

Test Procedure

SEISMIC VIBRATION TESTING OF
ONE (1) HYDROGEN ANALYZER ASSEMBLY
GENERAL ELECTRIC SPACE SYSTEMS
VALLEY Forge SPACE CENTER
UNDER PURCHASE ORDER NO. A28000A10155

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Reviewed by: Richard Gilfooy Jr. Date 9 July 79
Richard Gilfooy Jr., Chief Dynamics Engineer
Acton Environmental Testing Corporation

Reviewed by: Marcel E. Casaubon Date 7/9/79
Marcel E. Casaubon, Section Leader
Acton Environmental Testing Corporation

Approved by: Marvin L. Tolf Date 7/9/79
Marvin L. Tolf, President
Acton Environmental Testing Corporation

Approved by: J. O. Sullivan Date 8/6/79
General Electric Space Systems
Valley Forge Space Center, King of Prussia, PA

7/3/79
BE/hmf



1.0 TEST ITEM

One (1) Hydrogen Analyzer Assembly P/N 47E240609 consisting of one (1) free standing enclosure approximately 72-1/16" X 25-1/16" X 31-9/16" containing signal conditioning for hydrogen analyzers, one (1) hydrogen sensor and one (1) pressure transducer with a total weight of approximately 660 lbs will be submitted by General Electric Space Systems, Valley Forge Space Center for seismic vibration testing at Acton Environmental Testing Corporation (AETC).

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2.0 TEST REQUIREMENTS

The purpose of this test is to subject the panel specified in section 1.0 above to the seismic vibration test specified in section 3.0 below to determine its ability to withstand such vibration without evidence of mechanical damage, deterioration, or loss of its ability to operate properly during or after the simulated seismic event.

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3.0 TEST PROCEDURES

3.1 TEST MOUNTING

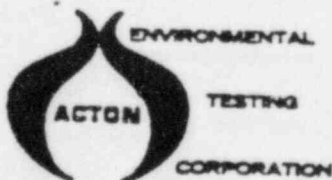
The hydrogen analyzer assembly specified in section 1.0 above will be mounted to a test fixture fabricated from structural steel. The test fixture will then be securely attached to the 45° biaxial table of the AETC Seismic Test facility. The use of the 45° biaxial table results in equal horizontal and vertical components.

3.2 TEST MONITORING

The hydrogen analyzer assembly will be monitored with triaxial groups of accelerometers to determine its mechanical response during the resonance survey and multiple frequency tests specified in sections 3.4 and 3.5 below. One (1) control accelerometer will be mounted on the test fixture. Up to eleven (11) monitoring accelerometers will be located on the hydrogen analyzer assembly/test fixture assembly at locations to be determined at the time of test.

During the resonance survey, data from all twelve (12) accelerometers through appropriate signal conditioning, will be recorded

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onto visicorder recording paper to be included with the final test report and onto magnetic tape.

During the multiple frequency test specified in section 3.5 below, data from all twelve (12) accelerometers, through appropriate signal conditioning will be recorded onto magnetic tape. Data from the one (1) control accelerometer will also be analyzed on line by a Spectral Dynamics SD321 Shock Spectrum Analyzer and the X-Y plots of the Test Response Spectra (TRS) of the control accelerometer will be included as part of the final test report.

The hydrogen analyzer assembly will be visually monitored for any evidence of mechanical damage or deterioration.

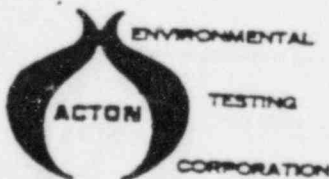
General Electric personnel will monitor the hydrogen analyzer assembly performance. General Electric will supply the required performance monitoring equipment including gas. AETC will supply two (2) channels of brush recorders.

3.3 TEST CONDITIONS

The hydrogen analyzer assembly will be tested at room temperature.

During the resonance survey specified in section 3.4, the hydrogen

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analyzer assembly will not be operational.

During the multiple frequency test specified in section 3.5 below, the hydrogen analyzer assembly will be operational. All electrical and operating test conditions will be set and controlled by General Electric personnel.

Acton Environmental Testing Corporation (AETC) will supply 115 VAC, single-phase, 60 Hz power and 220 VAC 3-phase power.

3.4 RESONANCE SURVEY

The resonance survey will consist of a biaxial sinusoidal input with peak horizontal and vertical accelerations of 0.2g's at frequencies from 1.0 through 35.0 Hz. The resonance survey will be performed at a sweep rate of 1/2 octave/minute. The input will be applied in two biaxial directions of excitation as follows:

<u>TEST NO.</u>	<u>BIAXIAL DIRECTION OF EXCITATION</u>
-----------------	--

1	Front-to-back & Vertical
---	--------------------------

2	Right-to-left & Vertical
---	--------------------------

3.5 MULTIPLE FREQUENCY TEST

A biaxial multiple frequency excitation will be applied. The

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test input will be recorded on a 14-channel tape recorder, each track having discrete frequency sine beats recorded at a different frequency and delay between beats. All frequencies will be recorded at maximum levels.

The input will be played back through a 14-channel tape recorder. The outputs of the 14 channels will then be combined in a 14-channel mixer which will result in a multiple frequency output.

The individual mixer channels will have gain controls so that the level of each output tape channel passing through the mixer can be controlled. In this manner, the required test spectrum can be shaped by controlling the level of individual frequencies.

Qualification tests, consisting of biaxial periodic pseudo-random excitation, will be performed. The level of the periodic pseudo-random excitation will be such that the Test Response Spectra (TRS), from the control accelerometer will envelop the appropriate Required Response Spectra (RRS) shown in Figure 1, except where limited by AETC shaker table capabilities.

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The input will be applied six (6) times in each of four (4) biaxial directions of excitations as follows:

TEST NO. BIAxIAL DIRECTION OF EXCITATION

- 3 Right-to-left & Vertical
- 4 Back-to-front & Vertical
- 5 Left-to-right & Vertical
- 6 Front-to-back & Vertical

The test duration for each input will be thirty (30) seconds.

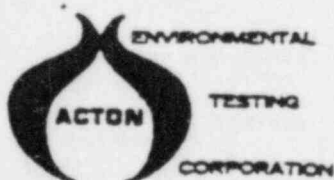
The level of the first five (5) inputs in each biaxial direction will be such that the TRS from the control accelerometer computed at $Q=10$ (5% damping) will envelop the OBE RRS shown in Figure 1, except where limited by AETC shaker table capabilities. The level of the sixth input in each biaxial direction will be such that the TRS computed at $Q=10$ (5% damping) will envelop the SSE RRS shown in Figure 1, except where limited by AETC shaker table capabilities.

Figure 1 is a composite curve of Revisions A of sketches S023-SK-S-655, S023-SK-S-656, S023-SK-S-633, S023-SK-S-634, S023-SK-S-739, S023-SK-S-725, S023-SK-737 and S023-SK-S-701 of Revision 1 of

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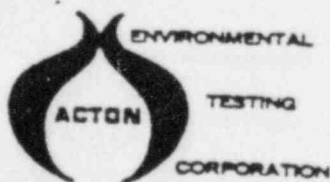
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of Appendix 4F "Criteria For Seismic Qualification of Seismic
Class 1 Equipment", dated July 20, 1973.

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4.0 TEST REPORT

The test report will include but not be limited to a detailed description of the test item, requirements, procedures, mounting, monitoring, test descriptions and test results. The test results section of the final report will include the X-Y plots of the Test Response Spectra for the control accelerometer. A test equipment list and photographs of the test setup and accelerometer locations will also be included in the test report. The visicorder chart recordings of the resonance survey will be sent along with the final report. The test report will be presented in the same general format as this test procedure.

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Test No. 17/5/79
 Date 17/5/79
 Customer 14950
 Test Item 1/N
 Test Item 5/N
 Type of Test 27.1.30X02
 Spec. No.
 Para. No.
 Conditions
 Temperature ROOM
 Period of Test 30 SEC
 Control Axis VERTICAL
 Pick-up No. CONTROL
 Pick-up Axis VERTICAL
 Operator
 Test Engr. 25 ES20570

GRMS



RECEIVED

RESERVE

SECRET

(KES)

Q-10 (500000000)

DCE

IS A

COMPOSITE

CF0

5023-5K-5-634 5% REV A
 5023-5K-5-633 5% REV A
 5023-5K-5-701 5% REV A
 5023-5K-737 5% REV A

DCE

IS A

COMPOSITE

CF0

5023-5K-5-656 5% REV A
 5023-5K-5-655 5% REV A
 5023-5K-5-725 5% REV A
 5023-5K-5-739 5% REV A

DCE

DCE

FIGURE 1

FIGURE 1

ACTON CORP.

S023-506-17-18-0

F-27/28

VENDOR QUALITY ASSURANCE ACCEPTANCE TAG

DATE OF VISIT

1-3 October '79

VENDOR NAME AND ADDRESS

ACTON ENVIRONMENTAL TESTING CORP.

P.O. NUMBER A 10155

AMEND

P.O. COMPLETE

☒ YES

☐ NO

S.O. NUMBER 1312-2F3-D1-000

PCS REMAINING

NONE

SERIAL NUMBER(S) - (WHEN APPLICABLE)

SHIFT TO -

NAGGIO.

P.C.

NA

ITEM NO

DRAWING NUMBER - REV - AN

PCS, ACC.

1 47E240609

HYDROGEN ANALYZER

FUNCTION PERFORMED/WITNESSED OR VERIFIED IN

ACCORDANCE WITH -

☒ P.O.

☒ DWG

☐ WORK STATEMENT

ENGR SPEC.

S.I. 250852-1

Q.A.P.

☐ IN PROCESS

☐ DIMENSIONAL

☐ FINAL DIMENSIONAL

☐ PRODUCTION

☐ LOT SAMPLING

☐ ULTRASONIC

☐ TEST

☐ PLATING

☐ SPECIAL PROCESS

☒ OTHER

QUALIFICATION

SEISMIC VIBRATION PER

S.I. 250852-1 S.I. 2-1

AND TEST - L.D. E.A.T. 70014

GE-VQA REPRESENTATIVE (SIGNATURE)

J.F. Murphy

FORM RS 1842 REV. (8/88)

VQA FIELD FOLDER

3929-29

ACCEPTED

S023-506-17-16-0

QUALITY CONTROL PERFORMANCE DATA SHEET

PAGE 1 OF 6

SITE RPT. NO. PART/TEST NOMENCLATURE 1 H2 ANALYZER SYSTEM		DRAWING NO. 2 47E240609		REV/ANG. E. SER. NO. A.F. VENDOR SER. NO. 3 06491563	
REF. RPT. NO. LEV. TYPE PROGRAM 7 0 9 SONG		VEN. NO. 11 47E240612		REV/ANG. P.O. CWO. 12 13	
SI/TR. NO. NO. C. REV. 250852 0		NCS/RVS. NO. 18		MAT'L LAB RT. MAT'L CERT. MAT'L LOT 19 20 21	
P.D.S. REV. P.D.S. REV DT. U.C.I. NO. 0 7-27-79		WEIGHT 25		REQUAL LOT NO. SECURITY CLASS 26 27	

TEST EQUIP. USED	EQUIPMENT NAME	25 MAKE	26 MODEL NO	27 IDENT. NO	28 CALCUL. DT.
	RECORDER, JAL CHAN.	ROUSH	1/10K 280	2E 302	1-2-80
	D-21	FLIKE	FL00A	1X 5633	12-12-79
	WILLI-VOLT SOURCE	WESTRONICS	MVS-A	VC 003	NLR
	PAC-BUTTON GAS	SCOTT	2.49%	—	—
	FUNCTION GENERATOR	MTS	410	PE 310	10-6-79
	CURTIS PUMP	MTS (HINSTR)	413	PE 301	3-10-80
	CONTROLLER	MTS	443	PE 307	3-10-80
	RECORDER	HONEYWELL	5600E	2E 345	12-22-79

4.1	POST SHIPMENT INSPECTION & FUNCTIONAL	PASS 10-2-79
4.2	SEISMIC VIBRATION QUAL TEST	PASS 10-3-79
4.3	RETURN SHIPMENT INSPECTION & FUNCTIONAL NR#54224	FAIL* 10-29-79

NOTE 5.1.2 # 250852-1 APPLIES FOR SECTION 4.2.

* FAILED VISUAL INSPECTION FOR SHIPPING DAMAGE AFTER VIBRATION & POST VIBRATION N.R. # 54224 WRITTEN TO DOCUMENT DAMAGE & REWORK. THIS DAMAGE WAS INCURRED DURING THE RETURN SHIPMENT TO VARIOUS LARGE PD. AFTER COMPLETION OF THE POST VIBRATION FUNCTIONAL TEST PER PARAGRAPHS 4.2.6, 4.2.6 & 4.2.7 OF THE S.I. (NOTE V.G.A. REPAIRING TAG.)

THE UNIT WAS REWORKED PER DISPOSITION OF N.R. 54224 AND COMPLETE ACCEPTANCE TEST PER S.I. 250852-1; REWORK AND RETEST WAS FOUND ACCEPTABLE

J. E. Murphy N.C.E.
10-14-79

F-30



TESTER J. E. Murphy	DATE 10-24-79	O. C. ENG J. E. Murphy	DATE 12-14-79	ACC. RE. CO. DATE TYPED 10 11 12
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PERFORMANCE DATA SHEET (Continuation)

REPORT NO. 5.1. 250152 REV. 0
P.D.S. REV. 0

6. AERIAL WIRELESS
MISSILE AND SPACE DIVISION
DRAWING NO. 47E240609

REVISION 6.649156
Page 2 of 6
SECURITY CLASS

TRAIN A				TRAIN B			
PARA.	TEST	SPEC.	ACTUAL	PARA.	TEST	SPEC.	ACTUAL
4.1.1	JUMPERS	PASS/FAIL	PASS	4.1.1	JUMPERS	PASS/FAIL	PASS
	250 Ω RES.	PASS/FAIL	PASS		250 Ω RES.	PASS/FAIL	PASS
4.1.4	PRE-AMP OUT	1.000 $\pm$ 0.040 VDC	0.8401 VDC	4.1.4	PRE-AMP OUT	1.000 $\pm$ 0.040 VDC	0.8057
	ANALYZER OUT	1.000 $\pm$ 0.040 VDC	0.4745 VDC		ANALYZER OUT	1.000 $\pm$ 0.040 VDC	0.5525
4.1.5	ATR2-1/ATR2-2	OPEN CKT.	PASS	4.1.5	BTB2-1/BTB2-2	OPEN CKT.	PASS
	ATR2-3/ATR2-4	OPEN CKT.	PASS		BTB2-3/BTB2-4	OPEN CKT.	PASS
4.1.6	ATR2-1/ATR2-2	CONTINUITY	PASS	4.1.6	BTB2-1/BTB2-3	CONTINUITY	PASS
	ATR2-3/ATR2-4	CONTINUITY	PASS		BTB2-3/BTB2-4	CONTINUITY	PASS
4.1.7	SET ALARM COND.	PASS/FAIL	PASS	4.1.7	SET ALARM COND.	PASS/FAIL	PASS
4.1.8	METER IND.	5.0 $\pm$ 0.5%	5.10%	4.1.8	METER IND.	5.0 $\pm$ 0.5%	5.18%
	PRE-AMP OUT	3.000 $\pm$ 0.040 VDC	2.517		PRE-AMP OUT	3.000 $\pm$ 0.040 VDC	2.547
	ANALYZER OUT	3.000 $\pm$ 0.040 VDC	2.870		ANALYZER OUT	3.000 $\pm$ 0.040 VDC	2.847

8023-508-17-12-0

GENERAL INFORMATION

PERFORMANCE DATA SHEET (Continuation)

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SECURITY CLASS

DATE

REVISION

PROJECT AND OFFICE DIVISION

DRAWING NO.

471240609

S.I. 250052 REV. 0

P.O.S. REV. 0

TRAIN A

TRAIN B

PARA.	TEST	SPEC.	ACTUAL	PARA.	TEST	SPEC.	ACTUAL
4.1.9	MTR. RESP.	PASS/FAIL	PASS	4.1.9	MTR. RESP.	PASS/FAIL	PASS
4.1.13	METER IND.	INFO ONLY	2.18%	4.1.13	METER IND.	INFO ONLY	2.21%
	PRE-AMP OUT		2.538%		PRE-AMP OUT		2.52%
	ANALYZER OUT	INFO ONLY	2.577%		ANALYZER OUT	INFO ONLY	2.593%
4.1.14	GAS ON TIME	XXXX MINUTES	1.55%	4.1.14	GAS ON TIME	XXXX MINUTES	1.55%
	METER IND.	INFO ONLY	1.3%		METER IND.	INFO ONLY	1.35%
	PRE-AMP OUT		1.420%		PRE-AMP OUT		1.434%
	ANALYZER OUT		1.410%		ANALYZER OUT		1.462%
	GAS X H ₂	INFO ONLY	2.47%		GAS X H ₂	INFO ONLY	2.47%
1.2.3		AXIS 1		1.2.3		AXIS 1	
	ANALYZER OUT	NO LEVEL SHIFT	PASS		ANALYZER OUT	NO LEVEL SHIFT	PASS
	HIGH ALARM	NO DISCONTIN.	PASS		HIGH ALARM	NO DISCONTIN.	PASS
	HAUT ALARM	NO DISCONTIN.	PASS		HAUT ALARM	NO DISCONTIN.	PASS

PERFORMANCE DATA SHEET (Continuation)

REVISION	61 SERIAL NO.	SECURITY CLASS
47E240609	61449/5-6	

DRAWING NO.	47E240609
5.1. 250852 REV. 0	
P.D.S. REV. 0	

TRAIN A				TRAIN B			
PARA.	TEST	SPEC.	ACTUAL.	PARA.	TEST	SPEC.	ACTUAL.
4.2.3		AXIS 2		4.2.3		AXIS 2	
	ANALYZER OUT	NO LEVEL SHIFT	PASS		ANALYZER OUT	NO LEVEL SHIFT	PASS
	HIGH ALARM	NO DISCONTIN.	PASS		HIGH ALARM	NO DISCONTIN.	PASS
	HALF ALARM	NO DISCONTIN.	PASS		HALF ALARM	NO DISCONTIN.	PASS
4.2.3		AXIS 3		4.2.3		AXIS 3	
	ANALYZER OUT	NO LEVEL SHIFT	PASS		ANALYZER OUT	NO LEVEL SHIFT	PASS
	HIGH ALARM	NO DISCONTIN.	PASS		HIGH ALARM	NO DISCONTIN.	PASS
	HALF ALARM	NO DISCONTIN.	PASS		HALF ALARM	NO DISCONTIN.	PASS
4.2.3		AXIS 4		4.2.3		AXIS 4	
	ANALYZER OUT	NO LEVEL SHIFT	PASS		ANALYZER OUT	NO LEVEL SHIFT	PASS
	HIGH ALARM	NO DISCONTIN.	PASS		HIGH ALARM	NO DISCONTIN.	PASS
	HALF ALARM	NO DISCONTIN.	PASS		HALF ALARM	NO DISCONTIN.	PASS



PERFORMANCE DATA SHEET (Continuation)

GENERAL ELECTRIC

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SECURITY CLASS

ADDRESS AND OFFICE DIVISION

DIVISION

GE SERIAL NO.

SECURITY CLASS

DRAWING NO.

471240609

H₂ ANALYZER SYSTEM

REV. 0

REV. 0

TRAIN A				TRAIN B			
PARA.	TEST	SPEC.	ACTUAL	PARA.	TEST	SPEC.	ACTUAL
4.1.1.3	POST VIB. 4.1.5	INFO ONLY	2.19	4.1.1.3	POST VIB. 4.2.5	INFO ONLY	2.29
	METER IND.		1.692		METER IND.		1.731
	PRE-AMP OUT				PRE-AMP OUT		1.774
	ANALYZER OUT		1.785		ANALYZER OUT		
4.1.1.4	GAS ON TIME	XXXX MINUTES		4.1.1.4	GAS ON TIME	XXXX MINUTES	
	METER IND.		2.19		METER IND.		2.29
	PRE-AMP OUT		1.692		PRE-AMP OUT		1.731
	ANALYZER OUT		1.785		ANALYZER OUT		1.774
	GAS & H ₂		2.47		GAS & H ₂		2.47
4.1.4	POST VIB. 4.2.7	INFO ONLY		4.1.4	POST VIB. 4.2.7	INFO ONLY	
	PRE-AMP OUT		1.545		PRE-AMP OUT		1.542
	ANALYZER OUT		1.675		ANALYZER OUT		1.543
4.1.5	ATH2-1/ATH2-2	OPEN CKT.	1.455	4.1.5	ATH2-1/ATH2-2	OPEN CKT.	1.455
	ATH2-3/ATH2-4	OPEN CKT.	1.455		ATH2-3/ATH2-4	OPEN CKT.	1.455

CRAI Q10 ELECTRONIC

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10

9

RESEARCH CLASS

Э. П. ШВАЦ

MOTIVATION

and no.

BULWING NO.

SYNOPSIS

S.I. 250852 REV. 0

P.D.S. REV. 0

TRAIN A

TRAIN B

[illegible]

508-17-18-1

F-35

FORM 7-9409 REV. (7-62)

1. Part No. 475240611	2. Date Recd. 10-15-79	3. Location LAWRENCE ASES	4. Contract No.	5. SO No. 1300-243-01-000	6. Part Name
7. Drawn By GMS	8. Drawn No. 475240611	9. Size A7	10. Supplier & Code No.	11. Entry C-10-10	12. P.C. Code
13. Part Name	14. Draw No. A7	15. Size	16. Supplier & Code No.	17. Volume No.	18. Source Map ☐ Draw ☐ GE
19. Part No. 475240611	20. Lot No. 1	21. Lot Size 1	22. No. Insp. 1	23. No. Req. 1	24. Test Spec. Spec. 250852 VISUAL
				25. Lot Date VIER.	26. Type Test Map QWL

27. Description of Nonconformance:

THE FOLLOWING DAMAGE WAS FOUND

DURING THE POST SHIPMENT VISUAL INSPECTION.

(1) ITEM #2, FOUR P-9 SURVEILLANCE MOUNTING FLANGES ON BOTH SIDE ARE BENT.

(2) ITEM #2, FOUR P-9 SURVEILLANCE POWER TRANSFORMER MOUNTING, SCREWS ARE MISSING & LOWER BASE PLATE IS BENT INWARD.

26. Part LWK	27. Resp. GE	28. Date & Stamp 12-14-79 54224
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(3) THE SUPPORT PROVIDED FOR SHIPPING.

(4) THE SUPPORT INSTALLED IN WRONG LOCATION.

ITEMS (1) & (2) ABOVE, REFERENCE TO DRAWING

BRUCE ZIGLER 12/14/79

29. Cause of Nonconformance:

NA - one time only condition

51-

54224

30. Engineering Date	31. Quality Date	32. Customer Date	33. Supplier Date	34. Date of Recd. 12-14-79	35. Supplier Date
36. DATE CODES 03	37. DATE CODES 03	38. DATE CODES 03	39. DATE CODES 03	40. DATE CODES 03	41. DATE CODES 03