3.10 SEISMIC QUALIFICATION* OF SEISMIC CATEGORY I INSTRUMENTATION AND ELECTRICAL EQUIPMENT

The seismic qualification* of Seismic Category I instrumentation and electrical equipment is described in the following subsections:

3.10a - NSSS Instrumentation and Electrical Equipment

3.10b - Non-NSSS Instrumentation

3.10c - Non-NSSS Electrical Equipment

In addition to seismic qualification, all Seismic Category I instrumentation and electrical equipment located in the Containment and the Reactor and Control Buildings are qualified for the combined seismic and hydrodynamic vibratory loadings. Procedures for the assessment and requalification of Seismic Category I instrumentation and electrical equipment for the additional hydrodynamic loads are described in Sections 7.1.6 and 7.1.7 of the Design Assessment Report (DAR).

* The term "Seismic Qualification" in this section is synonymous with "Seismic and Hydrodynamic Qualification."

3.10a SEISMIC QUALIFICATION OF SEISMIC CATEGORY I NSSS INSTRUMENTATION AND ELECTRICAL EQUIPMENT

3.10a.1 SEISMIC QUALIFICATION CRITERIA

3.10a.1.1 Seismic Category I Equipment Identification

Seismic Category I instrumentation and electrical equipment, as well as other equipment, can be found in Table 3.2-1. Pumps and valves which are qualified as seismically "active" are listed in Table 3.9-3.

All NSSS Seismic Category I instrumentation and electrical equipment will be designed to resist and withstand the effects of the postulated earthquakes. Seismic Category I instrumentation and electrical equipment is designed to withstand the effects of the Safe Shutdown Earthquake (SSE) defined in Subsection 3.7a, and to withstand the effects of hydrodynamic loads without functional impairment.

From the basic input ground motion data, a series of response curves at various building elevations are developed after the building layout is completed. This information is included in the purchase specifications for Seismic Category I equipment. Suppliers of equipment such as batteries and racks, instrument racks, control consoles, etc., are required to submit test data, operating experience and/or calculations to substantiate that their components, systems, etc., will not suffer loss of function during or after seismic and hydrodynamic loadings. The magnitude and frequency of the dynamic loadings which each component will experience is determined by its specific location within the plant.

The Class 1E instrumentation and electrical equipment (excluding motors and valve-mounted equipment) supplied by GE requiring seismic qualification are identified in Table 3.10a-1.

3.10a.1.2 Dynamic Design Criteria

3.10a.1.2.1 NSSS Equipment

The seismic criteria used in the design and subsequent qualification of all Class 1E instrumentation and electrical equipment supplied by GE was as follows: The Class 1E equipment shall be capable of performing all safety-related functions during (1) normal plant operation, during (2) anticipated transients, during (3) design basis accidents, and during (4) post-accident operation, while being subjected to, and after the cessation of the accelerations resulting from the OBE and SSE at the point of attachment of the equipment to the building or supporting structure.

The criteria for each of the devices used in the Class 1E systems depend on the use in a given system; for example, a relay in one system may have as its safety function to deenergize and open its contacts within a certain time, while in another system it must energize and close its contacts. Since GE supplies devices for many applications, the approach taken was to test the device in all modes in which it might be used. In this way, the capability of protective action initiation and the proper operation of safety-failure circuits is ensured.

3.10a.2 METHODS AND PROCEDURES FOR QUALIFYING ELECTRICAL EQUIPMENT AND INSTRUMENTATION (EXCLUDING MOTORS AND VALVE MOUNTED EQUIPMENT)

3.10a.2.1 Methods of Showing NSSS Equipment Compliance with IEEE 344-1971

(a) Scope - Compliance not applicable.

(b) Definition - Compliance not applicable.

(c) Procedures - GE supplied Class 1E equipment meets the requirement that the qualification should demonstrate the capability to perform the required function during and after the seismic and hydrodynamic load event. Both analysis and testing were used but most equipment was tested. Analysis was primarily used to determine the adequacy of mechanical strength (mounting bolts, etc.) after operating capability was established by testing.

1. Analysis - GE supplied Class 1E equipment performing primarily a mechanical safety function (pressure boundary devices, etc.) was analyzed since the passive nature of its critical safety role usually made testing impractical. Analytical methods sanctioned by IEEE 344-1971 were used in such cases (see Table 3.10a-1 for indication of which items were qualified by analysis).

2. Testing - GE supplied Class 1E equipment having primarily an active electrical safety function was tested in compliance with IEEE 344-1971, Section 3.2.

(d) Documentation - Available documentation verifies that the seismic qualification of GE supplied Class 1E equipment is in accordance with the requirements of IEEE 344-1971, Section 4.

3.10a.2.2 Testing Procedures for Qualifying Electrical Equipment and Instrumentation (Excluding Motors and Valve-Mounted Equipment)

(The following procedures are not applicable for the Diesel Generator 'E' facility where the seismic qualification conforms to project specification C-1041 or SD-140 and IEEE Standard 344-75.) In addition, replacement equipment may be seismically qualified to a version of the IEEE Standard 344 that is more recent than the 1971 version. Non-GE supplied replacement equipment is qualified to the provisions of FSAR Section 3.10b.

The test procedure required that the devices be mounted on the table of the vibration machine in a manner similar to which it was to be installed. The device was tested in the operating states that it is to be used in performing its Class 1E functions. These states were monitored before, during, and after the test to ensure proper function and absence of spurious function. In the case of a relay, both energized and deenergized states and normally open and normally closed contact configurations were tested if the relay is used in those configurations in its Class 1E functions.

The dynamic excitation was a single frequency continuous test in which the applied vibration was a sinusoidal table motion at a fixed peak acceleration and a discrete frequency at any given time. Each frequency and acceleration combination was maintained for about 30 seconds except when a resonance search was made (see IEEE 344-1971, paragraph 3.2).

The vibratory excitation was applied in three orthogonal axes individually with the axes chosen as those coincident with the most probable mounting configuration.

The first step was to search for resonances in each device. This was done since resonances cause amplification of the input vibration and are the most likely cause of malfunction. The resonance search was usually run at low acceleration levels (0.2G) to avoid destroying the test sample in case a severe resonance was encountered. The resonance search was performed in accordance with IEEE 344 in no less than 7 minutes; if the device was large enough, the vibrations were monitored by accelerometers placed at critical locations. Resonances were determined by comparing the acceleration level with that at the table of the vibration machine. Usually, the devices were either too small for an accelerometer, had their critical parts in an inaccessible location, or had critical parts that would be adversely affected by the mounting of an accelerometer. In these cases, the resonances were detected by visual (strobe light), audible observation, or performance.

Following the frequency scan and resonance determination, the devices were tested to determine their malfunction limit. This test was a necessary adjunct to the assembly test as will be shown later. The malfunction limit test was run at each resonant frequency as determined by the frequency scan. In this test, the acceleration level was gradually increased until either the device malfunctioned or the limit of the device (usually the case) was considered to be rigid (all parts move in unison) and the malfunction limit was therefore independent of frequency.

To achieve maximum acceleration from the vibration machine, rigid devices were malfunction tested at the upper test frequency since that allowed the maximum acceleration to be obtained from deflection- limited machines. The summary of the tests on the devices used in Class 1E applications given in Table 3.10a-1 includes the qualification limit for each device tested.

The above procedures were required of purchased devices as well as those manufactured by GE. Vendor test results were reviewed and if unacceptable, the tests were repeated either by GE or the vendor. If the vendor tests were adequate, the device was considered qualified to the limits of the test.

3.10a.2.3 Qualification of Valve-Mounted Equipment

The piping analyses establishes the response spectra, power spectral density function or time history characteristics, and develops a horizontal and a vertical acceleration for the pipe-mounted equipment. Class 1E motor-operated valves actuators were qualified per IEEE 382-1972, with the exception of DG-E motor-operated valve actuators which were qualified to IEEE 382-1980.

The safety/relief valve, including the electrical components mounted on the valve, are subjected to a dynamic test. This testing is described in Subsections 3.9.2.2a.2.15 and 3.9.3.2a.5.2.

3.10a.2.4 Qualification of NSSS Motors

Seismic qualification of the ECCS motors is discussed in Subsection 3.9.2.2a.2.7, in conjunction with the ECCS pump and motor assembly. Seismic qualification of the Standby Liquid Control (SLC) pump motor is discussed in Subsection 3.9.2.2a.2.10 in conjunction with the SLC pump motor assembly.

3.10a.3 METHODS AND PROCEDURE OF ANALYSIS OR TESTING OF SUPPORTS OF ELECTRICAL EQUIPMENT AND INSTRUMENTATION

3.10a.3.1 Dynamic Analysis Testing Procedures and Restraint Measures

3.10a.3.1.1 NSSS Equipment (Other Than Motors and Valve Mounted Equipment)

The Class 1E equipment supplied by GE is used in many systems on many different plants under widely varying seismic requirements. The dynamic qualification was performed in accordance with IEEE-344.

Some GE supplied Class 1E devices were qualified by analysis only (as noted in Table 3.10a-2). One of the analysis methods is shown in Subsection 3.10a.5. Analysis was used for passive mechanical devices and was sometimes used in combination with testing for larger assemblies containing Class 1E devices. For instance, a test might have been run to determine if there were natural frequencies in the equipment within the critical seismic frequency range (see IEEE 344-1971, paragraph 3.2). If the equipment was determined to be free of natural frequencies, then it was assumed to be rigid and a static analysis was performed (see IEEE 344-1971, paragraph 3.2). If it had natural frequencies in the critical frequency range, then calculations of transmissibility and responses to varying input accelerations were determined to see if Class 1E devices mounted in the assembly would operate without malfunctioning. In general, the testing of Class 1E equipment was accomplished using the following procedure.

Assemblies (i.e., control panels) containing devices which have had dynamic load malfunction-limits established were tested by mounting the assembly on the table of a vibration machine in the manner in which it was to be mounted in use. It was vibration tested by running a low level resonance search. As with the devices, the assemblies were tested in the three major orthogonal axes. The resonance search was run in the same manner as described for devices. If resonances were present, the transmissibility between the input and the location of each Class 1E device was determined by measuring the accelerations at each device location and calculating the magnification between it and the input. Once known, the transmissibilities could be used analytically to determine the response at any Class 1E device location for any given input. (It was assumed that the transmissibilities were linear as a function of acceleration even though they actually decrease as acceleration is increased-therefore a conservative assumption.).

Since control panels and racks constitute the majority of Class 1E electric assemblies supplied by GE, seismic qualification testing of these will be discussed in more detail. There are basically four generic panel types. One or more of each type was tested using the above procedures.

Figures 3.10a-1, 3.10a-2, 3.10a-3 and 3.10a-4 illustrate the four basic panel types referenced above and show typical accelerometer locations. The status of the dynamic tests on the Class 1E panels supplied by GE is summarized in Table 3.10a-2.

The full acceleration level tests described above disclosed that most of the panel types had more than adequate mechanical strength. A given panel design acceptability was shown to be only a function of its amplification factor and the malfunction levels of the devices mounted in it. Subsequent panels were, therefore, tested at lower acceleration levels and the transmissibilities measured to the various devices as described above. By dividing the devices' malfunction levels by the panel transmissibility between the device and the panel input, the panel seismic qualification level could be determined. Several high level tests have been run on selected generic panel designs to ensure the conservatism in using the transmissibility analysis described.

3.10a.4 OPERATING LICENSE REVIEW

3.10a.4.1 NSSS Control and Electrical Equipment (Other Than Motors and Valve Mounted Equipment)

The dynamic test results for safety-related panels and control equipment within the NSSS scope are maintained in a permanent file by GE and can be readily audited in all cases. The equipment used in Class 1E applications passed the prescribed tests. Where equipment failed to pass the tests, it was rejected. In some cases, equipment which failed one test was modified to meet the performance requirements and retested. If the retested equipment passed the latter test, it could be used in a Class 1E application.

Table 3.10a-1 lists the NSSS control devices by item number and vendor. Also, a summary of the test conditions for the devices used in Class 1E applications is given in Table 3.10a-2.

The acceleration level shown in the right hand columns of Table 3.10a-1 is the acceleration at which either the device malfunctioned or the limit of the vibration machine was reached.

3.10a.4.2 NSSS Motors

Seismic qualification test results for the ECCS motors are discussed in Subsection 3.9.2.2a.2.7 in conjunction with the ECCS pump and motor assembly. Seismic qualification test results for the Standby Liquid Control (SLC) motor are discussed in Subsection 3.9.2.2a.2.10 in conjunction with the SLC pump motor assembly.

3.10a.4.3 Valve-Mounted Equipment

The safety relief valves (including the electrical components mounted on the valve) are subjected to dynamic tests. The results of these tests are discussed in Subsections 3.9.2.2a.2.15 and 3.9.3.2a.5.2.

3.10a.5 Dynamic Analysis By Response Spectrum Method

The system stiffness and mass matrices are generated using standard techniques. A dynamic analysis is performed using the following equations of motion and procedure to uncouple these equations

The equations of motion in matrix form are as follows:

$$M(\ddot{X} + \ddot{Y}) + C\dot{X} + KX = 0 \qquad \text{(Eq. 3.10a-1)}$$

where

M	= mass matrix, nxn (this includes the hydrodynamic mass)
X	= column vector of displacement relative to ground* (nxl)
C	= damping matrix (nxn)
K	= stiffness matrix (nxn)
Y	= column vector of ground accelerations (nxl)
.	= first derivative with respect to time
..	= second derivative with respect to time

It should be noted that for equipment containing fluid, a hydrodynamic mass coupling exists between real structural masses. This hydrodynamic mass appears as diagonal and off-diagonal terms in the mass matrix. The overall system stiffness matrix K is determined by either the matrix force method or the matrix displacement method. The resulting stiffness matrix is similar.

Removing the driving-point acceleration vector to the right side of Eq. 3.10a-1, the equation reduces to the classical form:

$$M\ddot{X} + C\dot{X} + KX = M\ddot{Y} \qquad \text{(Eq. 3.10a-2)}$$

In order to decouple Eq. 3.10a-2, we set:

$$X = \phi q \qquad \text{(Eq. 3.10a-3)}$$

Eq. 3.10a-2 then becomes

$$M\phi q + C\phi q + K\phi q = -M\ddot{Y} \qquad \text{(Eq. 3.10a-4)}$$

Pre-multiplying by ϕT, the transpose of ϕ, and performing the coordinate transformation described in Eq. 3.10a-4 such that is defined by the following orthogonality conditions:

$$\phi TM \phi = I \qquad \text{(Eq. 3.10a-5)}$$

$$\phi TK \phi = w^2 \qquad \text{(Eq. 3.10a-6)}$$

where I is an identifying matrix (Nxn) and w^2 is a diagonal matrix of the eigenvalues. Then Eq. 3.10a-4 becomes

$$\phi^T M\phi\ddot{q} + \phi^T C\phi\dot{q} + \phi^T K\phi q = \phi^T M\ddot{Y} \quad \text{(Eq. 3.10a-7)}$$

$$\ddot{q} + \phi^T O\phi\dot{q} = w^2\ q = \phi^T M\ddot{Y} \quad \text{(Eq. 3.10a-8)}$$

The above procedure for decoupling the equation of motion by using the modal matrix of the undamped system assumes that damping in the system is small. It will further be assumed that the damping matrix C is such that $\phi^T C\phi$ is a diagonal matrix. The elements of this diagonal-matrix are the modal damping values.

With the above assumptions, Eq. 3.10a-8 may be written in the following uncoupled form:

$$\ddot{q}_i + \ + 2\beta_i w_i \dot{q}_i + w_i^2 q_i = S\ U \quad \text{(Eq. 3.10a-9)}$$

i = 1, 2, --- n

where

$$x_i = \begin{matrix} \chi^1 i \\ \chi^2 i \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \chi^n i \end{matrix} \qquad \phi_i = \begin{matrix} \phi 1_i \\ \phi 2_i \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \phi n_i \end{matrix}$$

The maximum physical displacement for each mass is then taken to the square root of the sums of the squares of each of the maximum displacement responses for each mode, i.e.,

where:

$$X\,max. = \left[\sum_{j=1}^{n} x_{ij}^2\right]^{1/2}$$

(X) maximum. is the column vector of maximum displacements. Similarly, the maximum load response for the i mode is found from

$$L_{ji} = \beta_j X_i$$

$$L_{ji} = \begin{matrix} L_{1i} \\ L_{2i} \\ \cdot \\ \cdot \\ \cdot \\ L_{mi} \end{matrix}$$

where

β_j is the stress matrix for element j, j=1, ...m

m = total number of elements.

where

β_i	=	damping ratio for the i^{th} mode expressed as percent of critical damping
w_i	=	i^{th} natural angular frequency of the system
S_i	=	modal participation factor the i^{th} mode = ϕ_i^t MD
U_g	=	ground or floor acceleration time history
ϕ_i^t	=	transpose of the i^{th} mode shape
D	=	earthquake direction vector

The response is calculated using the response spectra specified for the location of the input to the analytical model. The analytical procedure is described briefly in the following paragraphs.

The system of one degree-of-freedom equations represented by Eqs. 3.10a-8 or 3.10a-9 can be solved by the response spectrum method. With this method, the maximum modal response for each natural frequency of interest is found from the applicable response spectra. Response spectrum curves are essentially plots of the maximum responses of single degrees-of-freedom systems described by Eq. 3.10a-9 with S = 1.0 as a function of their natural frequencies.

Having found the maximum modal displacements q, i = I...m, the maximum physical displacement for the i[th] mode is given by:

$$X_i = \phi_i S_i q_i$$

The maximum load response is taken to be the square root of the sums of the squares of each of the maximum responses for each mode, i.e.,

$$L_j \max. = \left[\sum_{i=1}^{n} L_{ji}^2 \right]^{1/2} \quad : j = 1, 2, \ldots m$$

where (L) max is the column vector of maximum loads

The accelerations for each mode are determined by multiplying the displacements vector for that mode (X_i) by the natural frequency of (w_{2_i}) that mode.

$$A_i = X_i w_{2_i}$$

The maximum accelerations are then determined by

$$A \max. = \left[\sum_{i=1}^{n} A_i^2 \right]^{1/2}$$

TABLE - 3.10a-1

ESSENTIAL ELECTRICAL COMPONENTS AND INSTRUMENTS

----- DESCRIPTION -----					----- SEISMIC AND ENVIRONMENTAL QUALIFICATIONS -----					
ITEM NO.	NAME	VENDOR	QUANTITY	ENVIRONMENT[1]	OTHERS OF SAME TYPE IN SAME ENVIRONMENT			SEISMIC QUALIFICATION[4]		
								X	Y	Z
SYSTEM TITLE - REACTOR										
B11-D193	Power Range Detector	GE	43	In Vessel						
SYSTEM TITLE – NUCLEAR BOILER										
B21-N002	Pressure Switch		1	Area II						
B21-N004	Temp Element	PYCO	16	Area II.7				Note 2		
B21-N006	Diff Press Switch	BARTON	18	Area II	N007	N008	N009,	5	10	10
					N021	A,B,C,D				
B21-N010	Temp Element	CALIF. ALLOY	13	Area II	N014,	N016,	N017	5	5	5
B21-N015	Press Switch	BARKSDALE	4	Area III.3				5	10	10
B21-N020	Press Switch	BARKSDALE	34	Area II.1			N023,	5	15	15
					N039	N044,	N022			
B21-N024	Level Ind Switch	BARTON	10	Area II.1	N031,	N042		15	15	15
B21-N025	Level Ind Switch	YARWAY	4	Area II.1				1.5	1.5	1.5
B21-N026	Level Ind Trans Switch	BARTON	6	Area II.1	N037			5	5	5
B21-N027	Level Trans	ROSEMOUNT	25	Area II.1	N033,	N034		Note 2		
B21-N043	Press Trans	ROSEMOUNT	1	Area II.1				3	3	3
B21-N055	Press Trans	ROSEMOUNT	2	Area II.1				3	3	3
B21-N056 A&C	Vacuum Switch (Unit 1)	STATIC-O-RING	2	Area III.5						
B21-N056 B&D	Vacuum Switch (Unit 1)	BARKSDALE	2	Area III.5						
B21-N056B	Vacuum Switch (Unit 2)	STATIC-O-RING	1	Area III.5						
B21-N056 A,C, & D	Vacuum Switch (Unit 2)	BARKSDALE	3	Area III.5						

TABLE - 3.10a-1

ESSENTIAL ELECTRICAL COMPONENTS AND INSTRUMENTS

-------------------- DESCRIPTION --------------------					-------------------- SEISMIC AND ENVIRONMENTAL QUALIFICATIONS --------------------					
ITEM NO.	NAME	VENDOR	QUANTITY	ENVIRONMENT[(1)]	OTHERS OF SAME TYPE IN SAME ENVIRONMENT			SEISMIC QUALIFICATION[(4)]		
								X	Y	Z
B21-N064	Temp Element	CALIF. ALLOY	1	Area II				2	2	2
B21-N600	Temp Switch	RILEY	8	Area V	N603			Note 2		
B21-R004	Press Indicator	ROBERTSHAW	2	Area II.1				4	4	4
B21-R005	Diff Press Ind	BARTON	1	Area II.1				Note 2		
B31-N014	Flow Trans	ROSEMOUNT	8	Area II.1	N024			2	2	2
B31-N015	Diff Press Trans	ROSEMOUNT	1	Area II.1				Note 2		
B31-N016	Diff Press Switch	BARTON	13	Area II.1	N018A,	N019 thru		5	10	10
					N022					
B31-N018B	Press Switch	STATIC-O-RING	1	Area II.1				15	15	15
B31-N023	Temp Element	ROSEMOUNT	2	Area 1.4				Note 2		
B31-N035	Temp Element		2					Note 2		
SYSTEM TITLE – CRD HYDRAULIC CONTROL										
C12-N013	Level Switch	MAGNETROL	5	Area II.1				4.1	5	9.5
SYSTEM TITLE – FEEDWATER CONTROL										
C32-N003	Transmitter (Diff Press)	ROSEMOUNT	6	Area II.1	N004			Note 2		
C32-N005	Transmitter (Pressure)	ROSEMOUNT	2	Area II.1	N008			Note 2		
C32-N017	Diff Press Trans	STATHOM	2	Area II.1				Note 2		
SYSTEM TITLE – STAND BY LIQUID										
C41-N003	Temp Switch	CALIF. ALLOY	1	Area II.8				Note 2		
C41-N004	Press Trans	ROSEMOUNT	1	Area II.8				Note 2		
C41-N006	Temp Element		1	Area II.8				Note 2		
C41-R003	Press Indicator	ROBERTSHAW	1	Area II.8				Note 2		
SYSTEM TITLE – NEUTRON MONITORING										

TABLE - 3.10a-1

ESSENTIAL ELECTRICAL COMPONENTS AND INSTRUMENTS

-------------------- DESCRIPTION --------------------					-------------------- SEISMIC AND ENVIRONMENTAL QUALIFICATIONS --------------------					
ITEM NO.	NAME	VENDOR	QUANTITY	ENVIRONMENT(1)	OTHERS OF SAME TYPE IN SAME ENVIRONMENT			SEISMIC QUALIFICATION(4)		
								X	Y	Z
C51-J004	Valve, Guide Tube	GE	5	Area II.10						
C51-J008	Guidetubes	GE	1	Area II.10				Note 2		
C51-K002	Volt Preamplifier	GE	8	Area V				4	5	5
C51-K601	Intermediate Range Mon	GE	8	Area V				6	6	6
C51-K605	Pwr Rnge Instr	GE	1	Area V						
C51-N002	Detector	GE	8	Area I.3						
SYSTEM TITLE – REACTOR PROTECTION										
C72-N002	Prim Cont Press Switch	STATIC-O-RING	4	Area II.1				15	15	15
C72-N003	Turbine 1st Stage Pr SW	BARKSDALE	4	Area III.3				15	15	15
C72-N005	Turbine EMC Press SW	BARKSDALE	4	Area III.3						
C72-N006	Turb Stop Vlv POS SW	ACME CLEVELAND	4	Area III.3						
C72-N008	Turbine Bypass Vlv POS SW	ACME CLEVELAND	4	Area III.3						
C72-S003(A-H)	Elec. Prot. Assy.	GE	8	Not Required				Later		
SYSTEM TITLE – PROCESS RADIATION MONITORING										
D12-K603	Rad Mon & Ind (Mn St Ln)	GE	4	Area V						
D12-K609	Ind & Trip Unit	GE	12	Area V	K615,	K616	K617	3	3	3
					K618					
D12-N006	Detector (Mn St Ln)	GE	4	Area II.7						
D12-N015	Detector	GE	8	Area II.9	N016	N017,	N018	15	15	15
SYSTEM TITLE – RESIDUAL HEAT REMOVAL										

TABLE - 3.10a-1

ESSENTIAL ELECTRICAL COMPONENTS AND INSTRUMENTS

-------------------- DESCRIPTION --------------------					-------------------- SEISMIC AND ENVIRONMENTAL QUALIFICATIONS --------------------					
ITEM NO.	NAME	VENDOR	QUANTITY	ENVIRONMENT[1]	OTHERS OF SAME TYPE IN SAME ENVIRONMENT			SEISMIC QUALIFICATION[4]		
								X	Y	Z
E11-N001	Cond Element	BALSBAUGH	2	Area II.5				Note 2		
E11-N007	Diff Press Trans	ROSEMOUNT	5	Area II.5	N013,	N015		Note 2		
E11-N008	Diff Press Trans	BARTON	2	Area II.5				Note 2		
E11-N009	Temp Element	CALIF ALLOY	12	Area II.5	N029,	N030		2	2	2
E11-N010	Press Switch	STATIC-O-RING	8	Area II.5	N011			15	15	15
E11-N016	Press Switch	STATIC-O-RING	9	Area II.5	N018,	N020		15	15	15
E11-N019	Diff Press Switch	BARTON	2	Area II.5				5	10	10
E11-N021	Diff Press Ind Switch	BARTON	2	Area II.5				15	15	15
E11-N022	Press Switch	BARKSDALE	2	Area II.5				Note 3		
E11-N023	Level Switch	MAGNETROL	3	Area II.5		N024		Note 3		
E11-N026	Press Trans	ROSEMOUNT	3	Area II.5		N028		Note 3		
E11-N033	Flow Switch	FISHER & PORTER	2	Area II.5				Note 3		
E11-N600	Temp Switch		8	Area V	N601			4.5	4.5	4
E11-R002	Press Indicator	ROBERTSHAW OR CONTROL SPECIALTIES	8	Area II.5	R003			Note 3		
SYSTEM TITLE – CORE SPRAY										
E21-N001	Press Trans	ROSEMOUNT	2	Area II.5				Note 2		
E21-N003	Diff Press	ROSEMOUNT	2	Area II.5				Note 2		
E21-N004	Diff Press	BARTON	2	Area II.5				5	10	10
E21-N006	Flow Switch		2	Area II.5						
E21-N007	Press Switch		2	Area II.5				Note 2		
E21-N008	Press Switch		4	Area II.5						

TABLE - 3.10a-1

ESSENTIAL ELECTRICAL COMPONENTS AND INSTRUMENTS

---------- DESCRIPTION ----------					---------- SEISMIC AND ENVIRONMENTAL QUALIFICATIONS ----------					
ITEM NO.	NAME	VENDOR	QUANTITY	ENVIRONMENT[1]	OTHERS OF SAME TYPE IN SAME ENVIRONMENT			SEISMIC QUALIFICATION[4]		
								X	Y	Z
E21-R001	Pressure Indicator	ROBERTSHAW OR CONTROL SPECIALTIES	2	Area II.5				Note 2		
SYSTEM TITLE – MSIV LEAKAGE CONTROL										
E32-K601	Power Supply	GE	2	Area V				2.5	2.5	2.5
E32-N006	Flow Element	S & K INSTRUMENTS	4	Area II						
E32-N050	Press Trans	ROSEMOUNT	8	Area II	N055,	N058,	N060	3	3	3
					N061					
E32-N051	Press Trans	ROSEMOUNT	5	Area II	N056			3	3	3
E32-N053	Flow Trans	S & K INSTRUMENTS	4	Area II						
E32-N054	Diff Press Trans	ROSEMOUNT	2	Area II	N059			3	3	3
E32-N600	Timer	EAGLE SIGNAL	13	Area V	N601,	N602,	N604	2.5	2.5	2.5
E32-N650	Alarm	BAILEY METER	19	Area V	N651,	N653,	N654,	9	9.5	13
					N655,	N656,	N658,			
					N659,	N660,	N661			
E32-R601	MV/I	BAILEY METER	4	Area V				Note 2		
E32-R651	Meter	GE	18	Area V	R653 thru	R656,		Note 2		
					R658 thru	R661				
SYSTEM TITLE – HIGH PRESSURE COOLANT INJECTION										
E41-K600	Power Supply	GE	1	Area V				2.5	2.5	2.5
E41-K601	SO Root Converter	BAILEY METER	1	Area V				9	9	13

TABLE - 3.10a-1

ESSENTIAL ELECTRICAL COMPONENTS AND INSTRUMENTS

-------------------- DESCRIPTION --------------------					-------------------- SEISMIC AND ENVIRONMENTAL QUALIFICATIONS --------------------					
ITEM NO.	NAME	VENDOR	QUANTITY	ENVIRONMENT(1)	OTHERS OF SAME TYPE IN SAME ENVIRONMENT			SEISMIC QUALIFICATION(4)		
								X	Y	Z
E41-K603	Inverter	TOPAZ	1	Area V				5	10	8.5
E41-N001	Press Switch	BARKSDALE	6	Area II	N027	N031		29	29	29
E41-N002	Level Switch	MAGNETROL	5	Area II.4	N003,	N015,	N018	1.2	6	9.5
E41-N604	Diff Press Switch	BARTON	2	Area II	N005			5	10	10
E41-N005	Diff Press Switch	BARTON	1	Area II				Note 3		
E41-N008	Diff Press Trans	ROSEMOUNT	1	Area II				3	3	3
E41-N009	Press Trans	ROSEMOUNT	4	Area II	N013,	N016,	N019	Note 2		
E41-N010	Press Switch	STATIC-O-RING	7	Area II	N012,	N017		15	15	15
E41-N014	Level Switch	MAGNETROL	1	Area II				Note 2		
E41-N024	Temp Element	CALIF. ALLOY	16	Area II	N025,	N028,	N029,	2	2	2
					N030					
E41-N600	Temp Switch	GE	6	Area V	N601,	N602				
E41-R601	Press Indicator	ROBERTSHAW	4	Area II	R003,	R004,	R005	Note 2		
E41-R002	Temp Indicator	MOELLER	1	Area II				Note 2		
E41-R600	Controller	BAILEY METER	1	Area V				9	9	8
SYSTEM TITLE – REACTOR CORE ISOLATION COOLING										
E51-K603	Inverter(DC to AC)	TOPAZ	1	Area V				5	10	8.5
E51-N602	Timer		4	Area V	N603					
E51-N003	Diff Press Switch	BARTON	1	Area II.4				15	15	15
E51-N003	Diff Press Transmitter	ROSEMOUNT	1	Area II.4				3	3	3
E51-N004	Press Transmitter	ROSEMOUNT	4	Area II.4	N005,	N007,	N008	Note 2		
E51-N006	Press Switch	STATIC-O-RING	5	Area II.4	N019			15	15	15
E51-N009	Press Switch	BARKSDALE	8	Area II.4	N012,	N020,	N030	29	29	29

TABLE - 3.10a-1

ESSENTIAL ELECTRICAL COMPONENTS AND INSTRUMENTS

-------------------- DESCRIPTION --------------------				-------------------- SEISMIC AND ENVIRONMENTAL QUALIFICATIONS --------------------						
ITEM NO.	NAME	VENDOR	QUANTITY	ENVIRONMENT(1)	OTHERS OF SAME TYPE IN SAME ENVIRONMENT			SEISMIC QUALIFICATION(4)		
								X	Y	Z
E51-N010	Level Switch	MAGNETROL	1	Area II.4				Note 2		
E51-N011	Temp Element		20	Area II	N021,	N022,	N023			
					N025,	N026,	N027			
E51-N017	Diff Press Switch	BARTON	2	Area II	N018			5	10	10
E51-N600	Temp Switch	GE	14	Area V	N601 thru	N604				8
E51-R001	Press Indicator	ROBERTSHAW	4	Area II.4				Note 2		
E51-R005	Temp Indicator	MOELLER	1	Area II.4				5	5	5
E51-R600	Flow Indicator Cont	BAILEY METER	1	Area V				9	9	8
SYSTEM TITLE – REACTOR WATER CLEANUP										
G33-K600	Power Supply	GE	1	Area V				2.5	2.3	2.5
G33-K602	SQ Root Conv	GE	3	Area V	K603,	K605				
G33-K604	Summer	BAILEY METER	1	Area V				4	9	13
G33-N011	Flow Element	VICKERY SIMS	2	Area II.2.b	N035,	N040		Note 2		
G33-N012	Diff Press Trans	ROSEMOUNT	3	Area II	N036,	N041		3	3	3
G33-N016	Temp Element	CALIF. ALLOY	18	Area II	N022,	N023		2	2	2
G33-N044	Diff Press Switch	BARTON	2	Area II				15	15	15
G33-N600	Temp Switch	GE	12	Area V	N602					
G33-N603	Alarm	BAILEY METER	12	Area V				9	9.5	13
NOTES:										

TABLE - 3.10a-1

ESSENTIAL ELECTRICAL COMPONENTS AND INSTRUMENTS

---- DESCRIPTION ----				---- SEISMIC AND ENVIRONMENTAL QUALIFICATIONS ----				
ITEM NO.	NAME	VENDOR	QUANTITY	ENVIRONMENT(1)	OTHERS OF SAME TYPE IN SAME ENVIRONMENT	SEISMIC QUALIFICATION(4)		
						X	Y	Z

1. Refer to Tables 3.11-1, 3.11-2 and 3.11-3.
2. Classified as Pressure Integrity Instrument; Seismic qualification not required.
3. Hydrostatic test only required for qualification.
4. This table is based on the original seismic qualification effort performed by GE. Replacement equipment may be seismically qualified to a version of the IEEE Standard 344 that is more recent than the 1971 version. Non-GE supplied replacement equipment is qualified to the revisions of FSAR Section 3.10b.

TABLE 3.10a-2

SEISMIC QUALIFICATION TEST SUMMARY
CLASS 1E CONTROL PANELS AND LOCAL PANELS & RACKS

PANEL	DESCRIPTION	TYPE	CLASS 1E EQUIPMENT DESCRIPTION	COMMENTS
H12-P601	Reactor Core Cooling System	Benchboard	SBM & CR 2940 switches GEMAC instruments	Too long for test table – not tested [(1)] qualified by analysis
H12-P680	Unit Operating Bd. Reactor Water Cleanup & Recirculation	Benchboard	SBM & CR 2940 switches BEMAC instruments	Seismic test on similar type panel[(2)]
H12-P680	Reactor Control	Benchboard	Mode switch, range switches	Seismic test completed[(3)]
H12-P606	Radiation Monitor	2 Bay instrument rack	Startup neutron monitoring electronics	Seismic test completed
H12-P609	Reactor Protection System Division 1 & 2 Logic	Vertical board	HFA & HMA Relays, CR 105 contactor	Identical to U13-P611 panel tested[(4)]
H12-P611	Reactor Protection System Division 3 & 4 Logic	Vertical board	HFA & HMA Relays, CR 105 contactor	Seismic test completed
H12-P612	FW & Recirc Instruments	2 Bay instrument rack	GEMAC Instruments	Seismic test completed
H12-P613	NSSS Process Instruments	2 Bay instrument rack	GEMAC Instruments	Seismic test completed
H12-P618	Division 2 RHR/RCIC Relay	Vertical board	HFA & HMA Relays	Seismic test on similar type panel
H12-P621	Reactor Core Isolation Cooling Relays	Vertical board	HFA & HMA Relays	Seismic test on similar type panel
H12-P622	Inboard Isolation Valve Relays	Vertical board	HFA & HMA Relays	Seismic test on similar type panel
H12-P623	Outboard Isolation Valve Relays VB	Vertical board	HFA & HMA Relays	Seismic test on similar type panel
H12-P628	ADS Channel A Relay VB	Vertical board	HFA & HMA Relays	Seismic test on similar type panel
H22-P001	CS System Loc. Pnl. A	Local rack	Pressure Switch	Seismic test completed
H12-P631	ADS Channel B Relay VB	Vertical board	HFA & HMA Relays	Seismic test on similar type panel

TABLE 3.10a-2

SEISMIC QUALIFICATION TEST SUMMARY
CLASS 1E CONTROL PANELS AND LOCAL PANELS & RACKS

PANEL	DESCRIPTION	TYPE	CLASS 1E EQUIPMENT DESCRIPTION	COMMENTS
			Mon., Timers	
H12-P633	Radiation Monitor Instrument Panel B	2 Bay instrument rack	Startup Neutron Monitoring Electronics	Identical to H13-P606; Panel tested
H22-P002	Reactor Water Cleanup	Local rack	Pressure transmitters	Seismic test completed
H22-P004	Reactor Vessel Level & Pressure – A	Local rack	Pressure switches, level indicator/transmitter	Seismic test on similar type panel
H22-P005	Reactor Vessel Level & Pressure – B	Local rack	Pressure switches, level indicator/transmitter	Seismic test on similar type panel
H22-P006	Recirc A/Main Steam Flow A	Local rack	Pressure transmitter	Seismic test on similar type panel
H22-P009	Jet Pump Division 1	Local rack	Pressure transmitter	Seismic test completed
H22-P010	Jet Pump Division 2	Local rack	Pressure transmitter	Identical to H22-P009 panel tested
H22-P015	Main Steam Flow A	Local rack	Pressure switch	Identical to H22-P025 panel tested
H22-P017	RCIC Division 1	Local rack	Pressure transmitter/switches	Seismic test on similar type panel
H22-P018	RHR Panel A	Local rack	Pressure switches	Seismic test on similar type panel
H22-P021	RHR Panel B	Local rack	Pressure transmitter/switches	Seismic test on similar type panel
H22-P025	Main Steam Flow D	Local rack	Pressure switches	Seismic test completed
H22-P030	SRM & IRM Preamp A-D	NEMA 12 – Enclosures	SRM-IRM Preamplifiers	Seismic test completed
H22-P031	SRM & IRM Preamp A-D	NEMA 12 – Enclosures	SRM-IRM Preamplifiers	Identical to H22-P030 enclosure tested
H22-P032	SRM & IRM Preamp A-D	NEMA 12 – Enclosures	SRM-IRM Preamplifiers	Identical to H22-P039 enclosure tested

TABLE 3.10a-2

SEISMIC QUALIFICATION TEST SUMMARY
CLASS 1E CONTROL PANELS AND LOCAL PANELS & RACKS

PANEL	DESCRIPTION	TYPE	CLASS 1E EQUIPMENT DESCRIPTION	COMMENTS
H22-P033	SRM & IRM Preamp A-D	NEMA 12 – Enclosures	SRM-IRM Preamplifiers	Identical to H22-P030 enclosure tested
H12-P700	Termination Cabinet	4 Bay Cabinet	Cables	
H12-P701	Termination Cabinet	4 Bay Cabinet	Cables	
H12-P702	Termination Cabinet	4 Bay Cabinet	Cables	
H12-P703	Termination Cabinet	4 Bay Cabinet	Cables	
H12-P704	Termination Cabinet	4 Bay Cabinet	Cables	
H12-P705	Termination Cabinet	4 Bay Cabinet	Cables	
H12-P706	Termination Cabinet	4 Bay Cabinet	Cables	
H12-P732	Termination Cabinet	4 Bay Cabinet	Cables	

FOOTNOTES:

Seismic tests on essential C&I panels fall into the following categories:

1. Panels not tested — Due to size limitations, qualification completed by analysis.
2. Tests on similar panels — When panel size and configuration are very similar to but not necessarily identical, test results for a similar panel are used.
3. Seismic test completed — Tests run on essentially identical panels but possibly build for a different plant.
4. Tests on identical panels — When two panels are exact duplicates of one another, tests are run on only one panel (e.g., H12-P609 and H12-P611 are identical – only H12-P611 was tested).

TABLE 3.10a-3

SUMMARY OF SAMPLE SEISMIC STATIC ANALYSIS
FOR THREE TYPICAL CABINETS

Panel Description	Center of Gravity (in)	Number of Studs	Panel Forces (lb)/Ft of Panel FR to BK (F-B)	Panel Forces (lb)/Ft of Panel Side to Side (S-S)	Panel Forces (lb)/Ft of Panel Up	Panel Forces (lb)/Ft of Panel Down	Axial Load/Stud Tension (lb)	Axial Load/Stud Comp (lb)	Shear Load/ Stud (lb)	Combined Stress Shear (psi)	Combined Stress Normal (psi)	Margin of Safety* Yield	Stud Tensile Load (lb)**
NSSS Cabinet H-12-P608 Power Range Monitor	45	40	736	736	1656	2576	1748	174.8	349.6	6633	12,793	Tensile 0.95 Shear 1.07	1815
PGCC Computer Cabinet	40.5	4	561	561	1262	1963	1797	88	380	6878	13,206	Tensile 0.89 Shear 1.0	1874
Electro-Hydraulic Cabinet H-12-P863	43	24	637	637	1432	2228	2111	321	398	7953	15,398	Tensile 0.63 Shear 0.73	2185

* - A value for the margin of safety which is greater than zero (> 0) represents an adequate installation.

** - A value for the stud tensile load which is less than 4800 lbs. (< 4800) represents an adequate installation.

TABLE 3.10a-4

SEISMIC DESIGN VERIFICATION DATA SHEET

Cabinet Name: Area Radiation Monitor, H12-P605

Applied Horizontal Acceleration	1.6 G
Applied Vertical Acceleration	4.6 G
Tension Stress (Maximum-Yield)	25,000 PSI
Shear Stress (Maximum-Yield)	13,750 PSI
Weight of Cabinet (Approx.)	720 LBS
Number of Mounting Bolts	4
Height of Center of Gravity	45 Inches
Combined Stress (Tensile)	10,592 PSI
Combined Stress (Shear)	5,490 PSI
Margin of Safety (Tensile)	1.36
Margin of Safety (Shear)	1.50

Cabinet Name: TIP Control, H12-P607

Applied Horizontal Acceleration	1.5G
Applied Vertical Acceleration	2.6 G
Allowable Shear Stress in Weld	21,000 PSI
Weight of Cabinet (Approx.)	755 LBS
Number of Plug Welds Used for Mounting	8
Height of Center of Gravity	50 Inches
Total Normal Force per Plug Weld	858.8 LBS
Total Shear Force per Plug Weld	141.6 LBS
Stress in Weld	1,243 PSI
Margin of Safety (Shear)	15.9

Cabinet Name: Division A Radiation Monitor, H12-P606

Applied Horizontal Acceleration	1.6 G
Applied Vertical Acceleration	4.6 G
Tension Stress (Maximum-Yield)	25,000 PSI
Shear Stress (Maximum-Yield)	13,750 PSI
Weight of Cabinet (Approx.)	1,440 LBS
Number of Mounting Bolts	8
Height of Center of Gravity	45 Inches
Combined Stress (Tensile)	10,539 PSI
Combined Stress (Shear)	5,465 PSI
Margin of Safety (Tensile)	1.37
Margin of Safety (Shear)	1.52

Cabinet Name: Power Range Monitor, H12-P608

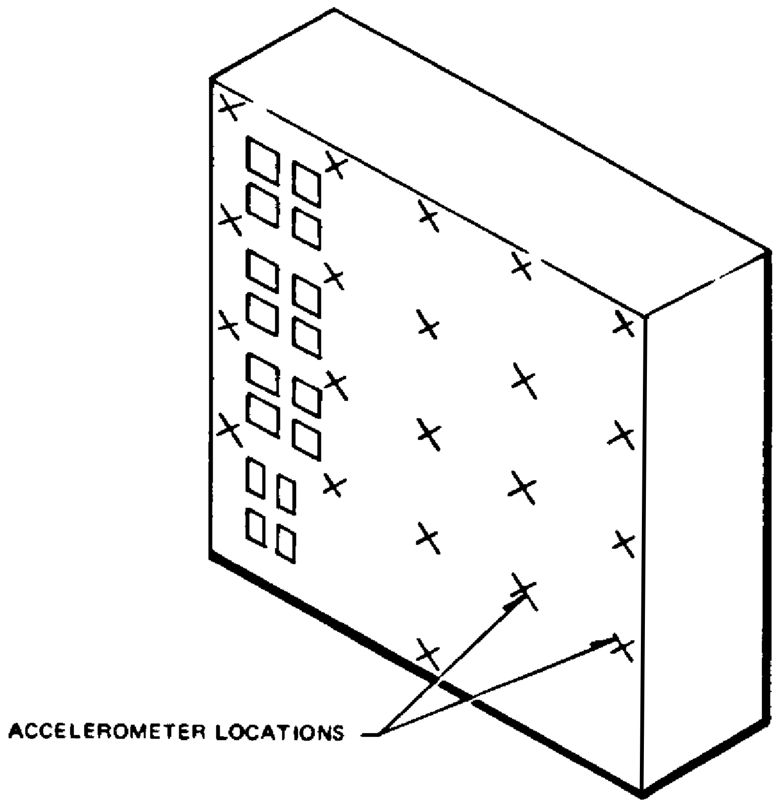
Applied Horizontal Acceleration	1.6 G
Applied Vertical Acceleration	4.6 G
Tension Stress (Maximum-Yield)	25,000 PSI
Shear Stress (Maximum-Yield)	13,750 PSI
Weight of Cabinet (Approx.)	5,750 LBS
Number of Mounting Bolts	40
Height of Center of Gravity	45 Inches
Combined Stress (Tensile)	12,793 PSI
Combined Stress (Shear)	6,633 PSI
Margin of Safety (Tensile)	0.95
Margin of Safety (Shear)	1.07

Cabinet Name: Rod Position Information System, H12-P615

Applied Horizontal Acceleration	1.6 G
Applied Vertical Acceleration	4.6 G
Tension Stress (Maximum-Yield)	25,000 PSI
Shear Stress (Maximum-Yield)	13,750 PSI
Weight of Cabinet (Approx.)	1,425 LBS
Number of Mounting Bolts	12
Height of Center of Gravity	45 Inches
Combined Stress (Tensile)	6,953 PSI
Combined Stress (Shear)	3,605 PSI
Margin of Safety (Tensile)	260
Margin of Safety (Shear)	2.81

IV. CONCLUSION

Review of the Margin of Safety for each standard cabinet indicates that the mounting bolts of each cabinet are capable of withstanding a seismic disturbance.



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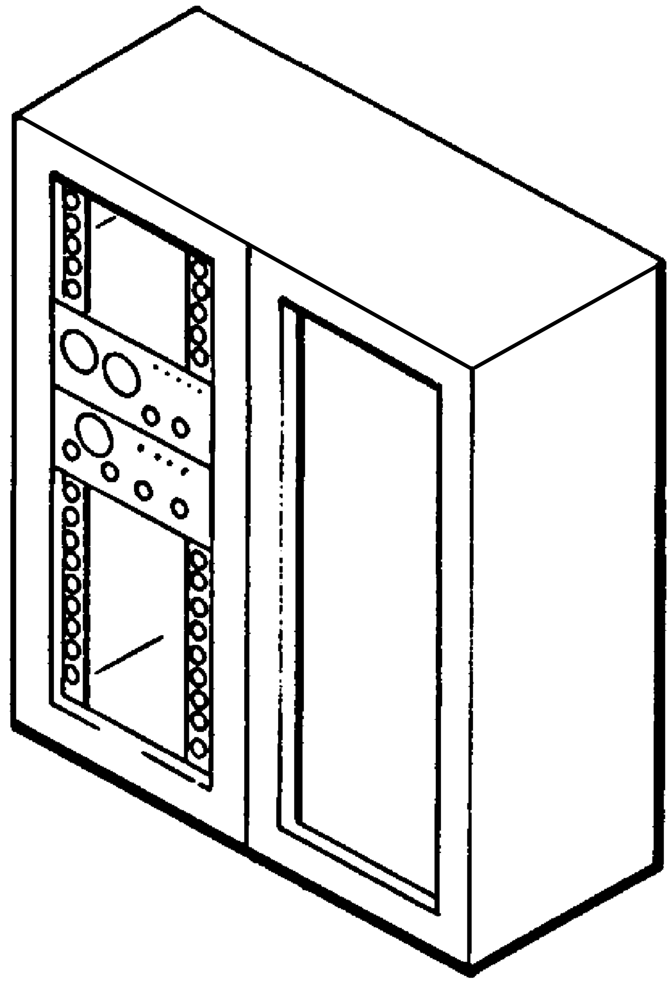
TYPICAL VERTICAL BOARD
(BENCHBOARD WOULD BE THE
SAME WITH A BENCH SECTION
PROTRUDING ABOUT
HALF-WAY DOWN)

FIGURE 3.10A-1, Rev. 47

Auto-Cad Figure Fsar 3_10A_1.dwg



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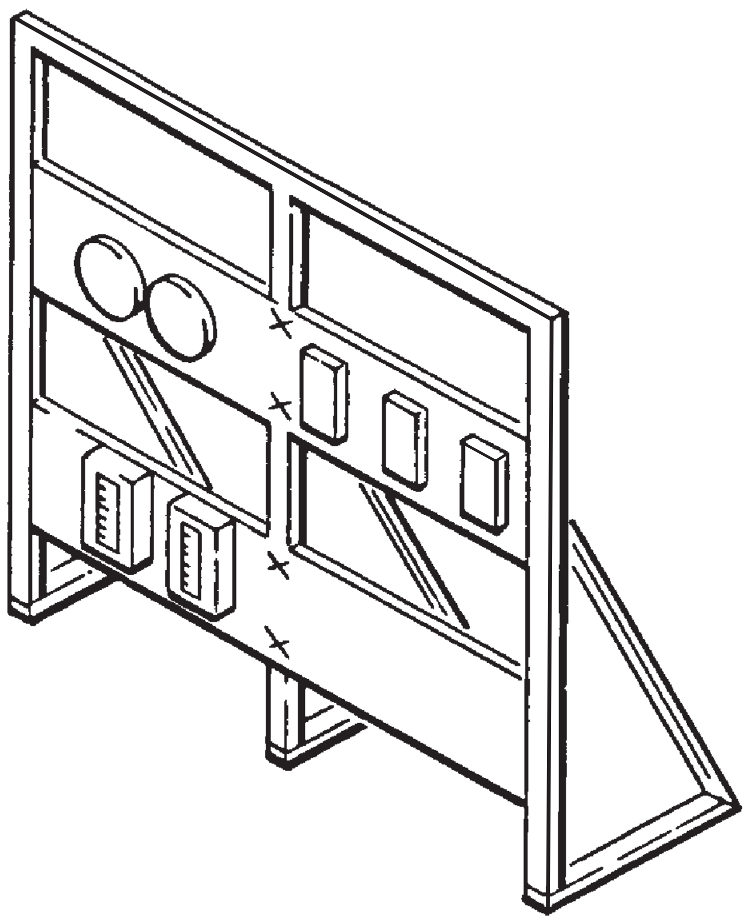
INSTRUMENT RACK

FIGURE 3.10A-2, Rev. 47

Auto-Cad Figure Fsar 3_10A_2.dwg



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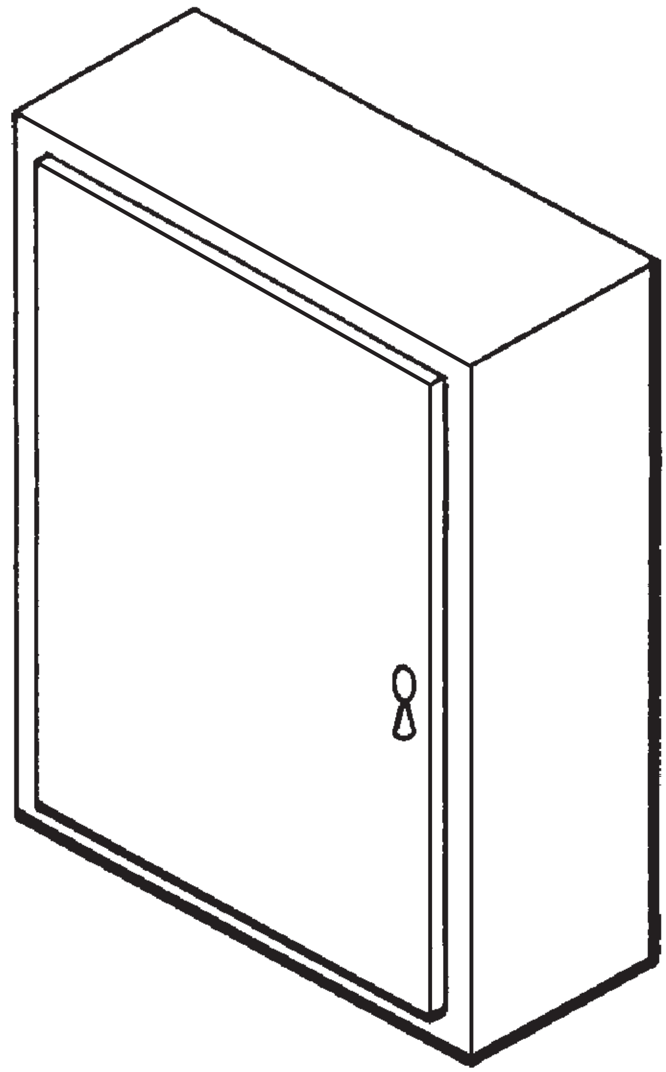
TYPICAL LOCAL RACK
(PIPING AND OTHER EXTERNAL
CONNECTIONS NOT SHOWN)

FIGURE 3.10A-3, Rev. 47

Auto-Cad Figure Fsar 3_10A_3.dwg



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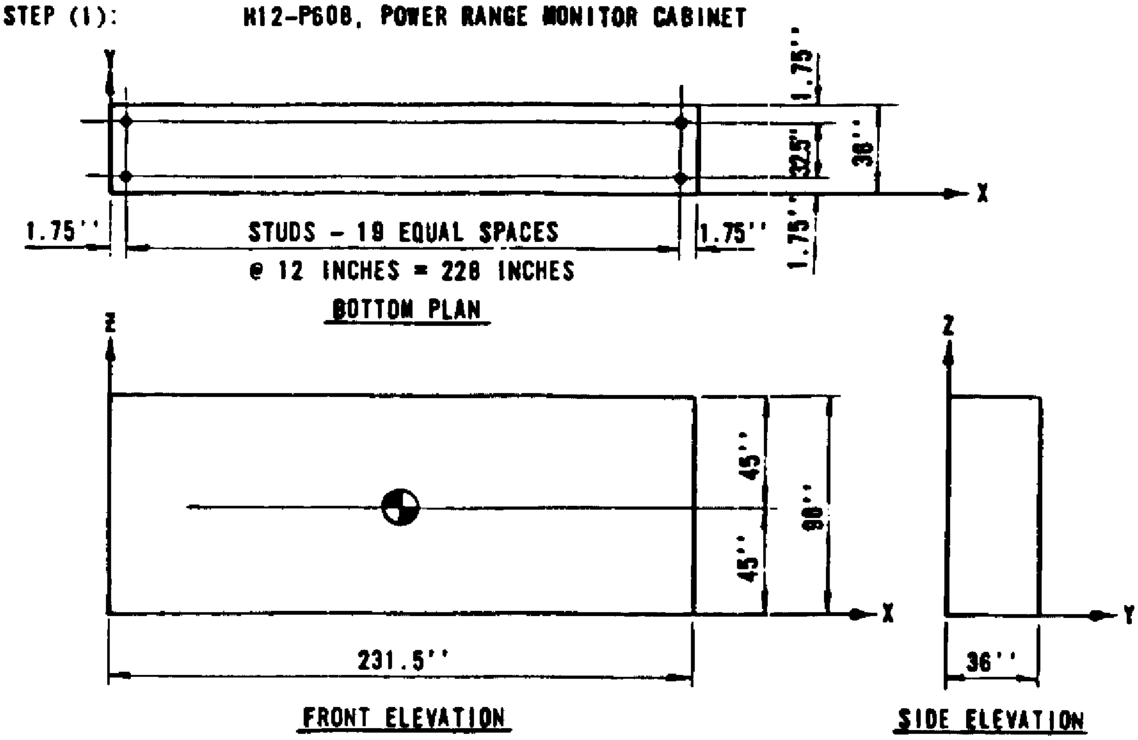
NEMA TYPE-12 ENCLOSURE
(INSTRUMENTS MOUNTED INSIDE
ON INTERNAL MEMBRANE
MOUNTED ON STANDOFFS
ATTACHED TO BACK)

FIGURE 3.10A-4, Rev. 47

Auto-Cad Figure Fsar 3_10A_4.dwg

STEP (1): H12-P608, POWER RANGE MONITOR CABINET



LEGEND OF TERMS

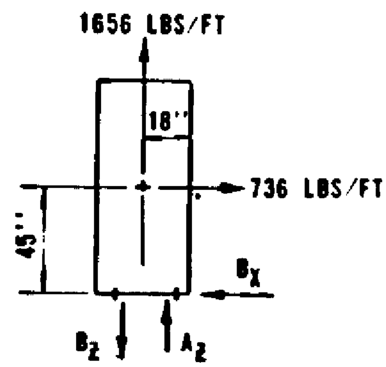
B_Z, A_Z = TENSION/COMPRESSION LOAD IN MOUNTING BOLT

B_X = SHEAR LOAD IN MOUNTING BOLT

B_X' = MAXIMUM COMBINED SHEAR LOAD AT A POINT IN BOLT DUE TO OVERTURNING AND UPLIFT

B_Y' = MAXIMUM COMBINED TENSION LOAD AT A POINT IN BOLT DUE TO OVERTURNING AND UPLIFT

S_t = MAXIMUM COMBINED TENSILE STRESS AT A POINT IN BOLT



FREE BODY DIAGRAM

STEP (2):

ABSOLUTE COMBINED LOADS (G's @ 3% DAMPING)

HORIZONTAL (3 TO 80HZ) 1.5G TO 1.6G [Gx, Gy]
VERTICAL (13 TO 18HZ) 4.6G [Gz]

PANEL FORCES PER FOOT OF PANEL

H12-P608

FRONT TO BACK Fx = 1.6G (460) = 736LB
SIDE TO SIDE Fy = 1.6G (460) = 736LB
UP +Fz = (4.6-1G) 460 = 1656LB
DOWN -Fz = (4.6+1G) 460 = 2576LB

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CABINET INSTALLATION FOR
SEISMIC AND HYDRODYNAMIC
LOADS - SAMPLE CALCULATION
(CABINET H12-P608)

FIGURE 3.10A-5-1, Rev. 47

Auto-Cad Figure Fsar 3_10A_5_1.dwg

STEPS (3) & (5): CASE 1

<u>FRONT TO BACK</u>

$$\overset{+}{\curvearrowleft}\Sigma M_A \quad \left[(3.75\ FT)(736\ LBS/FT)(19\ FT) + (1.5\ FT)(1656\ LBS/FT)(19\ FT) - (2.85\ FT)(B_Z)\right] \div 20\ STUDS = 0$$

$$B_Z = \frac{34,960\ LBS}{20\ STUDS}$$

$$B_Z = LBS\ PER\ STUD = \frac{34,960\ LBS}{20\ STUDS} = 1,748\ LBS/STUD\ TENSION$$

$$\Sigma F \updownarrow = 0 \quad \left[(1656\ LBS/FT)(19\ FT) + A_Z - 34,960\ LBS\right] \div 20 = 0$$

$$A_Z = \frac{3496\ LBS}{20\ STUDS}$$

$$A_Z = LBS\ PER\ STUD = \frac{3496\ LBS}{20\ STUDS} = 174.8\ LBS/STUD\ COMPRESSION$$

STEPS (4) & (5): SHEAR LOAD

$$B_X = \frac{(736\ LBS/FT)(19\ FT)}{40\ STUDS} = 349.6\ LBS/STUD$$

STEP (6): COMBINED STRESS

SHEAR

$$B'_X = \sqrt{B_X^2 + \left(\frac{B_Z}{2}\right)^2} = \sqrt{(349.6)^2 + \left(\frac{1748}{2}\right)^2}$$

$$B'_X = 941.33\ LBS/STUD$$

FORMULAS FOR COMBINED TENSION AND SHEAR AT A POINT MAY BE FOUND IN STRENGTH OF MATERIALS, 2ND ED. BY SINGER, HARPER & ROW PUBLISHERS, 1962.

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CABINET INSTALLATION FOR SEISMIC AND HYDRODYNAMIC LOADS - SAMPLE CALCULATION (CABINET H12-P608) FIGURE 3.10A-5-2, Rev. 47

Auto-Cad Figure Fsar 3_10A_5_2.dwg

NORMAL (TENSILE)

$$B'_Y = \frac{B_Z}{2} + \sqrt{B_X^2 + \left(\frac{B_Z}{2}\right)^2} = \frac{1748}{2} + \sqrt{349.6^2 + \left(\frac{1748}{2}\right)^2}$$

$$B'_Y = 874 + 941.33 = 1815.33 \text{ LBS/STUD}$$

$$S_t = \frac{B'_Y}{A_t} = \frac{1815.33}{.1419} = 12,793 \text{ PSI}$$

STEP (7): MARGIN OF SAFETY

TENSILE

$$\text{M.S. YIELD STRENGTH} = \frac{25,000}{12,793} - 1 = +.95$$

SHEAR

USE SHEAR YIELD = .55 TENSILE YIELD

$$\text{M.S. YIELD STRENGTH} = \frac{.55(25,000)}{\left(\frac{941.33}{.1419}\right)} - 1$$

$$= +1.07$$

ALL MARGINS OF SAFETY ARE POSITIVE, THERFORE, MOUNTING OF CABINET IS ADEQUATE TO RESTRAIN DESIGN LOADS.

STEP (8): STUD PRE-LOAD VS. STUD TENSILE LOAD

PRE-LOAD = 4800 LBS > B'_Y = 1815 LBS, THEREFORE, MOUNTING OF CABINET IS ADEQUATE TO RESTRAIN DESIGN LOADS.

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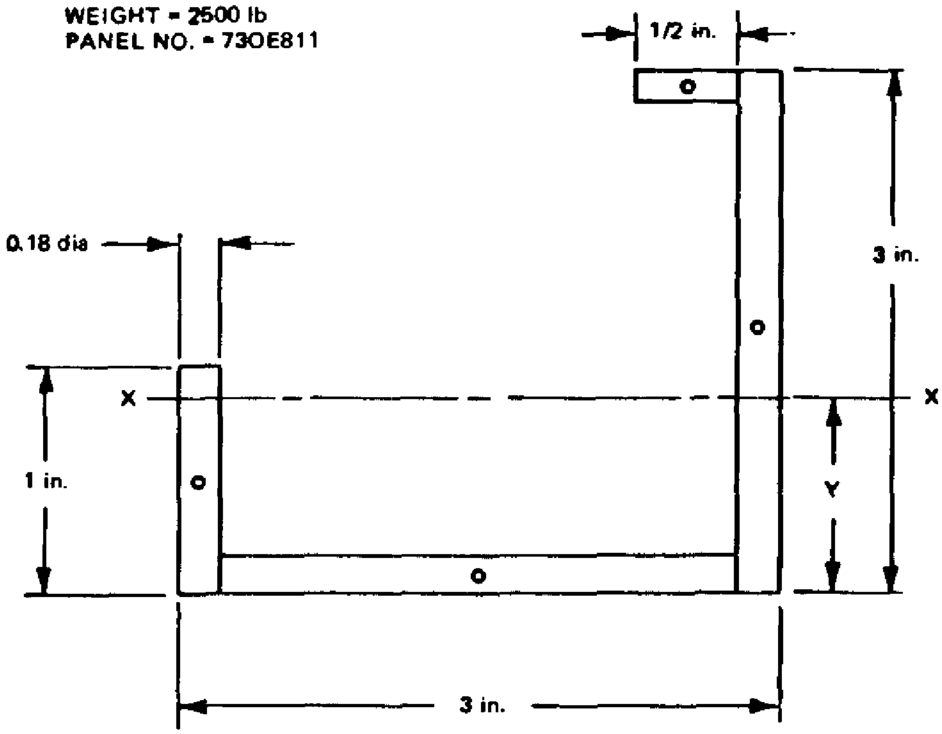
CABINET INSTALLATION FOR
SEISMIC AND HYDRODYNAMIC
LOADS - SAMPLE CALCULATION
(CABINET H12-P608)

FIGURE 3.10A-5-3, Rev. 47

Auto-Cad Figure Fsar 3_10A_5_3.dwg



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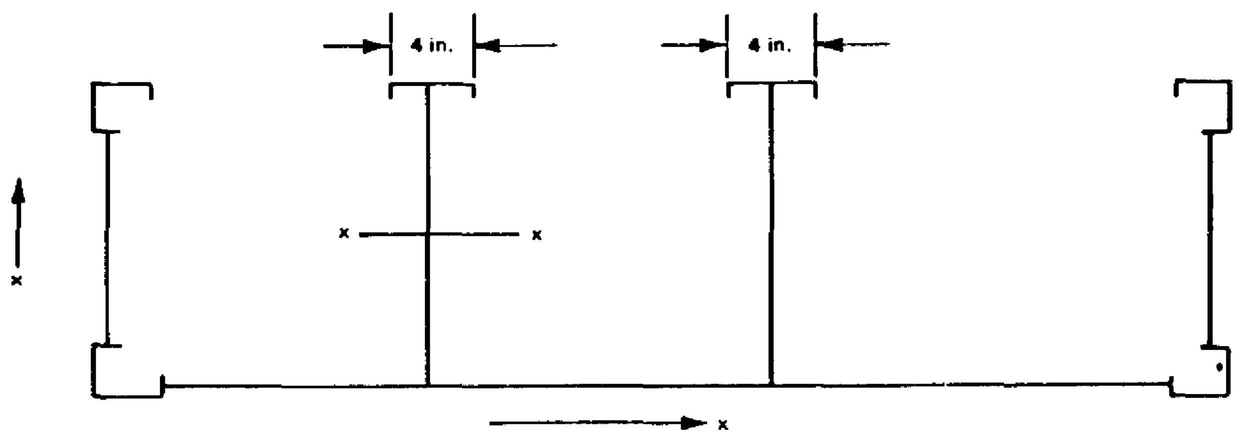
CORNER POST

FIGURE 3.10A-6, Rev. 47

Auto-Cad Figure Fsar 3_10A_6.dwg

SECOND APPROXIMATION

For a second approximation, consider two 0.18 in. x 20 in. barriers in addition to the corner posts. The plan view of the panel is shown in Figure 3.10C-2.



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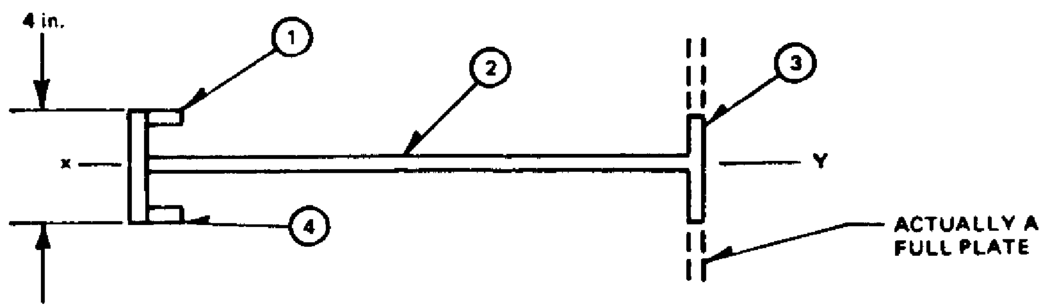
PLAN VIEW OF PANEL

FIGURE 3.10A-7, Rev. 47

Auto-Cad Figure Fsar 3_10A_7.dwg

In the X direction just one barrier will raise the frequency to 30HZ. Use 4 inches of the back panel for each of the two barriers (see Figure 3.10C-3) and the natural frequency in the Y direction becomes 4 HZ.



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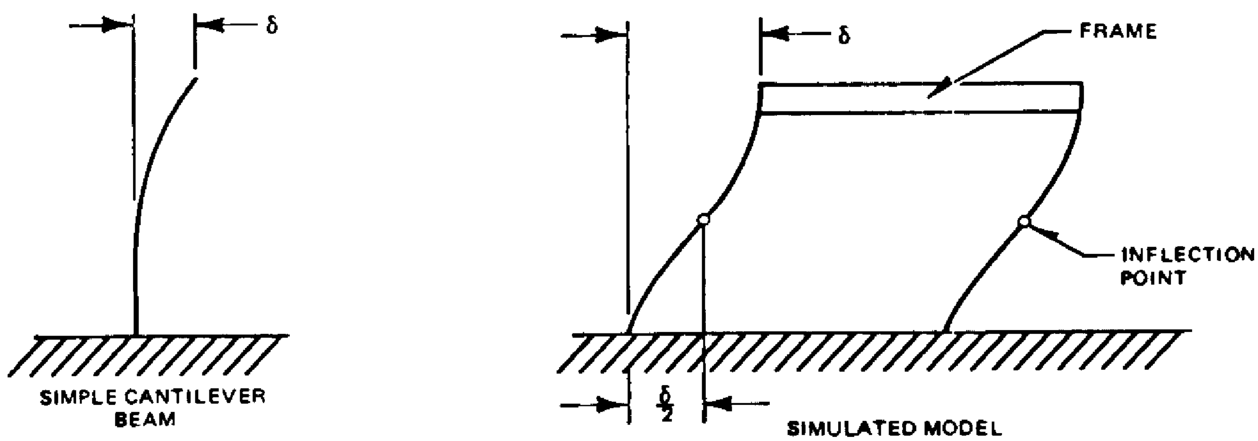
BARRIER WITH TWO END PLATES

FIGURE 3.10A-8, Rev. 47

Auto-Cad Figure Fsar 3_10A_8.dwg



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PANEL DEFLECTIONS

FIGURE 3.10A-9, Rev. 47

Auto-Cad Figure Fsar 3_10A_9.dwg

3.10b SEISMIC QUALIFICATION OF NON-NSSS SUPPLIED SEISMIC CATEGORY I INSTRUMENTATION

3.10b.1 SEISMIC QUALIFICATION CRITERIA

3.10b.1.1 Seismic Category I Equipment Identification

Seismic Category I instrumentation devices and panels were designed to withstand the dynamic effects of the Operating Basis Earthquake (OBE) and the Safe Shutdown Earthquake (SSE) established for this power plant. In addition, when required due to equipment location, instrumentation devices and panels are designed to withstand vibration due to Safety Relief Valve (SRV) and LOCA conditions in combination with OBE and SSE loads.

Instrumentation devices are mounted in instrumentation panels, on equipment racks, on piping, and mounted on building walls or wall structural elements. All devices, panels, and racks that are classified Seismic Category I are mounted on similarly classified supporting members and located within Seismic Category I structures.

Seismic qualification requirements were imposed on equipment through the purchasing documents that were used to procure that equipment. Accordingly, seismic qualification was achieved through analysis and/or testing of items identified on each purchase order for each type of device.

Qualification of instrumentation devices and of assemblies through testing was not mandatory. Equipment suppliers were permitted to qualify their equipment by any of the methods allowable in IEEE 344. However, when practical, testing was the preferred method. Analysis methods were not used when equipment was required to perform an active function under seismic conditions.

Instrument racks, instrument tube tray and their supports, and instrument impulse sensing lines were qualified by analysis.

3.10b.1.2 Seismic and Hydrodynamic Design Criteria

The seismic and hydrodynamic (i.e., SRV and LOCA) design and test criteria for qualification of safety related instrumentation for balance-of-plant systems are described below.

3.10b.1.2.1 Functional Criterion

Every instrumentation device shall be capable of performing its safety related function during plant operating conditions of startup, constant power operation, and normal or emergency shutdown without impairment of its safety related function while undergoing seismic and hydrodynamic excitation. The safety related function of instrumentation devices can be either passive or active. Where one type of device is used in both types of applications, the device is qualified for the worst-case application.

3.10b.1.2.2 Qualification Levels

From the plant OBE, SSE, SRV, and LOCA conditions a family of acceleration required response spectra (RRS) were generated for each building elevation for north-south, east-west and vertical directions. The spectra for each elevation where instrumentation is located were examined to establish the worst-case response spectra.

Pipe-mounted devices are procured for certain generic acceleration values (such as 3g or 6g) applied in the vertical and the weakest lateral axis simultaneously. These values are checked against the piping analysis to ensure that the piping response does not exceed the qualification level. Where equipment was not capable of meeting this generic value, the actual "g" value for that equipment was used for qualification.

For devices mounted in panels, the RRS used was derived from the panel analysis or from the panel shaker table test data.

3.10b.1.2.3 Instrumentation Supports

Instrumentation devices, assemblies, and control panels shall be seismically qualified using the supports that will be used during in-plant installation. These items of equipment are required to maintain their functional capability while undergoing earthquake excitation at the equipment supports.

3.10b.1.3 Device Qualification Test Criteria

Devices that were qualified by test were tested in accordance with IEEE Standard 344-1975. In general, test requirements and acceptance criteria are summarized as follows:

a) Devices under test are mounted in a manner that simulates intended use.

b) Devices are tested while in their normal operating condition (e.g., energized) to determine that vibratory conditions do not produce a malfunction or failure. Seismic Category I devices shall not malfunction during or after a safe shutdown earthquake.

c) Devices are tested in all three axes. Simultaneous excitation in all three axes is preferred; however, tests may be run one axis at a time and then be repeated for the other two axes as an acceptable alternative.

d) Where appropriate a frequency sweep (varying the frequency of excitation with time) is conducted at a low "g" value, e.g., 0.2g as noted in IEEE Standard 344. This test was performed to identify resonant frequencies in the range of interest.

e) Devices that are floor- or panel-mounted are subjected to five OBEs and one SSE in each axis tested. Each OBE and SSE consists of random input motion that envelopes the RRS for that device.

f) Devices that are pipe-mounted are subjected to sine-beat tests over the frequency range of 1 to 100 Hz where required. Each sine-beat test is performed at certain generic peak acceleration values (such as 3g or 6g) or to the peak acceleration for the specific mounting location. If used, the generic acceleration values are checked against the piping analysis to insure that the piping response does not exceed the qualification level.

g) The criteria for malfunction or failure include as many of the following characteristics as are applicable to the safety related function of the device during and after testing:

   1) Loss of output signal; e.g., open or short circuit
   2) Output variations greater than ±10 percent of full range
   3) Spurious or unwanted output; e.g., relay contact bounce
   4) Major calibration shift; e.g., greater than ±10 percent of range
   5) Structural failure; e.g., broken or loosened parts.

3.10b.2 SEISMIC CATEGORY I EQUIPMENT QUALIFICATION

Detailed information about seismic qualification of Non-NSSS Supplied Seismic Category I Instrumentation is maintained in a central file within PP&L. A synopsis of this information was by SQRT forms previously submitted to the NRC.

3.10b.3 Methods and Procedures of Analysis or Testing of Supports of Instrumentation

Instrumentation equipment was qualified by test. The instrument support design was considered during the qualification process.

3.10b.4 Operating License Review

Results of tests and analyses were provided in individual SQRT Forms.

3.10c SEISMIC QUALIFICATION OF NON-NSSS SEISMIC CATEGORY I ELECTRICAL EQUIPMENT

3.10c.1 SEISMIC QUALIFICATION CRITERIA

Seismic qualification of Seismic Category I electrical equipment and supports was demonstrated by the suppliers test laboratories, or consultants by analysis and/or by tests.

Seismic qualification of electrical equipment and supports was performed by analysis when the equipment could be modeled and the structural and functional integrity was adequately represented.

The analysis were performed by an equivalent static analysis or by a dynamic analysis. See Subsection 3.7b.3.5 for details of equivalent static load method of analysis.

The dynamic analysis was performed by the response spectrum method. See Subsection 3.7.3.1 for details of dynamic analysis. When analysis was not sufficient to determine seismic integrity, then tests or a combination of tests and analysis was performed to qualify the electrical equipment and supports.

3.1Oc.1.1 Equipment Location

Electrical equipment and supports are located within the several buildings on the Susquehanna Steam Electric Stations Units 1 and 2.

3.10c.1.2 Response Spectrum Curves for the Electrical Equipment and Supports

Response spectrum curves are based upon the seismic analysis of the supporting structure and represent the maximum seismic response, as a function of oscillator frequency, of an array of single degree of freedom damped oscillators at a particular location within the structure (See Section 3.7).

3.10c.1.3 Seismic Category I Electrical Equipment Loads

Seismic Category I electrical equipment will withstand simultaneously the horizontal and vertical accelerations caused by the OBE and the design SSE as defined herein, in conjunction with applicable electrical, mechanical, and thermal loads. The functions of electrical equipment or components, which are necessary for the functional requirements of the equipment, shall not be impaired when the equipment is subjected to the OBE or the SSE in conjunction with applicable electrical, mechanical, and thermal loads.

3.10c.1.4 Safe Shutdown Earthquake (SSE) Conditions

SSE is defined as an earthquake that produces the maximum vibratory ground motion for which certain structures, systems, and components are designed to remain functional. These structures, systems, and components are necessary to ensure the following:

a) Integrity of reactor coolant pressure boundary

b) Capability to shut down the reactor and maintain it in safe shutdown condition

c) Capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures to the radioactive material released to the environment.

The load combinations include gravity loads and operating loads. Allowable stresses in the structural portions may be increased to 150 percent of allowable working stress limits. The resulting deflections, misalignment or binding of parts, or effects on electrical performance (microphonics, contact bounce, etc) do not prevent the operation of the equipment during or after the seismic disturbance.

3.10c.1.5 Operating Basis Earthquake (OBE) Conditions

The load combinations include gravity loads and operation loads.

Allowable stresses in the structural steel portions may be increased to 125 percent of the allowable working stress limits as set forth in the appropriate design standards, that is, AISC Manual of Steel Construction, ANSI and other applicable industrial codes. The customary increase in normal allowable working stress due to earthquake is used if, according to the appropriate code, it is less than 25 percent. The resulting deflections, misalignment or binding of parts, or effects on electrical performance (microphonics, contact bounce, etc); does not prevent continuous normal operation of the equipment during and after the seismic disturbance.

For the Diesel Generator 'E' facility, the above 25% increase in allowable working stress limit is not allowed.

3.10c.1.6 Prevention of Overturning and Sliding

Stationary electrical equipment is designed to prevent overturning or sliding by the use of anchor bolts, welding, or other suitable mechanical anchorage devices.

3.10c.2 METHODS AND PROCEDURES FOR QUALIFYING ELECTRICAL EQUIPMENT

3.10c.2.1 Seismic Analysis Method

For the purpose of analysis, the equipment has been idealized as a mathematical model consisting of lumped masses connected by massless elastic structural members. For dynamic analysis, the frequencies and mode shapes have been determined for vibration in the vertical and two orthogonal horizontal directions, termed global directions. The effects of coupling between vibrations in all three global directions have been considered. The spectral acceleration per mode has been obtained from the appropriate response spectrum curve, which has been provided for the appropriate damping value. For determining the spectral acceleration from the response spectrum curves, the value chosen is the largest value on the curve when the

frequency in question varies by ±10 percent. Seismic response in terms of inertia forces, shears, moments, stresses, and deflections are determined for response to seismic excitation in each of the global directions for each mode. (See Subsection 3.7b.3.7)

For the consideration of stress or deflection at any point, the total seismic load consists of the most severe seismic load in one of the horizontal global directions combined by the sum of the absolute values method with the vertical seismic load. (See Subsection 3.7b.3.6)

For the Diesel Generator 'E' facility, responses at a point are obtained by taking the square root sum of the squares of corresponding responses due to three orthogonal components of earthquake acting simultaneously.

3.10c.2.2 Seismic Qualification for Electrical Equipment Operability

The seismic qualification of Category I electrical equipment, equipment supports, and material except in the Diesel Generator 'E' Building meets as a minimum the requirements of IEEE 344-1971 and project specification G-10, "General Project Requirements for A Seismic Design and Analysis of Class I Equipment and Equipment Supports" and complemented by Project Specification G-22, "Design Assessment and Qualification of Seismic Category I Equipment & Equipment Supports for Seismic & Hydrodynamic Loads." Project Specification G-10 is summarized in comparison to IEEE-344-1975 and Regulatory Guide 1.100 in Table 3.9-18.

Electrical equipment is qualified for functional operability during and after an earthquake of magnitude up to and including the SSE according to at least one of the following input excitation tests:

a) Single frequency sinusoidal motion or sine beat motions were continuously inputted during the test at specified frequencies to cover the frequency range up to 33 Hz.

b) Random waveform, multifrequency tests.

For the Diesel Generator 'E' facility, the seismic qualification of Category I electrical equipment, equipment supports and material meets as a minimum the requirements of IEEE 344-1975 and project specification C-1041, "General Specification for Seismic Criteria for Design and Qualification of Seismic Category I Equipment and Equipment Supports Located in the Diesel Generator 'E' Building".

3.10c.2.3 Seismic Test Report Analysis and Methods

The analysis and test reports furnished by the supplier demonstrate the ability of electrical equipment to perform its required function during and after the time it is subjected to the forces resulting from one SSE and a required number of OBE.

Four categories of reports are provided by the supplier of electrical equipment and material applicable to Seismic Category I qualification:

a) Electrical equipment qualified by testing method

b) Electrical equipment support and material qualified by analysis and calculation method

c) Electrical equipment qualified by supplier's certification of Seismic Category I requirements.

d) Combination of analysis and testing.

3.10c.2.3.1 Electrical Equipment Qualified by Testing and Combination of Testing and Analysis Method

Qualification of the electrical equipment listed below is based on testing performed by the suppliers or test laboratories. (Qualification may be based on tested equipment which is similar in design and assembly).

a) Indoor secondary unit substation and indoor power transformers (see Table 3.10c-1)
b) 480 V ac motor control centers (see Table 3.10c-2)
c) Soother monitors and fuse boxes (see Table 3.10c-3)
d) DC distribution panels (see Table 3.10c-4)
e) Battery racks (see Table 3.10c-5)
f) Electrical cable penetrations (see Table 3.10c-6)
g) Battery charger racks and cabinets (see Table 3.10c-8)
h) Panels and termination cabinets (see Table 3.10c-10)
i) Battery chargers (see Table 3.10c-11)
j) 4.16 kV switchgear (see Table 3.10c-12)
k) DC control and load centers (see Table 3. 10c-13)
l) Instrument ac transformers (see Table 3.10c-14)
m) Automatic transfer switches (see Table 3.10c-15)
n) Load isolation motor generator sets (see Table 3.10c-16)
o) Inverters and 120V AC instrument panels (see Table 3-10c-18)
p) Battery Shunt Box (See Table 3.10c-3)

3.10c.2.3.2 Electrical Equipment and Supports Qualified by Analysis Method

Cable trays were qualified by analysis method based on similarity in design and assembly, and representing the type of equipment shown in Table 3.10c-7.

3.10c.2.3.3 Electrical Equipment Qualified by Suppliers' Certification

Large induction motors (see Table 3.10c-9) were certified by the suppliers the motors had been previously qualified by tests equivalent to those described in Subsections 3.10c.1, or were analyzed and calculated.

3.10c.2.3.4 Minimum Operating Voltage of Voltage Relays

All non-NSSS and non-ACR voltage relays which must be energized or must remain energized to perform safety functions during a seismic event are tabulated in Table 3.10c.17.

3.10c.3 Methods and Procedures of Analysis or Testing of Supports of Electrical Equipment

Electrical equipment supports were qualified or tested with their associated equipment. See Subsection 3.10c.2 for a description of the applicable method or procedure.

3.10c.4 Operating License Review

A summary of tests and analyses is identified in Tables 3.10c-1 to 3.10c-16.

TABLE 3.10c-1 SECONDARY UNIT SUBSTATIONS AND POWER TRANSFORMERS

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT NO.	LOCATION BLDG.	ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
8856-E-117-57&58	Single Ended Secondary Unit Substation Consisting of: a. Terminal Chamber, b. 750 kVA Transformer, c. L.W. Switchgear	1B-210 1B-220 1B-230 1B-240 2B-210 2B-220 2B-230 2B-240	Reactor	749 749 719 719 749 749 719 719	1 1 1 1 2 2 2 2	I.T.E. Imperial Corporation	Wyle Laboratories Norco, California	Project Spec G-10* & IEEE-344-1975	Report # 26340-2 26340-3 26340-4 By: G. Shipway
Spec E-1023	1000 kVA Transformer 4.16KV-480V	0X565	D. Gen. 'E' Bldg.	675	Comm.	B.B.C.	Wyle Laboratories Huntsville, Alabama	Spec C-1041 & IEEE 344-1975	Report # 37-55778-STA By: C. E. Kunkel
Spec E-1023	5kV Switch	0S569	D. Gen. 'E' Bldg.	675	Comm.	B.B.C.	Wyle Laboratories Huntsville, Alabama	Spec C-1041 & IEEE 344-1975	Report # 37-55778-STA By: C. E. Kunkel

* NOTE: Specification G-10 is complemented by Specification G-22. For G-10 Specification Summary, See Table 3.9-31.

TABLE 3.10c-2 MOTOR CONTROL CENTERS (Page 1 of 2)

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT NO.	LOCATION BLDG.	ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
8856-E-118	Motor Control Center	0B-136	Control	783	Cmmn	Cutler-Hammer	Wyle Laboratories Huntsville, Alabama	Project Spec C-10* & IEEE-344-1975	Report #42966-1
		0B-146	Control	783	Cmmn				
		0B-516	D.Gen. 'A-D'	677	Cmmn				By: J. Foreman
		0B-517		677					Wyle
		0B-526		677	Cmmn				Report #45590-1
		0B-527		677	Cmmn				#45590-2
		0B-536		677	Cmmn				
		0B-546		677	Cmmn				By: Vincent F. Kearns III
		1B-216	Reactor	683	1				
		1B-217		749	1				C. H. Eaton
		1B-219		670	1				Report #DA57-3251 By:
		1B-226		683	1				Vincent F. Kearns III
		1B-227		749	1				
		1B-229		719	1				
		1B-236		719	1				
		1B-237		670	1				
		1B-246		719	1				
		1B-247		670	1				
		2B-216	Reactor	683	2				
		2B-217		749	2				
		2B-226		683	2				
		2B-227		749	2				
		2B-236		719	2				
		2B-237		670	2				
		2B-246		719	2				
		2B-247		670	2				

* Note: Specification G is complemented by Specification G-22

TABLE 3.10c-2 MOTOR CONTROL CENTERS (Page 2 of 2)

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT NO.	LOCATION BLDG.	ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
		1Y-216	Reactor	683	1				
		1Y-218		719	1				
		1Y-226		683	1				
		1Y-236		719	1				
		1Y-246		719	1				
		2Y-216		683	2				
		2Y-218		719	2				
		2Y-226		683	2				
		2Y-236		719	2				
		2Y-246		719	2				
Spec E-1024	Motor Control Center	OB-565	D. Gen. 'E'	675		Comm. Telemecanique	Wyle Laboratories Huntsville, Alabama	Spec C-1041 & IEEE 344-1975	Telemecanique Report No. SC-655 By: Paul W. Higgins

TABLE 3.10c-3
BATTERY MONITORS AND FUSE BOXES

ITEM NO.	EQUIPMENT IDENTIFICATION		LOCATION		UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
	DESCRIPTION	EQUIPMENT NO.	BLDG	ELEV.					
8856-E-0119AC	Battery Monitor 24V	1D-675	Control	771	1	Power Conversion Products, Inc.	Wyle. Laboratories, Huntsville, Alabama	Project Spec G-10* & IEEE 344-1975	Vincent F. Kearns Test Report #45463-1 Rev. A
		1D-676			1				
		1D-685			1				
		1D-686			1				
		2D-675			2				
		2D-676			2				
		2D-685			2				
		2D-686			2				
	Battery Monitor 125V	1D-691			1				
		1D-692			1				
		1D-693			1				
		1D-694			1				
		2D-691			2				
		2D-692			2				
		2D-693			2				
		2D-694			2				
	Battery Monitor 250V	1D-695			1				
		1D-696			1				
		2D-695			2				
		2D-696			2				
	125V Fuse Box 2-1000A	1D-611			1				
		1D-621			1				
		1D-631			1				
		1D-641			1				
		2D-611			2				

*NOTE: Specification G-10 is complemented by Specification G-22.

TABLE 3.10c-3
BATTERY MONITORS AND FUSE BOXES

ITEM NO.	EQUIPMENT IDENTIFICATION		LOCATION		UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
	DESCRIPTION	EQUIPMENT NO.	BLDG	ELEV.					
		2D-621			2				
		2D-631			2				
		2D-641			2				
	250V Fuse Box 2-1600A	1D-651			1				
		1D-661			1				
		2D-651			2				
		2D-661			2				
	Fuse Box, 24V, 2-100A	1D-671			1				
		1D-681			1				
		2D-671			2				
		2D-681			2				
Spec E-1025	Battery Monitor 125V	0D-601	D. Gen. 'E'	656	Comm.	Vitro Corp.	Wyle Laboratories Huntsville, Alabama	Spec C-1041 & IEEE 344-1975	C&D Power Systems Test Report No. QR2-13201-1 By: Paul Wagner
	Battery Float Current Shunt Box 125V	0D595A			0				
		1D610A, 2D610A			1 2				
		1D620A, 2D620A			1 2				
		1D630A, 2D630A			1 2				
		1D640A, 2D640A			1 2				
	Battery Float Current Shunt Box 250V	1D650A, 2D650A			1 2				
		1D660A, 2D660A			1 2				

TABLE 3.10c-4 DC DISTRIBUTION PANELS

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT NO.	LOCATION BLDG.	ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
8856-E-120	DC Distribution	1D-614	Control	771'	1	I.T.E.	Wyle	Project Spec	Report #26340-5
	Panels	1D-615			1	Imperial	Laboratories	C-10* & IEEE-	By: G. Shipway
	125V 225A	1D-624			1	Corporation	Novco,	344-1975	
	Main Bus	1D-625			1		California		Report #26340-3
		1D-634			1				26340-6
		1D-635			1				By: G. Shipway
		1D-644			1				
		1D-645			1				
	24V 100A	1D-672			1				
	Main Bus	1D-682			1				
	125V 225A	2D-614			2				
	Main Bus	2D-615			2				
		2D-624			2				
		2D-625			2				
		2D-634			2				
		2D-635			2				
		2D-644			2				
		2D-645			2				
	24V 100A	2D-672			2				
	Main Bus	2D-682			2				
Spec E-1027	DC Switchboard 125V	OD-597	D. Gen 'E'	656	Comm	Square 'D' Company	(Qualified by Test) Farwell & Hendricks, Inc. Milford, Ohio	Spec C-1041 & IEEE 344-1975	Square 'D' Report No. 8998-10.09-L74 8998-10.09-L84 By: R. A. Diersing
	DC Distribution Panel 125V	OD-599	D Gen. 'E'	660	Comm	Square 'D' Company	(Qualified by Test) Farwell & Hendricks, Inc. Milford, Ohio	Spec C-1041 & IEEE 344-1975	Square 'D' Report No. 8998-10-09-L74 By: R. A. Diersing

*NOTE: Specification G-10 is complemented by Specification G-22.

TABLE 3.10c-5
BATTERY RACKS

ITEM NO.	EQUIPMENT IDENTIFICATION		LOCATION		UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
	DESCRIPTION	EQUIPMENT NO.	BLDG	ELEV.					
8856-E-119B	Stationary Batteries 24V 75AH	1D-670	Control	771	1	C&D Batteries Co.	Structural Dynamic Research Corporation, Milford, Ohio for Corporate Consulting Development Co.	Project Spec G-10* & IEEE-344-1975	Report #A379-81-01 Stephen A. Lehrman Dr. John Roland Yow
		1D-680			1				
		2D-670			2				
		2D-680			2				
	Stationary Batteries 125V 720AH	1D-610			1				
		1D-620			1				
		1D-630			1				
		1D-640			1				
		2D-610			2				
		2D-620			2				
		2D-630			2				
		2D-640			2				
	Stationary Batteries 250V 1800AH	1D-650			1				
		1D-660			1				
		2D-650			2				
		2D-650			2				
Spec E-1025	Stationary Batteries 125V 825AH	OD-595	D Gen. 'E'	656	Comm	C&D Power Systems	Wyle Laboratories Huntsville, Alabama	Spec C-1041 & IEEE 344-1975	C&D Power Systems Report No. QR2-54035-1 By: Paul Wagner

NOTE: Specification G-10 is complemented by Specification G-22.

TABLE 3.10c-6 ELECTRICAL CABLE PENETRATION (Page 1)

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT NO.	LOCATION BLDG.	ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
8856-E-135	Electrical Cable Penetrations:					Westinghouse	Action Labs	Project Spec G-10* & IEEE-344-1975	Report #PEN-TR-16404-81N By: A. Lebourdais
	Neutron Monitor	1W-100A	Reactor	707'	1				
		1W-100B		707'	1				
		1W-100C		707'	1				
		1W-100D		707'	1				
		2W-100A		707'	2				
		2W-100B		707'	2				
		2W-100C		707'	2				
		2W-100D		707'	2				
	Medium Voltage	1W-101A		735'-9"	1				
		1W-101B		733'	1				
		1W-101C		733'	1				
		1W-101D		700'	1				
		1W-101E		730'-2"	1				
		1W-101F		727'-0"	1				
		2W-101A		735'-9"	2				
		2W-101B		733'	2				
		2W-101C		733'	2				
		2W-101D		700'	2				
		2W-101E		730'-2"	2				
		2W-101F		727'-0"	2				
	Low Level Signal	1W-102A		729'-1"	1				
		1W-102B		729'-1"	1				
		2W-102A		729'-1"	2				
		2W-102B		729'-1"	2				
		1W-103A		707'	1				
		1W-103B		712'	1				
		2W-103A		707'	2				
		2W-103B		712'	2				
	Control Rod Drive	1W-104A		707'	1				
		1W-104B		712'	1				
		1W-104C		712'	1				
		1W-104D		712'	1				
		2W-104A		707'	2				
		2W-104B		712'	2				
		2W-104C		712'	2				
		2W-104D		712'	2				

* NOTE: Specification G-10 is complemented by Specification G-22.

TABLE 3.10c-6 ELECTRICAL CABLE PENETRATION (Page 2)

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT NO.	LOCATION BLDG.	ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
B856-E-135	Electrical Cable Penetrations					Westinghouse	Action Labs	Project Spec G-10* & IEEE-344-1975	Report #16404-81" By: A. Labouriis
	Power	1W-105A	Reactor	729'-1"	1				
		1W-105B		729'-1"	1				
		1W-105C		729'-1"	1				
		1W-105D		741'	1		Seismic Test		
		2W-105A		729'-1"	2		for Modular		
		2W-105B		729'-1"	2		Penetration		
		2W-105C		729'-1"	2		5" Dia.		
		2W-105D		741'	2				
	Low Voltage	1W-106A		729'-1"	1				
		1W-106B		729'-1"	1				
		1W-106C		729'-1"	1				
		1W-106D		741'	1				
		1W-107		741'	1				
		1W-108		729'-1"	1				
		2W-106A		729'-1"	2				
		2W-106B		729'-1"	2				
		2W-106C		729'-1"	2				
		2W-106D		741'	2				
		2W-107		741'	2				
		2W-108		729'-1"	2				
	Suppression Pool Low Voltage, Control and Power	1W-300		688'-6"	1				
		1W-301		688'-1"	1				
		2W-300		688'-6"	2				
		2W-301		688'-1"	2				

* NOTE: Specification G-10 is complemented by Specification G-22.

TABLE 3.10c-7 CABLE TRAYS "SAFEGUARD" (Page 1 of 2)

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT NO.	LOCATION BLDG.	ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
8856-E-132	Cable Trays: 3"D x 24"W 3"D x 18"W 3"D x 12"W 5"D x 24"W 5"D x 18"W 5"D x 12"W	 S9N1-24-144 S9N1-18-144 S9N1-12-144 S9N1-24-144 S9N1-18-144 S9N1-12-144	Control Reactor	670' to 770'	1&2	Husky Product Inc.	Husky Products, Inc. 7405 Industrial Rd Florence, Kentucky	Project Spec G-10 & IEEE-344-1975	1-29-76 a. Test No. 977-978 Load Test-(Trays) By: T. O'Hara B. Heinz b. (Hold Down Test 4/12/76 Test No. 1127-L,H,V, 5/14/76 1151& 1152 7/21/76 1188 8/10/76 1196-H,V c. Electric Test 12/12/72 Harper-Morrez B. Schuster d. Seismic Calculation 8/11/76 By: B. Schuster

TABLE 3.10c-7 CABLE TRAYS "SAFEGUARD" (Page 2 of 2)

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT NO.	LOCATION BLDG.	ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
Spec E-1032	Cable Trays: 3"D x 12"W		D. Gen 'A-D' and 'E'			T. J. Cope	(By Analysis)	Spec C-1041 & IEEE 344-1975	PP&L Calc. No. JI-CMHR-102 By: T. A. Gorman
	3"D x 18"W								
	3"D x 24"W								
	5"D x 12"W								
	5"D x 18"W								
	5"D x 24"W								
	5"D x 36"W								

TABLE 3.10c-8
BATTERY CHARGER RACKS AND CABINETS

ITEM NO.	EQUIPMENT ID		LOCATION		UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
	DESCRIPTION	EQUIPMENT NO.	BLDG	ELEV.					
8856-E-119-AC	Battery Chargers 125V 100A	1D-613	Control	771'	1	Power Conversion Products Inc. 42 East Street, Crystal Lake, Illinois 66014	Wyle Laboratories Huntsville, Alabama	Project Spec G-10* & IEEE-344-1975	Test Report #45463-1 Rev. A Vincent F. Kearns
		1D-623			1				
		1D-633			1				
		1D-643			1				
		2D-613			2				
		2D-623			2				
		2D-633			2				
		2D-643			2				
		0D-673			Cmmn				
	Battery Chargers 250V 300A	1D-653A			1				
		1D-653B			1				
		1D-663			1				
		2D-653A			2				
		2D-653B			2				
		2D-663			2				
		0D-683			Cmmn				
	Battery Chargers 24V 25A	1D-673			1				
		1D-674			1				
		1D-683			1				
		1D-684			1				
		2D-673			2				
		2D-674			2				
		2D-683			2				
		2D-684			2				
		0D-685			Cmmn				
Spec E-1025	Battery Charger 125 V 200A	0D-596	D. Gen. 'E'	656	Comm	C&D Power Systems	Wyle Laboratories Huntsville, Alabama	Spec. C-1041 & IEEE 344-1975	C&D Test Report QR2-52666-1 By: Paul Wagner

*NOTE: Specification G-10 is complemented by Specification G-22.

TABLE 3.10c-9 LARGE INDUCTION MOTORS 4000V

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT NO.	LOCATION BLDG.	LOCATION ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "R1" SIGNED BY:
8856-P-112	Large Induction Motors 4000V 3ø						The motors are qualifieid by seismic analysis by McDonald Engineering Analysis, Inc., Birmingham, Alabama	Project Spec. G-10* IEEE 344-1975	C. K. McDonald Report # ME-573 ME-574
	450 HP 1800 RPM	0P-504-A		685	Cmmn	General Electric			
	Emergency	0P-504-B			Cmmn				
	Service Water	0P-504-C			Cmmn				
	Pump	0P-504-D			Cmmn				
	600 HP 4000V	1P-506-A		685	1				
	1200 RPM	1P-506-B			1				
	RHR Service	2P-506-A			2				
	Water Pump	2P-506-B			2				

* NOTE: Specification G-10 is complemented by Specification G-22.

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TABLE 3.10c-10
PANELS AND TERMINATION CABINETS

ITEM NO.	EQUIPMENT IDENTIFICATION		LOCATION		UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
	DESCRIPTION	EQUIPMENT NO.	BLDG	ELEV.					
	Transfer Panels	0C512E-A	D. Gen. 'E'	656'-6"	1	York Electro-Panel	(By Analysis)	Project Spec C-1041* & IEEE 344-1975	N&S Reports 1290-1 and 1290-2 By: M. Randall
		0C512E-B			2				
		0C512E-C			1				
		0C512E-D			2				
	Termination Cabinets	0TC512-A/C			1				
		0TC512-B/D			2				
	Transfer Panels	OC512-A	D. Gen. 'A-D'	710'-9"	1				
		0C512-B			2				
		0C512-C			1				
		0C512-D			2				
	Synchronizing Panel	0C619	D. Gen. 'E'	675'-6"	Comm	Golden Gate Switchboard Co.	Wyle Labs Norco Calif.	Project Spec. C-1041# IEEE 344-1975	Wyle Labs Report No. 53444 By: C. C. Lee

* NOTE: Spec C-1041 is complemented by Spec. E-1026.
# NOTE: Spec C-1041 is complemented by Spec. E-1022.

TABLE 3.10c-11
BATTERY CHARGERS

EQUIPMENT IDENTIFICATION									
ITEM NO.	DESCRIPTION	EQUIPMENT NO.	BLDG	ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
8856-E-119-AC	Battery Chargers 125V 100A	1D-613	Control	771	1	Power Conversion Products, Inc.	Wyle Laboratories, Huntsville, Alabama	Project Spec G-10* & IEEE-344-1975	Test Report #45463-1 Rev. A Vincent F. Kearns
		1D-623			1				
		1D-633			1				
		1D-643			1				
		2D-613			2				
		2D-623			2				
		2D-633			2				
		2D-643			2				
		2D-673			Comm				
	Battery Chargers 250V 300A	1D-653A			1				
		1D-653B			1				
		1D-663			1				
		2D-653A			1				
		2D-653B			2				
		2D-663			2				
		2D-683			2				
		2D-684			2				
		0D-685			Comm				
	Battery Chargers 24V 25A	1D-673 1D-674 1D-683 1D-684 2D-673 2D-674 2D-683 2D-684 0D-685			1 1 1 1 2 2 2 2 Comm				
Spec E-1025	Battery Charger 125V 200A	0D596	D. Gen. 'E'	656	Comm	C&D Power Systems	Wyle Laboratories Huntsville, Alabama	Spec. C-1041 & IEEE 344-1975	C&D Test Report QR2-52666-1 QR2-52666-1 By: Paul Wagner

*NOTE: Specification G-10 is complemented by Specification G-22.

TABLE 3.10c-12 4.16 KV SWITCHGEAR

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT NO.	LOCATION BLDG.	ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
8856-E-109-34	4.16 kV Switchgear	1A-201	Reactor	749	1	Westinghouse	Wyle Laboratory, Huntsville, Alabama and Wyle Laboratory Novco, CA	Project Spec G-10* & IEEE-344-1975	Report #'s 57577-1 57588 58642 58664 G. Shipway
		1A-202		749	1				
		1A-203		719	1				
		1A-204		719	1				
		2A-201		749	2				
		2A-202		749	2				
		2A-203		719	2				
		2A-204		719	2				
Spec E-1022	4.16 kV Switchgear	OA510	D. Gen. 'E'	657	Comm	B.B.C.	Wyle Laboratories Huntsville, Alabama	Spec C-1041 & IEEE 344-1975	C&D Report No. 37-55736-SSA By: C. E. Kunkel
		OA510A OA510B OA510C OA510D	D. Gen. 'A-D'	710	Comm	B.B.C.			

* NOTE: Specification G-10 is complemented by Specification G-22.

TABLE 3.10c-13 DC CONTROL AND LOAD CENTERS

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT NO.	LOCATION BLDG.	ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
8856-E-121-22-1	DC Control Centers 250V	1D-254	Reactor	670	1	General Electric Co.	Wyle Laboratory, Novco, CA	Project Spec C-10* & IEEE-344-1971	Report# 26340-8 By: G. Shipway
		1D-264	Reactor	683	1				
		1D-274	Reactor	683	1				
		2D-254	Reactor	670	2				
		2D-264	Reactor	683	1				
		2D-274	Turbine	729	2				
8856-E-121-22-3	DC Load Centers 250V	1D-652	Control	771	1			Project Spec G-22 & IEEE-344-1975	Report #'s 26340-2 26340-3 26340-7 By: G. Shipway
		1D-662	Control	771	1				
		2D-652	Control	771	2				
		2D-662	Control	771	2				
	DC Load Centers 125V	1D-612	Control	771	1				
		1D-622	Control	771	1				
		1D-632	Control	771	1				
		1D-642	Control	771	1				
		2D-612	Control	771	2				
		2D-622	Control	771	2				
		2D-632	Control	771	2				
		2D-642	Control	771	2				
Spec E-1024	DC Motor Control Center 125V	OD598	D Gen 'E'	657	Comm	Telemecanique	Wyle Laboratories Huntsville, Alabama	Spec. C-1041 & IEEE 344-1975	Telemecanique Report No. SC-655 By: Paul Wiggins

* NOTE: Specification G-10 is complemented by Specification G-22.

TABLE 3.10c-14 INSTRUMENT AC TRANSFORMERS

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT IDENTIFICATION EQUIPMENT NO.	LOCATION BLDG.	LOCATION ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E1" SIGNED BY:
8856-E-136	Instrument AC	1X-216	Reactor	683	1	Federal Pac.	Wyle	Proj Spec	Report #
	Transformers	1X-226		683	1	Electric Co.	Laboratory,	G-10* &	45455-1
	37.5 kVA, 3Ø	1X-236		719	1		Huntsville,	IEEE 344-	By:
	4 Wire, 480-	1X-246		719	1		Alabama	1975	Vincent F. Kearns III
	208y/120V	2X-216		683	2				
		2X-226		683	2				
		2X-236		719	2				
		2X-246		670	2				
	25 kVa, 1Ø	1X-201A	Reactor	761	1				
	480-120/240 V	1X-201B		761	1				
		2X-201A		761	2				
		2X-201B		761	2				
	15 kVa, 1Ø	OX-507	D. Gen. 'A-D'	710	Comm				
	480-120/240V	OX-508		710	Comm				
		OX-509		710	Comm		Qualified by Analysis		
		OX-510		710	Comm				
		OX-512	ESSW	685	Comm				
		OX-513	Pump-house	685	Comm				
Spec E-1024	30 kVa, 3Ø	OLX-5B	D. Gen. 'E'	675	Comm	Telemecanique	Wyle	Spec C-1041 &	Telemecanique
	480-480/277						Laboratories	IEEE 344-1975	Report No.
							Huntsville,		SC-665
							Alabama		By: J. D. Owens

* NOTE: Specification G-10 is complemented by Specification G-22.

TABLE 3.10c-15 AUTOMATIC TRANSFER SWITCHES

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT NO.	LOCATION BLDG.	ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "EI" SIGNED BY:
8856-E-152	Automatic Transfer Switch	OATS-516	D Gen. 'A-D'	677'	Comm	Russelelectric, Inc. Alabama for C.C & D Company Ltd.	Wyle Laboratory,	ProjectSpec G-10* & IEEE-344-1975	Report # 44434-1 By: James W. Foreman
		OATS-526	Gen.	677'	Comm				
		OATS-536		677'	Comm				
		OATS-546		677'	Comm				
		1ATS-219	Reactor	670'	1				
		1ATS-229		719'	1				
		2ATS-219	Reactor	670'	2				
		2ATS-229		719'	2				
		OATS-556	D Gen. 'E'	656'-6"	Comm	Gould/ Telemecanique (TE)	Wyle Laboratory Huntsville, Alabama	Project Spec. C-1041# & IEEE 344-1975	TE Report SC-657, Rev. 1 By: P. Higgins

* NOTE: Specification G-10 is complemented by Specification G-22.
\# NOTE: Spec. C 1041 is complemented by Spec. E-1024.

TABLE 3.10c-16

LOAD ISOLATION MOTOR-GENERATOR SETS

ITEM NO.	EQUIPMENT IDENTIFICATION DESCRIPTION	EQUIPMENT NO.	LOCATION BLDG.	ELEV.	UNIT NO.	SUPPLIER	TESTING FACILITIES	QUALIFICATION CRITERIA	QUALIFICATION "E" SIGNED BY:
8856-E-151	Load Isolation Motor Generator Sets:								
	Motor 150 HP. 3ϕ, 480 V	1S-246	Reactor	670'	1	Engine Power Co./ Kato Engineering	Wyle Labs and R. W. Siegfried Associates	Project Spec G-10* & IEEE-344-1975	Wyle Report # 58393 58411 By: W. M. West Report #4058 R. W. Siegfried Report #4058
	Generator 100 kv, 3ϕ 480 V	1G-202		670'	1				
		1S-247		719'	1				
		1G-203		719'	1				
		2S-246		670'	2				
		2G-202		670'	2				
		2S-247		719'	2				
		2G-203		719'	2				
	Control Panels for Motor-Generator Sets	1C-246		670'	1				
		1C-247		719'	1				
		2C-246		670'	2				
		2C-247		719'	2				

NOTE: Specification G-10 is complemented by Specification G-22.

TABLE 3.10c-17

NON-NSSS AND NON-ACR RELAYS REQUIRED TO BE ENERGIZED
(Units 1 & 2 Devices Are Identical)

Device No.	Relay Function	Location	Manufacturer Type	Operating (Volt) Normal	Minimum	Seismically Type Tested	Remarks
27	Supervise 480 V Auto Transfer Switches	0ATS219, 0ATS229 0ATS516, 0ATS526 0ATS536, 0ATS546	Russel-Electric UV-100/42 480/500	480 ac	432 ac	432 Vac	
27A	Initiates 4 kV Bus Auto Transfer	1A201, 1A202 1A203, 1A204	ABB/West. – SVF31	119	107	24 Vac	
27AI	Permissive to Close 4 kV Incom Breakers	1A201, 1A202 1A203, 1A204	ITE-270	119	107	110 Vac	
43	Transfer Relay for 480 V Auto Transfer Switches 0ATS536, 0ATS546	1ATS219, 1ATS229 0ATS516, 0ATS526	Ward-Leon ARD Bul-130	480 ac	432 ac	432 Vac	
44	Initiation of 4 kV ESF Loads	1A201, 1A202 1A203, 1A204	ABB/West – SSV-T	120 ac	90 ac	90 ac	
59N	Trip ±24 vdc Battery Charger on Overvoltage	1D672, 1D682	GE – NSV	24 dc	28 dc	30 dc	
51V	480 V Swing Bus M-G Set Protection	1C246, 1C247	ABB/West – Cov-9	120 ac	108 ac	80 ac	
62	Time Delay Relay	Various inplant Locations	Agastat 7000 Series	125 dc	105 dc	120 dc	
62	Time Delay Relay	Various inplant Locations	Agastat 7000 Series	120 ac	108 ac	120 ac	
62	Time Delay Relay (480 V Auto Transfer Switches	1AT219, 1AT229 0ATS516, 0ATS526 0ATS536, 0ATS546	Ind. Timer CSF-30M	120 ac	108 ac	120 Vac	
X	Auxiliary Control Relays	1ATS219, 1ATS229 0ATS516, 0ATS526 0ATS536, 0ATS536	Ward – Leon ARD 130-6429	125 dc	105 dc	125 Vdc	
X	Auxiliary Control Relays	1C246, 1C247	GE-HFA	125 dc	105 dc	125 Vdc	

TABLE 3.10c-17

NON-NSSS AND NON-ACR RELAYS REQUIRED TO BE ENERGIZED
(Units 1 & 2 Devices Are Identical)

Device No.	Relay Function	Location	Manufacturer Type	Operating (Volt) Normal	Operating (Volt) Minimum	Operating (Volt) Seismically Type Tested	Remarks
X	Auxiliary Control Relays	1C661A, 1C661B 0C877A, 0C877B 0C876A, 0C876B	GE-HFA	120 ac	108 ac	125 Vdc	
X	Auxiliary Control Relays	1C661A, 1C661B	GE-HMA	120 ac	108 ac	96 ac	
X	Auxiliary Control Relays	1C661A, 1C661B	GE-HMA	125 dc	105 dc	125 Vdc	
X	Auxiliary Control Relays	1C661A, 1C661B 0C578, 0C681 1C681, 0C877A 0C877B, 0C883A 0C883B, 0C876A 0C876B	Agastat-GPI	120 ac	108 dc	96 Vac	
X	Auxiliary Control Relays	0C519A, 0C519B 0C519C, 0C519D 0C519E, 0C521A 0C521B, 0C521C 0C521D, 0C521E	Agastat-GPD	125 dc	105 dc	125 Vdc	
X	Auxiliary Control Relays (prevent cycling of 4 kV Bkr)	1A201, 1A202 1A203, 1A204	ABB/West – AR	125 dc	105 dc	125 Vdc	
X	Auxiliary Control Relays	1A201, 1A202 1A203, 1A204	ABB/West – MG6	125 dc	105 dc	125 Vdc	
X	Isolation Relays	1A201, 1A202 1A203, 1A204	P.B. MDR – 5062/ 5151	125 dc	105 dc	105 dc	(1)
X	Isolation Relays	1C661A, 1C661B 0C877A, 0C877B 0C876A, 0C876B 0C529A, 0C529B	P.B. MDR – 4094/ 4094-1/4165	120 ac	92 ac	90 ac	(1)

Remarks

(1) Test made by Arkansas Unit 1.

TABLE 3.10C-18 - INVERTERS AND 120 VAC INSTRUMENT PANELS

Item No.	Equipment Identification		Location		Unit No.	Supplier	Testing Facilities	Qualification Criteria	Qualification "E1" Signed By:
	Description	Equipment No.	Bldg.	Elev.					
	Inverters 2KVA, 120VAC	1D115 1D125 2D115 2D125	Control	754' 714' 754' 714'	1 1 2 2	General Electric	Wyle Laboratories Novco, California	Project spec G10* and IEEE 344-1975	ADO-01294-1 and -9 signed by D.A. Kneerea
	Instrument Distr. Panels 120VAC, 100A Main Bus	1Y115 1Y125 2Y115 2Y125	Control	754' 714' 754' 714'	1 1 2 2	Eaton Corp.	Wyle Laboratories Novco, California	Project Spec G10* and IEEE 344-1975	45590-1 signed by V.F. Kearns, III

*NOTE: Specification G-10 is complemented by Specification G-22. For G-10 specification summary, see Table 3.9-31.