unit 2

QDR-5437-241-01

SECTION #1

COMPLETE CHECKLIST,
FIGURES, & WORKSHEETS

Rev	Date	By	App

Form QDR-3/01/80 Sheet 1
Client ID: Virginia Electric & Power Company QDR-5437 - 241-01
Plant: Surry Unit 2

Qualification Document Review Checklist

Review for: DOR Guidelines ☐ NUREG-0588 ☒

1. Name of the Reviewer: Manhar Patel Date: 2-17-82

2. Equipment Covered: Rosemount Transmitters Model No.1152DP&AP

3. Equipment Tag No(s).: PT-LM-201A, PT-LM-201B

		YES	NO	NA	Page Ref.
4.	Does the report address all of the Class IE equipment in this category listed in the master IE equipment list?	X			P.O. No. 39306, Ref. Report #6, Sect. 6 & Work-sheet #10.3-1&2
*5.	Is the report traceable to the plant equipment?	X			Attachment #1
*6.	Does the report specify an acceptance criteria for equipment performance?	X			Ref. Report #6, Page 2,Sec.4.1, & Attachment #1
*7.	Was a base line test done to establish the reference basis?	X			Ref. Report #6, Page 3,Sec.5.2
*8.	Do the maximum and/or accident temperature and pressure used in the test envelope those for the plant? (Table 1)	X			Attach. #1,Fig. 3 & 3A & Sec. 5.5 of Reference #6
9.	Are thermal aging parameters chosen and used in the tests supported by adequate documentation or references? Note: Aging times less than 100 hrs not acceptable.		X		Attach. #1 & Sec. 5.2 of Ref. Report #6
*10.	Is radiation aging addressed? (Test or analysis. If analysis, is adequate documentation provided?)	X			Ref. Report #6, Page 5, Sec. 5.3
*11.	Does the radiation dose profile, i.e., integrated dose for normal operations and accident for the plant, fall within the envelope used in qualifications?	X			Attach. #1 and worksheet nos. 10.3.1 and 10.3.2

NOTE: Asterisk * indicates items applicable to DOR guidelines.

		Yes	No	NA	Page Ref.
*12a.	Does the total integrated dose include Beta radiation?		X		Transmitters are located outside the containment
b.	If not is there an analysis for this?			X	
c.	Is it required?		X		
13.	Was humidity aging considered? (Not required for cables.)	X			Ref. Report #6, Sec.5.5&Attach.#1
14.	Was vibration (ambient) aging addressed?			X	
*15.	Was mechanical and/or electrical cycling addressed?			X	
*16.	Do the DBE test parameters meet or exceed those given in the specification? Make a copy of the temperature envelope used in the test and superimpose it on the required environmental envelope. Assure that deviations between the two are justified in the report.	X			Attach. #1, Fig. 3 & 3A and Sec. 5.5 of Reference Report #6
17.	Does DBE temperature envelope used in the test contain the double peak required by IEEE-323-74?			X	
*18.	Does the DBE qualification include chemical spray? (Test or analysis)			X	Transmitters are located outside the containment & worksheet #10.3-1 & 10.3-2
19.	Does the spray concentration used in tests meet or exceed those to be used for the plant? -			X	
20.	Was the spray testing done while under the extremes of pressure and temperature?			X	
*21.	Are the margins used in DBE test parameters defined?		X		Attachment #1, Sec. 5.3 thru 5.5 of Ref. Report #6
22.	Do the margins conform to those required by IEEE-323-1974 and any applicable daughter standard for this equipment?	X			

		Yes	No	NA	Page Ref.
*23.	Did the specification provide the required operating time for the equipment in the DBE or other specified harsh environment?	X			Worksheets 10.3.1 and 10.3.2
*24.	Does the test operating time under the harsh environment equal or exceed that in the equipment specification? Assure that adequate justification is provided for deviation.	X			Attachment #1
*25.	Does the specification call out the submergence requirements if any?			X	Worksheet No. 10.3.1 & 10.3.2
*26.	Does the test program include submergence tests? If not assume that the justification is provided.			X	
*27.	Is the accuracy demonstrated during testing equal to or better than that specified?	X			Ref. Report #6, Sec. 5 & Attach. #1
*28.	Are the mounting and installation interfaces used in the test configuration similar to those used in the plant?	X			Attachment #1
29.	Was the test measuring equipment (TME) calibration addressed in the report?	X			Appendix 1, Page 28 of Ref. Report #6 and Attachment #1
30.	Does it specify that the calibration of the TME is traceable to NBS or other secondary standards?		X		
31.	Was the seismic testing/analysis done on aged component or equipment?	X			Ref. Report #6 Page 6, Sec. 5.4
32.	Did the seismic testing/analysis address effects of age?	X			
33.	Does the seismic test response and/or criteria used envelope the required response spectra for the plant?	X			

		Yes	No	NA	Page Ref.
*34.	Was the same test specimen subject to the entire test sequence? (Including aging tests? - NUREG 0588)	X			Ref. Report #6, Page 3, Sec. 5.1 & 5.5.2
*35.	Compare the block diagram for this report against the one you have prepared from your understanding of what test and procedures are required as per IEEE-323-1974 and any applicable daughter standard for this equipment. Do you believe the report meets the intent of these standards?	X			Figures 1 and 2
*36.	Is the qualified life (QL) explicitly stated? Fill this information in the master IE equipment list.	X			Sec. 5.3.4 of Ref. Report #6 and Attach. #1
*37.	Do the aging tests/analysis results support the QL conclusion and is adequate documentation provided to support this conclusion?		X		Sec. 5.2 of Ref. Report #6 & Attachment #1
*38.	Review the test results on a relative comparison basis (i.e., performance parameters of the base line tests versus those during the various tests). Was there any major discrepancy?	X			
*39.	If so, was it satisfactorily explained in the report?	X			Attachment #1
*40.	Are maintenance requirements and component replacement intervals specified?		X		
*41.	Have you compared maintenance and replacement requirements to those in the standard instruction/maintenance manuals and identified any special items in Table 2?			X	

List all the reference documents used for this review by their titles and identification no., with their revision level and date.

1) IEEE Std. 323-1974 - IEEE Standard for Qualified Class IE Equipment for Nuclear Power Generation Stations.

2) NUREG-0588 - Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment.

3) IE Bulletin 79-01B - TMI Review Response Submittal, dated Feb. 1, 1981 Worksheet Nos. 10.3-1 & 10.3-2.

4) Environmental Zone Description, dated Aug. 24, 1982 VEPCO Surry Power Station Units 1 & 2.

5) VEPCO Purchase Order No. 39306 dated May 17, 1980 for Differential Capacitance Absolute Pressure Transmitters.

6) (Reference Report No. 6) Qualification Tests for Rosemount Pressure Transmitters Model 1152. RMT Report No. 117415, Rev. B,dated Oct. 26, 1976.

TABLE 1

Special Environmental Requirements

ROSEMOUNT TRANSMITTERS MODEL NO. 1152 AP

PARAMETER	SPECIFIED	QUALIFIED	DOCUMENT REFERENCE	
			SPECIFIED	QUALIFIED
OPERATING TIME	120 Days	> 120 Days	W Ref. Ltr. No. NN-SS-79287	Ref. Report #6, Sec. 5.5.2 and Attach. #1, Question 8 of this QDR
TEMPERATURE	Accdt: 205°F Max. Normal: 100°F	350°F Max.	S&W Calc. 12846.44-PE-050-0	Ref. Report #6, Section 5.5.2
PRESSURE	Accdt: 15.2 psia	84.7 psia Max.	SAME	SAME
RELATIVE HUMIDITY	Accdt: 100% Normal: NC*	100%	SAME	SAME & Attach. #1, Quest. 13 of this QDR.
RADIATION	40 Yrs: 4.87×10^3 Accdt: 9.3×10^5	$5. \times 10^6$	S&W Calc. 12846.44-UR (B)-043-0	Ref. Report #6, Section 5.3
SUBMERGENCE	NR	NR	Env. Zone Description Table AB-13A (0)	NR

NR = Not Required
NC = Not Calculated

Table 2

Special Requirements

1. **Maintenance Requirements/Intervals**

   1) Consult manufacturer's recommendations as sated in his maintenance manual.

   2) These transmitters are recommended for inclusion in an on going aging surveillance program.

2. **Replacement Requirements/Intervals**

   1) As we calculated the 18 month life of these transmitters we recommend to inspect and conduct usual tests during each refueling outage for any required replacement.

3. **Storage Requirements***

   N/A

4. **Installation Requirements***

   None special

*Applies to spare parts and replacement only for operating plants.

QUALIFICATION REPORT REVIEW SUMMARY

1. Equipment Qualification Reviewed: Qualification Tests Report #117415, Rev. B for Rosemount Pressure Transmitter Model 1152, dated Oct. 26, 1976.

2. Status of Qualification Records:

X Records identified (Full/~~Partial~~), obtained (Full/~~Partial~~), and review (Full/~~Partial~~) summarized on QDR-3/01-80 forms.

____ The following additional documents have been requested:

1. _____ 2. _____
3. _____ 4. _____
5. _____ 6. _____

X Following areas/documents require additional review:

1. Vendors New Aging Test Parameters 2. _____
3. _____ 4. _____
5. _____ 6. _____

____ Other comments on status of qualification records:

_____

_____

_____

3. Status of Qualification

X Equipment qualification meets the guidance of NUREG-0588. For additional comments and recommendations, see section 5.

X Additional evaluation is needed to justify qualification status. Details of additional evaluation needs attached.

____ Qualification tests consistent with the recommendations of NUREG-0588 for Category 1 equipment should be performed on the equipment.

_____ Equipment should be relocated to an area where it will not be exposed to a harsh environment.

_____ Other recommendations:

_____

_____

_____

5. Additional Comments/Recommendations

1) Rosemount tested model no. 1152 transmitters in 1975 per IEEE-323, 1971 and now is committed to retest them to qualify per IEEE-323-1974.

Initially Rosemount tested these transmitters for two cycles (100°-0°-200°-100°F) of eight hours each which is not enough to establish a qualified life of 40 yrs. We are unable to justify more than 18 months life even after taking the credit from extended steam pressure test (See Question 9 in Attachment #1). Hence we recommend including these transmitters in an ongoing aging surveillance program.

2) For additional comments see attachment no. 1.

Environmental qualification documents for the equipment identified herein have been reviewed and determined to be adequate and auditable.

Prepared by: M. N. Patel MNP Date: 4/7/82

Certified by: R. J. Bell R.J.B. Date: 4/28/82

_____ Date: _____

_____ Date: _____

ATTACHMENT #1

Question Nos. 4 & 5

System component evaluation worksheets for PT-LM-101A and 101B indicate only Rosemount 1152 AP transmitters are used in Surry Plant. Reference Report #6, Section 6.0, covers type testing of the 1152 AP transmitter. Hence the report is considered traceable to the plant equipment.

Question No. 6

Per reference report no. 6, sec. 4.1 on page 2 satisfactory performance criteria is based on:

(1) Performed within 2.0% accuracy after being subjected to 5×10^6 gamma radiation dose. The accuracy after recalibration was within ±0.25% of the span.

(2) Remained operable, within ±0.25% accuracy when subjected to seismic disturbance of 3g level over a range of 5-100 Hz.

(3) Performed within an accuracy better than 1/2% full scale after exposure to steam pressure environment.

Question Nos. 8, 16 & 24

As shown in Figures 3 & 3A Rosemount conducted a steam pressure test for 50 hours (Sec. 5.5 of Ref. report no. 6) which envelops the required one hour plant HELB conditions. Hence the conducted test is considered more severe and the transmitters are qualified for HELB conditions.

Question Nos. 9, 36 & 37

Rosemount conducted two cycles (100°-0°-200°-100°F) of eight hours each towards the thermal aging test. This is not enough to satisfy IEEE-323-1974. The vendor qualified these transmitters per IEEE-323-1971 in the past and is committed to conduct additional tests to qualify them per IEEE-323-1974 by the end of 1982.

At this time even though we take credit for the extended steam pressure test we are unable to qualify these transmitters for more than 18 months (see the analysis below). Hence we recommend including these transmitters in an ongoing aging surveillance program to extend the qualified life till Rosemount completes the tests per IEEE-323-1974 and a new qualified life is established.

ATTACHMENT #1

Question Nos. 9, 36 & 37 (Cont'd)

Analysis for Qualified Life:

Following tests were considered:

i) Thermal aging test: 2 cycles (100°-0°-200°-100°F; 2 hrs each, per Sec. 5.2 of Ref. #6) of 8 hrs each. Out of this test only four hours at 200°F are considered because other temperature values are lower than the plant ambient temperature.

Applying Arrhenius equation:

$$T_x = T_{L_1} e^{-\frac{\phi}{K}\frac{(T_2-T_1)}{T_1 \times T_2}}$$

T_{L_1} = Life @ ambient temperature = 100°F - 311°K

T_x = 4 hrs. @ 200°F = 366°K

T_1 = 311°K

T_2 = 366°K

ϕ = 0.7 (See note below)

Substituting the values and solving:

T_{L_1} = 203 hours.

ii) Credit from extended steam pressure test:

In the following calculations the first one hour (See fig. 3) of the test which envelops the plant HELB conditions is not considered.

a) Test profile FG:

T_1 = 100°F = 311°K

T_2 = 303°F = 424°K

T_x = 7 hrs.

T_{L_1} = to be calculated

ϕ & K are same as in (i)

ATTACHMENT #1

Question Nos. 9, 36 & 37 (Cont'd)

Substituting these values in Arrhenius equation and solving:

T_{L_1} = 7,386 hrs.

b) Test Profile HI:

T_1 = 100°F - 311°K

T_2 = 230°F = 383°K

T_x = 42 hrs.

T_{L_2} = to be calculated

$\emptyset$ & K are same

Substituting these values in Arrhenius equation and solving:

T_{L_2} = 5,699 hrs.

Hence combining the results from (i) and (ii) above the total qualified life = 203 + 7,386 + 5,699 = 13288 hrs = 1.5 yrs.

NOTE: 2nd Para, Page 83 of Rosemount Report No. 57820 in QDR-5437-13-01 reads as follows.

The integrated circuit used is a linear device of monolithic bipolar construction; it is an LM308 device. An estimate of the activation energy is provided in a military technical report generated by the Air Force Rome Air Development Center (reference 9.7). In the conclusion of this document, it is stated that a range of activation energies for microcircuit technology varies from 0.7 to 2.3 electron volts with no discernable correlation with microcircuit technologies, packages or manufacturer. Using the smallest value of this range gives the most conservative estimate of test time for thermal aging when used in conjunction with the Arrhenius equation.

ATTACHMENT #1

Question No. 11

Equipment Evaluation Worksheets indicates the transmitters may be exposed to the maximum radiation dose of 4.87×10^3 RADS 40 yrs (TID) plus 9.3×10^5 RADS DBE. (Total 1×10^6 RADS). Reference Report #6, page 5, section 5.3 indicates 1152 model transmitter was exposed to total of 5×10^6 RADS during radiation test, which equals the anticipated 40 yrs TID plus DBE dose.

Question Nos. 27 and 39

Accuracy after recalibration remained sufficiently near to the specified value at all times except during the extreme conditions of the steam pressure test which were well above the plant service conditions. Since the accuracy returned to within 0.25% of specified following the steam pressure test, it is the judgement of NUS that this is not a detriment to qualification.

Question No. 28

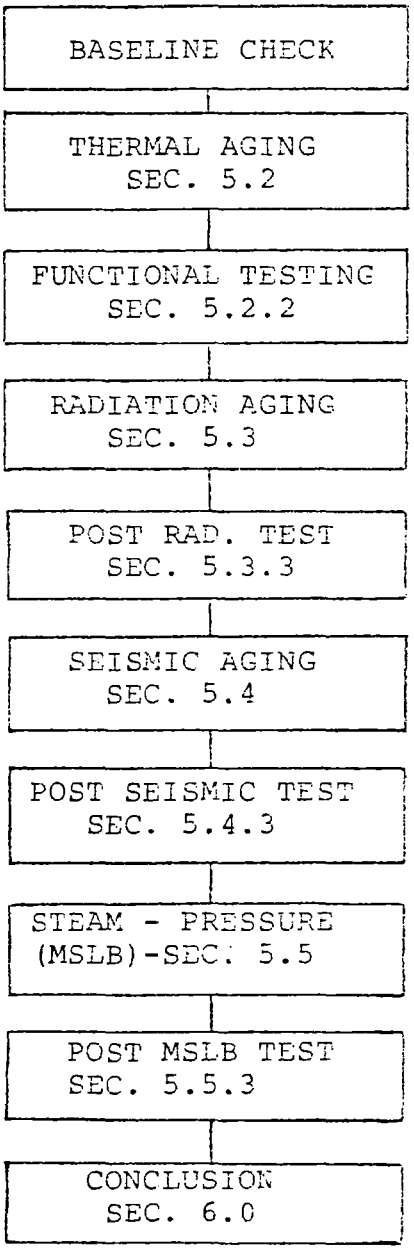
The test report does not define mounting details except for seismic testing. It is assumed that for both the manufacturer sponsored type testing and for installation in the plant that the manufacturer's mounting recommendations were followed.

Question Nos. 29 and 30

The TME calibration dates are recorded in Appendix 1, page 28 of the test report. The traceability of calibration to NBS is not considered critical since generally the test facilities have a qualify control procedure which is recognized by the industry and which assures proper maintenance of calibration for the TME.

FIGURE 1

Block Diagram for Qualification and Type Test Procedure for Pressure Transmitter, Rosemount Model No. 1152 AP, DP, GP. Rosemount Report No. 117415,Rev. B, dated Sept. 24, 1975 (Ref. Report No. 6)



CLASS IE EQUIP. QUALIF. TYPE TEST PROGRAM PER IEEE-323 STANDARD 1974

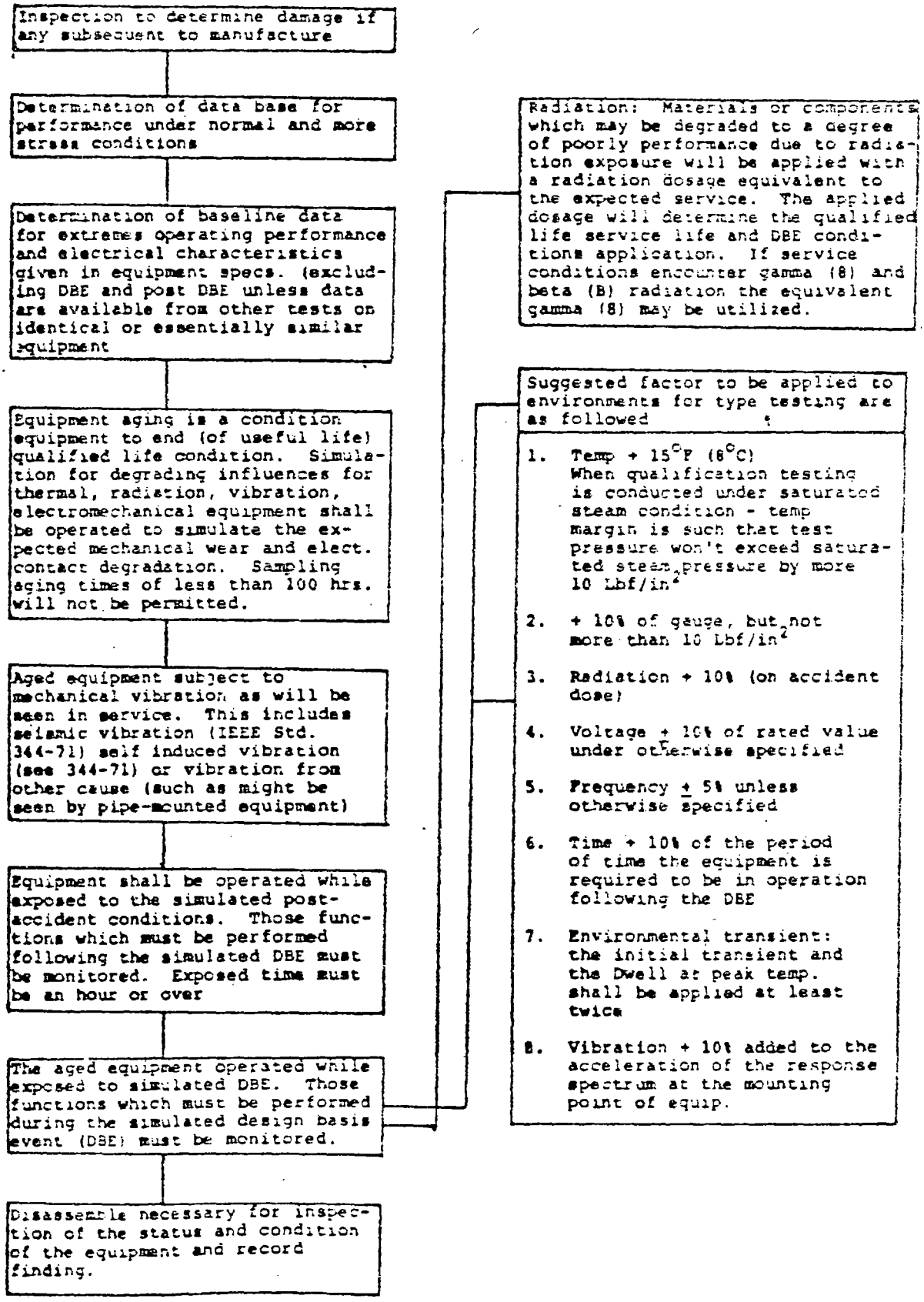
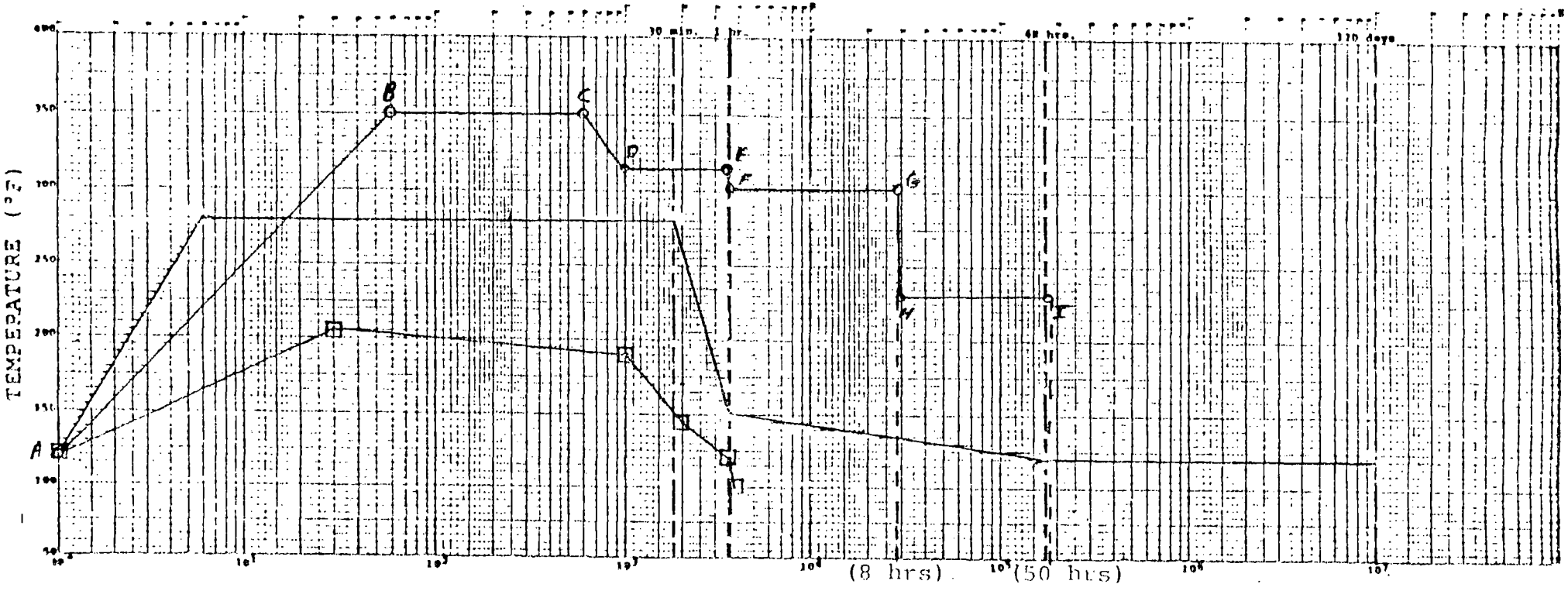


FIGURE 2



NOTE: Required HELB conditions exist for one hour only.

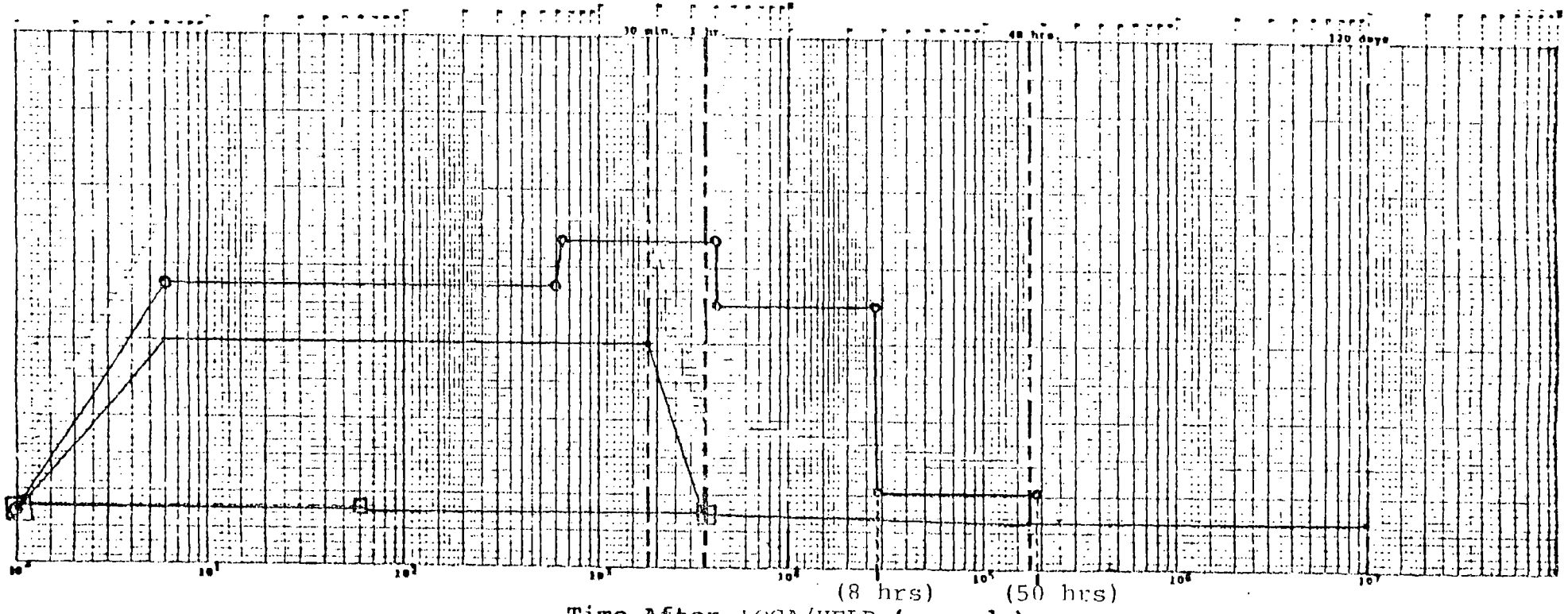
——— LOCA PROFILE [Ref.: S&W Calculation No. 12846.44-US(B)-052-1 for Zone for inside containment]

o———o **ACTUAL TEST PROFILE** (Ref. Section 5.5, Rosemount Report No. 117415, Rev. B dated 9/24/75)

□———□ HELB PROFILE (Ref. S&W Calc. 12846.44-PE-050-0 for Zone AB-13A)

LOCA/HELB TEMPERATURE TRANSIENT

FIGURE 3



Time After LOCA/HELB **(seconds)**

——— LOCA **PROFILE** [**Ref.: S&W Calculation No. 12846.44-US(B)-052-1 for** Inside Containment]

o———o **ACTUAL TEST PROFILE** (Ref. Section 5.5 Rosemount Report No. 117415, Rev. B dated 9/24/75)

□———□ HELB PROFILE (Ref. S&W Calc. 12846.44-PE-050-0 for Zone AB-13A)

LOCA/HELB PRESSURE TRANSIENT

FIGURE 3A

Facility: VEPCO, SURRY
Unit: 2
Docket: 50-281

SYSTEM COMPONENT EVALUATION WORK SHEET - SUPPLEMENT 3

SYSTEM: LEAKAGE MONITORING / EQUIPMENT DESCRIPTION	Units	Environment: Specification	Environment: Qualification	Documentation Reference: Specification	Documentation Reference: Qualif.	Method	Outstanding Items
	OPER. TIME	120 days	~~Note 1~~ 7120 Days	Westinghouse Ref. Ltr. No. NS-SS-79287	~~Note 1~~ 6,17	~~Note 1~~ Type Test + analysis	~~Note 1~~ None
PLANT ID NO. PT-LM-201A	TEMP °F	~~NR~~ See Fig. 3	~~NR~~ See Fig. 3	S+W Calc. ~~NR~~ 12846.44-PE-050-0	6,17 ~~NR~~	Type Test ~~NR~~ + analysis	None
COMPONENT: Pressure Transmitter							
MANUFACTURER: Rosemount Inc.	PRESS. psia	~~NR~~ See Fig. 3A	~~NR~~ See Fig. 3A	~~NR~~	6,17 NR	Type Test + ~~NR~~ analysis	None
MODEL NUMBER: 1152AP7A22PB	REL. HUM. %	~~NR~~ 100%	~~NR~~ 100%	~~NR~~	6,17 ~~NR~~	Type Test ~~NR~~	None
FUNCTION: Post-accident Monitoring	CHEM. SPRAY	NR	NR	Env. Zone ~~NR~~ Description AB-13A(o)	NR ~~NR~~	NR ~~NR~~	None
ACCURACY: Spec: ±.25% of Span Demo: ±.25% of Span	RAD.	LOCA = ~~2.5 x 10⁶~~ 9.3×10^5 40 Yr = ~~2.5 x 10⁴~~ 4.87×10^3	5×10^6 ~~Note 1~~	S&W Calc. ~~12846.38-RP-026-0~~ 12846.44-UR(B)-043-0 - VEPCO P.O. No. 39306 Data Sheet	~~Note 1~~ 6,17 - 6,17	Type Test ~~Note 1~~	None ~~Note 1~~
LOCATION: AB-13A(o) Aux. Bldg.	AGING	~~Enclosure 4 Guidelines~~ Section 7.0 40 yrs.	40 yrs.			Type Test + Refer to Report Sec. 3.1.2 (Aging) analysis	Note 1 None
SERVICE: Reactor Containment Pressure				Env. Zone ~~NR~~ Description AB-13A(o)			
FLOOD LEVEL ELEV: -21'11" ABOVE FLOOD LEVEL: X Yes No	SUB.	NR	NR		NR	NR	None

NR = Not required. All numbers written in Documentation Reference Qualification column are identified in Section 10.5.

NOTES: 1. Transmitter is qualified to the requirements of IEEE-323-1971. At present transmitters are being qualified to the requirements of IEEE-323-1974. To obtain a 40 yrs. life this transmitter is to be included in VEPCO's Ongoing Aging Surveillance Program.

Facility: VEPCO, SURRY
Unit: 2
Docket: 50-281

SYSTEM COMPONENT EVALUATION WORK SHEET - SUPPLEMENT 3

SYSTEM: LEAKAGE MONITORING		Environment		Documentation Reference			Out-standing Items
	Units	Specification	Qualification	Specification	Qualif.	Method	
EQUIPMENT DESCRIPTION	OPER. TIME	120 days	>120 Days ~~Note 1~~	Westinghouse Ref. Ltr. No. NS-SS-79287	6,17 ~~Note 1~~	Type Test ~~Note 1~~ + analysis	None ~~Note 1~~
PLANT ID NO. PT-LM-201B	TEMP °F	~~NR~~ See Fig. 3	~~NR~~ See Fig. 3	S&W Calc. ~~NR~~ 12846.44-PE-050-0	6,17 ~~NR~~	Type Test ~~NR~~ + analysis	None
COMPONENT: Pressure Transmitter							
MANUFACTURER: Rosemount Inc.	PRESS. psia	~~NR~~ See Fig. 3A	~~NR~~ See Fig. 3A	~~NR~~	6,17 ~~NR~~	Type Test ~~NR~~ + analysis	None
MODEL NUMBER: 1152AP7A22PB	REL. HUM. %	~~NR~~ 100%	~~NR~~ 100%	~~NR~~	6,17 ~~NR~~	~~NR~~ Type Test	None
FUNCTION: Post-accident Monitoring	CHEM. SPRAY	NR	NR	Env. Zone ~~NR~~ Description AB-13A(o)	NR ~~NR~~	NR ~~NR~~	None
ACCURACY: Spec: ±.25% of Span Demo: ±.25% of Span	RAD.	LOCA = ~~2.5 x 10⁶~~ 9.3×10^5 40 Yr = ~~2.5 x 10⁶~~ 4.87×10^3	5×10^6 ~~Note 1~~	S&W Calc. ~~12846.38-RP-026-0~~ 12846.44-UR(B)-043-0	6,17 ~~Note 1~~	Type Test ~~Note 1~~	None ~~Note 1~~
LOCATION: AB-13A(o) Aux. Bldg.	AGING	~~Enclosure 4 Guidelines Section 7.d~~ 40 yrs.	40 yrs.	• VEPCO P.O. No. 39306 Data Sheet	-6,17	Type Test + Refer to Report Sect. 3.1.2 (Aging) analysis	Note 1 ~~None~~
SERVICE: Reactor Containment Pressure							
FLOOD LEVEL ELEV: -21'11" ABOVE FLOOD LEVEL: X Yes No	SUB.	NR	NR	Env. Zone ~~NR~~ Description AB-13A(o)	NR	NR	None

NR = Not required. All numbers written in Documentation Reference Qualification column are identified in Section 10.5.
NOTES: 1. Transmitter is qualified to the requirements of IEEE-323-1971. At present there are no transmitters qualified to the requirements of IEEE-323-1974. To obtain a 40 yrs. life this transmitter is to be included in VEPCO's Ongoing Aging Surveillance Program.

SECTION #2

SPECIFICATIONS, PURCHASE ORDERS,
VENDOR PROPOSAL

VEPCO P.O. NO. 39306
DATED JUNE 17, 1980

NOTES OF TELEPHONE CONVERSATION
SURRY POWER STATION- UNITS 1 & 2

STONE & WEBSTER ENGINEERING CORPORATION
Page of

J. O. NO. 12946.22
ETA NO. 22009

Call Date: 6 Mar 81
Time: 2:35 p

From To

of VEPCO

X R T Grindle of S&W

X Gary Lee of Rosemount (Lead, IPL) of

SUBJECT Status of Model 152 Xmtr responding to IEEE 323-74

SUMMARY Requested status of response of Xmtr to IEEE 323-74; Xmtr already qualified to 323-71; when engineering to be complete and when report will be available.
G.L. will check and get back to me with info by 3/11/81.

ACTION REQUIRED

~~F.M. Alligood~~
M. Bowling
~~J. Eastwood~~
VEPCO Proj. Engr.

~~G.J. Burroughs~~
~~H.W. Durkin~~
D.A Piccione
~~E. Sherwood~~
~~L.W. Brown~~

✓ File Job Book
All Participants

Preparer R T Grindle

Proj. Engr.
Concurrence
(required for any changes scope or schedule)

356.5F

VIRGINIA ELECTRIC AND POWER COMPANY

GENERAL OFFICES • RICHMOND, VIRGINIA

ORDER NO. 6

39306

OUR PURCHASE ORDER NO. AND REQUISITION NO. MUST APPEAR ON ALL INVOICES, SHIPPING PAPERS, PACKAGES, AND CORRESPONDENCES.

PURCHASE ORDER

ROSEMOUNT, INC.
1000 FOREST AVE.
RICHMOND, VA. 23229

SHIP TO
VIRGINIA ELECTRIC AND POWER COMPANY
AT
SURRY POWER STATION
(SEE BELOW)

.48

BILL TO
VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VA. 23261

ZST/P

SUBJECT TO CONDITIONS SPECIFIED BELOW

PER QUOTATION

ACCOUNT NO.	REQUISITION NO.	MATERIAL REQUIRED	PROMISED	PRICE F.O.B.	TERMS	DATE
1[illegible]522	12[illegible]556	PRIORITY	PRIORITY	P/S	NET	5/17/80

FURNISH AS ATTACHMENT

Delivery
10/17/80

TONS_____ BUNDLES_____ BOXES_____ CRATES_____ BBLS._____

LOAD_____ CAR NO._____ WEIGHT_____ PRO. OR FREIGHT BILL NO._____

TRANSPORTATION INFORMATION

ARCEL POST
REIGHT
AL DEL. } _____ NAME OF CARRIER

☐ PREPAID CHARGES $_____
☐ COLLECT CHARGES $_____
CHARGED TO_____

ATE RECEIVED_____

RECORD ALL PARTIAL SHIPMENTS ON REVERSE SIDE OF NO. 3 COPY OF THIS ORDER.

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RIGHT RECEIPT

VIRGINIA ELECTRIC AND POWER COMPANY

PURCHASE ORDER

ORDER NO. 39306

PAGE NO. 1

QUANTITY REQUIRED	UNIT	VEPCO STOCK NO.	DESCRIPTION	*UNIT PRICE	*DISC.
4		→ for SWB	Differential Capacitance Absolute Pressure Transmitters, Rosemount Inc., Model No. 1152AP7A22PB (Mark Nos. PT-LM101A,B; 201A,B)		$960 UO
2		→ for LEN	Differential Capacitance Level Transmitters, Rosemount Inc., Model No. 1152DP5A22PB (Mark Nos. LT-CN100, 200)		$960
			Transmitters shall be per the requirements specified in this requisition and tabulated on		

QUANTITY REQUIRED	STOCK NUMBER	DESCRIPTION	*PRICE	*UNIT
		Transmitters shall be capable of continuous operation under the following ambient conditions:		
		Normal Operating Conditions		
		1. Temperature 5-120°F		
		2. Pressure Atmospheric		
		3. Humidity 50 percent		
		4. Radiation 3×10^2 rads (40 yr dose)		
		Normal Design Conditions		
		1. Temperature 125°F		
		2. Pressure Atmospheric		
		3. Humidity 100 percent		
		4. Radiation 5×10^6 rads (40 yr dose)		
		Pressure retaining parts of the transmitters will be exposed to, and shall be capable of withstanding, the following post-accident environment for 40 minutes: Initial temperature of 280°F, decreasing within 10 minutes, and a pressure of 42.5 psig.		
		Transmitters shall be capable of continued operation with all normal operating loads acting simultaneously with the Operating Basis Earthquake (OBE) seismic loadings.		

QUANTITY REQUIRED	STOCK NUMBER	DESCRIPTION	*PRICE	*UNIT
		The horizontal and vertical OBE seismic loadings are:		
		Horizontal 1.68g*		
		Vertical 3.02g*		
		Transmitters shall be capable of withstanding the combined effects of all normal operating loads acting simultaneously with Design Basis Earthquake (DBE) seismic loads without loss of safety function or structural integrity. The horizontal and vertical DBE seismic loadings are:		
		Horizontal 2.475g*		
		Vertical 3.60*		
		For a base natural frequency above 8 Hz, the following g* values are applicable.		
		(OBE) Horizontal 0.21		
		Vertical 0.19		
		(DBE) Horizontal 0.30		
		Vertical 0.30		
		*g = acceleration due to gravity		
		Vendor shall perform hydrostatic and performance tests in accordance with his Standard procedures for nuclear pressure transmitters.		

B.	QUANTITY REQUIRED	STOCK NUMBER	DESCRIPTION	PRICE	UNIT
			Vendor shall submit the following documents to the Purchaser for review and approval prior to the start of manufacturing of the transmitters:		
			Seismic Qualification Test Procedure		
			Quality Assurance Manual		
			Vendor shall forward, with the shipment, one copy each of the documents and reports listed below, with the remainder sent to the Purchaser:		
			(4) Calibration Test Report		
			(4) Performance Test Report		
			(4) Hydrostatic Test Report		
			(4) Seismic Test Report		
			(4) Seismic Certificate of Compliance		
			(4) Certified Material Test Reports (pressure retaining parts)		
			(4) Certificate of Conformance		
			(5) Complete Sets of Manufacturer's prints		
			(5) Installation and Maintenance Instruction Manuals		
			(4) Environmental Test Report		
			All documentation shall reference applicable transmitters by equipment number and manufacturer's serial number.		

VIRGINIA ELECTRIC AND POWER COMPANY
PURCHASE REQUISITION

	QUANTITY REQUIRED	STOCK NUMBER	DESCRIPTION	PRICE	UNIT
			Materials for pressure retaining parts shall be traceable in accordance with 10CFR50, Appendix B. Certified Mill Test Reports shall be provided for all pressure retaining parts.		
			Transmitters shall be qualified per the requirements of IEEE-344-1975 and IEEE-323 1974, or IEEE-344-1971 and IEEE-323-1971 as alternates (If unable to meet 344-1975 and 323-1974).		
			10CFR Part 21 applies.		

PAGE NO.

1. Ship to:

Surry Power Station
Virginia Electric and Power Company
Attn: Resident Coordinator
Rt. 650, off Rt. 10
Surry, Virginia 23883

2. Shipping Instructions:

The seller shall prepare all material for shipment in such a manner as to protect it from damage in-transit. All boxes should be tagged or otherwise labeled with the following information:

Vepco P.O. No. 39306
Vepco Account No. 7138452 2
Vepco Project Title Cont. Pressure & Cond. Level Indicator
Storage Level: B
Design Change No. 80-537 ; QA Code C

Certificate of Conformance

The seller or fabricator shall furnish a certificate of conformance stating the items are supplied or fabricated from the specified materials in accordance with all referenced specification codes and procedures. The certificate shall be identified with Surry Power Station, purchase order number, work order no., and description of items furnished as well as seller's or fabricator's name and address.

All correspondence relative to the order shall be addressed to:

Mr. R. M. Berryman
Virginia Electric & Power Company
P.O. Box 26666
Richmond, Virginia 23261

	INITIAL	DATE
PREPARER	RTV	12/21/79
SPECIALIST	[illegible]	[illegible]

PAGE 1
SPEC. NO
J.O. NO. 12846-38

CLIENT VEPCO
PROJECT SURRY UNITS 1 & 2

EQUIP NO.	PT-1M1DIA	PT-1M1DIB		
SERVICE	REACTOR CONTAINMENT PRESSURE	REACTOR CONTAINMENT PRESSURE		
OPERATING CONDITIONS				
FLUID OR GAS	AIR	AIR		
TEMPERATURE °F	60°F - 120°F	60°F - 120°F		
PRESSURE ~~PSIG~~ PSIA	10 PSIA	10 PSIA		
RADIATION (40 YR LIFE)	5×10^6 RADS	5×10^6 RADS	(1)	
ELEMENT TYPE	CAPACITANCE	CAPACITANCE	(1)	
ELEMENT MATERIAL	316 SS	316 SS		
ENCLOSURE (NEMA TYPE)	WEATHERPROOF	WEATHERPROOF		
MOUNTING	WALL MOUNTED	WALL MOUNTED	(1)	
BODY MATERIAL	316 SS	316 SS		
MAX PROCESS TEMP	280°F	280°F		
RANGE	0 - 150 PSIA	0 - 150 PSIA		
OVERRANGE PROTECTION TO	2000 PSIG	2000 PSIG		
SPAN LIMITS PSIA *	0-50 / 0-300	0-50 / 0-300	(2)	
OUTPUT SIGNAL	4-20 MA DC	4-20 MA DC		
OUTPUT SIGNAL TO	—	—		
PROCESS CONN. SIZE	1/4" NPT	1/4" NPT	(1)	
CONDUIT CONN. SIZE	1/2" NPT	1/2" NPT		
ACCURACY	±.25% of SPAN	±.25% of SPAN		
REPEATABILITY	±.25% of ~~SPAN~~ UPPER RANGE	±.25% of UPPER RANGE	(1)	
DEADBAND	NONE	NONE	(1)	
ACCESSORIES	—	—		
MANUFACTURER *	ROSEMOUNT INC.	ROSEMOUNT INC	(1)	
MODEL NO. *	1152AP7A22 PB	1152AP7A22 PB	(1) (2)	
WEIGHT *	12 LBS	12 LBS	(1)	
CATEGORY	I	I		

NOTES:
1) TRANSMITTERS ARE TO BE QUALIFIED TO IEEE 323-1974 & IEEE 344-1975 OR TO IEEE 323-1971 & IEEE 344-1971 AS AN ALTERNATE
2) TRANSMITTERS TO BE SUPPLIED WITH A SS TAG, STAMPED WITH EQUIPMENT NO. AND SECURELY FASTENED TO TRANSMITTER
3) DUPLICATE TRANSMITTERS TO BE SUPPLIED FOR UNIT 2, TAGGED AS PT-LM201A AND PT-LM201B

~~4 EFFECTIVE FORCE BALANCE OR DIFFERENTIAL CAPACITANCE~~ (1)

REV.	(1)	RTV	2/15/80	(2)	RTV	5/13/80	3		/	4		/

* INFORMATION FURNISHED BY SELLER

COPY OF THIS ORDER.

RECEIVED BY _____

PARTIAL RECEIPT

VIRGINIA ELECTRIC AND POWER COMPANY

GENERAL OFFICES • RICHMOND, VIRGINIA

39306

OUR PURCHASE ORDER NO. AND REQUISITION NO. MUST APPEAR ON ALL INVOICES, SHIPPING PAPERS, PACKAGES, AND CORRESPONDENCES.

PURCHASE ORDER

ROSEMOUNT, INC.
1000 FOREST AVE.
RICHMOND, VA. 23229

SHIP TO
VIRGINIA ELECTRIC AND POWER COMPANY
AT
SURRY POWER STATION
(SEE BELOW)
J-6. NOS. 12846-3 & 5
12846-48

BILL TO
VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VA. 23261

SUBJECT TO CONDITIONS SPECIFIED BELOW

PER QUOTATION

ZST/P

QUANTITY	DESCRIPTION	MATERIAL REQUIRED	PROMISED	PRICE F.O.B.	TERMS	DATE
[illegible]	[illegible]	PRIORITY	PRIORITY	P/S	NET	6/17/70

FURNISH AS ATTACHMENT

CARTONS _____ BUNDLES _____ BOXES _____ CRATES _____ BILLS _____

AIRLOAD _____ CAR NO. _____ WEIGHT _____ PRO. OR FREIGHT BILL NO. _____

TRANSPORTATION INFORMATION

PARCEL POST
FAST
FREIGHT
EXPRESS
AIRLINE
NAME OF CARRIER

[ ] PREPAID CHARGES $. _____
[ ] COLLECT CHARGES $. _____
CHARGED TO _____

DATE RECEIVED _____

REFER TO NOTE PARTIAL SHIPMENTS ON REVERSE SIDE OF NO. 3 COPY OF THIS ORDER.

RECEIVED BY _____

SECTION #3

QUALIFICATION REPORTS

ROSEMOUNT REPORT NO. 117415, REV. B
DATED SEPTEMBER 24, 1975
(REFERENCE NO. 6)

NO. 117415, REV. B
BER 24, 1975
E NO. 6)

Reference No. 6

Rosemount

ROSEMOUNT INC., POST OFFICE BOX 35129 / MINNEAPOLIS MINNESOTA 55435 / TEL. (612) 941-5560

TWX: 910-576-3103. TELEX 29-0183

QUALIFICATION TESTS FOR ROSEMOUNT PRESSURE TRANSMITTER MODEL 1152

RMT Report No. 117415
Rev. B

Written by Linda Kinne Date 9/19/75
Design Engineering

Approved by R. W. Tisdale Date Sept 23, 1975
Project Engineer

Approved by J. A. Lenz Date Sept 24, 1975
Engineering Supervisor

Approved by [illegible] Date Sept. 24, 1975
Quality Assurance

Form No. 16215A

REVISION STATUS

Rev.	Page	Para-graph	Change Description	Engr App	QC App	Date
A			Recollated Appendix, Delete Report 2758 add summary page 37, add page 38 to Appendix; Change para. 4.1, 5.5.2; LL reference and spec. deleted.	[illegible]	[illegible]	5/3/76
B	1		Changed reference date of IEEE 323 to 1971.	[illegible]	[illegible]	10/26/76

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QUALIFICATION TESTS
FOR ROSEMOUNT
PRESSURE TRANSMITTER
MODEL 1152

RMT Report No. 117145

1.0 SCOPE

The objective of this document is to verify performance of Rosemount Model 1152 pressure transmitter under normal operating conditions; during and after radiation exposure, seismic events and a loss-of-coolant accident (LOCA).

The unit was subjected to a series of independent tests in accordance with IEEE 323 (1971) and IEEE 344 (1975), which includes aging, radiation, seismic vibration and steam-pressure tests. Performance of the transmitter during the test program is described in Section 4.1.

2.0 INTRODUCTION

The 1152 differential pressure transmitter is intended for use in nuclear power stations and other applications where stringent quality control of pressure retaining material and cleanliness are necessary to insure high reliability over an extended service life. Typical applications for the pressure transmitters are where equipment failure can result in the release of radioactive materials. (See specification drawings in Appendix II).

This report covers procedures, testing and results for exposure to radiation, seismic vibration and steam-pressure conditions performed on a test unit, Model 1152DP4A22, serial number 090.

Qualification testing of the 1152 pressure transmitter, serial number 090, began on January 13, 1975, and was completed on April 9, 1975.

3.0 REFERENCE DOCUMENTS

3.1 IEEE 323 (1971) - IEEE Standard for Qualifying Class IE Equipment for Nuclear Power Generating Stations.

3.2 IEEE 344 (1975) - IEEE Recommended practices for Seismic Qualification of Class IE Equipment for Nuclear Power Generating Stations.

3.3 Rosemount Report 2758 - Seismic Qualification Test for 1151/1152 Pressure Transmitter with Stainless Steel Electronic Housing; by Ismail Ismail

3.4 1152DP specification drawing for differential pressure transmitters.
1152AP specification drawing for absolute pressure transmitters.
1152HP specification drawing for high line pressure transmitters
1152 GP specification drawing for gage pressure transmitters.

4.0 TEST PROGRAM

The test unit was first subjected to thermal aging followed by radiation exposure of 5.0×10^6 Rads total integrated dose of gamma radiation. The unit was recalibrated and then subjected to seismic vibration in each of the three major axes independently, while it was pressurized at 60% of full scale. Vibration testing was performed with and without the mounting bracket at the .3" double amplitude or 3g level, over a frequency range of 5-100 Hz. Finally, the unit was subjected to sequential pressures of 60 psig, 350°F, dry heat environment for 10 minutes; 70 psig 316°F, saturated steam environment for 1 hour; 55.4 psig, 303°F, saturated steam environment for 7 hours; and 6 psig, 230°F, saturated steam environment for 42 hours.

Calibration data was recorded before, during and after each major portion of the qualification tests.

4.1 PERFORMANCE CRITERIA

The 1152 pressure transmitter performed to within 2.0% accuracy after being subjected to 5×10^6 Rads total integrated dose of gamma radiation. The accuracy after recalibration was within $\pm$ 0.25% of the span. Additionally, the transmitter remained operable, within the specified accuracy of $\pm$0.25%, during and after a seismic disturbance in each of the three major axes at the .3" double amplitude or 3g level over a frequency range of 5-100 Hz, with and without the panel mounting bracket.

Finally, the test unit was exposed to a steam-pressure environment. An output drift of 12% of span occurred during sequential exposure to 60 psig, 350°F for 10 minutes; 70 psig, 316°F for 1 hour; 55.4 psig, 303°F for 7 hours; and 6 psig 230°F for 42 hours. These temperatures are far in excess of the normal operating limit of the model 1152 (200 Degrees F) so no performance limit was set. Data was taken during the simulated accident temperatures for information only, and are proffered in Figure 6.

After exposure to the steam-pressure environment, the unit performed within an accuracy better than 1/2% Full Scale.

5.0 QUALIFICATION TEST

Type testing of the actual equipment using simulated service conditions is the preferred method of the IEEE standards and the procedure used for qualification requirements of the Rosemount Model 1152 pressure transmitters. Qualification is satisfied if the equipment to be tested is aged, subjected to environmental influences, and operated under post-event conditions to provide assurance that all such equipment will be able to perform their intended function for the required operating time.

The type test for qualification of the 1152 was a planned sequence of test conditions that met or exceeded the expected or specified service conditions and took into account both normal and abnormal operation.

5.1 TEST SEQUENCE

The test unit was subjected to the following sequence of tests:

Thermal Aging (Section 5.2)
Radiation Exposure (Section 5.3)
Seismic Vibration (Section 5.4)
Steam-pressure Environment (Section 5.5)

5.2 AGING

The transmitter was subjected to two complete thermal cycles from 100-0-200-100°F, both as a preliminary aging and as an initial bench mark to compare with all future test data.

5.2.1 Test Procedure

The aging test was performed on the transmitter at Rosemount Inc., Mpls. The transmitter was subjected to two complete temperature cycles of 100°F, 0°F, 200°F and 100°F. All temperatures were sustained for a minimum of one hour before readings were recorded to assure that the transmitter was stabilized at that temperature.

5.2.2 Test Data

Table 1: 1st Calibration Data for Aging
(Duration of the test was approximately 8 hours)

% Full Scale	Temperature 100°F	0°F	200°F	100°F
0	1.997	2.003	1.984	1.992
20	3.590	3.616	3.557	3.585
40	5.185	5.222	5.131	5.180
60	6.784	6.828	6.717	6.778
80	8.365	8.421	8.281	8.360
100	9.985	10.044	9.882	9.978
Span	7.988	8.041	7.898	7.986

Table 2: Calibration Check Between Aging Cycles (at 75°F)

	% Full Scale					
	0%	20%	40%	60%	80%	100%
Output Voltage (VDC)	2.001	3.598	5.195	6.795	8.380	10.001

Table 3: 2nd Calibration Data for Aging
(Duration of the test was approximately 8 hours)

% Full Scale	Temperature 100°F	0°F	200°F	100°F
0	2.000	2.014	2.000	2.005
20	3.592	3.622	3.570	3.596
40	5.185	5.231	5.142	5.190
60	6.783	6.835	6.725	6.789
80	8.364	8.425	8.287	8.370
100	9.984	10.050	9.889	9.990
Span	7.984	8.036	7.889	7.985

5.2.3 Discussion of Aging Results

The transmitter exhibited no significant change at any temperature and performed satisfactorily within the specification limit during and following approximately sixteen hours of thermal aging.

5.3 RADIATION

Radiation testing was performed at Isomedix Inc. to find the effects of 5.0×10^6 Rads total integrated dose of gamma radiation on the performance of the 1152 pressure transmitter.

5.3.1 Pre-test

Table 4: Calibration Data Recorded at Isomedix Inc. Before Exposure to Radiation (Room Temperature-in Radiation Cell, 70°F)

% Full Scale	1152 Output (VDC)
0	2.003
25	3.992
50	5.991
75	7.970
100	9.990
Span	7.987

5.3.2 Test Procedure

The test unit was exposed to radiation from cobalt 60, a source of gamma rays. Dose rate was 1.0×10^6 Rads per hour for five hours with data recorded every hour during radiation exposure. The test was performed in a radiation chamber, in air at ambient temperature (70°F) and a slight negative pressure (1/4" water).

Table 5: Data Recorded During Radiation Test at Isomedix

% Full Scale	Hours of Exposure				
	1	2	3	4	5
0	1.941	1.930	1.930	1.932	1.936
25	3.926	3.918	3.917	3.920	3.925
50	5.930	5.920	5.920	5.925	5.931
75	7.911	7.900	7.905	7.909	7.914
100	9.934	9.924	9.927	9.933	9.937
Span	7.993	7.994	7.997	8.001	8.001

5.3.3 Post-test

Table 6: Calibration Data after Return to Rosemount following the Radiation Test

% Full Scale	Temperature 100°F	0°F	200°F	100°F
0	1.916	1.927	1.944	1.943
20	3.512	3.540	3.515	3.535
40	5.109	5.152	5.090	5.132
60	6.710	6.760	6.675	6.731
80	8.295	8.355	8.240	8.314
100	9.918	9.985	9.843	9.933
Span	8.002	8.058	7.899	7.990

5.3.4 Discussion of Radiation Exposure Results

The test unit received a total of 5×10^6 Rads total integrated dose of gamma radiation over a period of five hours. Maximum changes in output, before (Table 3) after (Table 6) and during (Table 5) radiation exposure are as follows:

	Pre to Post	During
Zero Pressure Shift	-84mv (1.05%)	-73mv (0.9%) max.
Span Shift	+18mv (0.23%)	+14mv (0.2%) max.
Linearity	+1mv (0.01%)	-3mv (0.04%) max.
(0°F-200°F) Zero Temp Coefficient	+31mv (0.4%)	
(0°F-200°F) Span Temp Coefficient	-12mv (0.15%)	

From the results, we see that the maximum change was zero shift of 1.05% of full scale. This shift is within the performance specification of the transmitter, (See Appendix II). Next, the transmitter was recalibrated to the original output accuracy with the span and zero adjustments provided on the Model 1152. This allows for easy maintenance during the projected operating life (40 years) of the transmitter.

5.4 SEISMIC TEST

Seismic vibration was performed at Rosemount Inc., Mpls., to simulate an earthquake disturbance. A frequency range of 5-14 Hz was covered at .3" D.A. level and 14-100 Hz at the 3 g level. The test was performed in three major axes independently; vertical, horizontal and 90° to horizontal, mounted with and without the panel bracket. (See Drawing #1 "Three Axes Orientation and Panel Mounting Bracket").

5.4.1 Pre-test

Table 7: Calibration after Radiation and Recalibration (Taken at Room Temperature)

		% Full Scale					
		0%	20%	40%	60%	80%	100%
Output Voltage (VDC)	up scale	1.999	3.596	5.195	6.796	8.381	9.997
	down scale	2.000	3.597	5.196	6.798	8.383	--

5.4.2 Test Procedure

The same transmitter tested previously in radiation was subjected to seismic vibration. The unit was pressurized at 60% of full scale (90 inches H_2O) during vibration and a resonant search over a frequency range of 5-14Hz was performed at a .3" input and 14-100 Hz at 3 g level. (Frequencies lower than 5 Hz were not covered because of the testing machine capability.) A dwell for a period of 30 seconds was performed at each resonant point. If no resonance was found, then dwelling was done at frequencies of 10, 20 and 30 Hz.

Table 8: Hard Mount - No mounting bracket (see Figure 1 in Appendix I).

Axis	Frequency (Hz)	Dwell (Sec)	Double Amplitude or G Level	Output (VDC)	Graph
Vertical	10	30	.3"	6.798	#1
	20	30	3g	6.797	#1
	30	30	3g	6.798	#1
Horizontal	10	30	.3"	6.845	#2
	20	30	3g	6.845	#2
	30	30	3g	6.845	#2
90° To Horizontal	10	30	.3"	6.795	#3
	20	30	3g	6.795	#3
	30	30	3g	6.795	#3

Table 9: Transmitter Mounted with Panel Bracket (See Figure 2, 3 and 4 in Appendix I)

Axis	Resonance Frequency (Hz)	Dwell (Sec)	Double Amplitude or G Level	Output (VDC)	Graph
Vertical	68	30	3g	6.797	#4
Horizontal	78	30	3g	6.747 *	#5
	24	30	3g	6.749 *	#5
90° to Horizontal (outside bracket)	69	30	3g	6.797	#6
	61	30	3g	6.797	#6
	22	30	3g	6.797	#6
90° to Horizontal (inside bracket)	52	30	3g	6.797	#7
	26	30	3g	6.797	#7

(refer to pictures and graphs in Appendix I)
* Static head effect

5.4.3 Post-test

Table 10: Calibration at Room Temperature After Vibration

		% Full Scale					
		0%	20%	40%	60%	80%	100%
Output Voltage (VDC)	up scale	1.999	3.595	5.196	6.801	8.385	10.000
	down scale	2.001	3.597	5.202	6.802	8.388	--

5.4.4 Discussion of Seismic Vibration Results

There was no resonance at any frequency in the range of 5-100 Hz at the .3" double amplitude or 3g level when the transmitter was hard mounted (no mounting bracket) in the vertical, horizontal and 90° to the horizontal positions.

On the other hand, there was resonance when the panel mounting bracket was used in the positions mentioned above. All resonances were dwelled at for 30 seconds with no significant change in the transmitter readings. Strip chart records demonstrated that there was no shift during seismic vibration and the data in Tables 7 and 10 shows there was a negligible calibration change from before to after seismic testing.

The 92 option (stainless steel electronics housing rather than aluminum) was vibration tested as documented in RMT Report 2758 and summarized in Appendix II. Subsequent to this Qualification Report, A random multi-frequency test was successfully conducted at Wyle Laboratories on a different 1152 test unit. One is referred to RMT Report 127516 for details of this testing; a brief summary appears in Appendix II.

5.5 STEAM PRESSURE

Steam pressure testing was performed at Rosemount, Inc., Minneapolis. The test demonstrated that the test unit is capable of operating in the steam pressure environment of a simulated loss-of-coolant accident and will continue to operate in the post accident period.

5.5.1 Pre-test

Table II: Calibration Check (unit installed in steam chamber)

	Before Steam-Pressure Test % Full Scale					
	0%	20%	40%	60%	80%	100%
Output Voltage up scale	1.998	3.598	5.198	6.798	8.384	10.001
(VDC) down scale	2.002	3.599	5.199	6.800	8.385	--

5.5.2 Test Procedure

Tested the same transmitter that was exposed to radiation and seismic tests. The transmitter was installed in a steam autoclave with a pressure input line connected to the high side of the 1152 and the low side vented to the outside atmosphere. (Refer to Figure 5 in the Appendix I. The electrical wiring was connected to the signal terminals of the housing and a pressure tight conduit connection from the housing through the autoclave wall was used to prevent the terminal side from filling with condensed water. The steam generator used can only provide saturated steam. Thus, because of the difficulty in supplying super heated steam at 60 psig, auxiliary heaters and dry air were used to raise the chamber temperature to 350°F in five minutes. The following sequence was then followed:

Temperature	Pressure	Hold Time	Steam Environment
350°F	60 psig	10 minutes	Dry
316°F	70 psig	1 hour	Saturated
303°F	55.4 psig	7 hours	Saturated
230°F	6 psig	42 hours	Saturated

(Refer to Figure 6 in Appendix I , 1152 Steam-pressure: Output vs Time).

Table 12: Calibration Check during Steam-pressure Test (at 230°F)
(Data was recorded 40.5 hours after the start of the 50 hour steam-pressure test)

	% Full Scale					
	0%	20%	40%	60%	80%	100%
Output Voltage (VDC)	2.101	3.662	5.220	6.783	8.314	9.782

5.5.3 Post Test

Table 13: 1st Calibration Data After Steam-Pressure Test Unit at > 200°F (5 minutes after test).

	% Full Scale					
	0%	20%	40%	60%	80%	100%
Output Voltage (VDC)	2.117	3.650	5.220	6.784	8.293	9.872

Table 14: 2nd Calibration Data after Steam-Pressure Test
(Data taken after return to room temperature, 75°F)

	% Full Scale					
	0%	20%	40%	60%	80%	100%
Output Voltage up scale	2.041	3.639	5.240	6.843	8.430	10.036
(VDC) down scale	2.043	3.640	5.240	6.847	8.431	--

Table 15: 3rd Calibration check after Steam-pressure

% Full Scale	Temperature (°F)				
	Room Temp	100°	0°	200°	100°
0	2.045	2.047	2.075	2.060	2.044
20	3.644	3.642	3.676	3.630	3.639
40	5.245	5.238	5.276	5.203	5.236
60	6.846	6.838	6.875	6.788	6.836
80	8.431	8.421	8.461	8.349	8.418
100	10.038	10.026	10.060	9.939	10.022
Span	7.993	7.979	7.985	7.879	7.978

5.5.4 Discussion of Steam-Pressure Test Results

Comparison of data before and after steam testing shows an increase shift at all pressures. However, the shift was 1/2% full scale between the readings on tables 11 and 15 at room temperature.

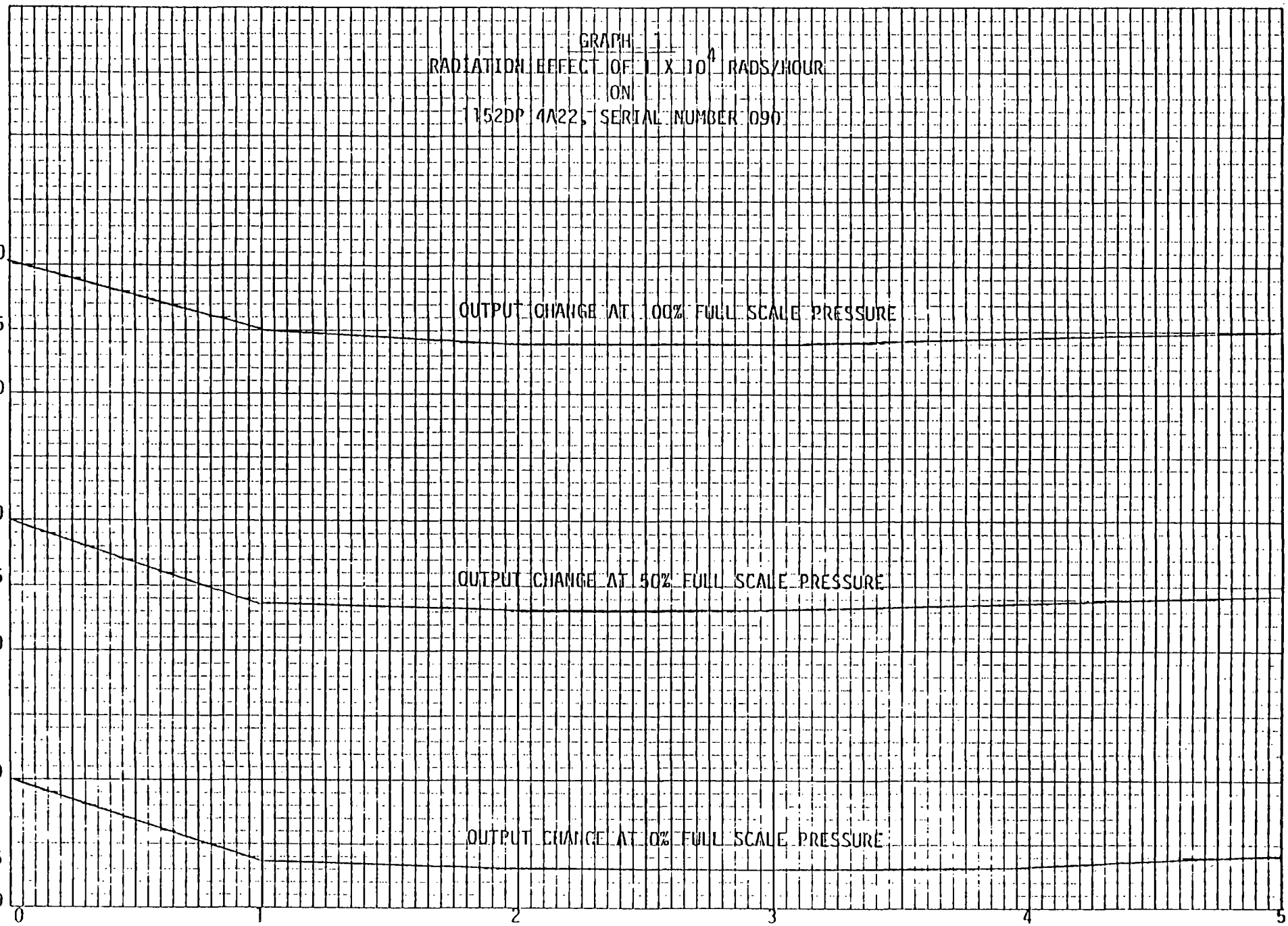
6.0 CONCLUSION

All qualification tests for radiation, seismic vibration, and steam-pressure were passed by the 1152DP test transmitter. The 1152DP (differential pressure) is representative of the other models of pressure transmitters AP (absolute), GP (gage) and HP (highline) in mechanical and electrical features. The only differences in the varios models is the input (pressure) and output (electrical) relationships. These are primarily calibration differences; not influencing qualification capability.

The output option D differs physically from the A option by a slightly different amplifier printed wire board assembly. The D option amplifier board was tested independently in radiation and has passed the same levels as described in Section 5.3.

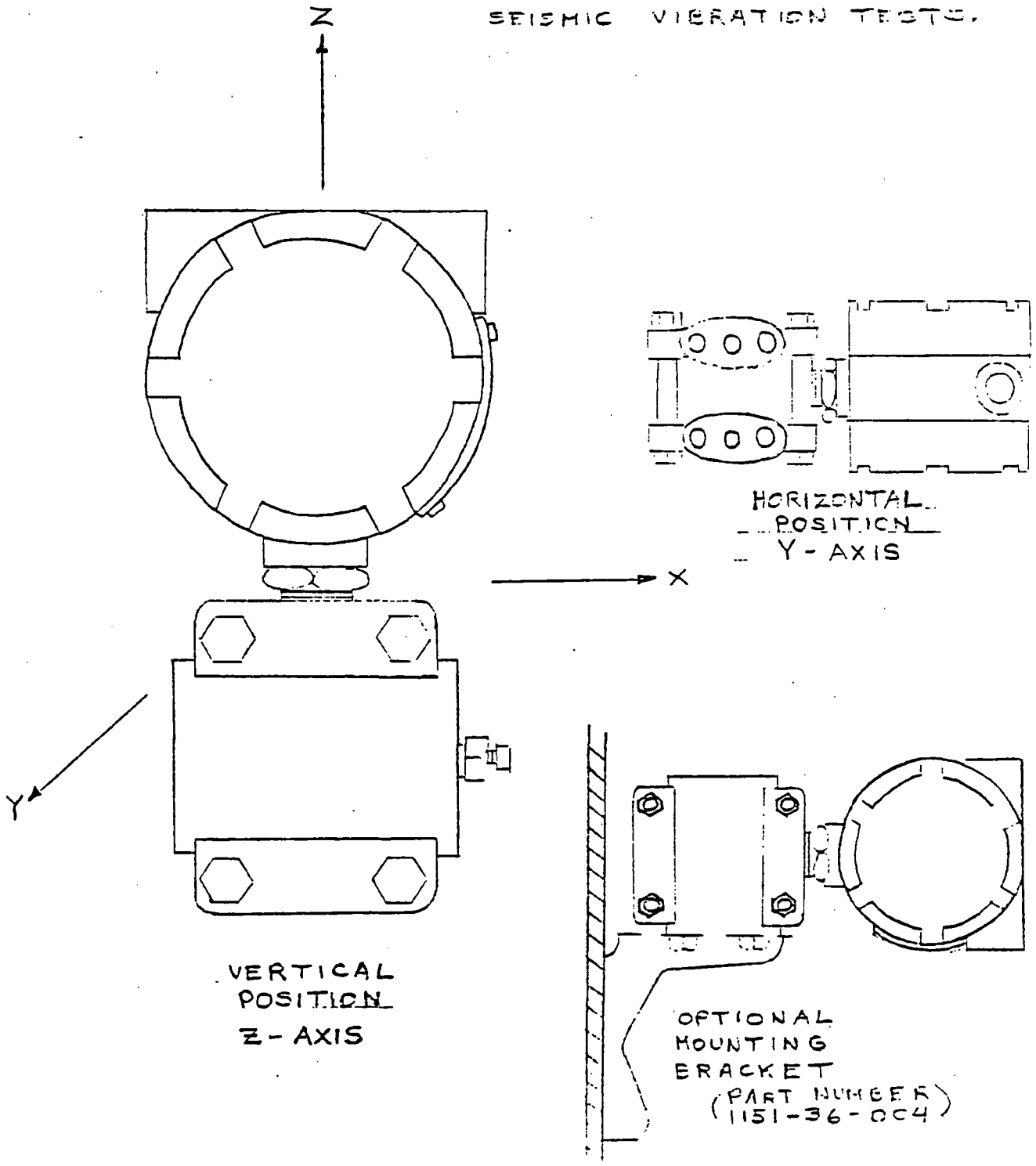
Similarly, the 1152 transmitter is mechanically identical to the 1151 model. The 1152 has the requirements of material traceability of pressure retaining parts and the use of non-Teflon wire in its assembly. The 1151 also has DP, AP, GP, HP and pressure transmitters that are qualified by similarity to the 1152 DP test transmitter, except for radiation levels.

7.0 APPENDIX I


GRAPH 1
RADIATION EFFECT OF 1 X 10^4 RADS/HOUR
ON
152DP 4A22, SERIAL NUMBER 090
OUTPUT CHANGE (% FULL SCALE)
OUTPUT CHANGE AT 100% FULL SCALE PRESSURE
OUTPUT CHANGE AT 50% FULL SCALE PRESSURE
OUTPUT CHANGE AT 0% FULL SCALE PRESSURE
0
-.5
-1.0
0
-.5
-1.0
0
-.5
-1.0
0
1
2
3
4
5

DRAWING #1

1152 PRESSURE TRANSMITTER THREE AXIS ORIENTATION AND MOUNTING BRACKET USED IN SEISMIC VIBRATION TESTS.



K&E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7522

DATE 3-20-75 GRAPH# 1a

MODEL 1152 SN 90

AXIS VERT. HARD MOUNT

F.O. RANGE 6 HZ TO 100 HZ

V. INPUT .3" DA OR 3 GPK

CONT. ACC. LOC. BLOCK

MONITER ACC. LOC. TOP, ELECT. HOUSING

@

INPUT ACCELERATION G's

TRANSITION POINT FROM .3" DOUBLE AMPLITUDE TO 3 g LEVEL INPUT

THIS SECTION ILLUSTRATES A CONSTANT AMPLITUDE — (NOT A RESONANCE BUILD UP)

10 100

TEST FREQUENCY HZ

K&E LOGARITHMIC 3 x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7522

DATE 3-20-75 GRAPH# 2

MODEL 1152 SN 90

AXIS HORZ, HARD MOUNT

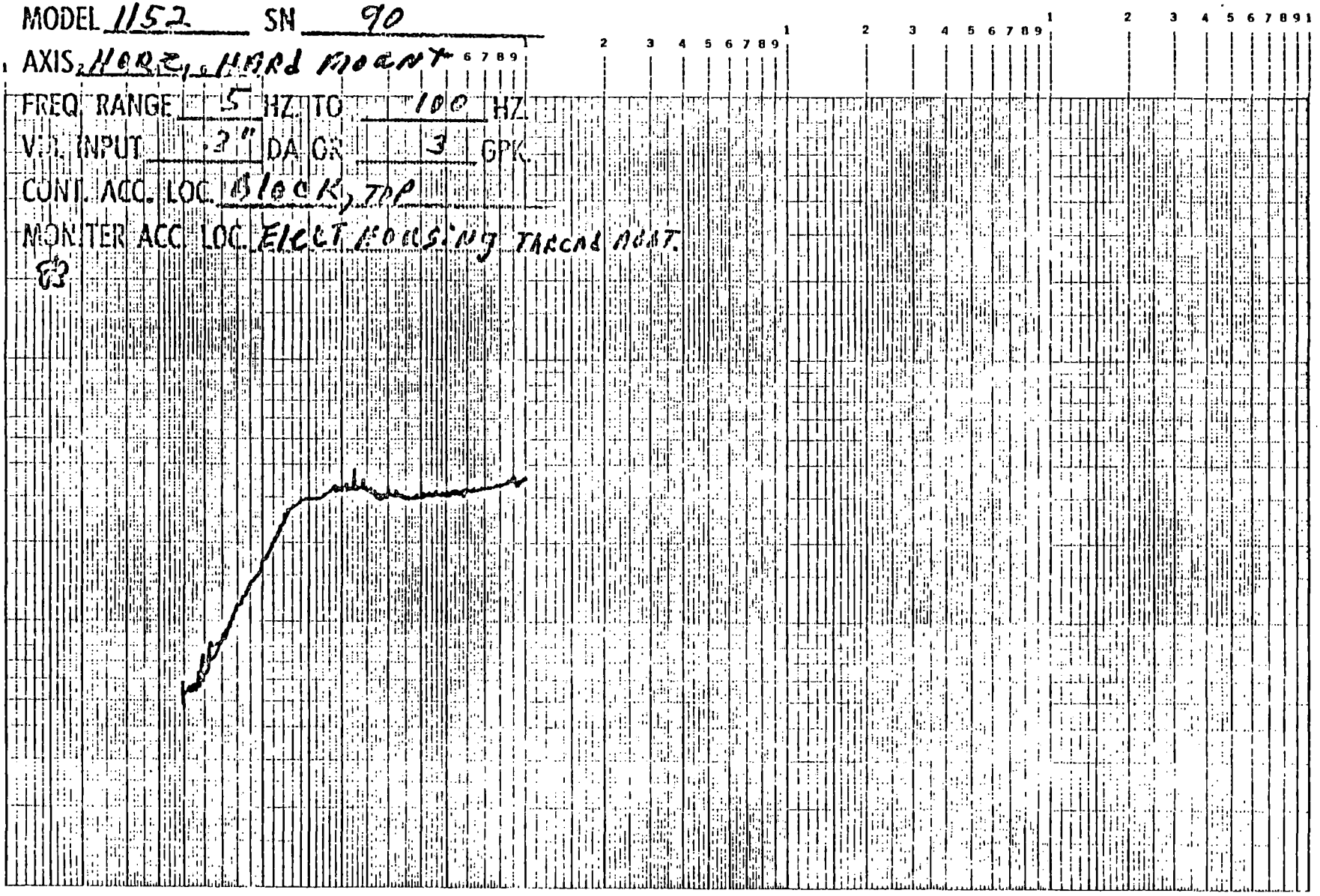
FREQ. RANGE 5 HZ TO 100 HZ

VEL. INPUT .2" DA OR 3 GPK

CONT. ACC. LOC. BLOCK, TOP

MONITER ACC. LOC. ELECT HOUSING THERM MOUNT.

G3



INPUT ACCELERATION G's

46 7522

DATE 3-20-75 GRAPH# 3

MODEL 1152 SN 90

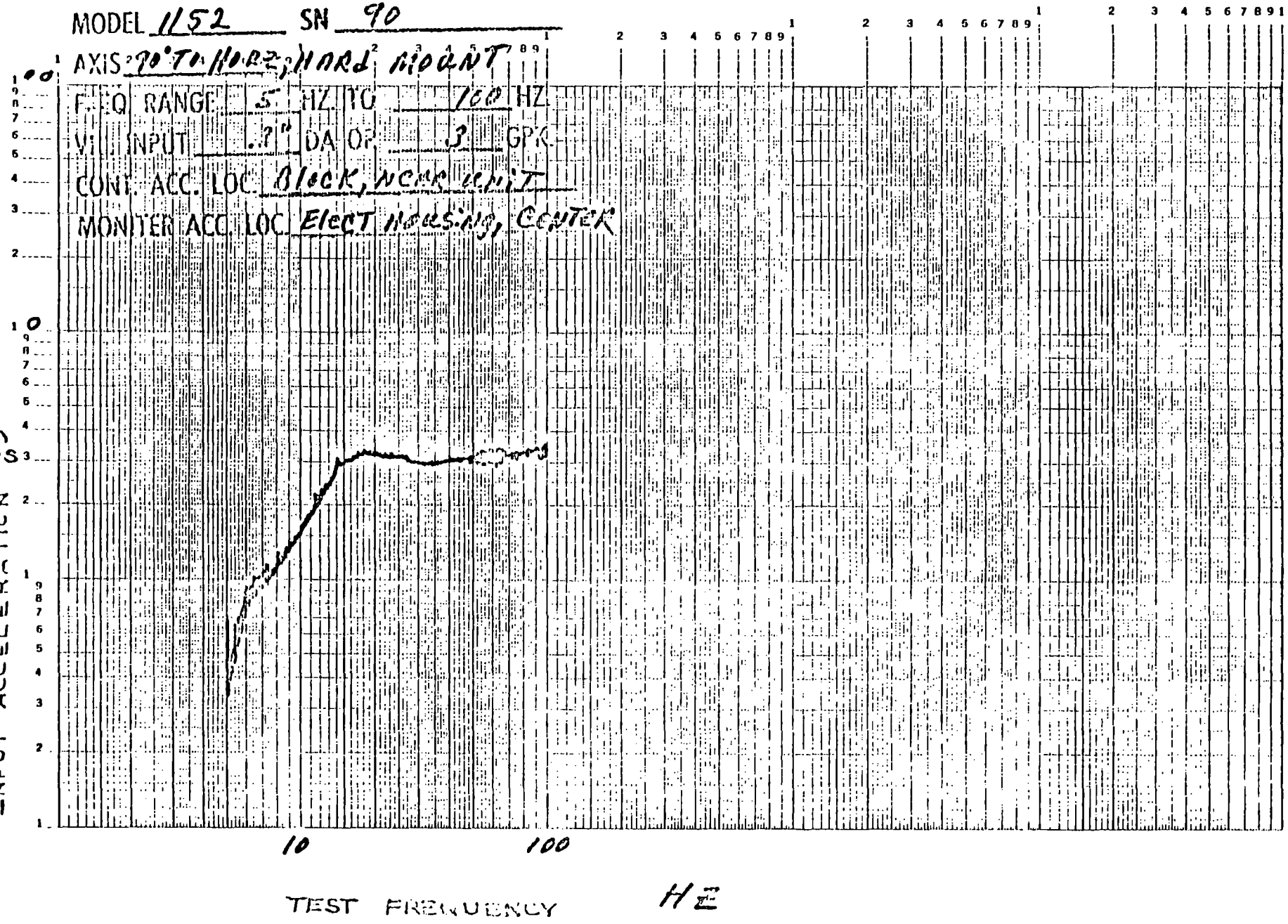
AXIS 90° TO HORZ, HARD MOUNT

FREQ RANGE .5 HZ TO 100 HZ

VEL INPUT .3" DA OR 3 GPK

CONT. ACC. LOC. Block, near unit

MONITER ACC. LOC. Elect Housing, Center



K&E LOGARITHMIC 3 x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7522

DATE 3-20-75 GRAPH# 4

MODEL 1152 SN 90

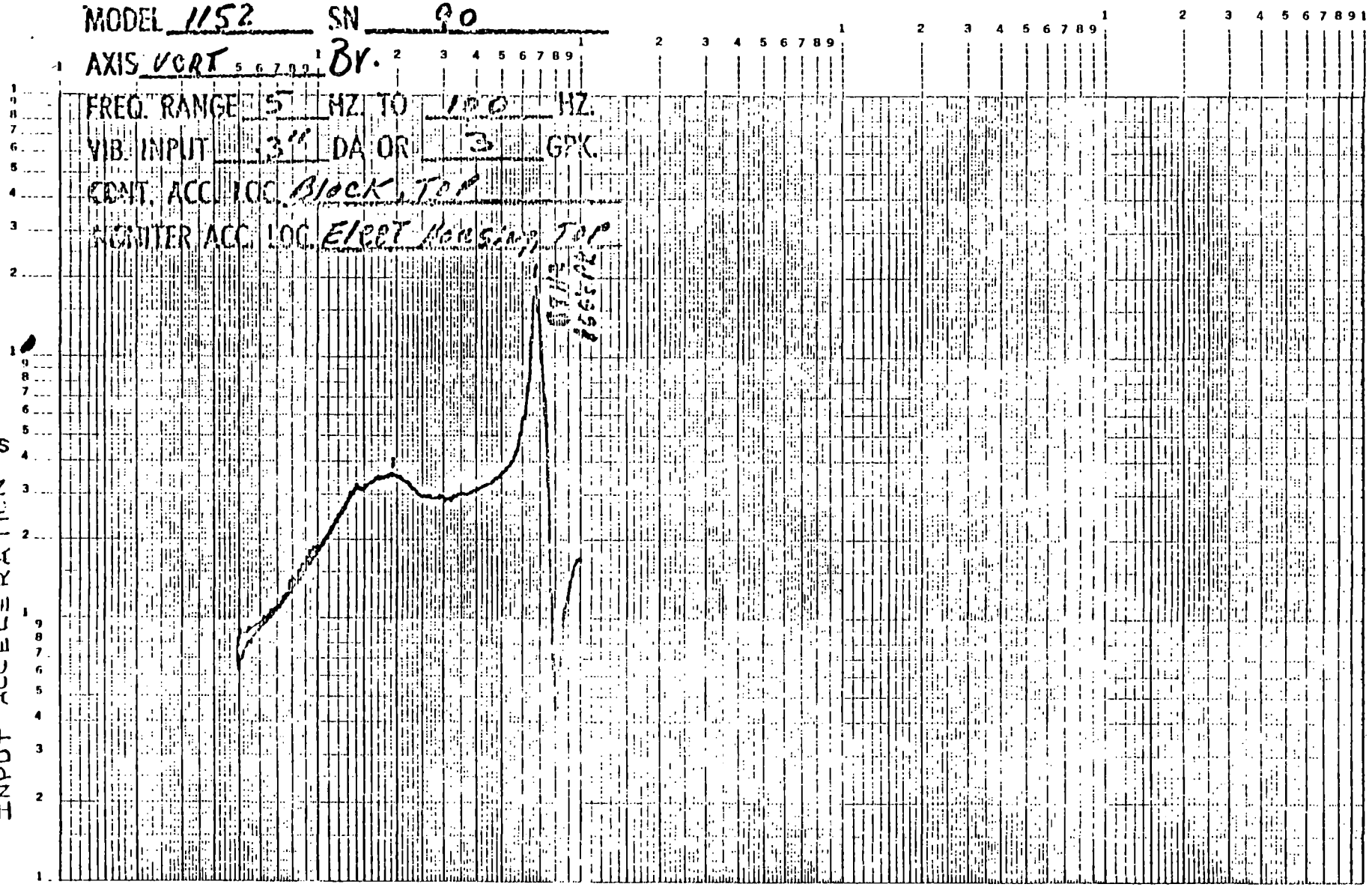
AXIS VERT 5 6 7 8 9 1 Br. 2 3 4 5 6 7 8 9 1 2 3 4 5 6 7 8 9 1 2 3 4 5 6 7 8 9 1

FREQ. RANGE 5 HZ. TO 100 HZ.

VIB. INPUT .3" DA OR 3 GPK.

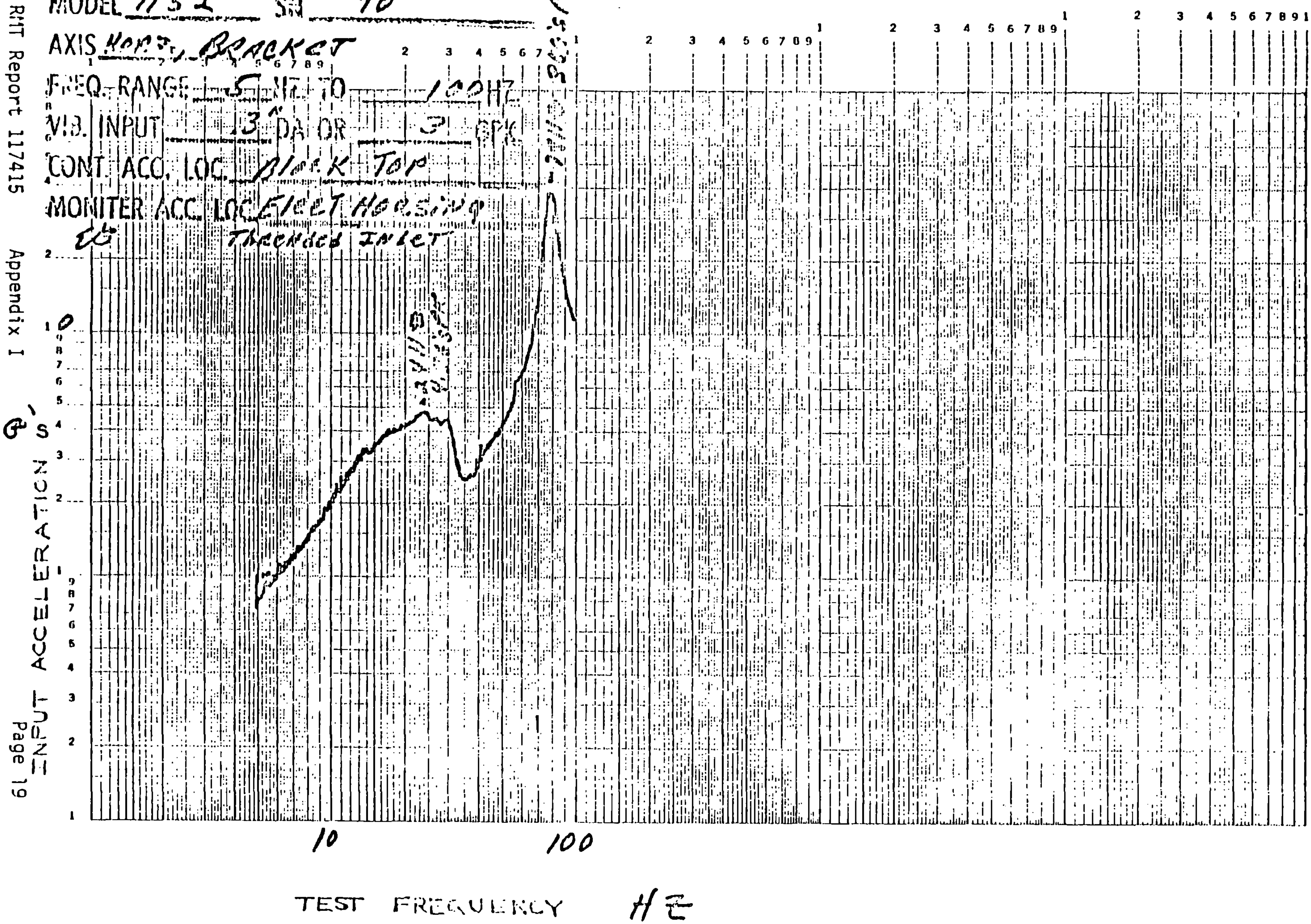
CONT. ACC. LOC. Block, Top

RECEIVER ACC. LOC. Elect Housing, Top



K+E LOGARITHMIC 3 x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 7522

DATE 3-20-75 GRAPH # 5
MODEL 1152 SN 90
AXIS Norm. Bracket
FREQ. RANGE 5 HZ TO 100 HZ
VIB. INPUT .3" DA OR 3 GPK
CONT. ACC. LOC. Block Top
MONITER ACC. LOC. Elect Housing @ Threaded Inlet



K&E LOGARITHMIC 3 x 5 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7522

DATE 3-20-75 GRAPH# 6

MODEL 1152 S/N 90

AXIS 90° TO HORZ BRACKET

FREQ. RANGE 5 100 HZ.

INPUT .3" 3 GPK.

CONT. ACC. LOC. BRACK TOP

MONITER ACC. LOC. Elect. Housing, Centr.

OUTPUT ACCELERATION G's

10 100

TEST FREQUENCY HZ

DATE 3-20-75 GRAPH# 7

MODEL 452 SN 90

AXIS 90° TO MORE UNIT INSIDE BRACKET

FREQ. RANGE 5 HZ TO 100 HZ

INPUT .3 DATA OR 3 GPK

CONT. ACC. LOC. Block Top

MONITER ACC. LOC. Elect Housing Center

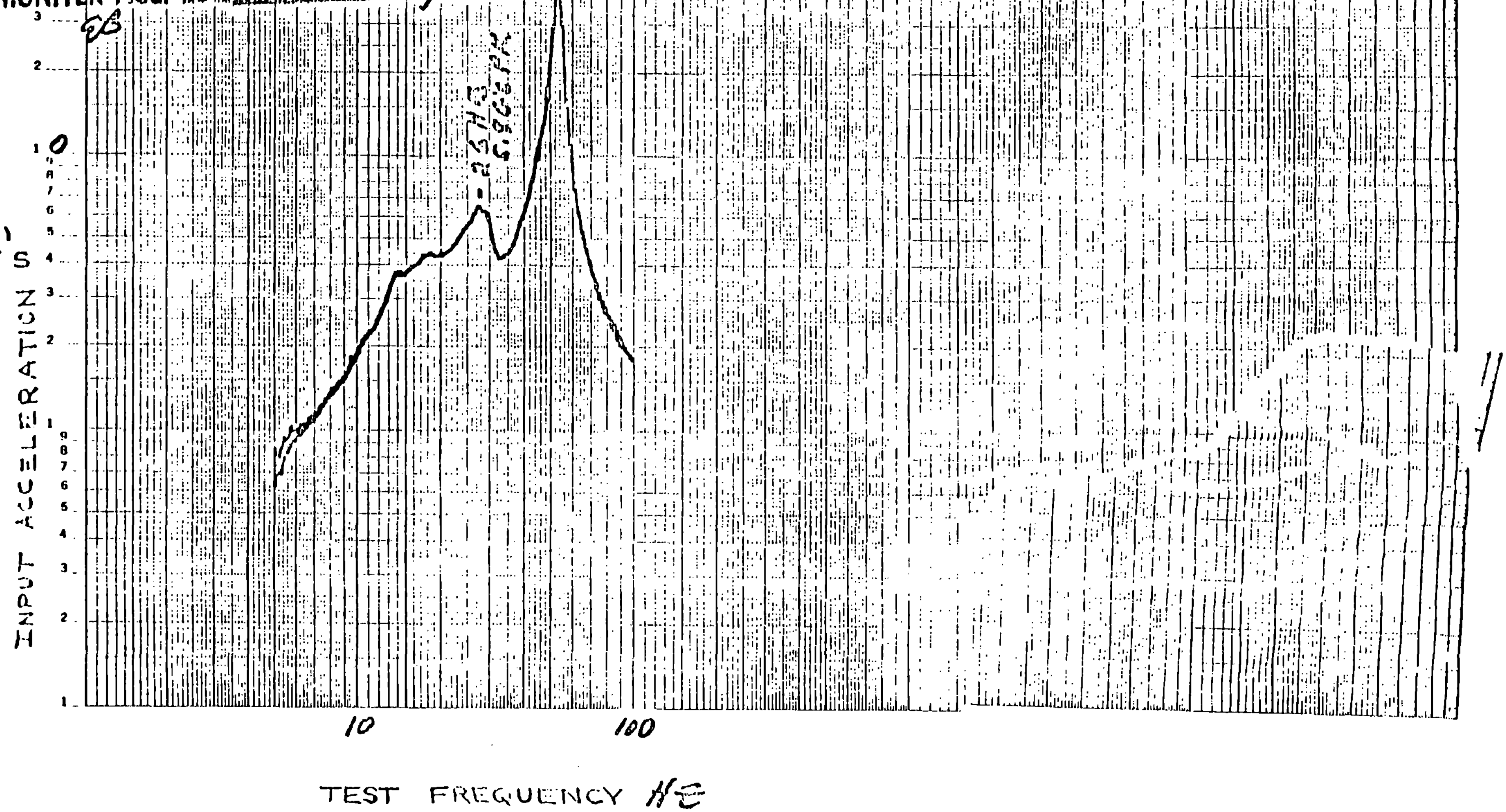


Figure 1

Seismic Vibration: 90° to horizontal, hard mount - no bracket, refer to Graph #3.

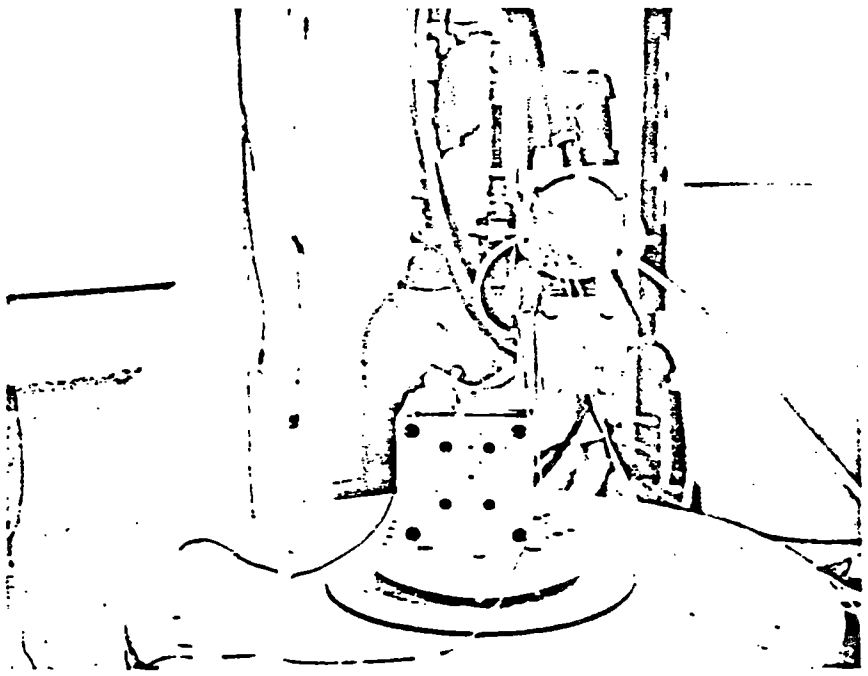


Figure 2

Seismic Vibration: Vertical, bracket mount, refer to Graph #4

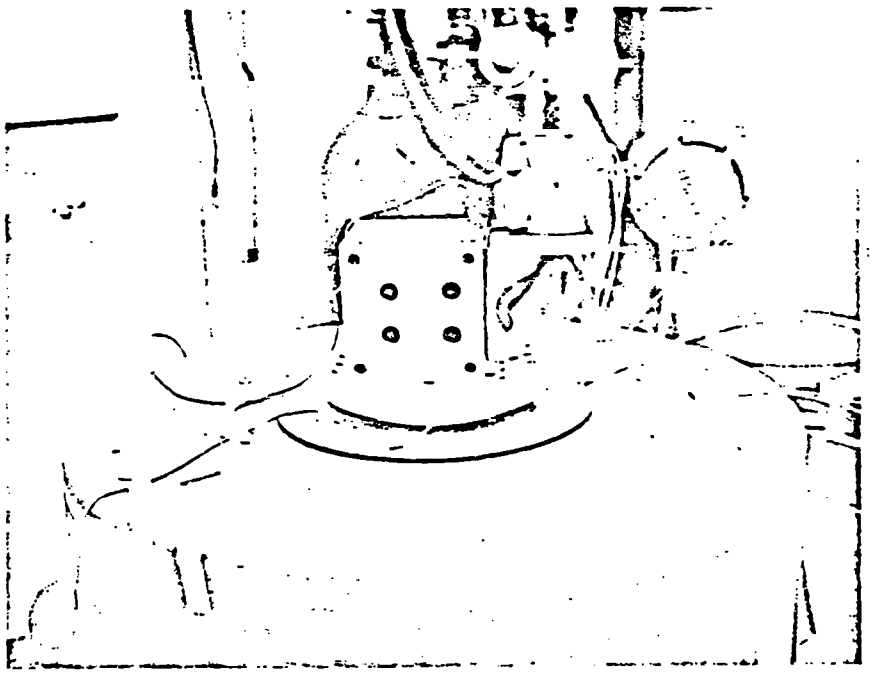


Figure 3
Seismic Vibration: 90° to horizontal, outside mounting bracket, refer to Graph #6.

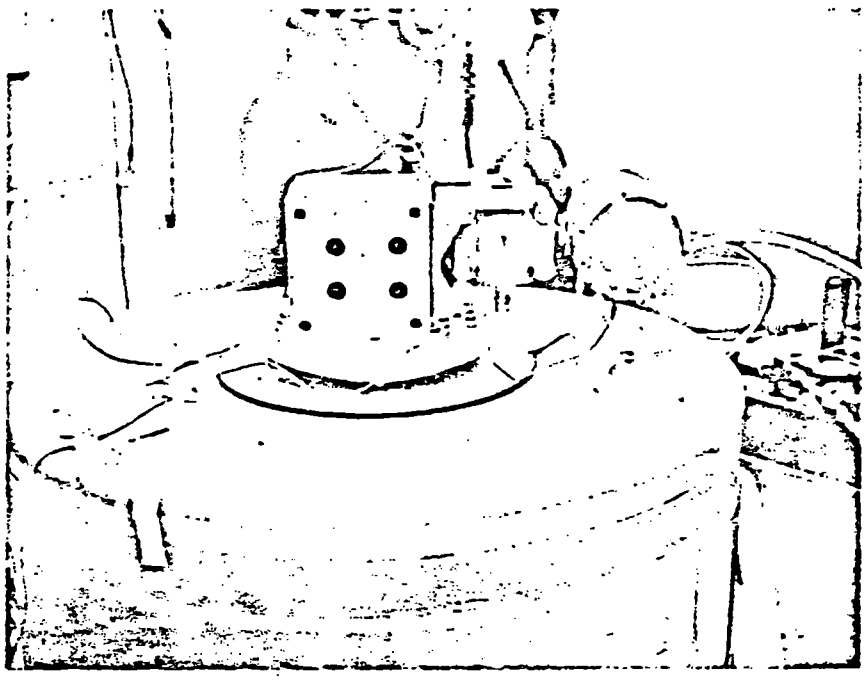
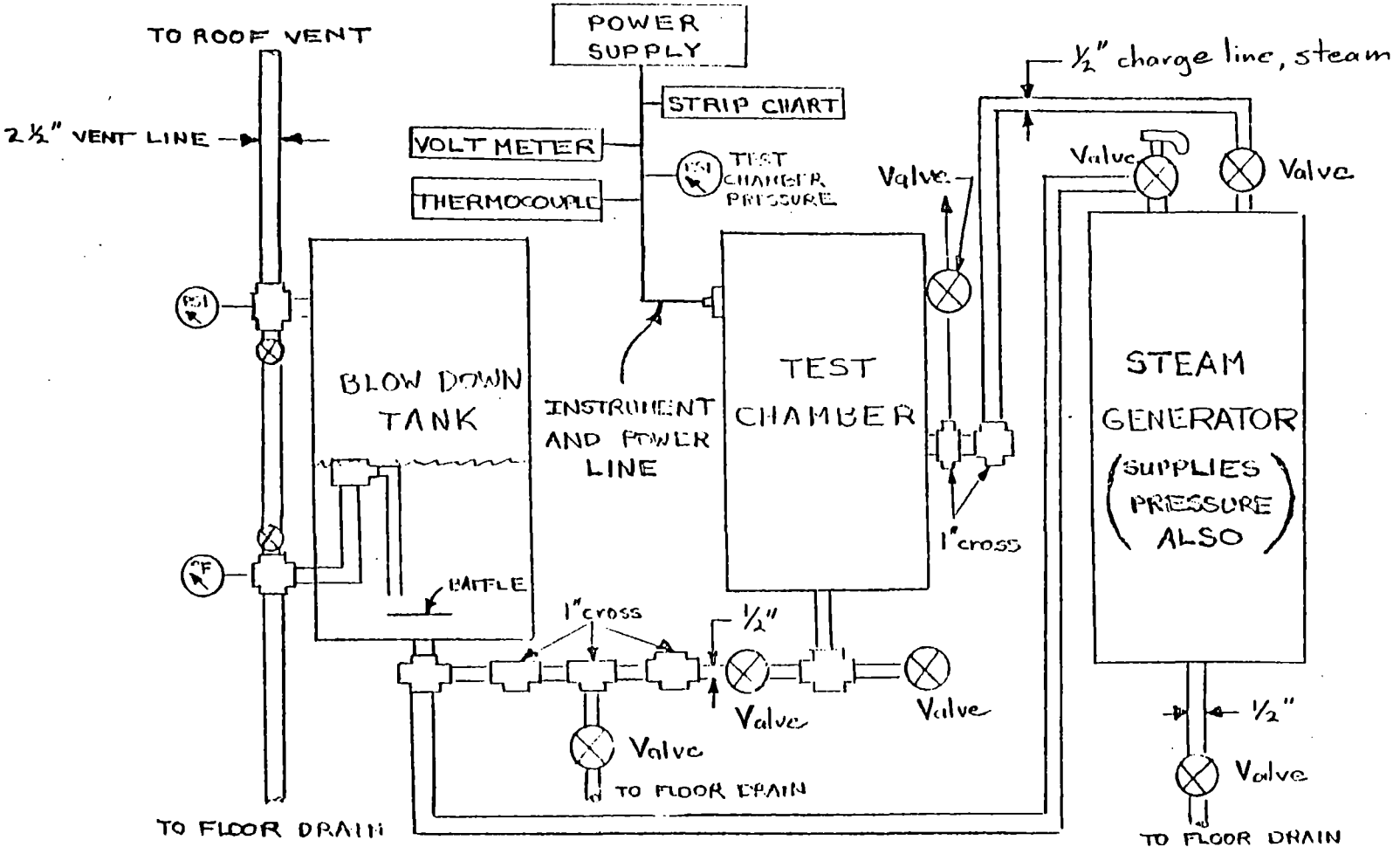


Figure 4
Seismic Vibration: 90° to horizontal, inside mounting bracket, refer to Graph #7.



SCHEMATIC DRAWING OF STEAM-PRESSURE TEST EQUIPMENT

FIGURE: 5

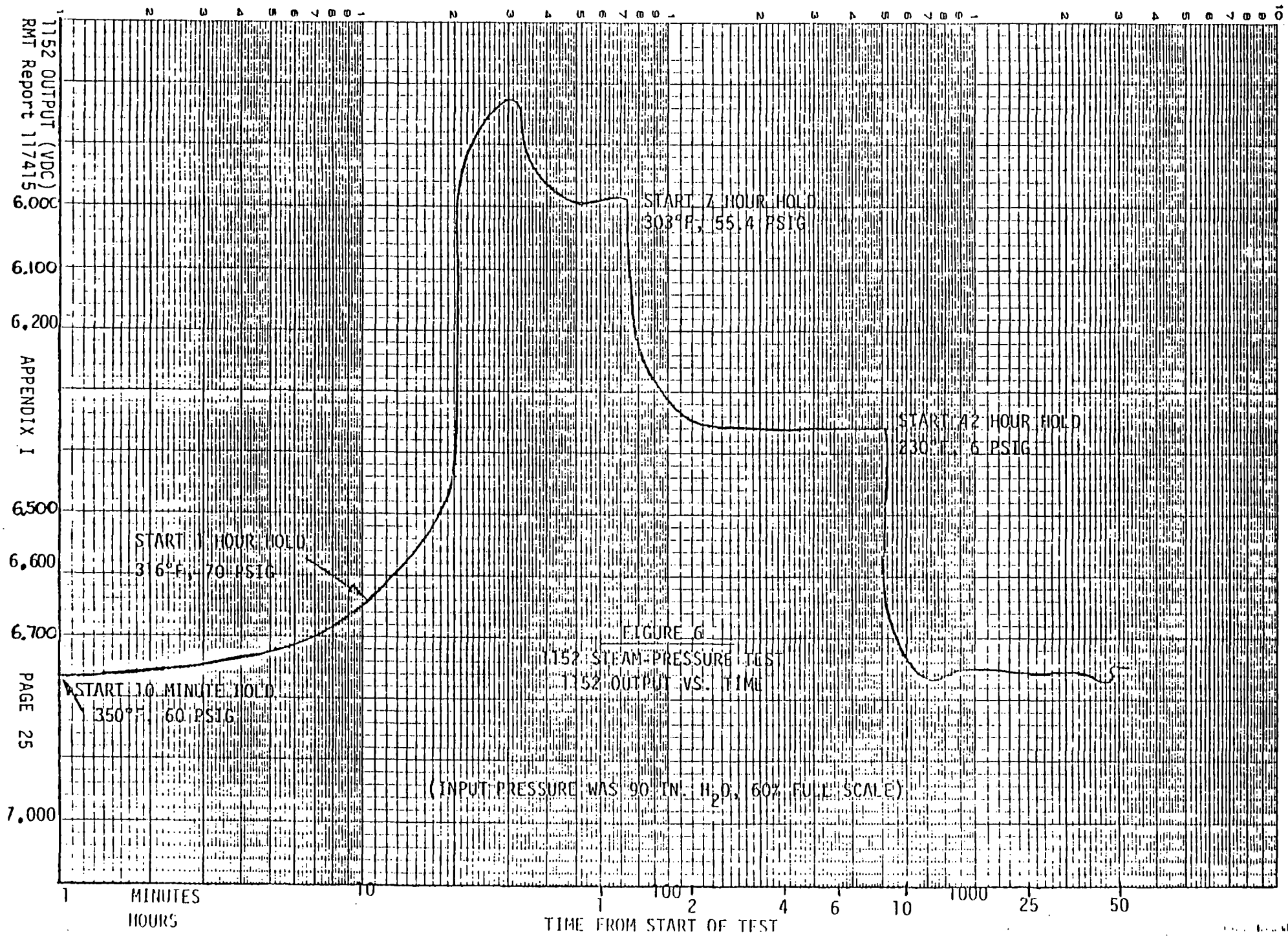


FIGURE 6
1152 STEAM-PRESSURE TEST
1152 OUTPUT VS. TIME

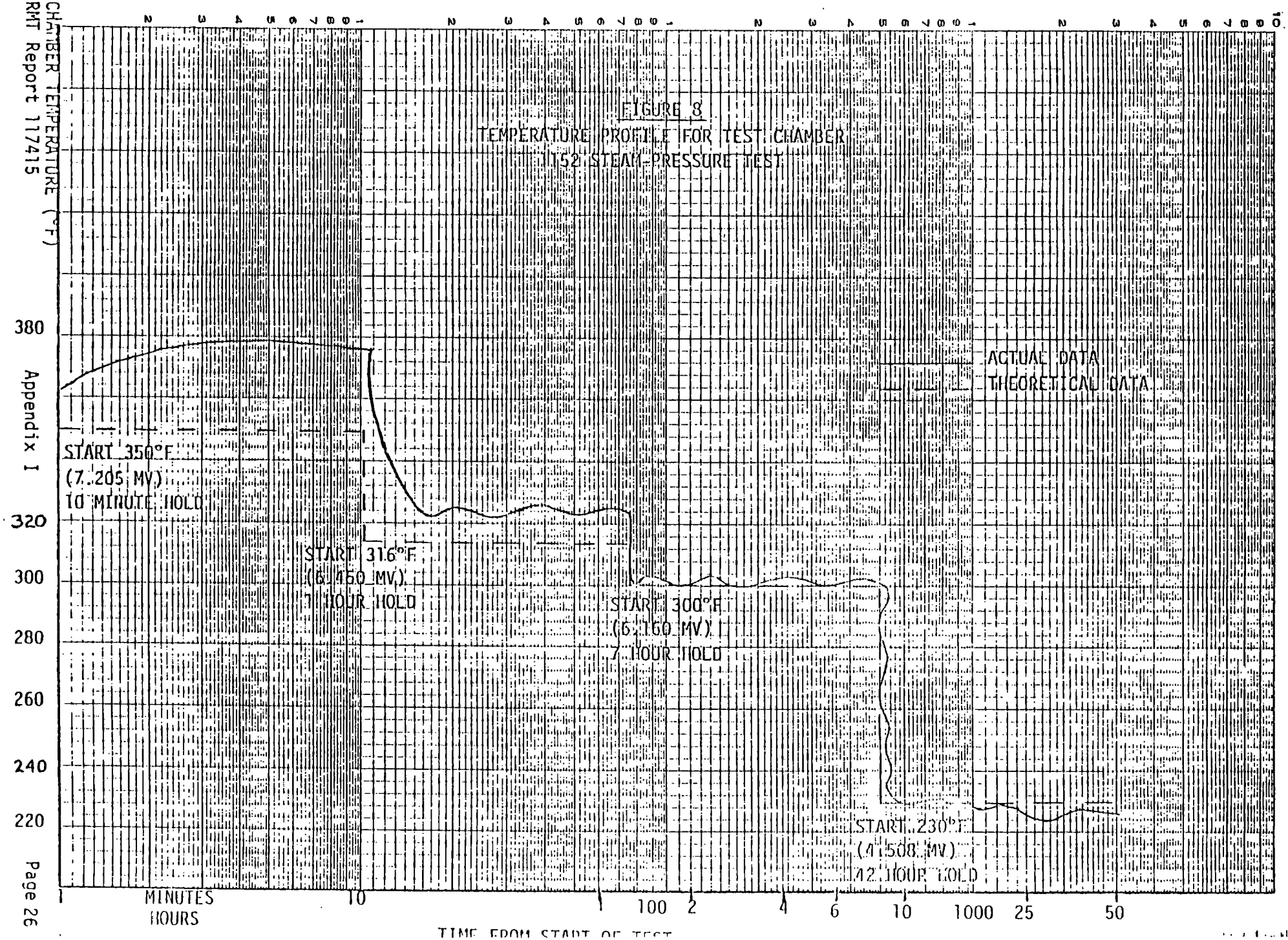
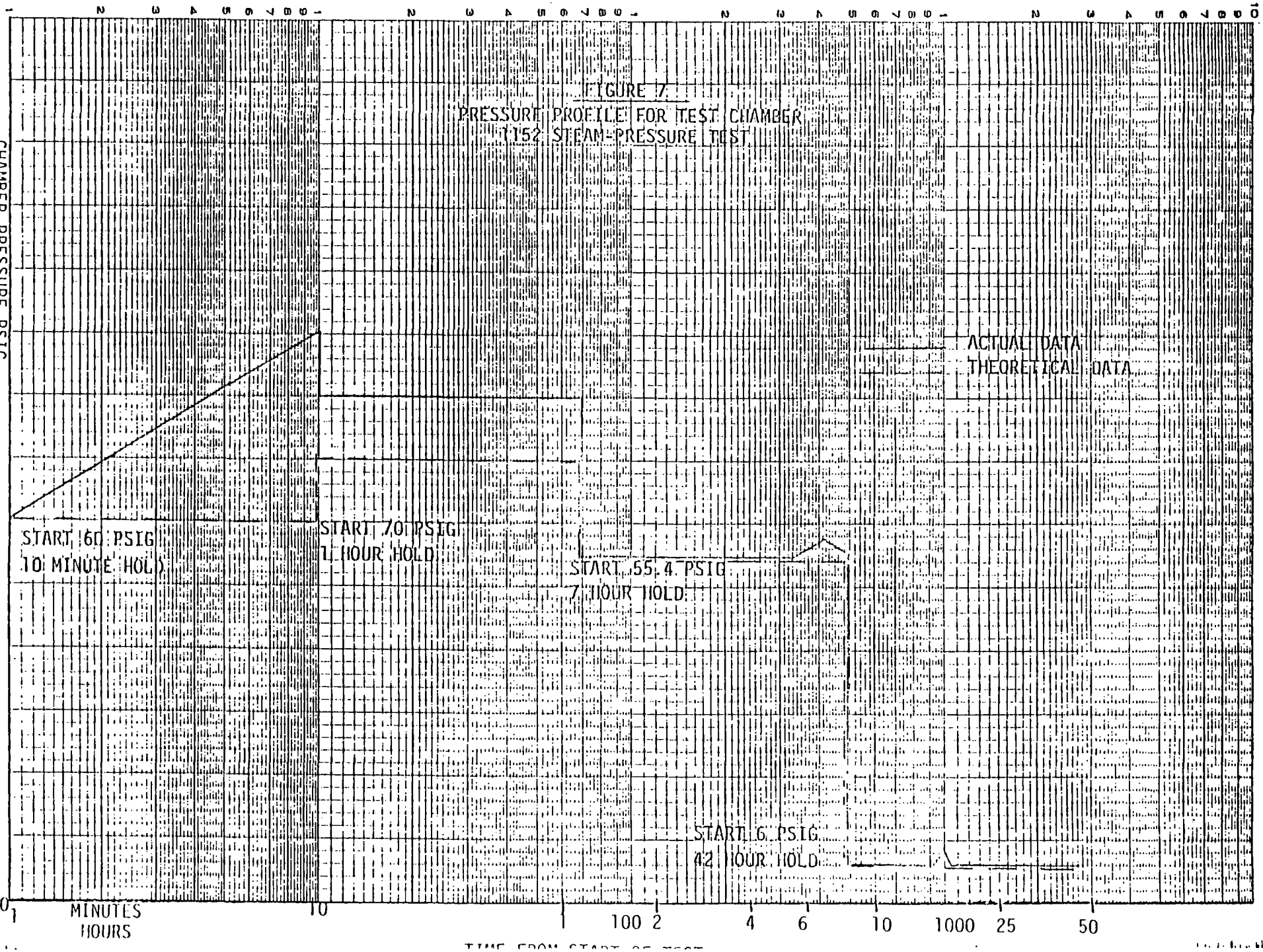


FIGURE 8
TEMPERATURE PROFILE FOR TEST CHAMBER
152 STEAM-PRESSURE TEST

FIGURE 7
PRESSURE PROFILE FOR TEST CHAMBER
1152 STEAM-PRESSURE TEST



EQUIPMENT LIST

ITEM	DESCRIPTION	MFGR	Serial Number MODEL	RANGE	ACCURACY	CALIB. FREQ. (MOS.)
1	Digital Multimeter	Systron Donner	7205	0-1000VDC; 0-1000VAC 0-10MΩ; 0-1Amp	±.02% Rdg; ±1% Rdg ±1% Rdg	3
	VIBRATION TEST EQUIPMENT LIST					
2	Power Supply	Kepco	---	0-40V	---	As used
3	Vacuum Tube Voltmeter	HP	001-33143	1mv-300V RMS	±2%	3
4	Logarithmic Converter	HP	561	.001 to 1V AC, .00316 to 3.16 DC	±0.5db	6
5	Vibration System	Unholtz Dickie	NA	10	10	1
6	X-Y Recorder	HP	806-03398	0-50 V/inch	0.2% of full scale	6
7	Resistance Box	REC	NA	200Ω + 500Ω	.01%	12
8	Digital Multimeter	Fluke	51412	0-1000V DC	±.03% of range	3
9	Pressure Tester	Mansfield & Green	67818	0-831" H_2O	0.025%	12
10	Signal Cond. Amplifier	Unholtz Dickie	340	2Hz to 30KHz	±5%	3
11	Tracking Filter	Unholtz Dickie	239	5Hz-5KHz	±.5DB ±.3%FS	3
12	Charge Amplifier	Unholtz Dickie	390	20Hz to 100Hz	10	6
13	Fixture	RMT	---	---	---	---
	STEAM-PRESSURE EQUIPMENT LIST					
14	Power Supply	---	---	Set for 30V	---	As used
15	Potentiometer	L & N	1606954	-11 101MV	±.05%	4
16	Triple Beam Balance	Chaus	None	0-2610 grams	0-10 gr; -.2 gram 10-2610 gr; ±1 gr.	3
17	Speedomax Recorder-Azar	L & N	68-58144-1-1	0-100MV	(10)	6

TABLE EQUIPMENT LIST

ITEM	DESCRIPTION	MFGR	MODEL	RANGE	ACCURACY	CALIB. FREQ. (MOS.)
18	Recorder	HP	903A08223	10	10	6
19	Pressure Tester	Mansfield & Green	67818	0-831" H_2O	0.025%	12
20	Digital Voltmeter	Fluke	77420	0-1000V DC; 1-10KΩ 0-300V AC	±.01% Rdg DC;±.03%RdgΩ ±1% Rdg AC	3
21	Pressure Gage 400#	U.S. Gage	---	5 to 400#	±5#	12
22	Resistance Box	RMT	NA	200 ohms 500 ohms	±.02%	2
23	Type K Thermocouple	---	---	---	---	---
			RADIATION EQUIPMENT LIST			
		Power and Pressure Source in console built by Rosemount.				
		Power Supply set for 30 V DC.				
		Load Resistor 500 ohm (calibrated at 500.08 ohm).				
		Pressure from six inch bellows.				
		Calibrated model 1151 DP4A24, cell Serial No. 44-39755.				

8.0 APPENDIX II

SPECIFICATIONS

SCOPE

The Model 1152 differential pressure transmitter is intended for use in nuclear power stations and other applications where stringent quality control of pressure retaining material, cleanliness, and safety are necessary to insure high reliability over an extended service life. Typical applications for the Model 1152 are where it is important to normal reactor operation and where equipment failure can result in release of radio-active materials.

The transmitter is identical in construction and performance to the proven Model 1151 transmitter. The Model 1152 provides the following features which are in excess of those provided by the general use industrial differential pressure transmitter:

A) Designed and built using "ASME Boiler and Pressure Vessel Code, Section III, Nuclear Power Plant Components" as a guide.

B) Traceability of materials used in the pressure retaining boundary to raw material heat numbers.

C) The process wetted boundary is cleaned to a level of less than 1 ppm chloride content.

D) Pressure boundaries are hydrostatically tested to 150% of maximum rated line pressure (1.5 x 2000 psi).

E) Seismic qualified with and without panel mounting bracket.

F) Qualified to radiation level of 5 X 10^6 Rads T.I.D.

G) Qualified to steam pressure environment.

Seismic, radiation, and steam qualification (type) test is contained in Rosemount Report 117415.

FUNCTIONAL SPECIFICATIONS

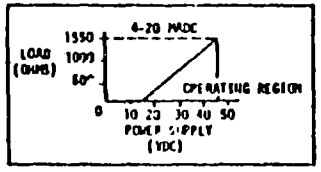
SERVICE Liquid, gas or vapor

RANGES 0-5 inches H_2O to 0-1000 psi. See Table 1.

OUTPUT 4-20 MADC

POWER SUPPLY External power supply required, 15 VDC (No load) to 45 VDC.

LOAD LIMITATIONS - See graph below



SPAN AND ZERO Continuously adjustable externally

ELEVATION AND SUPPRESSION

Zero suppression up to 150% of span (ranges 1,4,5) or 50% of span (ranges 6,7,8) but span may not exceed 100% of maximum range.

VOLUMETRIC DISPLACEMENT Less than 0.01 cubic inches.

TURN ON TIME 2 seconds, no warmup required.

DAMPING

Output Option A - Fixed response of 0.2 seconds, corner frequency of 0.8 Hz.

Output Option B - Four position variable time constant positions are set at response times of 0.2, 0.5, 1.0, or 2.0 seconds.

ENVIRONMENTAL SPECIFICATIONS

STEADY STATE TEMPERATURE LIMITS

-20°F to +200°F, Amplifier operating

-20°F to +220°F, Sensing element operating

-50°F to 250°F, Storage

STATIC PRESSURE AND OVERPRESSURE LIMITS

27 inches mercury vacuum to 2000 psig on either side without damage to the transmitter.

HUMIDITY 0-100% R.H.

NUCLEAR QUALIFICATION

The model 1152 is qualified by type test to the following levels of radiation, seismic vibration, and steam pressure. The test transmitter was subjected to the 3 tests sequentially - reference Rosemount Report No. 117415.

Radiation: Performance to within 2.0% accuracy to 5x10^6 Rads TID gamma radiation. Accuracy within ±0.25% of span after recalibration.

Seismic: Transmitter will perform during and after a seismic disturbance defined by 3 g's, 5-100 hz, with and without the mounting bracket option.

The transmitter was tested by vibration in each of 3 major axes to the procedure of IEEE-344 (1975).

Steam Pressure: The model 1152 will perform during and after sequential exposure to steam pressure of 70 psig, 345°F for 1 hour; 55.4 psig, 303°F for 7 hours; 6 psig, 239°F for 42 hours.

PERFORMANCE SPECIFICATIONS
(Zero based spans)

ACCURACY Includes effects of linearity, hysteresis, and repeatability.
±0.2% of calibrated span, Ranges 3,4,5
±0.25% of calibrated span, Ranges 6,7,8

DEAD BAND None

STABILITY ± 0.25% of upper range limit per 6 months.

STEADY STATE TEMPERATURE EFFECT

At maximum span (e.g. 0-150" H_2O for 0-25/150" H_2O range)

Zero error: ±0.5% of span per 100°F

Total effect including span and zero errors:
±1.0% of span per 100°F

At minimum span (e.g. 0-25" H_2O for 0-25 (150" H_2O range)

Zero error: ±1% of span per 100°F

Total effect including span and zero errors:
±3.5% of span per 100°F

OVERPRESSURE EFFECT

Overpressure of 2000 psi will cause a zero shift of less than:
±0.25% of upper range - Ranges 3,4
±1.0% of upper range - Range 5
±3% of upper range - Ranges 6,7,8

WEIGHT 11.5 pounds, excluding options, with aluminum housings.
15.5 pounds, with SST housings.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	[illegible] CLASSIFICATION STATEMENTS ADD REF [illegible] OPTION, DELETE METRIC OPTION.	[illegible]	JE
	A	[illegible] DRAWING	[illegible]	JE

STATIC PRESSURE EFFECT

Zero Error: ±0.25% of upper range limit per 2000 psi - ranges 4,5
±0.5% of upper range limit per 2000 psi - Range 3,6,7,8

Span Error: -1 ±0.25% of reading per 1000 psi - Ranges 1,5,6,7,8
-1.5 ±0.25% of reading per 1000 psi - Range 3

This is a systematic error which can be calibrated out for a particular pressure before installation.

POWER SUPPLY EFFECT

Less than 0.005% per volt.

LOAD EFFECT

No effect other than the change in power drawn by the transmitter.

MOUNTING POSITION EFFECT

Zero shift up to 1" H_2O which can be calibrated out. No span effect.

MATERIALS OF CONSTRUCTION

PRESSURE BOUNDARY

Materials constituting the pressure boundary are traceable to the original raw metal heat number through physical marking (if possible) or where parts are too small, through material certification. Whenever possible, materials have been selected to accordance with ASME, Section III.

Parts which are pressure retaining are:

A) Flanges* - 316 SST ASTM A182-F316
B) Flange bolting - Plated high strength carbon steel per ASTM A-540
C) Isolator seal -ring* - 316 SST ASTM A-276
D) Cell cup - nickel/iron alloy
E) Vent/Drain valves* - 316 SST ASTM A-276 *wetted parts

OTHER MATERIALS

Fill Fluid: Silicone Oil
Electronics Housing: Low-copper aluminum, acrylic baked enamel painted or optional stainless steel
O-Rings: Ethylene Propylene and Buna N
Labels and Tags: Stainless Steel

WELDS
All welds are classified as seal welds.

QUALITY ASSURANCE

A. Quality Program: The Quality Program used to manufacture the Model 1152 Pressure Transmitter shall be in accordance with 10CFR, Pt 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants."

B. Quality Documentation: Certification of compliance shall be provided for the following requirements.

- Pressure boundary material is in accordance with applicable material specifications and that chemical and physical reports are on file at Rosemount.
- The identification of pressure boundary material contained in each transmitter is on file at Rosemount.
- Pressure Boundaries were hydrostatically tested at 150% of maximum rated line pressure per Rosemount, Procedure 1746.
- Process wetted boundaries were cleaned to a level of less than 1 ppm chloride content per Rosemount Procedure 127278.
- Report of accuracy at 0, 20, 40, 60, 80, and 100% of calibrated span.
- Nuclear Qualification per this specification.

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES REMOVE ALL BURRS AND SHARP EDGES MACHINE SURFACE FINISH 125
-TOLERANCES-
DECIMALS: X ± 1, .XX ± .42, .XXX ± .010
FRACTIONS: ± 1/32
ANGLES: ± 2°
DO NOT SCALE PRINT

CONTRACT NO
DR BY J. L. F. - [illegible] DATE [illegible]
CHK BY J. A. S. [illegible]
APPD
APPD GOVT

Rosemount Inc. MINNEAPOLIS, MINNESOTA

TITLE: OUTLINE DIMENSION AND SPECIFICATION CONTROL DRAWING FOR DIFFERENTIAL PRESSURE TRANSMITTERS

SIZE	CODE IDENT NO	DRAWING NO	
C	04274	1152DP	A

SCALE NT SHEET 1 OF 3

TAG TABLE AND NOTE

MODEL	TAG NUMBERS	NOTES
1152DP		

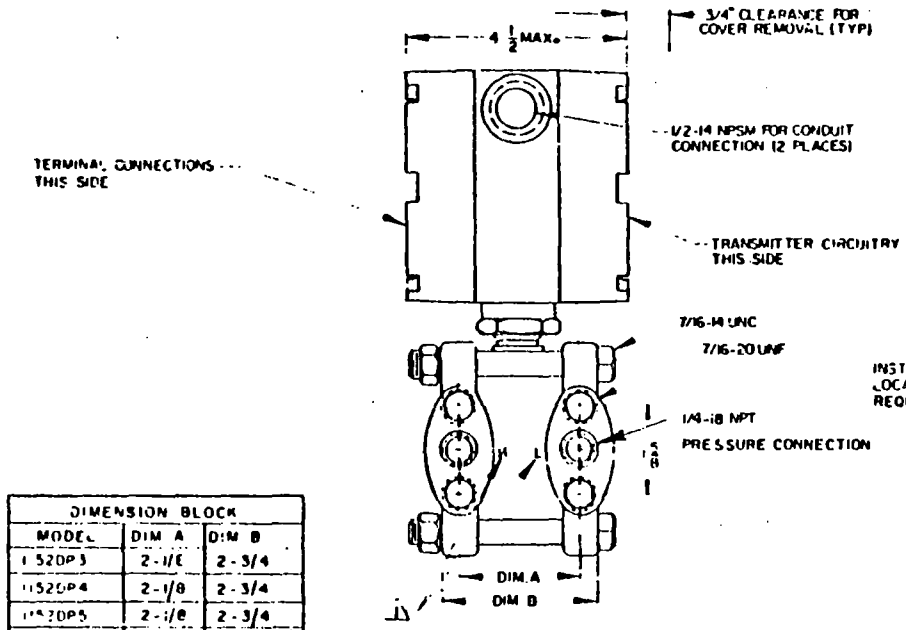
NOTES:

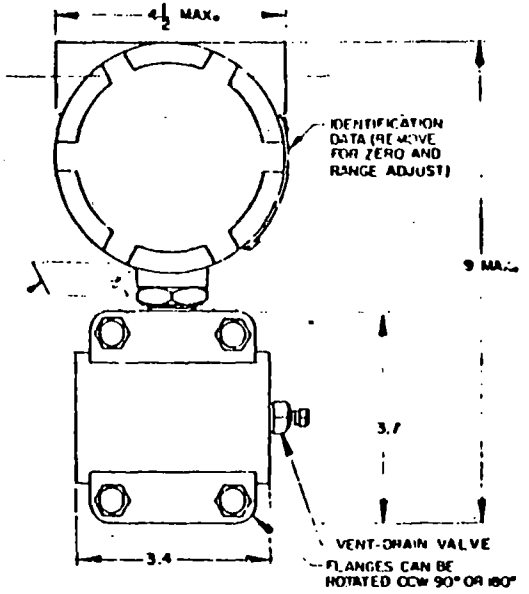
ROSEMOUNT MODEL 1152DP IS COVERED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 3,618,390; 3,271,669; 3,318,153; 3195,028; 3793885; 3246538; CR 3800,413. OTHER PATENTS PENDING CANADA PATENTED 1968, 1974, 1975.

TABLE I
Range and Option Information

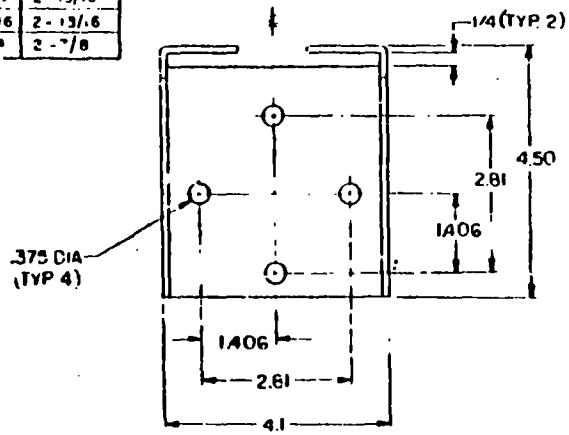
MODEL 1152DP	ALPHALINE DIFFERENTIAL PRESSURE TRANSMITTER				
CODE	RANGES				
3	0-5 to 0-10 inches H_2O (0-127 to 0-762 mm H_2O)				
4	0-25 to 0-150 inches H_2O (0-63 to 0-3810 mm H_2O)				
5	0-125 to 0-750 inches H_2O (0-3175 to 0-19, 050 mm H_2O)				
6	0-17 to 0-100 psi (0-1.2 to 0-7.0 kg/cm^2)				
7	0-50 to 0-300 psi (0-3.5 to 0-21 kg/cm^2)				
8	0-170 to 0-1000 psi (0-12 to 0-70 kg/cm^2)				
CODE	OUTPUT				
A	4-20 madc				
D	4-20 madc, 4 position time constant				
CODE	MATERIALS OF CONSTRUCTION				
	Flanges	Drain/Vent Valves	Isolating Diaphragms	Electronics Housing & Covers	
22	316SS	316SS	316SS	Aluminum	
92	316SS	316SS	316SS	Austenitic SS	
CODE	OPTIONS				
PB	Mounting Bracket (Panel Mounting)				
1152DP	4	A	22	PB	——COMPLETED DESIGN SPECIFICATION

SIZE	CAGE IDENT NO	DRAWING NO
C	04274	1152DP
SCALE	WT	SHEET 2 OF 2

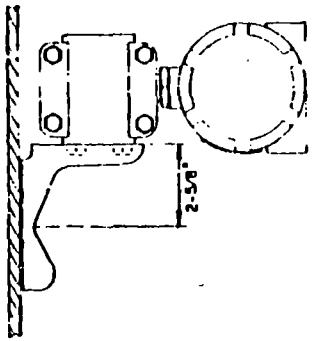




DIMENSION BLOCK		
MODEL	DIM A	DIM B
1152DP3	2-1/8	2-3/4
1152DP4	2-1/8	2-3/4
1152DP5	2-1/8	2-3/4
1152DP6	2-3/16	2-13/16
1152DP7	2-3/16	2-13/16
1152DP8	2-1/4	2-7/8



PANEL MOUNTING HOLE PATTERN

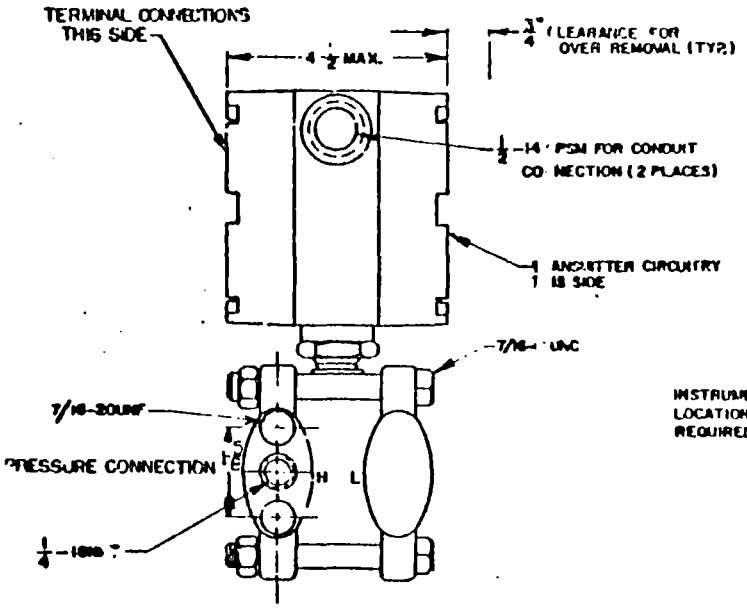


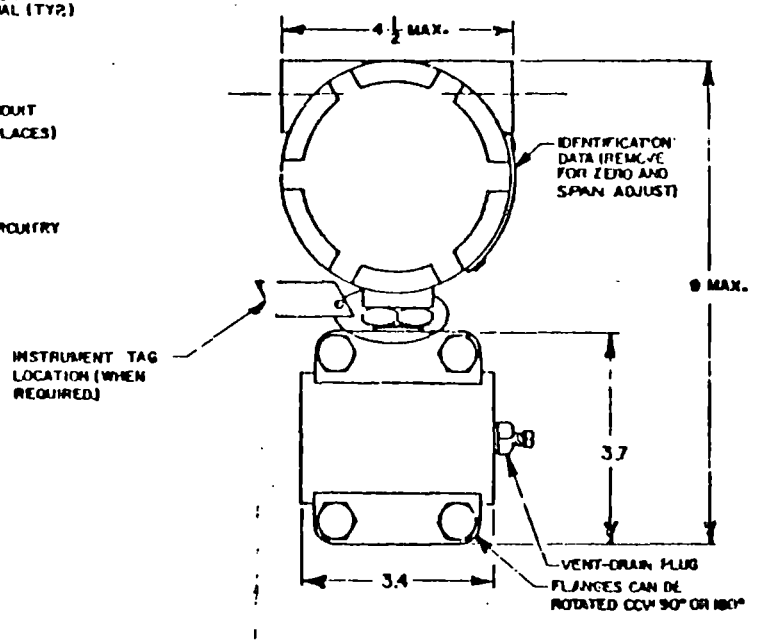
OPTIONAL MOUNTING BRACKET FOR PANEL MOUNT SHOWN IN TYPICAL MOUNTING CONFIGURATIONS

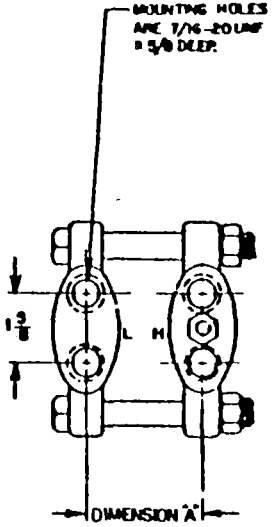
⚠ LETTERS H AND L NOTE HIGH AND LOW SIDES FOR PRESSURE CONNECTIONS

CAGE CODE NO.	SIZE	DRAWING & PART NO.
04274	C	1152DP

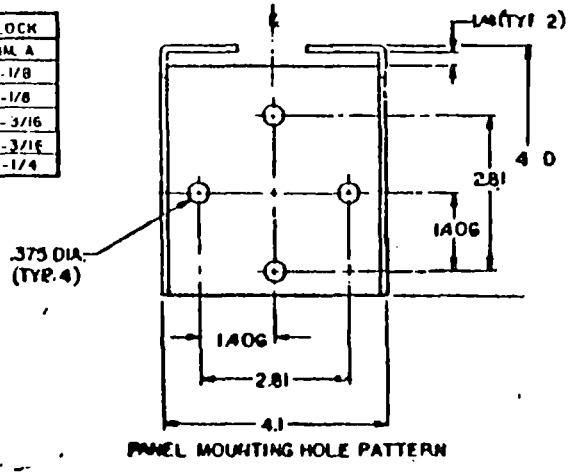
1152AP



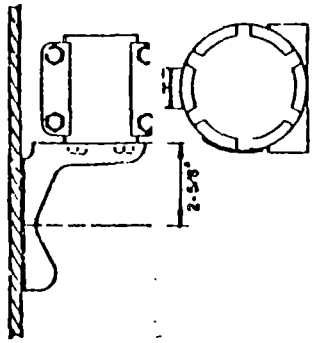




DIMENSION BLOCK	
MODEL	DIM. A
1152AP4	2-1/8
1152AP5	2-1/8
1152AP6	2-3/16
1152AP7	2-3/16
1152AP8	2-1/4

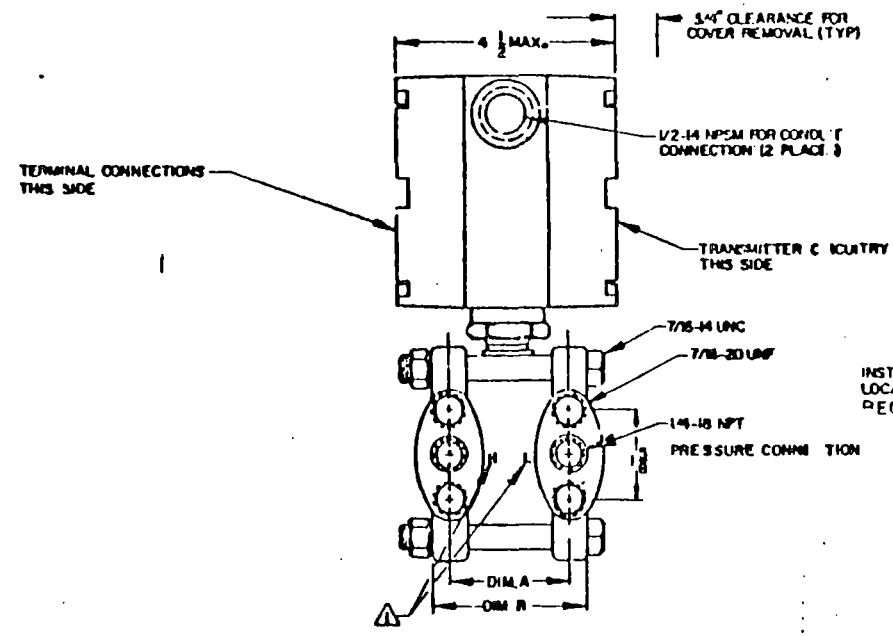


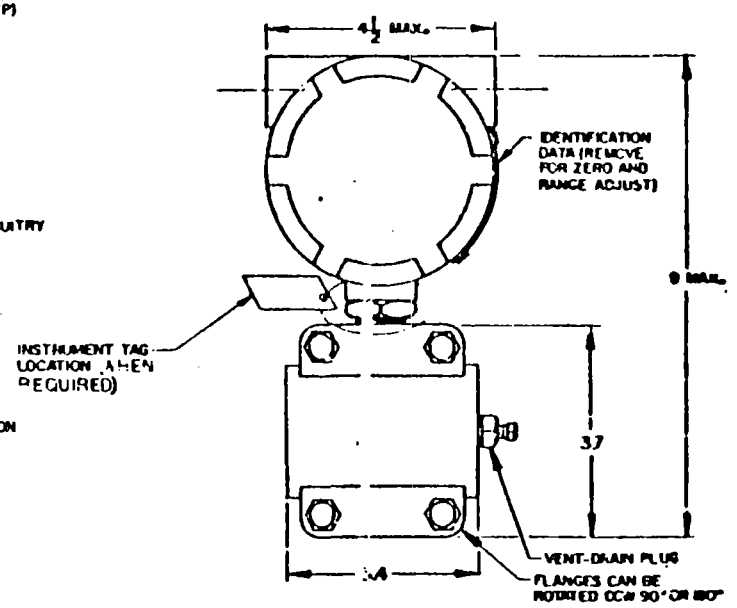
PANEL MOUNTING HOLE PATTERN



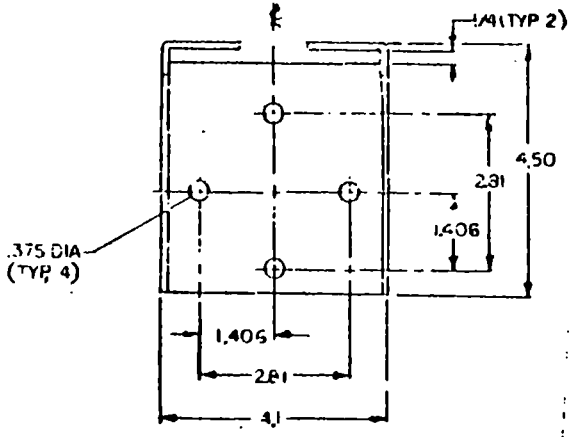
OPTIONAL MOUNTING BRACKET FOR PANEL MOUNT SHOWN IN TYPICAL MOUNTING CONFIGURATIONS

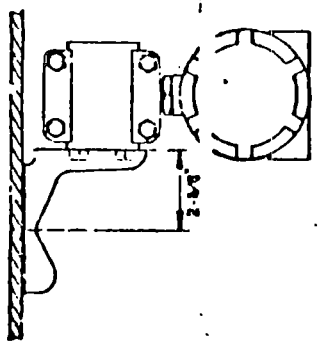
CODE IDENT NO	SIZE	DRAWING & PART NO	REV.
04274	C	1152AP	
SCALE ——		SHEET 2 OF 2	





DIMENSION BLOCK		
MODEL	DIM. A	DIM. B
1151HP4	2-1/8	2-3/4
1151HP5	2-1/8	2-3/4
1151HP6	2-3/16	2-13/16
1151HP7	2-3/16	2-13/16





OPTIONAL BRACKET FOR PANEL MOUNTING SHOWN IN TYPICAL MOUNTING CONFIGURATION

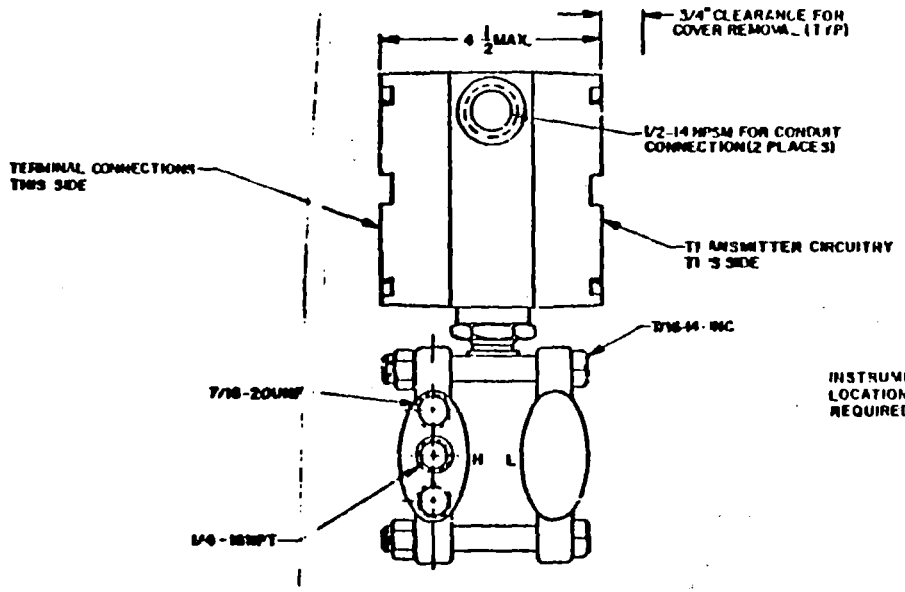
NOTES

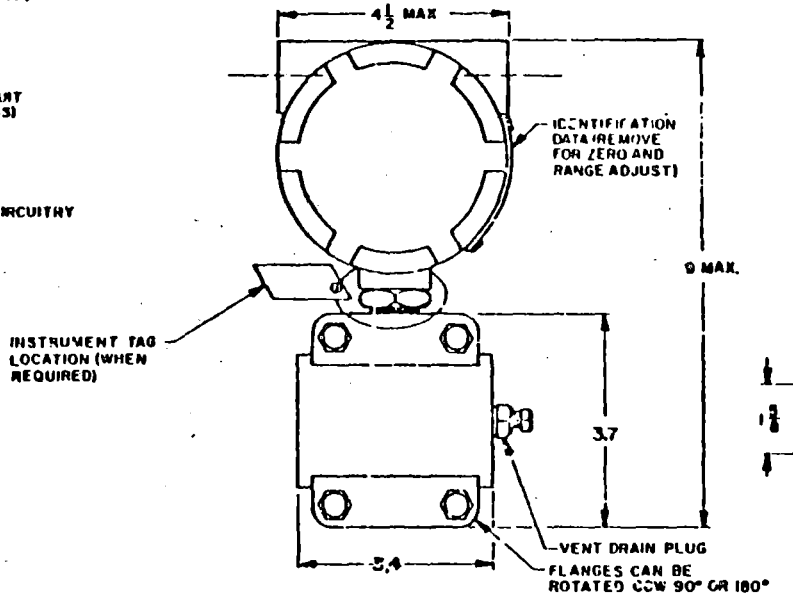
⚠ LETTERS DENOTE HIGH AND LOW SIDES FOR PRESSURE CONNECTION.

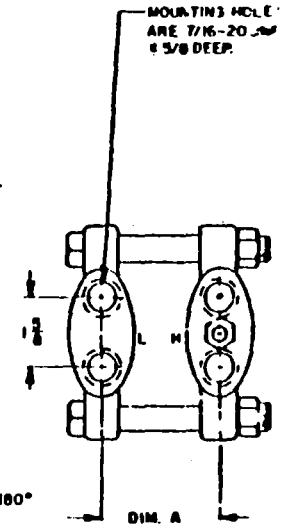
C	04274	1152HP

RMT NO.

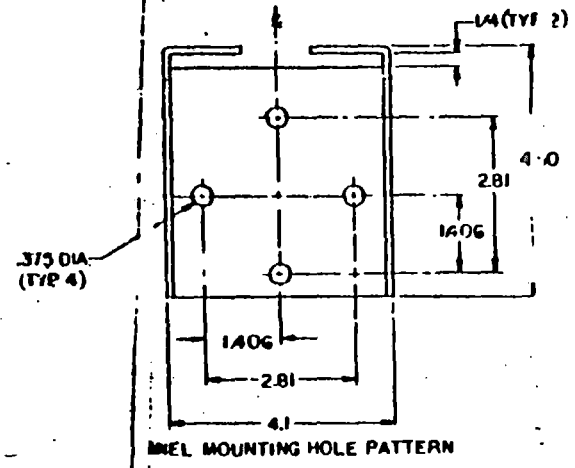
1152GP



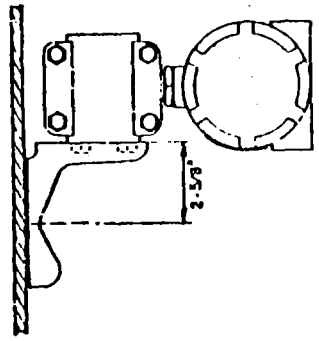




TABULATION	
MODEL NO	DIM A
1152GP3	2-1/8
1152GP4	2-1/8
1152GP5	2-1/8
1152GP6	2-3/16
1152GP7	2-3/16
1152GP8	2-1/4
1152GP9	2-9/32
1152GP0	2-21/64



PANEL MOUNTING HOLE PATTERN



OPTIONAL MOUNTING BRACKET FOR PANEL MOUNT SHOWN IN TYPICAL MOUNTING CONFIGURATIONS

⚠ LETTERS H AND L NOTE HIGH AND LOW SIDES FOR PRESSURE CONNECTIONS

04774	C	1152GP

SEISMIC TESTING 1151/1152 TRANSMITTER
WITH
STAINLESS STEEL ELECTRONIC HOUSING
(Summary of Report 2758)

The testing consisted of six separate test configurations: rigidly mounted and panel bracket (PB option) mounted in each of three orthogonal axes. The manner of test was to perform sinusoidal frequency sweeps from 5 - 70 Hz for each configuration at levels of .5, 1, 3, and 4 g's. These frequency sweeps were for a duration of approximately 4 minutes each. If resonance was found, the frequency of maximum resonance was dwelled at for an additional thirty seconds. Following these series of frequency sweeps, each configuration was vibrated for 2 minutes at 10 Hz and 4 g's for fragility investigation.

During the frequency sweeps at various g-levels the test specimen demonstrated sufficient integrity to withstand without comprimise of structure or electrical function the described environment. However, during the 2 minute dwell at 4 g's in the X-axis configuration (after 4 g/2minute dwell in the Z-axis) a crack started to show in the panel bracket. Because of this, a fragility limit of 3 g's is established for the transmitter/bracket assembly. In the case of the panel mounting configuration, resonance was found at 25, 50, and 29 Hertz for the x, y, and z axis, respectively.

RMT Report 117415

RANDOM MULTI-FREQUENCY SEISMIC TESTING
(Summary of Report 127516)

Two DP transmitters with aluminum housing were tested by Wyle Laboratories. Each was submitted to two different test series. The first was a biaxial test series and the second was a psuedo-biaxial "fagility" test series. All vibration was random multi-frequency input motion. One transmitter was a model 1151 the other was a model 1152; mechanical features of the two are identical for seismic considerations. The test units were powered continuously and were pressurized at approximately 50% full scale.

During the biaxial testing, the test specimens were subjected to horizontal/vertical and lateral/vertical phase incoherent inputs of random motion; consisting of frequencies spaced one-third octave apart over the frequency range of 1 Hz to 31.6 Hz. A minimum of five biaxial tests at one-half level followed by a full level test, each of 30 seconds duration, was performed in both the horizontal/vertical and lateral/vertical orientations. The full level test exceeded a response spectrum defined by the following, at three percent damping: 1 Hz, .5 g; 3 Hz, 1.5 g; 3.5 to 6 Hz, 2.7 g; 10 Hz, 1 g; 30 Hz, .5 g. Both transmitters were mounted with the Rosemount panel bracket (PB option).

Fragility testing was done on a long stroke single axis machine inclined 45° to the horizontal. One transmitter, the model 1151, was mounted using the panel bracket (PB); the other, model 1152, was rigidly mounted. The specimens were mounted with their longitudinal axis parallel to the horizontal and the input motion was inclined at 45° to the horizontal. The specimens were tested in the vertical and first horizontal axis simultaneously, and then the fixturing was rotated 90° and the test repeated for the vertical and second horizontal axis. This was repeated until all four principle horizontal directions were tested. Input motion along the 45° inclined axis was analyzed at a 5% damping value. The response spectrum for this table motion exceeds a curve defined by the following: 3 g, 1 Hz; 15 g, 3 Hz to 40 Hz. Horizontal and vertical components can be determined by dividing by the square root of 2.

It was demonstrated that models 1151 and 1152 possessed sufficient integrity to withstand, without comprimise of structures or electrical functions, the described simulated seismic environment. And, although a slight amplification did occur at three Hertz during the biaxial testing, no significant resonance was found below 5 Hertz. This is additionally demonstrated by the fragility test data.

SECTION #4

CONCLUSION SECTION & REFERENCE SECTION &

YE-VMS-200C-1	2273AM20	10.3-13
YE-VMS-200C-2	2273AM20	10.3-14
YE-VMS-201A-1	2273AM20	10.3-15
YE-VMS-201A-2	2273AM20	10.3-16
YE-VMS-201B-1	2273AM20	10.3-17
YE-VMS-201B-2	2273AM20	10.3-18

The monitoring equipment is currently in the process of being qualified to the requirements of IEEE 323-1974. The information on the worksheets is the levels to which the equipment will be tested. The test report is due by December 31, 1981.

4. Endevco Supplied Cable - Acoustical Monitoring Equipment

Plant ID No.	Model	Worksheet Page No.
Low Noise Cable	3075M6	10.3-19

The cable is currently in the process of being qualified to the requirements of IEEE 323-1974. The information on the worksheet reflects the levels to which the equipment will be tested. The test report is due by December 31, 1981.

5. Rosemount Inc. - Pressure Transmitters

Plant ID No.	Model	Worksheet Page No.
PT-LM-201A	1152AP7A22PB	10.3-1
PT-LM-201B	1152AP7A22PB	10.3-2

Transmitters test documentation is presently being upgraded from IEEE 323-1971 to IEEE 323-1974.

6. Valcor - Solenoid Operated Valves

Plant ID No.	Model	Worksheet Page No.
TV-SS-202A	V526-5683-19	10.3-32
TV-SS-202B	V526-5683-19	10.3-33
TV-SS-206A	V526-5683-19	10.3-34
TV-SS-206B	V526-5683-19	10.3-35
HCV-SS-201D	V526-5683-19	10.3-36
HCV-SS-202A	V526-5683-19	10.3-37
HCV-SS-200A	V526-5683-19	10.3-38
HCV-SS-200B	V526-5683-19	10.3-39
TV-SS-203A	V526-5683-19	10.3-40
TV-SS-203B	V526-5683-19	10.3-41
S2-XCV-2401A	V526-5683-19	10.3-62
S2-XCV-2401B	V526-5683-19	10.3-63
S2-XCV-2422A	V526-5683-19	10.3-64
S2-XCV-2422B	V526-5683-19	10.3-65
TV-GW-200	V526-5695-31	10.3-76

SECTION 10.5

REFERENCES

1. Automatic Switch Co. - Test Report No. AQS21678/TR, Rev. A.

2. Cleveland Development Co. - Qualification of NAMCO Controls Limit Switch Model EA-180 to IEEE Standards 344 (1975), 323 (1974) and 382 (1972), March 3, 1980.

3. Babcock & Wilcox Transmittal 86-1119091-00.

4. Comsip Delphi Test Report No. 1035-1 dated 12-1980 for Delphi KIII-KIV Hydrogen Analyzer.

5. VALCOR IEEE Qualification Letter SK-10616.

6. Qualification Tests for Rosemount Pressure Transmitter Model 1152, Rosemount Report No. 117415, Rev. B dated September 24, 1975.

7. VALCOR Qualification Report QR-52600-515, dated

8. NAMCO Controls Report on switches EA-180 - "Estimation of Qualified Life of Nuclear Switches" Rev. dated April 26, 1979.

9.

10.

11.

12.

13.

14.

15. QDR-5437-252-01.

16. QDR-5437-245-01.

17. QDR-5437-241-01.

18. QDR-5437-251-01.