

EIS IDENT: ELEC PROT ASSY

GENERAL ELECTRIC

REVISION STATUS SHEET

NUCLEAR ENERGY DIVISION

22A5941  
CONT ON SHEET 2 SH NO 1

ENCLOSURE 5

DOCUMENT TITLE ELECTRICAL PROTECTION ASSEMBLY

SPECIFICATION  DRAWING  OTHER \_\_\_\_\_ TYPE DESIGN SPECIFICATION

PMF REACTOR PROTECTION SYSTEM

LEGEND OR DESCRIPTION OF GROUPS

MPL No. PRODUCT SUMMARY

GROUP 1 - 60 Hz

GROUP 2 - 50 Hz

		REVISIONS				C		
tbn	0	AMF-500	MAR 01 1979					
		PRINTS TO						
MADE BY	ISSUED BY	DATE	DEPT	LOCATION				
KR MILLER	KR MILLER	MAR 28 1979	C&I	SAN JOSE				
CHKD BY	ISSUED BY	DATE						
J. Laboy		MAR 01 1979						
		CONT ON SHEET 2 SH NO 1						

## 1. SCOPE

1.1 This specification provides the design base engineering requirements for a Class 1E Electrical Protection Assembly (EPA) to be used with the Reactor Protection System (RPS) of a boiling water reactor power plant.

## 2. APPLICABLE DOCUMENTS

2.1 General Electric Documents. The following documents form a part of this specification to the extent specified herein.

### 2.2 Supporting Documents

- a. Qualification and Procurement Requirements for Class 1E Purchased Equipment 262A6590
- b. BWR Equipment, Environmental Interface Data 22A3093

### 2.3 Codes and Standards

- a. Quality Assurance Requirements for Nuclear Power Plants, 10 CFR 50, Appendix B

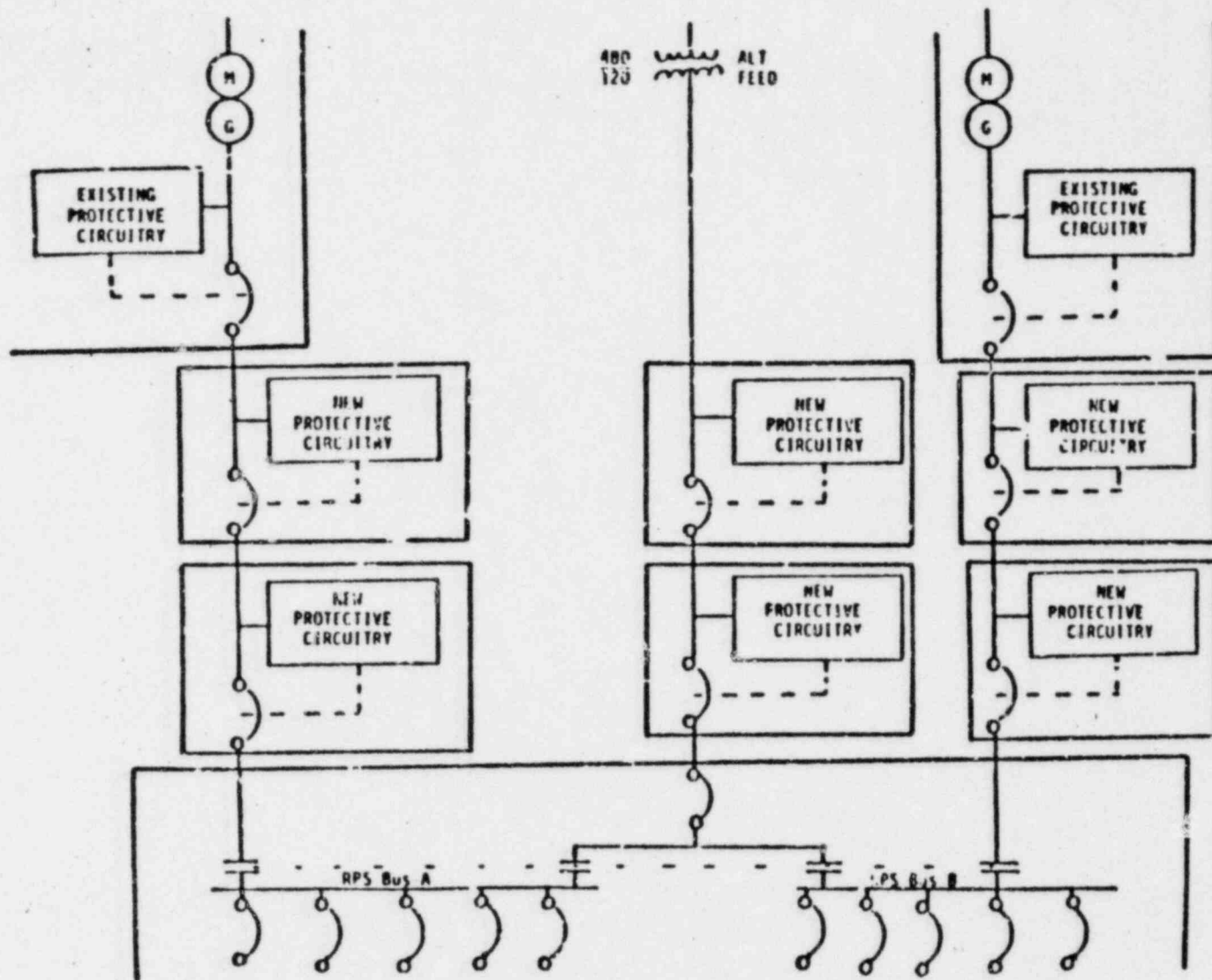
## 3. DESCRIPTION

3.1 The Electrical Protection Assembly (EPA) provides redundant protection to the Reactor Protection System (RPS), and other associated systems, against power source transitory over-voltage, under-voltage, and under-frequency conditions.

3.2 Two EPA's are installed, in series, between each of the two RPS motor-generator sets and the RPS buses and between the auxiliary power source and the RPS buses. Six EPA's are normally required for each plant.

3.3 The block diagram in Figure 1 provides an overview of the six EPA units and their connections between the power sources and the RPS circuits.

3.4 The EPA is fully qualified as a Class 1E electrical component per the generic environmental and seismic practices in Specification 262A6590 and the requirements of this specification.



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REV. 0  
 22A5941  
 SH. NO. 3

FIGURE 1 ELECTRICAL PROTECTION ASSEMBLY FOR RPS, BLOCK DIAGRAM

#### 4. REQUIREMENTS

4.1 Protective Enclosure. The EPA components shall be mounted in an enclosure that provides physical protection. Adequate cooling including louvers shall be provided by natural air convection. Components shall be readily accessible. The EPA enclosure shall be capable of being mounted separately from the MG sets on a seismic category I building wall or other seismically compatible structure.

4.2 Design. The EPA shall be provided in two groups as follows:

- a. Group 1 - for 60 Hz frequency
- b. Group 2 - for 50 Hz frequency

4.2.1 The EPA shall operate and provide electrical protection under the following nominal input power:

- a. Power 18.7 kVA
- b. Voltage 120 V ac  $\pm$  2%
- c. Phase 1 $\phi$
- d. Frequency 60 Hz - 1% slip  
50 Hz - 1% slip
- e. Current 156A (actual)  
175A (design)

4.2.2 The EPA over- and under-voltage trip levels shall be adjustable over a range of 80 percent to 115 percent of the nominal input voltage of 120 V ac and 40 to 70 Hz frequency.

4.2.3 The EPA under-frequency trip level shall be adjustable from 65 percent to 100 percent of the nominal input of 60 Hz for Group 1 and 50 Hz for Group 2.

4.2.4 The EPA shall disconnect the RPS power sources whenever the ac voltage exceeds the nominal 120 V by 10 percent (+ 0 percent to - 2.5 percent of trip setting), or decreases below nominal by 10 percent (+ 2.5 percent to - 0 percent of trip setting)\*. The EPA shall also disconnect the power sources whenever the frequency decreases below 95 percent of the nominal 60 Hz or 50 Hz (+ 2 percent to - 0 percent of trip setting)\*. The trip settings shall be repeatable within the trip setting tolerances.

\* Final trip setpoints will be selected on site after installation. Determination will be based on line resistance losses and 115 V ac at downstream component locations.

4.2.5 The EPA shall incorporate continuously adjustable independent time-delay trip mechanisms with a minimum range of 0.1 to 3.0 seconds. A transient power source trip condition existing for a period less than the selected time delay shall not cause the EPA to disconnect the power source. The time delay shall be factory set for 0.1 sec  $\begin{matrix} +2 \\ -0 \end{matrix}$  cycles. An independent time delay shall be provided for each of the over-voltage, under-voltage, and under-frequency functions.

#### 4.3 Qualification and Acceptance

4.3.1 The EPA shall be qualified for operation in the following environment:

- a. Temperature 40 to 137°F\*
- b. Relative humidity 10 to 95%\*
- c. Radiation  $2.0 \times 10^5$  rad (total integrated dose)

4.3.2 The EPA shall be seismically qualified to the acceleration response spectrum shown in Figure 2 and to the following summary requirements:

- a. Operation Base Earthquake 5.0 g
- b. Safe Shutdown Earthquake 7.0 g
- c. Frequency spectrum 1 to 33 Hz

4.3.3 The minimum acceptance requirements shall be unconditional and fully documented seismic and environmental qualification per Paragraphs 4.3.1 and 4.3.2.

4.4 Electrical Connectors. The EPA shall incorporate adjustable electrical terminals for integration with RPS power cables that range from AWG No. 6 to 250 mcm.

4.5 Switches, Lamps, and Test Jacks. The EPA shall incorporate an external keylock switch, indicator lamps, and test jacks as needed for circuit calibration and maintenance. One set of form C, switch contacts shall be wired out to an internal terminal board for optional bypass annunciation.

\* For abnormal conditions, the EPA must demonstrate the ability to operate under the following conditions: a) 137°F, >2.0 hr at 95% RH; b) 122°F, >24.0 hr at 90% HR.



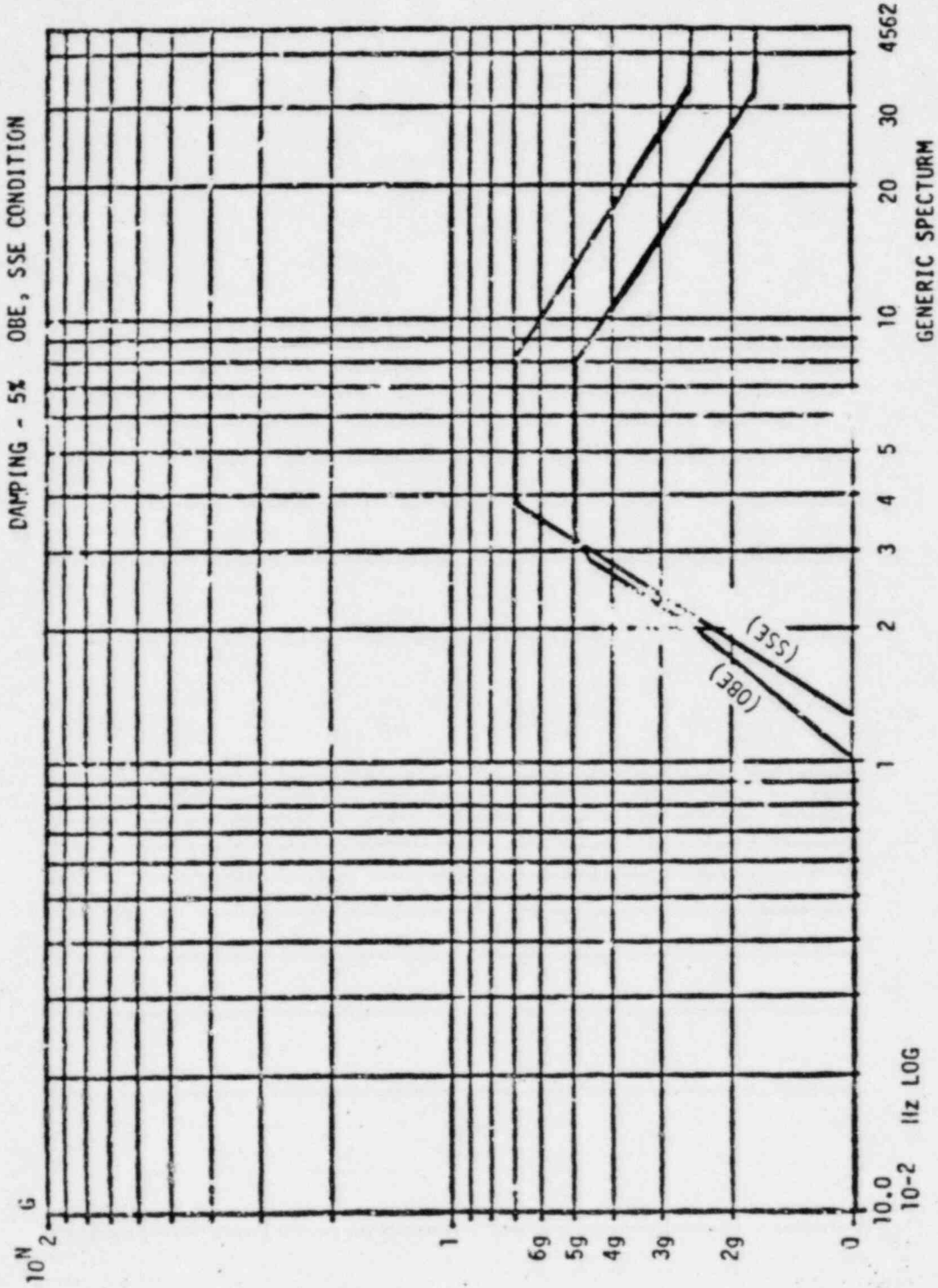


FIGURE 2 TEST RESPONSE SPECTRUM FOR RPS PROTECTIVE CIRCUIT (EPA)

**4.6 Life Expectance.** The EPA shall have a design life expectancy of 40 years, including periodic maintenance as required. Mean time between failure (MTBF) shall be 5 years.

**4.7 Quality Assurance.** The EPA shall be designed and fabricated to meet the requirements of 10 CFR 50, Appendix B, "Quality Requirements for Nuclear Power Plants".

**4.8 Functional Acceptance.** Each production unit shall be functionally tested to the over-voltage, under-voltage and under-frequency criteria specified in this document (Paragraph 4.2.4) prior to shipment to the field or after 180 days in storage, followed by shipment.