

**GENERAL ELECTRIC**  
*Re-entry & Environmental  
 Systems Division*

**TEST & OPERATIONS**  
**TEST PROCEDURE  
 COVER SHEET**

TR NO. 405863	REV 0	ISSUE DATE 22 July 1981	SHEET NO. 1
TYPE OF TEST QUALIFICATION FOR CLASS I E SERVICE OF THE ELECTRICAL PROTECTION ASSEMBLY - DWG. #914E175		PROGRAM QUALIFICATION	
		SAFETY CATEGORY <input checked="" type="checkbox"/> I <input type="checkbox"/> II <input type="checkbox"/> III	

PREPARED BY E. J. LEARY	TITLE <i>E. J. Leary</i>	T & O COMPONENT MANAGER
T & O TEST DIRECTOR / SUPV. ENGINEER E. J. LEARY	DESIGN ENGINEER / CHIEF ENGINEER <i>J. J. Lang</i> J. J. LANG	
INDUSTRIAL SAFETY / SYSTEM SAFETY	QUALITY ASSURANCE	
H. G. KIMBALL	J. R. THILL - E.S.E ENGINEERING	

TPC INCORPORATIONS				UNIT	TPC
TPC(S) 16	APPROVAL 17	RE-ISSUE DATE 18	SHEETS AFFECTED 19	EFFECTIVITY 20	LOG BOOK INFORMATION 21

B409240224 B40917  
 PDR ADDOCK 05000440  
 A PDR

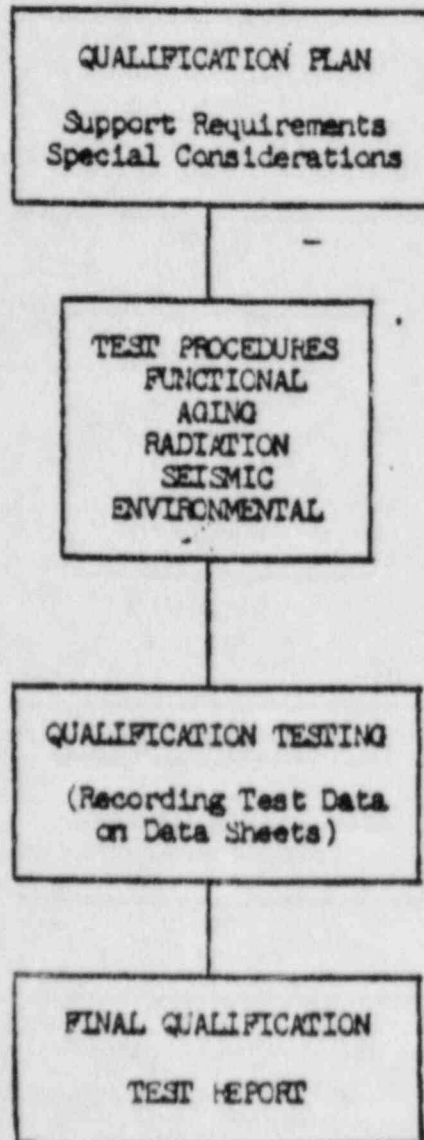
1/4 OF ITEM OR SYSTEM TESTED	TEST ENGINEER	DATE
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ELECTRICAL PROTECTION ASSEMBLY  
CLASS 1E-SAFETY ESSENTIAL  
QUALIFICATION PROGRAM

The qualification program consists of a Qualification plan, procedures, an implementation or testing phase and publication of a final qualification report.



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1. SCOPE

1.1 Test Purpose - The purpose of the test series described herein is to satisfy the requirements for qualification of the Electrical Protection Assembly (EPA). The test series consists of performance testing of the EPA under normal, abnormal, design basis, and post design basis event conditions. The testing specified here will be preceded by normal acceptance inspection and testing. The normal acceptance inspection and testing is performed to Test Procedure 405835.

1.2 Test Article Function - the EPA is a Class 1E device that provides redundant protection to the Reactor Protection System power bus against power source transitory over-voltage, under-voltage, and under-frequency conditions. The EPA is housed in a metal enclosure whose dimensions are 16" x 20" x 6". The enclosure is to be mounted on a Seismic Class I wall.

1.3 Test Article Description

EPA Assembly Drawing 914E175

EPA Qualification Serial No. 201

Sub-Assemblies

- Transformer Dwg. #219B4603 -
- Transformer Dwg. #219B4606
- Circuit Breaker Dwg. #184C4494
- Printed Circuit Board Dwg. #47D523796

2. SUPPORT REQUIREMENTS

2.1 Reference Documents

2.1.1 Applicable Specifications

- a. Electrical Protection Assembly, Purchase Specification, NEPD, 21A3120, Rev. 2
- b. Electrical Protection Assembly, Design Specification, NEPD, 22A5941, REV. 0
- c. Qualification and Procurement Requirements - GE 262A6590
- d. Seismic Test Requirements - GE 22A4320
- e. Aging Plan for Electrical Protection Assembly #3353-171-01-001
- f. Acceptance Test Procedure 405835

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2.1.2 Applicable Drawings

- a. Electrical Protection Assembly, GE RESD, 914E175

2.1.3 Other Documents

- a. Quality Operating Procedure, Test Procedure, GE RESD, QOP 12.1 SP
- b. -Quality Operating Procedure, Test Control, GE RESD, QOP 12.2SP

2.2 Test Equipment

2.2.1 Electrical

- a. Fluke 8000A Digital Voltmeter
- b. California Instruments Model 1501 TC a.c. Power Source
- c. General Radio Model 1191 Frequency Counter
- d. Tektronic Scope Model 466

2.2.2 Mechanical

- a. Seismic Test Fixture - Supplied by Seismic Facility

2.3 Facilities

2.3.1 The following facilities will be provided by a qualified test vendor:

- a. Environmental chamber
- b. Biaxial seismic simulator
- c. Accelerometers
- d. Recording equipment for environmental and seismic tests
- e. Irradiation facilities



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3. SPECIAL CONSIDERATIONS

- 3.1 Quality Assurance Provision - Testing will be performed in accordance with Quality Operating Procedure, Test Control QOP 12.2SP.
- 3.2 Care must be taken to avoid false influence of the test fixture or loose components on the seismic response of the unit under test.
- 3.3 During the qualification testing, readjustments of the units under test are allowed only if those same adjustments would be performed in the course of normal in-service maintenance.
- 3.4 If a component failure has occurred in the module which requires replacement prior to completion of the test series, then one of the following may be done only if it can be positively determined that the failure was caused by external sources. i.e., defective test cable, test procedure error, operator error.
  - a. A new component may be installed and the test continued if it can be justified by analysis that the replacement of the component has no effect on the results of any remaining tests.
  - b. A component which has been tested in accordance with the same procedure as the failed one may be substituted and the test(s) continued.

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4. PERFORMANCE TEST

4.1 Test Preparation

4.1.1 Verify that the EPA Qualification unit has been acceptance tested per Test Procedure 405835.

4.1.2 All test equipment shall have power applied, and have reached a stable operating temperature for not less than fifteen minutes prior to measurements.

4.1.3 All personnel directly involved with acceptance testing of the EPA shall have made themselves familiar with the EPA Instruction Manual prior to conducting the EPA Acceptance Tests. (Only qualified personnel shall perform the functional testing, and reading of the instruction manual shall be requisite for qualification).

4.1.4 One (1) EPA will be manufactured using the materials, components and processes specified for normal production. This EPA will be processed for delivery in the same manner as production units, to include inspection and production acceptance testing.

4.1.5 The requirement to test the unit under the extremes of electrical characteristics is not necessary because it is the function of the units to monitor the power quality and respond to it. Therefore, the performance testing of the unit establishes this capability.

4.1.6 Qualification of this unit will be performed in the sequence shown Fig. 1.

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<u>SEQUENCE</u>	<u>TASK</u>
1.	INSPECTION
2.	BASELINE PERFORMANCE TESTING
3.	AGING TO END-OF-LIFE CONDITION
4.	RADIATION AGING
5.	SEISMIC TESTING
6.	ENVIRONMENTAL TEST (TEMP/HUMID)
7.	INSPECTION

- A PERFORMANCE TEST SHALL BE DONE AFTER EACH QUALIFICATION ENVIRONMENT.

FIGURE 1 - TEST SEQUENCE  
ELECTRICAL PROTECTION ASSEMBLY

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4.2 Base Line Test

4.2.1 Power cables and monitoring equipment will be connected in accordance with EPA Qualification Configuration (See Fig. #2). Turn key lock switch to the "Normal" position. Verify that the "Power In" lamp is lighted. Actuate the circuit breaker to the "On" position and verify that the "Power Out" lamp is lighted.

4.2.2 Over Voltage Trip Point

Adjust the input power source to 120 VAC, 60 Hz. Connect the red test lead to scope input. Slowly increase the input voltage to 132 VAC. Measure and record the voltage at which the circuit breaker trips and verify that the Over Voltage indicator on the front panel is actuated. Spec = 128.7 to 132 VAC. Readjust the input voltage to 120 VAC and reset breaker.

4.2.3 Under Voltage Trip Point

Connect the green test lead to scope input. Slowly reduce the input voltage to 108 VAC. Measure and record the voltage at which the circuit breaker trips. Verify that the Under Frequency indicator on the front panel is actuated. Spec = 108 to 110.7 VAC. Readjust the input voltage to 120 VAC and reset breaker.

4.2.4 Under Frequency Trip Point

Connect the white test lead to the scope input. Slowly reduce the input frequency to 57 Hertz. Monitor and record the frequency at which the circuit breaker trips. Verify that the Under Frequency indicator on the front panel is actuated. Spec = 57 to 58.14 Hertz. Readjust the input voltage to 120 VAC 60 Hertz.

4.2.5 Time Delay Trip Point

4.2.5.1 Repeat the Over Voltage test as described in Para 4.2.2. Monitor and record the time delay of the circuit breaker trip at the over voltage trip level. Spec = 100 to 133 milliseconds.

4.2.5.2 Repeat the Under Voltage test as described in Para 4.2.3. Monitor and record the time delay of the circuit breaker trip at the under voltage trip level. Spec = 100 to 133 milliseconds.

4.2.5.3 Repeat the Under Frequency test as described in Para 4.2.4. Monitor and record the time delay of the circuit breaker at the under frequency trip level. Spec = 100 to 133 milliseconds.

Note: Time Delay Trip Point tests of 4.2.5 may be accomplished in conjunction with Para. 4.2.2, 4.2.3 and 4.2.4 tests.

4.2.6 Cal/Test Position Test

Insert the key into the key lock switch and turn to the "Cal/Test" position. Disconnect the 120 VAC from the circuit breaker and apply the 120 VAC to the test jacks on the front panel. Repeat the tests described in paragraphs 4.2.2, 4.2.3 and 4.2.4. Remove the 120 VAC from the test jacks and reconnect to the circuit breaker.



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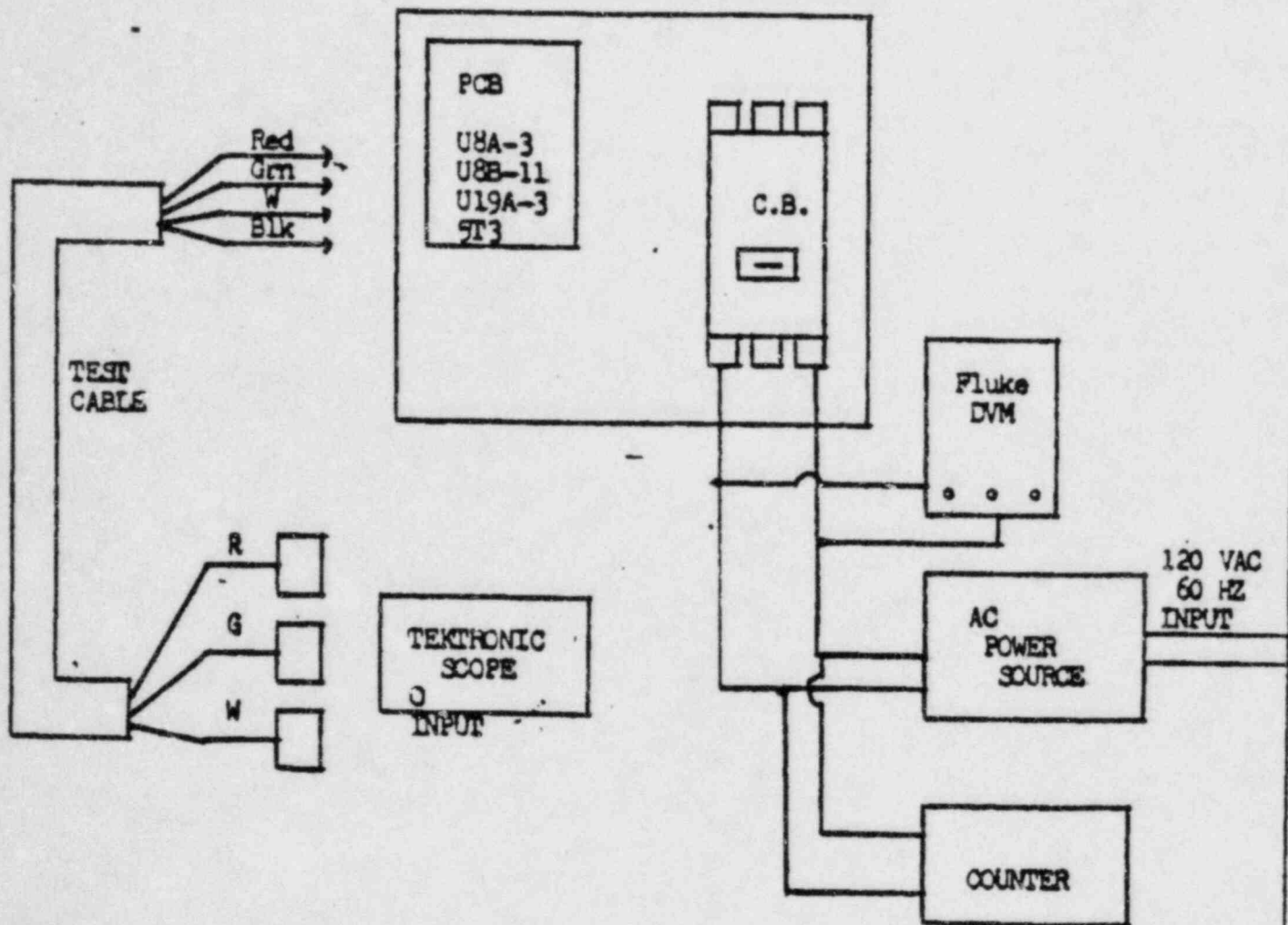
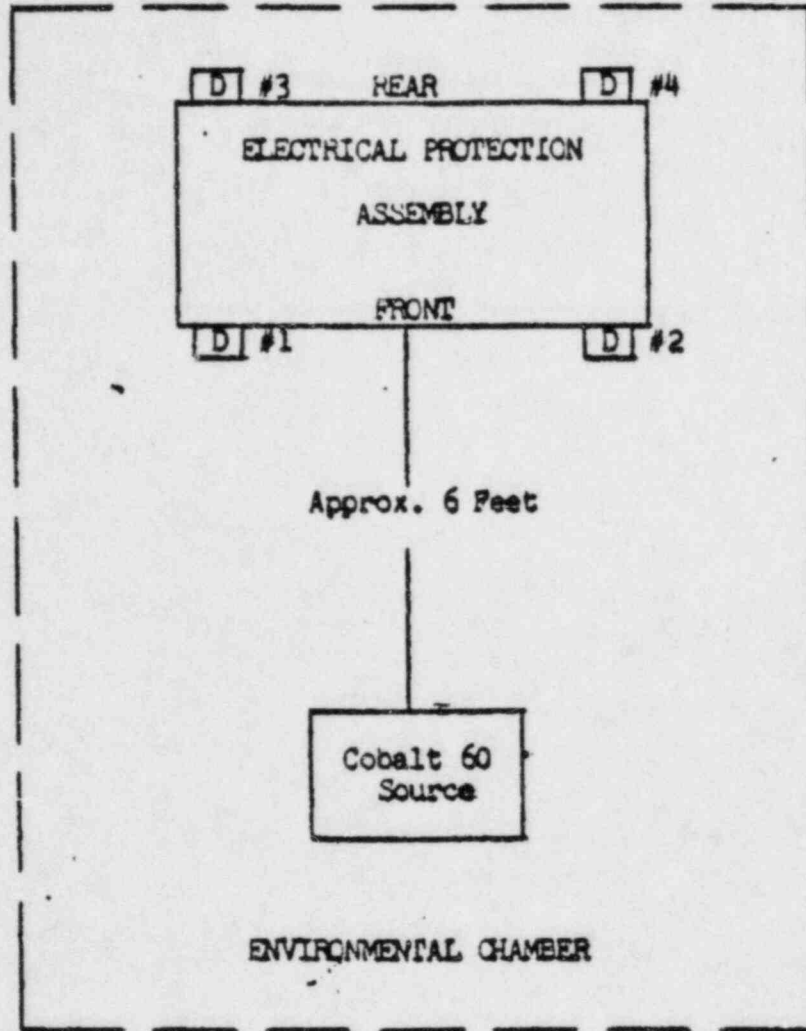


FIGURE 2

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D = Dosimeter 4 Ea.

RADIATION - FIG. 3

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4.3 Radiation Exposure

- 4.3.1 Mount the EPA into the environmental chamber as shown in Fig. 3.
- 4.3.2 After placing the EPA in the environmental chamber and locating the monitoring dosimeters as shown in Fig. 3, irradiate the inverter with a total integrated gamma dosage of  $2.0 \times 10^5$  RAD.
- 4.3.3 Rotate the EPA to assure uniform exposure.
- 4.3.4 After exposure, record the dosimeter readings time and dose rates on the data sheet.
- 4.3.5 Remove the EPA from the environmental chamber and perform tests per paragraphs 4.2.2 thru 4.2.5.3 of this test procedure.

4.4 Seismic Vibration Test

- 4.4.1 The seismic testing will consist of five (5) OBE level tests and one SSE level test. The table input will be biaxial random vibration with a duration of 30 seconds and will produce a Test Response Spectrum (TRS) that envelopes completely the RRS. This series will be performed twice. For the second series, the test fixture will be rotated 90° in the horizontal plane and reattached to the test table to provide for testing in all three axes. During the OBE vibration runs, power shall be applied at normal 120 VAC 60 Hertz the circuit breaker shall not trip during the vibration runs. During the SSE runs, perform para 4.2.2 Over Voltage Trip in the horizontal axis and para 4.2.3 Under Voltage Trip in the vertical axis. After each OBE and each SSE, the EPA shall be performance tested to paragraphs 4.2.2 thru 4.2.5.3 of this test procedure.
- 4.4.2 Seismic test Required Response Spectra (RRS) and Test Response Spectra (TRS) are defined in GE NPSED document titled "Seismic Test - Electrical Protection Assembly" Number TP (later).

4.5 Environmental (Temp/Humidity) Test

- 4.5.1 Install the EPA into a temperature/humidity chamber. Apply nominal voltage input (120 VAC 60 Hertz) to the EPA. During the temp/humidity excursions monitor the EPA to assure that the circuit breaker does not trip.
- 4.5.2 Design basis environmental testing will consist of subjecting the unit to the following environments sequentially with no discontinuity between the conditions:
  - a. 137°F, 95% relative humidity for 2 hours;
  - b. 122°F, 90% relative humidity for 24 hours;
  - c. 75°F, 60% relative humidity stabilized for performance testing.

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4.5.3 During the last ten (10) minutes of each temp/humidity soak period (as described in para. 4.5.2 a, b, c). Perform the tests of paragraphs 4.2.2 thru 4.2.5.3.

At the completion of each test, quickly open the chamber door and reset the circuit breaker.

4.5.4 Paragraphs 4.5.2 and 4.5.3 shall be repeated a second time in accordance with requirements of GE Spec 262A6590. After the second cycle, perform a test per para. 4.2.6 of this test procedure.

4.5.5 At the completion of the Qualification tests, perform a complete Acceptance Test per T. P. 405835.

4.6 Post-test Provisions

4.6.1 The EPA will be fully disassembled and inspected to identify any damage that may have occurred. Any damage that is found will be reported in the Final Inspection Report.

4.6.2 A test report will be prepared in accordance with the Qualification Report Format Instruction, GE NEPD, 235A1327, Rev. 1.

5.0 DATA REQUIREMENTS

5.1 The following data will be obtained prior to test, as applicable.

5.1.1 Test equipment

- 1. Equipment type
- b. Manufacturer and Model Number
- c. Serial Number
- d. Date due for calibration

6.0 DATA SHEETS

One or more the data sheets specified in Quality Operating Procedure, Test Procedure, QOP 12.1SP will be used to record the applicable data specified in paragraph 5. The test conductor will specify the data sheets.



ENGINEERING WORK AUTHORIZATION	RECEIVED	ISSUE DATE	EWA NO.
	OCT 16 1981	OCT 16 1981	EJ36-FR
C.M.P.			SHEET 1 OF 3

TASK TITLE Seismic/Environmental Test - Electrical Protection Assembly

ORIGINATED BY	DATE	COMP	M/C	PERF COMP APPROVAL	DATE	COMP	M/C
W.H. Hendrix	9/15/81	909	432	R. J. Niemi	10/1/81	524	587
APPROVED BY	DATE	COMP	M/C	T. E. Adams	10/2/81	503	504
B.P. Grim	9/15/81	909	432	R. Fisher	10-2-81	107	028
ACCEPTED BY	DATE	COMP	M/C				
S. Nunez	9/15/81	940	428				

APPLICABLE TO	CHARGE NUMBER	COST ACCUMULATION DATA
Requisition BWR's	MP180	<input type="checkbox"/> T & M
AUTHORITY PWA's 0776KN, 1127KH, 1256KN, 1523KS, 1565KT, 1701KG, 1430KR	CAID: TEO: EGCOS	<input type="checkbox"/> FIXED PRICE
		<input type="checkbox"/> OTHER (EXPLAIN BELOW)

EWA REVISION DUE TO

<input type="checkbox"/> INDUSTRIAL STANDARD CHANGE	<input type="checkbox"/> CUSTOMER CHANGE	<input checked="" type="checkbox"/> OTHER
<input type="checkbox"/> REGULATORY CHANGE	<input type="checkbox"/> INTERNAL GE CHANGE	ERRORS in original EWA, which do not meet in line with EOP Requirements
<input type="checkbox"/> CONTRACT CHANGE	<input type="checkbox"/> COST RECOVERABLE	

SPECIFIC OBJECTIVES, OVERALL SCOPE, SCHEDULE: SUPPLEMENTS EAJ36-FR REV. 0 ISSUED 8/135

- 1.0 Purpose  
Perform seismic/environmental qualification testing of the Electrical Protection Assembly (EPA) as part of the Class 1 Qualification Program #405863 developed by GE-RSD Lompoc.
- 2.0 Scope
  - 2.1 Perform seismic tests on one EPA, Serial No. 201. The GE-NEBG Purchase Specification No. is 21A3120G001, Rev. 2. The EPA Assembly Dwg. No. is VPF-3830-111-1 (GE-RSD No. 914E175G001 Rev. 0)

This seismic testing is part of GE-RSD (Lompoc) Qualification Program #405863. The EPA is being qualified for service as a Class 1E component per IEEE Standards 323-1974 and 344-1975 and GE Specs 262A6590 Rev. 1 and 22A4320 Rev. 2. The EPA's are for Safety Related Service.
- 3.0 Special Instructions
  - 3.1 This work is to be done for Requisition Plants (GE-RSD) and Engineering Coordination by CIO (Lompoc).
  - 3.2 GE-RSD (Lompoc) will deliver the EPA and all required equipment for mounting and monitoring to the Seismic Test Facility on approximately 8/10/81. Testing is to start as soon as possible and be completed 5 days after equipment is available.
  - 3.3 The EPA unit shall be mounted directly to the seismic shaker table.
  - 3.4 GE-RSD (Lompoc) will setup and monitor all functional parameters before, during and after the seismic testing as described in RSD Test Procedure 405863 Section 4.4, and will be responsible for removing the EPA and all test equipment at the completion of the seismic test.

DISTRIBUTION  
K.R. Miller M/C 275  
D.D. Oliver M/C 587

3.5 The Seismic Test Facility is to provide a 220 volt, 60 Hz, single phase, 10 ampere electrical circuit.

4.0	Schedule	committed completion dates	responsible component
	Test Freeze Dage	8135	524
	Function Test	8136	909
	Seismic Test	8136	503
	Seismic Test Report	8137	524

5.0 Reference Documents

5.1 IEEE-323-1974, Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.

5.2 IEEE-344-1975, Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.

5.3 22A5741, Rev. 1, Group 1 Design Specification Electrical Protection Assembly.

5.4 22A5940, Rev. 1, Group 1 Test Specification Electrical Protection Assembly Qualification.

5.5 22A4320, Rev. 2, Seismic Qualification Procedure for Class 1E Electrical Equipment.

6.0 Drawings

6.1 GE-NEBG Purchase Specification 21A3120G001, Rev. 2

6.2 EPA Assembly VPF-3830-111-1 (GE-RSD 914E175G001)

7.0 Environmental Requirement

Seismic testing will be performed under ambient temperature, humidity, and radiation conditions.

9.0 Bolt-Down Instructions

Install EPA on seismic table using 5/8" 11NC bolts through all holes provided at the bottom into holes tapped into the seismic table. Torque to 70 ft. lbs. Bolts will be grade 5 or better. Lockwashers will be used and bolt threads lubricated slightly. If bolts do not line up, use clamps as required.

Note: Check bolt torque before SSE and before mounting fixture is rotated. Retorque to initial value.

10.0 Vibration Tests

10.1 Perform a low level resonance search per Paragraph 5.1.4 of 22A4320, Rev. 2. Record resonance gain and frequency for accelerometers mounted on the EPA.

10.2 Perform seismic vibration per Paragraphs 5.1.5 and 5.1.6 of 22A4320, Rev. 2.

10.3 Vibration input OBE/TRS and SSE/TRS data shall be recorded on magnetic tape. The OBE/TRS and SSE/TRS shall exceed by 10% the amplitude of the 2% OBE/RRS and 3% SSE/RRS curves. Figure 3 and 4 of 22A4320, Rev. 2, but not to exceed table limits.

10.4 The seismic qualification procedure for Class 1E electrical equipment 22A4320, Rev. 2 is applicable, except that IEEE standard 344-1975 is controlling.

**11.0 Test Sample Photographs**

- 11.1 Black and white information: photographs will be taken to display the following information:
- 11.1.1. A full image of the test input mounted to the vibration table which will display the location of the table accelerometers in respect to the test sample.
  - 11.1.2 Close-up of the EPA mounting to the mounting fixture.
  - 11.1.3 Close-up of the Mounting Fixture to seismic table bolts or clamps.
  - 11.1.4 Close-up of the accelerometers mounted to the EPA.

**12.0 Design Record File (DRF)**

- 12.1 DRF-0500 (GE-RSD) Custodian Ed Leary (DRF-0500 is not an NEBG DRF)
- 12.2 DRFA00-980 (GE-NEBG) Custodian K. Utsumi M/C432 *KU*

Note: All data pertaining to the seismic test shall be sent to Ed Leary to be inputted in DRF-0500.

**13.0 Test Plan and Procedure (TP&P)**

- 13.1 A Test Plan and Procedure shall be written and approved before the seismic test is performed.

**14.0 Data Transmittal**

Data transmittal will be within 2 weeks after the seismic test and sent to W.H. Hendrix M/C 432

- 14.1 A write-up will be submitted within 10 working days from the last data point to show the following:
  - 14.1.1 The test was performed per the TP&P
  - 14.1.2 Submittal of Data Tapes
  - 14.1.3 Reduced Data to Show:
    - 14.1.3.1 Response Spectrum Test Results
    - 14.1.3.2 Resonance Gains and Frequencies

**15.0 Environmental Testing**

- 15.1 Make environmental test chambers available for GE-RSD (Lompoc) to perform TP No. 406087, Paragraph 4.3.6
- 15.2 GE-RSD (Lompoc) will perform equipment monitoring of EPA's while undergoing environmental testing.