PY Chen
incomplete in WYLE test report.

Seismic Qualification of G.E. 250 MVA 4.16 kV Switchgear Installed at PB & E, Diablo Canyon Nuclear Plant Units 1 and 2

Test Plan

Submitted to Pacific Gas and Electric Company

Revision 0 5/4/78
Revision 1 5/30/78
Revision 2 7/27/78

Switchgear Business Department
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I. INTRODUCTION

The selection of the test specimen is the most important decision in the seismic qualification of Class IE equipment. Since it is not practical to test an entire line-up of equipment, the judicious selection of a test sample is vital to ensure that the total equipment is adequately represented. A recommendation is here made to test three switchgear cabinets. Reasons for this recommendation are given below.

The object of the seismic qualification test is to demonstrate that the Class IE switchgear retains its normal function before, during and after the seismic event. In addition, any non-class IE equipment must not fail in a manner to jeopardize the Class IE function. To demonstrate normal function of the switchgear all control circuits must be energized to duplicate exactly during the test their normal state, and power must be applied to the trip coils and operating mechanisms of the circuit breakers. During the seismic event circuit breakers are tested in the open, closed and in the actual tripping and closing operation or other sequences required to demonstrate the Class IE function. As a backup, the state of selected relay contacts is recorded for monitoring purposes and also sometimes for chatter duration. However, by itself chatter duration does not conclusively demonstrate normal function or lack of normal function. If a relay contact is an input to a Class IE device not located on the switchgear then the relay contact must be monitored and the chatter or change of state record analysed to demonstrate Class IE function.

Of interest during the seismic test sequence are the acceleration levels, the frequency content of the motion and the duration of shaking. The first two are given by the response spectrum and the third by the actual duration given in seconds of each seismic test. Two types of response spectra are commonly employed.

i) The Required Response Spectrum (RRS) defines the required seismic event to which the equipment must be subjected to qualify for a specific location.

ii) The Test Response Spectrum (TRS) defines the actual exposure to which the equipment was subjected in a test.

iii) To qualify, the concept of enveloping is employed. The TRS must envelope (be greater than) the RRS in order for an equipment to be qualified.

The great margins inherent today in the process of seismic testing are well documented in the literature. It is vital to design a realistic seismic test since it is not the purpose of testing to eliminate equipment which in fact is adequate for a given location by subjecting it to overly conservative tests. The nature of the conservatism may arise from many factors including excessive duration or level of acceleration or a poorly synthesized frequency ensemble. The need for realism is even more underscored by the fact that the Diablo Canyon site has the highest seismic levels required for any nuclear plant in this country. In this test plan specific recommendations for a realistic seismic testing sequence are made together with their technical justification.

2. SELECTION OF TEST SPECIMEN

2.1 Selection Criteria

i) The test specimen must enable normal Class IE function to be demonstrated before, during and after the seismic event. Circuit breakers must operate when called upon to do so and they must not spuriously close or trip. Relay settings must remain within defined tolerances after the seismic testing.

ii) The test specimen must have a configuration which enables data to be obtained to allow the remaining equipment in a line-up to be qualified using the method of extrapolation of test data.

iii) Structurally the test specimen must be representative of the equipment in a line-up. This is because the structure must remain functional and also it determines the nature of the acceleration which acts at the mounting location of relays, instruments and other devices.

iv) The number of units to be tested to represent a line-up is an important factor to consider. Practical considerations do not allow a complete line-up to be tested. In general it is preferrable to test the maximum number of units which the size of the shaker table permits. One unit by itself has low frequency torsional modes of vibration which do not exist in a line-up and consequently a test of one unit tends to be overly conservative. The added advantage of testing a number of units is that doors containing different relay configurations can be tested simultaneously.

v) A complete analysis has been made of the Class IE switchgear in Diablo Canyon Units 1 and 2. The switchgear in the two units is the same and the RRSs for the mounting location of the switchgear in the two units are the same. Therefore test results based on testing switchgear from either unit automatically apply to the other. For the selection of a test sample the switchgear in Unit 1 is described below.

Bus	Switchgear Cell Numbers	G.E. Front View Dwg. No. Unit #1	Unit #2
F	7-15	107D9928	121D6300
G	5-15	" 29	" 01
H	7-15	" 30	" 02

Table I - Summary of Class IE 4.16 kV Switchgear. Unit 1 & 2 (Cell G15 does not have a Class IE function)

Relays and Breakers - Examining these tables it is seen that the variety of relay complements are the same for all busses. Bus G is different in that it contains one 2000A breaker (G15) which is heavier than the 1200A breakers. G15 does not have a Class IE function, however its proximity to the rest of the Class IE switchgear will affect the seismic performance and consequently the test specimen must contain at least one 2000A breaker.

Switchgear Cell No.	5	6	7	8	9	10	11	12	13	14	15
Class IE Bus F and H											
Circuit Bkr Rating Amps	-	-	Cell 7-15 all 1200A.								
Relay Type IJCV			3								
SV			1						1		
S-D			1	1	1	1	1	1			1
IAC				3	3	3	3	3	3	6	3
HFA				2	2		2	2			2
RAV								1			
IAV								1	1		
Class IE Bus G											
Circuit Bkr Rating Amps			Cell 5-14 all 1200A.								2000
Relay Type IJCV	3										
SV	1								1		
S-D	1	1	1	1	1	1	1	1			
IAC		3	3	3	3	3	3	3	3	6	
HFA		2	2	2	2		2	2			
RAV								1			
IAV								1	1		

TABLE II. Summary of Class IE 4.16 kV Switchgear. Unit 1

Bus Duct - A number of the switchgear cells are served by bus duct which must be reviewed since it structurally is part of the switchgear and therefore has the potential of affecting the seismic performance.

i) G15 is served by a 2000A bus entering bus from below. There is minimal seismic interaction on the switchgear because the body is rigidly connected to the floor and the conductor mass distribution is concentrated in the lower part of Cell 15.

ii) F14, G14 and H14 are linked by an overhead 1200A bus duct supported on the switchgear. (3/8 x 4 inch copper conductor, weight per foot of bus duct 60 lbs.).

iii) F13, G13 and H13 are linked by overhead bus duct supported on the switchgear. There is an incoming line of 2000A into F13 and it continues at 2000A to G13. (5/8 x 6 inch aluminum conductor, weight per foot of bus duct 55 lbs.) The bus G13 to H13 is 1200A with weight as given in ii) above.

2.3 The Preferred Test Specimen

Based on the selection criteria 2.1, and the description of the Class IE equipment 2.2, the following considerations were made in recommending the preferred test specimen.

i) Practical limitations in the size of the shaker table make three switchgear cells the maximum number to be used. This is felt to be adequate to represent the entire line-up structurally since it is not as extreme as testing only one cell. Therefore the test sample should contain three switchgear cells.

ii) Since there is one 2000A circuit breaker in the Class IE equipment (G15) at least one 2000A circuit breaker must be included in the test specimen.

iii) An extensive study of the overhead bus duct has been made. Rather than complicate the qualification of the switchgear by requiring additional tests with the bus duct which does not perform a Class IE function, a modification will be made in the field to completely dynamically decouple the two. An earthquake joint will be inserted at the point of entry of the bus duct into the switchgear. The seismic interaction forces will be reduced to zero and thus the switchgear may be tested by itself. To aid in the design of the earthquake joint, the motion of the top of the switchgear relative to the floor will be measured during seismic testing.

iv) On examining Table II it can be seen that all the relay types employed can be represented in three doors. That is door F7, G5 or H7, door F12, G12 or H12 and door F13, G13 or H13. Door 12 is the worst case door since it has the heaviest relay complement.

The determination of the preferred test specimen is summarized in Table III. This table indicates that a test specimen containing G12, G13, G14 and G15 would be ideal. A good alternative to narrow it down to three cells is G13, G14 and G15 with the G12 door on G15, and the G5 door on G14.

Selection Criteria	Unit 1 Switchgear Cell Numbers to be Represented in Test Specimen
i) Number of Cells	3
ii) Representation of Circuit Breakers	Include at least one 1200A and one 2000A Use G15 and any others.
iii) Relay Type Representation	Include F7, G5, or H7, F12, G12 or H12, and F13, G13, or H13.

TABLE III. Summary of Unit 1 Test Specimen Determination

2.4 The Selected Test Specimen

The preferred test specimen in 2.3 includes switchgear cells G13, G14 and G15. These cells are connected by overhead, bus duct or bus duct entering from below. Since the switchgear will be completely decoupled from the bus duct by an earthquake joint, there is no need to test the bus duct and therefore an alternative test sample to G13, G14 and G15 has been selected to simplify the disassembly of Class IE bus line-ups.

The alternative test sample which has been selected is H7, H8 and H9. The following additions or modifications will be made to these three units to make them fully equivalent to G13, G14 and G15.

i) Relay complements on doors will be as described in 2.3. Door H7 is automatically included. Door H12 will be mounted and wired into Cell H8 and Door H13 will be mounted and wired into Cell H9 to the extent that all Class IE control circuits will be included to allow normal function to be demonstrated during the seismic testing. During the seismic test program an on-going review will be conducted to study the performance of the relays. If the testing demonstrates that a relay or relays do not perform their Class IE functions, it is planned to relocate such relays off the switchgear door panels on a more rigid structure. To provide for such a relocation while minimizing the number of tests to which the switchgear test sample has to be exposed, an equivalent rigidly mounted relay will also be attached to the shaker table. The motion of the back of this relay case will be monitored by recording the Front to Back, Side to Side and Vertical acceleration time histories during each test and this provide the data for qualifying the same or a replacement relay using device test data.

ii) Cells 13 and 14 have PT roll-out units mounted on the upper front of the cabinets. These PT roll-out units will be mounted on H8 and H9. This fully duplicates the most heavily loaded, lowest natural frequency condition which from experience has been found to be the worst case for seismic performance. If during testing malfunction occurs with the elevated PT roll-outs, they will be removed and mounted rigidly to the test table and their performance evaluated in that position. If this change is required in the seismic test program then all elevated PT roll out units in the entire Class IE bus, consisting of cells F13, G13 and H13 and F14, G14 and H14 in

both Diablo Canyon Units 1 and 2 will be identically mounted rigidly to the floor or to a wall at the switchgear location.

iii) To include the effect of a 2000A breaker in G15, the 1200A breaker in H7 will be modified to simulate the 2000A breaker. The overall dimensions, the frame and mechanisms of the two breakers are the same. The 1200A breaker weighs 1000# and the 2000 amp breaker weighs just 100# more, mainly due to the heavier conductors. To simulate the weight of the 2000A breaker a dummy weight of 150# will be rigidly attached to the existing breaker in H7. The additional 50 pounds is to simulate the bus duct conductor mass also associated with cell G15.

2.5 General Statements on Extrapolation of Test Results

The following general statements summarize the basis upon which seismic test results from a sample of three switchgear cells can be justified to apply to an entire line-up of switchgear.

i) From Table II it can be seen that the Class IE switchgear line-up have the following number of cells, Bus F and H have 9 cells and Bus G has 10. (The 2000A circuit breaker G15 does not have Class IE function.) The switchgear cells all have the same rating circuit breakers, that is 1200A, and they all have the same physical dimensions. The structural steel frames and doors of all the cells are identical. There are some variations in the arrangements of the primary electrical bus and location of PT and CT instrumentation. With the possible exception of the elevated PT roll out units in cells 13 and 14, already described in 2.4 para ii), the variations in primary electrical bus and PT and CT instrumentation do not significantly alter the seismic performance of one switchgear cell compared to any other.

ii) Past seismic testing of metalclad switchgear has shown that the addition of overhead potential transformer roll out (PTRO) units and/or overhead bus compartments changes the seismic response compared to the same structure without such overhead mass distributions. Measurable effects include a decrease in lowest mode frequencies, for example, in the side to side direction, the magnitude can be as much as 2 Hertz. Essentially the combination of greater mass, longer moment arms and longer time durations associated with the lowered mode frequencies results in greater deflections and thereford greater accelerations for such overhead mass equipments. Based on this consideration it is always conservative to test such lower frequency equipment and to extrapolate results to other switchgear cells of the same type provided that such equipment is essentially the same as described in i) above. Accelerometers are located throughout the equipment to enable the important natural frequencies to be determined during the optional sine sweep tests performed as part of the seismic program.

iii) Three switchgear cells will be seismically tested. The heaviest cells will be included in the test sample. This will include the simulation of the 2000A circuit breaker since this can affect the seismic performance of the adjoining 1200A breakers. Included also will be the high PT roll out units as discussed in 2.4 para ii).

iv) From Table II it can be seen that the relay complements on the front doors vary between 4 to 8 relays per switchgear cell. The doors to be tested namely H7, H12 and H13 include 5, 8 and 5 relays respectively. This does not include control switches and other non Class IE devices such as meters. The variation in mass due to the different relays amounts to around 20 to 30 lbs. per door. The front doors are to be modified for this test to raise their lowest natural frequency higher than around 20 Hz. The type of stiffening being employed, namely a matrix of substantial stiffening ribs, makes the seismic response essentially the same at all relay mounting locations. Note that Class IE relays are all mounted in the upper door and at the same range of height in all cells. Even with the variation in mass distribution it is expected that the natural frequency of the different doors will not vary by more than 1 to 2 Hz. Accelerometers will be located on Class IE relays in the front doors to substantiate these claims. Based on this data it is concluded that seismic test results from the three test cells can be extrapolated to the relays in the entire switchgear line-ups.

3. PRE-TEST CALIBRATION AND QA

Extensive structural modifications are planned for the switchgear cells to be seismically tested. After successful completion of seismic testing the same modifications will be made to all Class IE switchgear line-ups in Diablo Canyon Units 1 and 2. Before the seismic test it is vital to document certain base-line information to establish the pre-test condition of the switchgear. All relays will be calibrated and the data recorded at the test laboratory to eliminate possible deviations in performance caused by shipping vibrations.

Before, during, and after the welding of structural reinforcement to the switchgear frames, tolerance adjustments and QA will be necessary. Critical tolerances and alignments of the equipment and the circuit breakers must be checked at the testing laboratory to eliminate changes caused by shipping vibrations.

4. SEISMIC TEST PROCEDURES

4.1 Definition of Required Response Spectra RRSs

The RRSs for the particular location of the Class IE switchgear line-ups in Diablo Canyon Units 1 and 2 are given by the following figures:

Turbine Building El. 119 ft. John A Blume and Associates/Res. Div.

Figure 1 Horizontal Composite of Blume Brace #16 dated 7/29/77 (NS), Newmark Brace #16 dated 7/29/77 (NS) and Newmark Mode 47, Bent 3.5, Bents 1-5, 31-35 (EW).

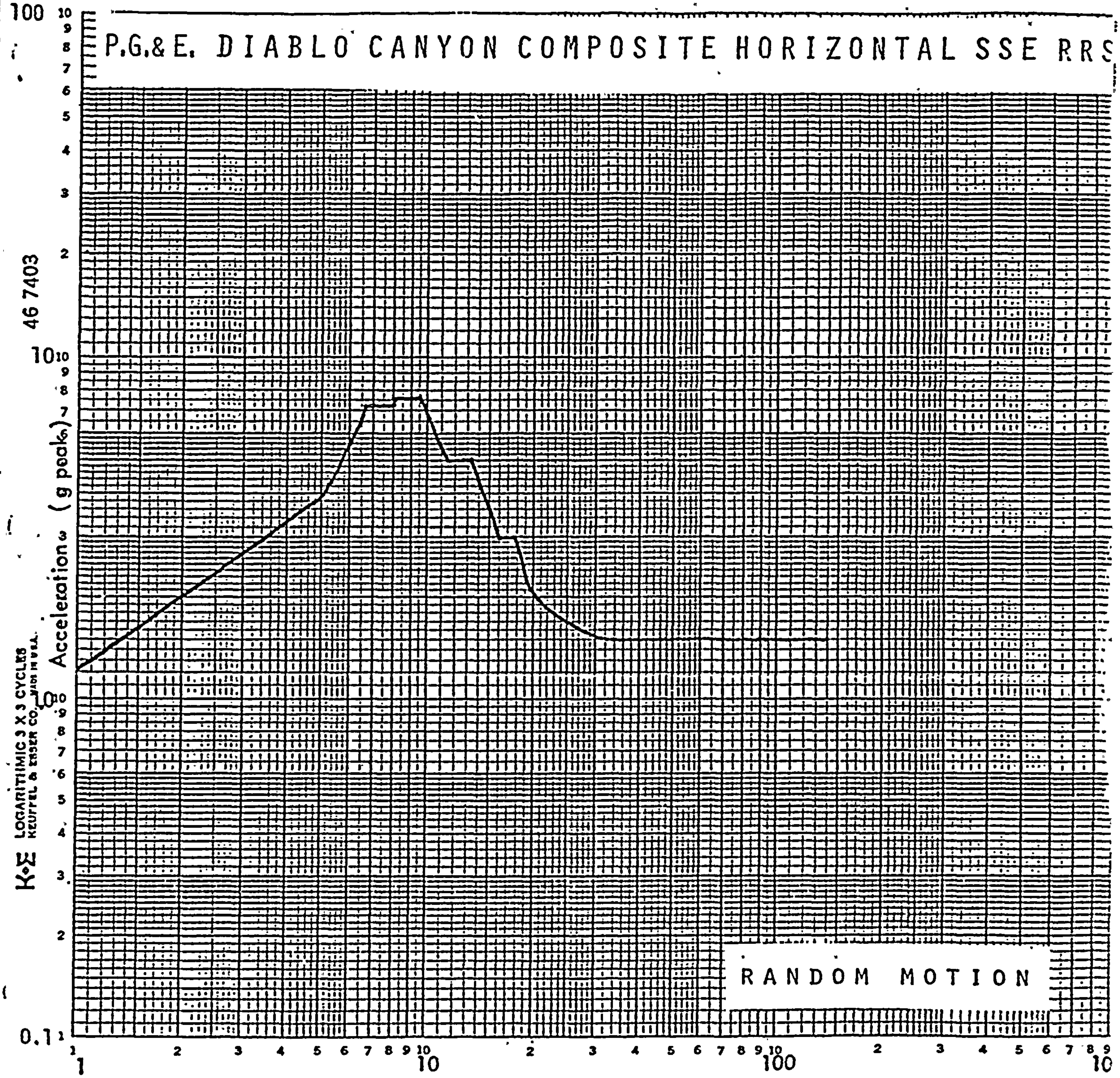
Figure 2 Vertical - Newmark in area of line 3.5 Node 41

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [3%]

FIGURE 1



AXIS H

LOCATION NO. Turbine Building 119 ft. 7/21/78

TEST RUN NO. ________

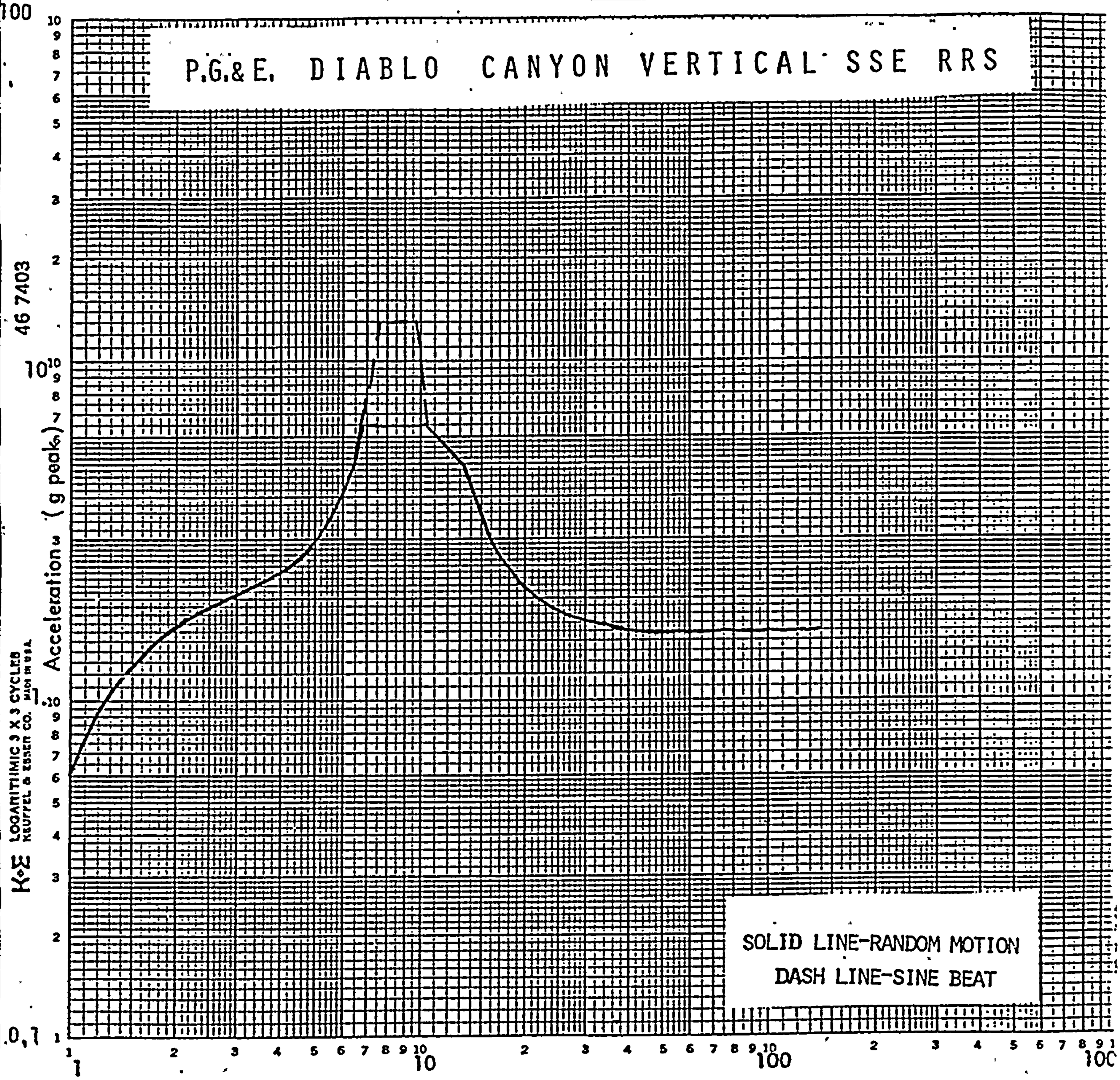
E M FitzGerald

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 3%

FIGURE 2



AXIS V

LOCATION NO. Turbine Building 119 ft. 7/21/78

TEST RUN NO. ________

E. McFitzgerald

4.2 Seismic Test Sequence

Following the procedures of IEEE 344-1975 the proof test will be conducted in the sequence tabulated in Table IV. For conservatism the horizontal NS and EW SSE RRS referenced in 4.1 have been combined to provide the horizontal composite SSE-RRS shown in Figure 1. The horizontal OBE RRS is considered to have 50% of the Figure 1 SSE RRS response acceleration levels at each value of frequency. The vertical SSE RRS referenced in 4.1 is shown in Figure 2 and its OBE RRS is considered to have 50% of the Figure 2 SSE RRS response acceleration levels at each value of frequency. The duration of each OBE and SSE test will be 30 seconds. This conservatively meets the requirements in IEEE 344-1975 Para 3.1 and Para 6.6.5.

Random motion will be utilized for all OBE tests and for horizontal SSE tests. Random motion with sine beat will be utilized for the vertical SSE tests because such motion corresponds to the predominant single frequency building response in the vertical direction. To provide for possible variations in the vertical response frequency, four SSE tests will be conducted using random motion with superimposed sine beats with frequencies at one sixth octave frequency values between 7.1 Hertz and 10 Hertz.

4.3 Monitoring During Seismic Tests

A number of accelerometers not exceeding 37 will be required in the test sample to monitor the acceleration levels at various points in the equipment to provide the necessary data to justify extrapolation of test results. This does not include the shake table accelerometers required to obtain TRSs. Accelerometer locations in the equipment will be as shown in General Electric Company drawing 0156C1250, Sh. 111, Rev. 1.

The displacement at the top of the switchgear relative to the shake table will also be measured during the SSE tests. This information is required to justify the design of the bus duct earthquake joint.

Ten unenergized electrical contacts are to be monitored for chatter and change of state and recorded on paper oscillograms. These contacts are identified on Wiring Instructions transmitted to PG & E and dated 7/12/78.

During the test program transmissibility plots from a maximum of 6 response accelerometers in each direction (axis) of testing will be required before proceeding with the biaxial tests. No biaxial test shall be run until the test engineer has reviewed the TRSs and has evaluated and if necessary remedied the source of any malfunctions occurring during the previous test. Malfunctions may require electrical changes or welding in the equipment. Depending on the exact nature of malfunctions some tests may be required to be repeated. Depending on the performance of Relays as described in 2.4 para i) and PTs 2.4 para ii), it may be necessary to repeat some of the SSE tests which may also require 90 degree rotation of the equipment. The schedule for the testing program must therefore be flexible to accommodate these requirements.

TABLE IV. SEISMIC TEST SEQUENCE DIABLO CANYON UNITS 1 AND 2 4.16 KV SWITCHGEAR

Condition	Axes	Horizontal RM ZPA g	Horizontal RM Figure No.	Vertical RM or RM + SB ZPA g	Vertical RM or RM + SB Figure No.	Sine Beat Freq. Hz.	Bkr. Pos.	Remarks
1	SS	.2	-	-	-	-	C	1-33 Hz-Sweep
2	SS	.2	-	-	-			33-1 " "
3	V	-	-	.2	-	↓	↓	1-33 " "
4	V	-	-	.2	-			33-1 " "
5	SS-V	.75	50%-1	.8	50%-2			1 OBE
6							O	2
7		↓	↓	↓	↓		CO	3 ↓
8	↓						OC	4
9							COC	5
10		1.5	1	1.6	2	7.1	C	1 SSE
11						8	O	2
12		↓	↓	↓	↓	9	CO	3 ↓
13						10	OC	4
		Rotate Sample 90°						
14	FB	.2	-	-	-	-	C	1-33 Sweep
15	FB	.2	-	-	-		C	33-1 "
16	FB-V	.75	50%-1	.8	50%-2	↓	C	1 OBE
17							O	2
18		↓	↓	↓	↓		CO	3 ↓
19							OC	4
20							COC	5
21	↓	1.5	1	1.6	2	7.1	C	1 SSE
22						8	O	2
23		↓	↓	↓	↓	9	CO	3 ↓
24						10	OC	4

Legend

RM - Random Motion
RM & SB-Random Motion with Sine Beat
ZPA - Zero Period Acceleration
SS - Side to Side
V - Vertical
FB - Front to Back
Bkr.Pos. - Breaker Movable Contact Position

Notes

The circuit breaker should be lowered and re-raised after selected tests at the direction of the General Electric Company Representative. At such times, the PTRO's will also be opened and inspected.

4.4 Documentation

i) Accelerometer time histories shall be recorded on magnetic tapes to allow analysis of TRSs for various mounting locations in the equipment. This data is required to justify extrapolation of test results to other relays and, if necessary, to provide data for device testing after the assembly test program.

ii) Paper oscillogram records of all electrical contacts monitored for chatter or change of state will be required. To allow analysis of results each paper oscillogram must also include a record of the Horizontal and Vertical control accelerometer time history.

iii) For each orientation of testing, transmissibility plots for up to 6 response accelerometers in the equipment will be required before proceeding with the biaxial tests. For report purposes, transmissibility plots for in direction of testing and the two cross coupling directions are required on each sine sweep test for accelerometers 2,4,7,9,10,11,13 designated on 0156C1205 Sheet 111. For report purposes transmissibility in the direction of testing will be required for accelerometers 1,3,5,6,8 and 12.

iv) 3% horizontal and vertical TRS plots are required for each test of the biaxial series. Approximately 80 5% TRS plots will be selected after the test series for inclusion in the test report. This data will be selected based on the need to justify extrapolation of test results.

4.5 Control Power

The control power requirements are as shown on the Wiring Instructions dated July 12, 1978.

5. POST-TEST CALIBRATION, INSPECTION, AND MAINTENANCE

All relays will be rechecked for changes in calibration after the completion of the testing program. Selected relays will be spot checked for calibration changes after the side-to-side-vertical orientation testing. All data must be recorded. This work must be performed at the testing laboratory to eliminate possible deviations in performance caused by shipping vibrations.

The test samples must be inspected and any significant deviations from the original condition must be recorded. Complete maintenance and restoration to the original condition is required prior to installation in the original position in Unit 2 bus H.

6. CRITERIA TO DETERMINE PASS/FAIL PERFORMANCE

The following general statements are aimed to provide guidance in evaluating pass/fail performance during the seismic test sequence. If malfunction occurs during the test, the source must be located. A determination must then be made as to the extent of modifications required to eliminate the malfunction. Corrective action must be made and, if necessary, some retesting may be required in order to qualify the equipment. If it can be determined that the malfunction was due to random or external sources not

associated with the seismic testing, then it is not a malfunction and the test may be repeated.

i) All Class IE relays and control circuits are loaded to simulate their normal state. When the proper relay function (absence of unacceptable contact chatter or changes of state during the seismic event) can be ascertained by monitoring breaker status or downstream auxiliary relay status that is an acceptable pass/fail indication.

ii) When a relay contact provides an input to a Class IE device not located on the switchgear, normal Class IE function will be ascertained as in i), and then the contact status must be monitored and recorded to allow pass/failure to be analysed after each test. Indicating lights are only considered Class IE if their failure (blown filament, shorting to ground, or blown fuse, etc.) causes a Class IE circuit to malfunction. These criteria are employed in the selection of which relay contacts or circuits are required to be monitored.

iii) Failure of the circuit breakers to change state on command or to spuriously change state is a malfunction.

iv) Structural failures, such as cracked welds, plastically deformed members or gross motion or dislocation of parts, during an SSE are considered malfunction if a Class IE function is impaired by the failure. During the OBE tests structural failures are unacceptable if the conditions remaining undetected could produce malfunction in a subsequent SSE event. Structural repairs such as welding or rebolting loose hardware are permitted following each SSE test in an axis. Repairs if made should be documented. Repairs made during or after OBE testing should be reviewed and the need for retesting should be considered and documented.

v) The Class IE relays must be checked for performance after testing is completed as discussed in 5. Based on IEEE Std. 501-1978, Seismic Testing of Relays, "5.2.4.4 Post Test. Failure of the relay to perform within twice accepted tolerances as stated in 4.1 after the fragility testing is completed without readjustment shall be classified as a test failure."

July 12, 1978

WIRING INSTRUCTIONS

DIABLO CANYON SWITCHGEAR TEST SAMPLE

4.16 KV-1200-250 MVA

A. Diagrams

Cell	Skematics	Connection Diagrams
7	441356	441589
8	Marked copy 441302	HH53078
9	Marked copy 441307	HH53178

B. Control Power Connections

Cell 7 (441589)

a) 2W-DC-125V-20A Supply, (+) to DC3, (-) DC1

b) 3W-AC-120V-3Ø-60 Hz Supply, Leg A to X5, Leg B to X7, Leg C to X6

4W-AC-5A-3Ø-60 Hz Supply, Leg A to CG4, Leg B to CG5, Leg C to CG6, Neutral to CG1

Both supplies needed for IJCV Relays. Leg A, Leg B and Leg C for voltage and current sources are related to Wyle's Ø1, Ø2 and 0/3 respectively.

IMPORTANT The 3Ø 120 volt circuit should not be energized when primary compartment covers or panels are removed so that primary conductors are exposed. If interaction effects between primary conductors and Wyle instrumentation can not be readily resolved, the PTRO primary fuses will be removed to de-energize the primary conductors.

c) Wyle is to provide a remote 3Ø switch to disconnect power to the 59HHG 1 & 2(SV relay) coils. This switch will be open for the majority of tests to simulate the Diesel Generators not being energized.

d) Connect NO "Close" Push Button to B5 and B6.
Connect NO "Trip" Push Button to DD7 and DD8.

e) Remove and tape ground leads from ground bus in rear of cell

Cell 8 with Cell 12 door (53078)

a) 2W AC 1Ø 5A 60 Hz supply, Leg 1 to C18, Leg 2 to CD4 (IAC66 source)

b) 3W AC 3Ø 120V 60 Hz supply, Leg A to AK8, Leg B to AK9, Leg C to AK10(R
Jumper AK8 to AH15 and AK9 to AH16 (IAV)

c) Connect NO "Close" Push Button in series with a NC 43 X HH12 contact to DD4 and BB9. PG&E to provide connection details.
Connect NO "Trip" Push Button to DD4 and DD7. Jumper DD9 to EE1

d) Remove and tape ground leads from ground bus in rear of cell.

Rev 1 7/27/78 EMD.

B. Control Power Connections (Cont'd.)

Cell 9 with Cell 13 door (53178)

a) 2W AC1Ø 5A 60 Hz., Leg 1 to C18, Leg 2 to CD4 (IAC53)

b) 2W AC1Ø 120 60 Hz.,Leg A to AF15, Leg B to AF16 (Øs A & B to IAV)

c) 2W AC1Ø 120 60 Hz.,Leg A to AG9, Leg B to AG8 (Øs B & C to SV)

d) PG&E to provide details for 120V AC energization of Agastat Relay.

e) Connect "Close" Push Button to DD9 and BB6
Connect "Trip Push Button to DD9 and BB9

f) Remove and tape ground leads from ground bus in rear of cell.

C. Electrical Monitoring

Cell 7 (441589)

52HH7 Aux. Sw.	A contact	GG5 & GG6
3HH1 lockout NO contact from Safe Guard Panel PG&E to furnish connection details for 3HH1 relay to be energized by the 59HHG 1 & 2 SV relay contacts.		G6 C17

Cell 8 with Cell 12 door (53078)

52HH8 Aux. Sw.	A contact	FF11 & FF12
27ZHHB2 W SG contact on Safeguard Panel PG&E to furnish connection details for 27ZHHB2 to be energized from IAV relay		AA8 AA12
4HH14 W SG contact on Safe Guard Panel PG&E to furnish connection details for 4HH14 to be energized by the RAV relay.		C6 C4

Cell 9 with Cell 13 door (53108)

52HH9 Aux. Sw.	B contact	FF9 & FF10
52HH9 CI	NO breaker raised	HH1 & HH2
52HH9 CI	NC breaker raised	HH3 & HH4
2HH9 AGA	NO	DE2 & DE6
2HH9 AGA	NC	DE2 & DE4

D. Non Electrical Monitoring

PG&E to provide connection details to energize blue lights from 51X HH7, HH8 and HH9. HFA relays. Not class 1E.

E M Fitzgerald
July 14, 1978
Rev 1 7/27/78 EMF

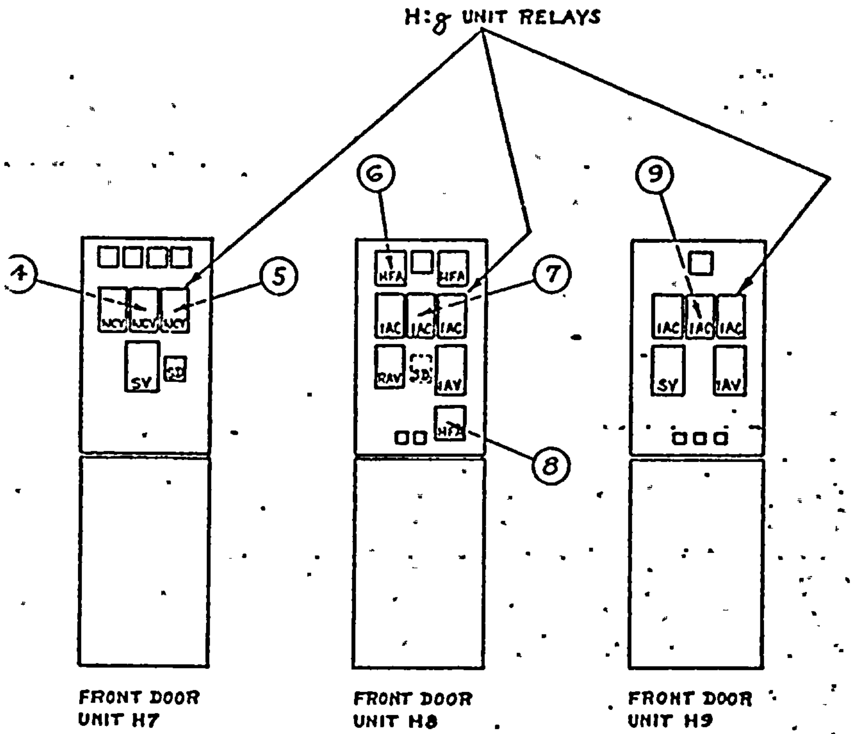
GENERAL ELECTRIC 0156C1250

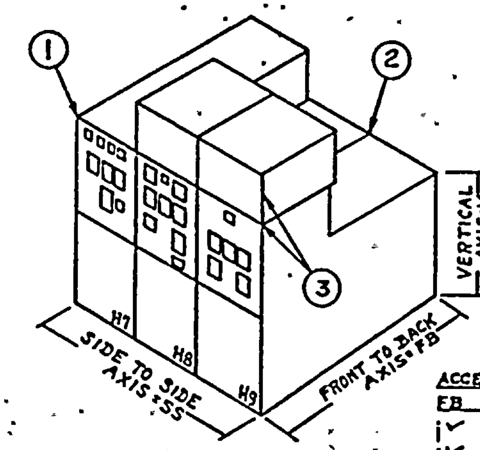
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING: APPLIED PRACTICES — SURFACES ✓ — TOLERANCES ± ± ±

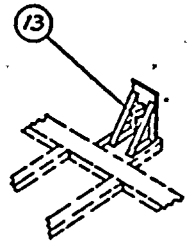
ACCELEROMETER LOCATIONS

FIRST MADE FOR 250MVA 4.16 KV SWITCHGEAR
PG&E DIABLO CANYON

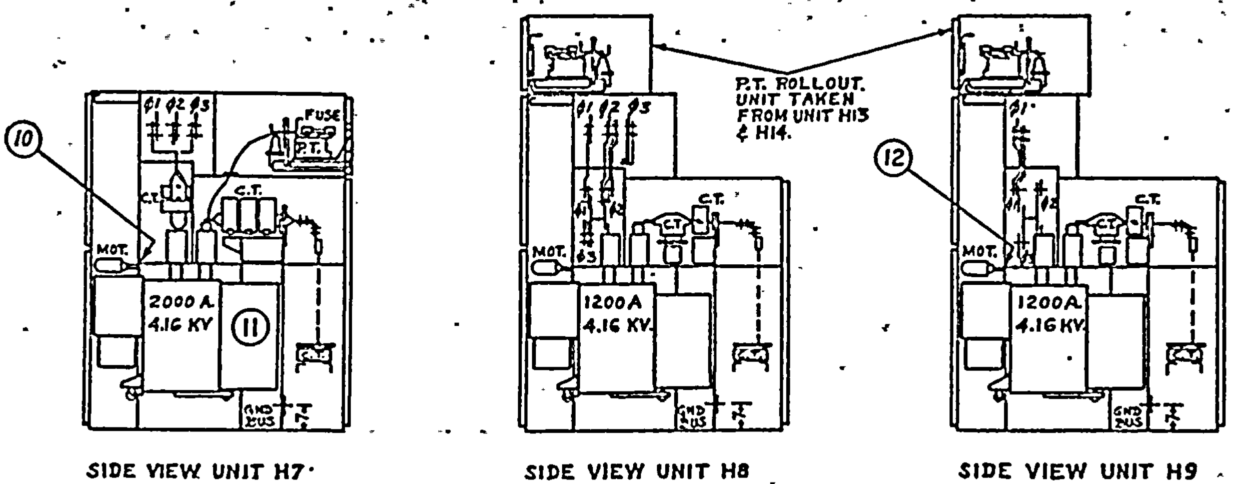
G.E. REQ'N 474-68849







ACCELEROMETER AXIS FB	SS	V	POSITION NO.	LOCATION
✓	✓		1	TOP FRONT LEFT CORNER H7
✓	✓	✓	2	TOP REAR JUNCTION OF H8 & H9, MOTION AT EARTHQUAKE JOINT
✓	✓	✓	3	P.T. ROLLOUT TRAY
✓	✓	✓	4	BACK OF MIDDLE IJCV RLY H7
✓	✓	✓	5	BACK OF RIGHT IJCV (H:g UNIT) RELAY H7
✓	✓	✓	6	BACK OF TOP LEFT HFA RELAY H8 (H12 DOOR)
✓	✓	✓	7	BACK OF MIDDLE IAC RELAY H8 (H12 DOOR)
✓	✓	✓	8	BACK OF LOWER HFA RELAY H8 (H12 DOOR)
✓	✓	✓	9	BACK OF MIDDLE IAC RELAY H9 (H13 DOOR)
✓	✓	✓	10	INSIDE FRAME RIGHT SIDE 44 INCH LEVEL H7
✓	✓	✓	11	ARC CHUTE 2000A BRKR H7
✓	✓		12	INSIDE FRAME RIGHT SIDE 44 INCH LEVEL H9
✓	✓	✓	13	RIGID RELAY MOUNTING LOCATION.



REVISIONS: 1 — ADDED AXIS #13 — 7-19-78

6-2-78

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