



# U.S. NRC

United States Nuclear Regulatory Commission

*Protecting People and the Environment*

## ***ELECTRICAL SYSTEMS***

# **US-APWR Technology Chapter 9.0**

# Objective 1

State the purposes of the following:

- a. Onsite standby gas turbine generators
- b. Alternate ac gas turbine generators
- c. Class 1E onsite ac power system
- d. Non-Class 1E onsite ac power system
- e. Class 1E dc power system
- f. Non-Class 1E dc power system

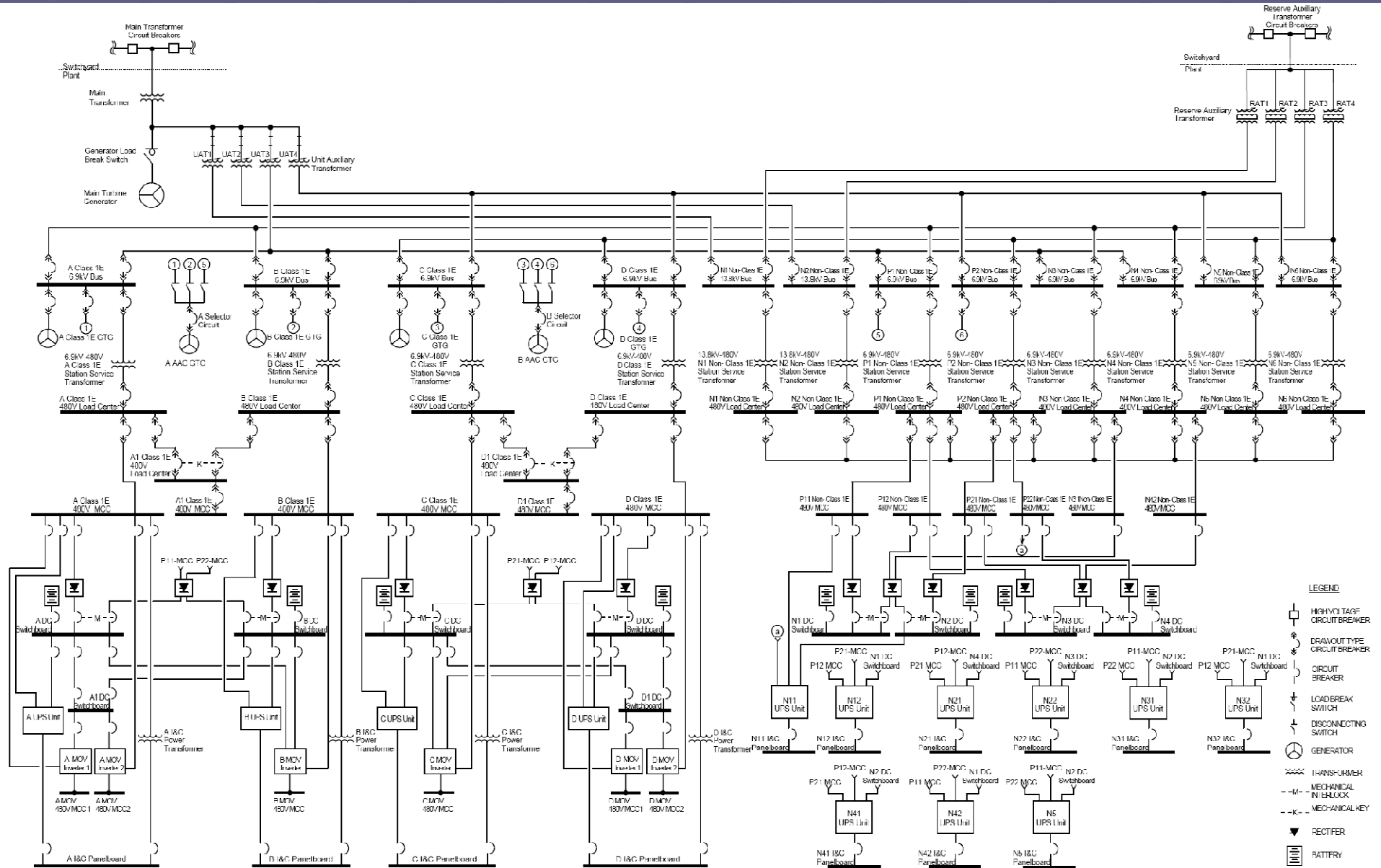
# Objective 2

Describe the major differences between the electrical system design of the US-APWR and those of currently operating PWRs.

# Power Systems

- Offsite power system: 2 independent connections to the transmission system via the switchyard
- Onsite power systems:
  - Non-Class 1E onsite ac power system
  - Class 1E onsite ac power system
  - Class 1E dc power system and
  - Non-Class 1E dc power system

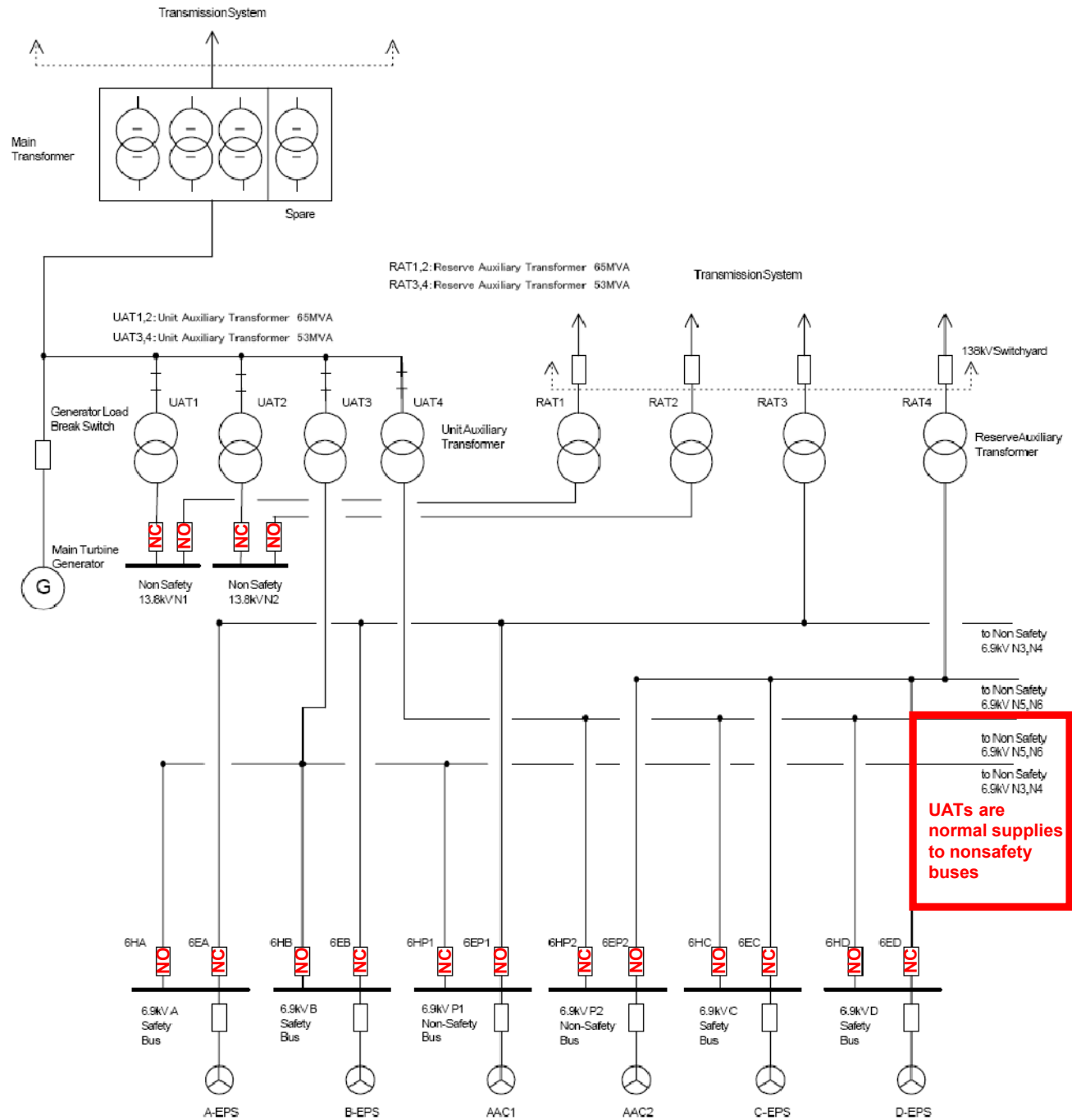
# Simplified 1-Line Diagram – Fig. 9-1



# Onsite AC Power System

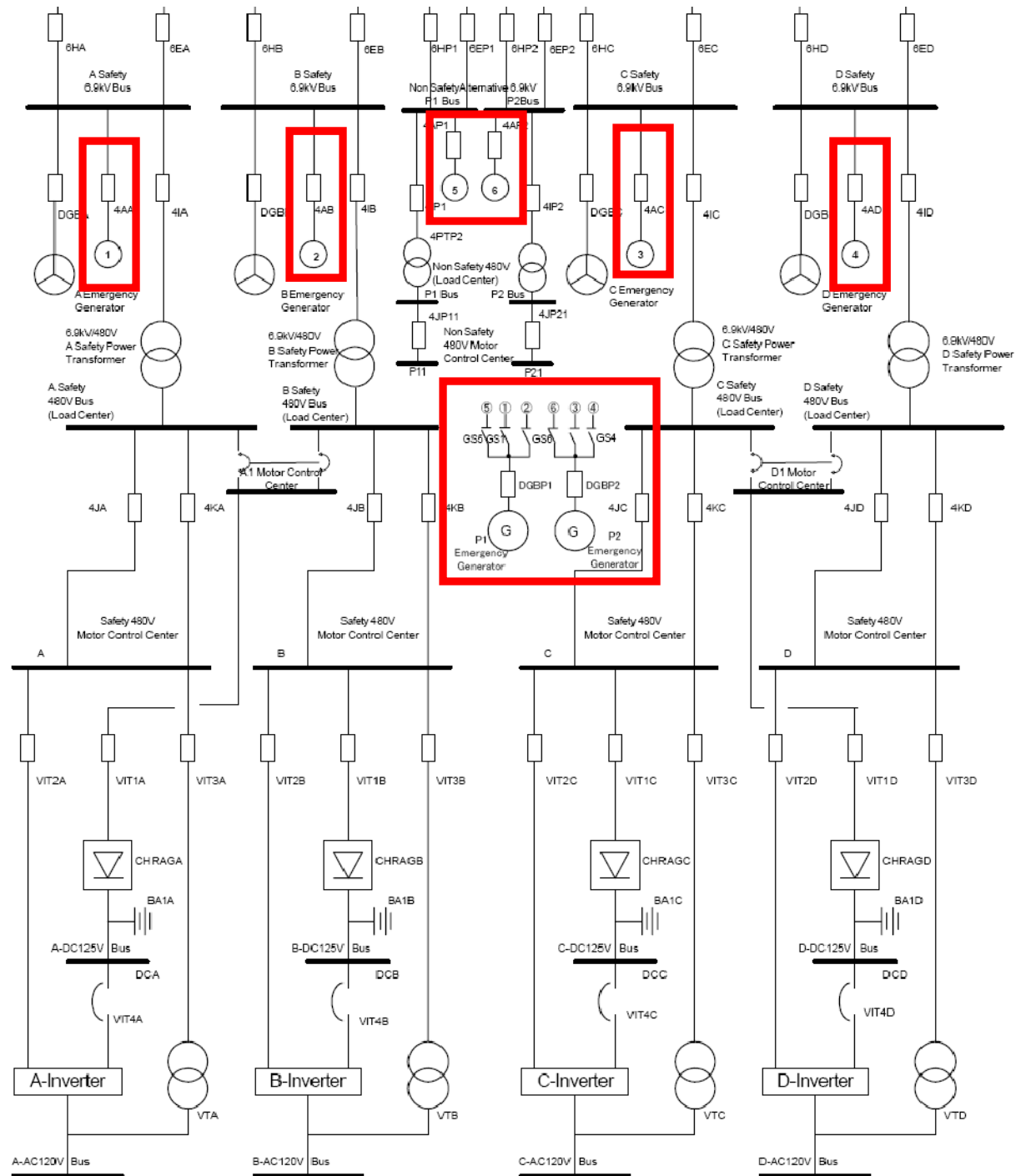
- 2 connections to offsite, via MT circuit breakers & RAT circuit breakers.
- 4 RATs normally supply Class 1E buses A, B, C, D.
- Turbine-generator via 4 UATs normally supplies nonsafety buses N1, N2, N3, N4, N5, N6, P1, P2. With GLBS open, offsite power to N1 – N6, P1, P2 via MT & UATs.
- An emergency GTG (4 total) for each Class 1E bus, & an AAC GTG (2 total) for each permanent bus.

# Power supplies to N1, N2; P1, P2; A, B, C, D



# AAC GTG Power Supply Options

Power to a  
Class 1E bus  
can be  
restored  
within 60  
min.

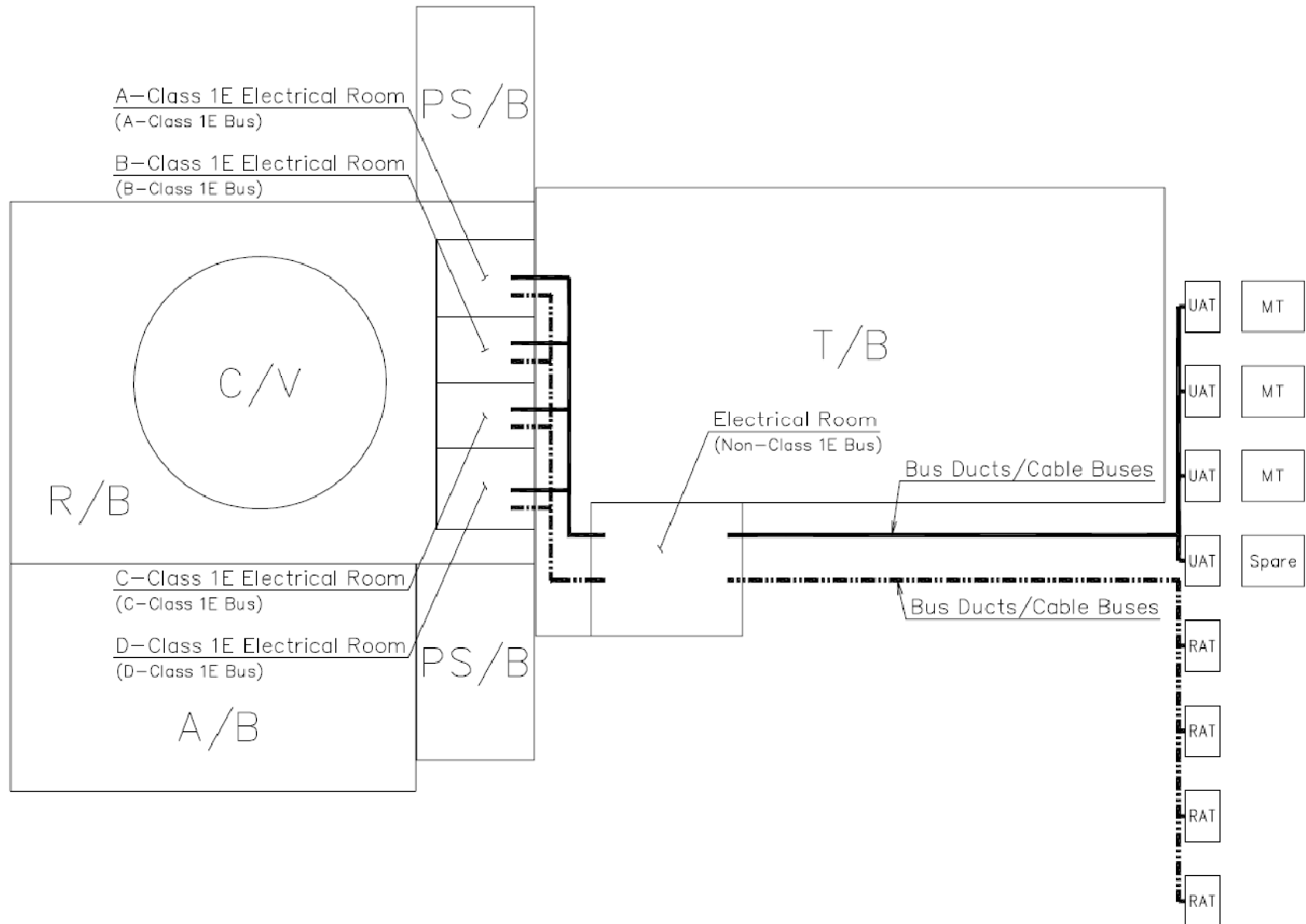




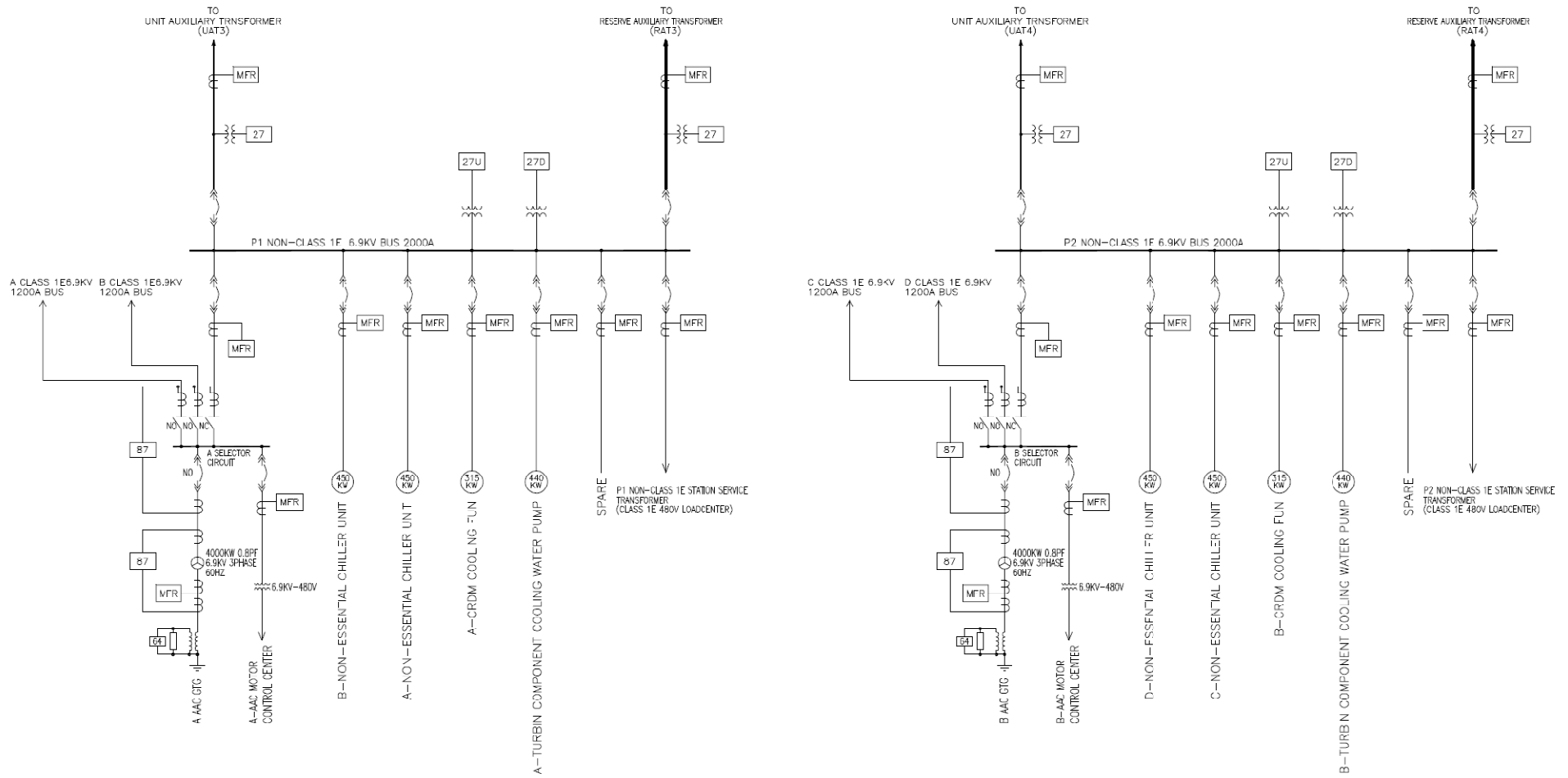
# Why GTGs?

- More reliable; fewer components & aux. systems than DGs have
- No cooling water requirements
- Need less space than DGs
- Require less maintenance than DGs
- Safety analyses can accept longer start time for emergency power (100 sec for GTGs; 10 sec typical for existing EDGs)

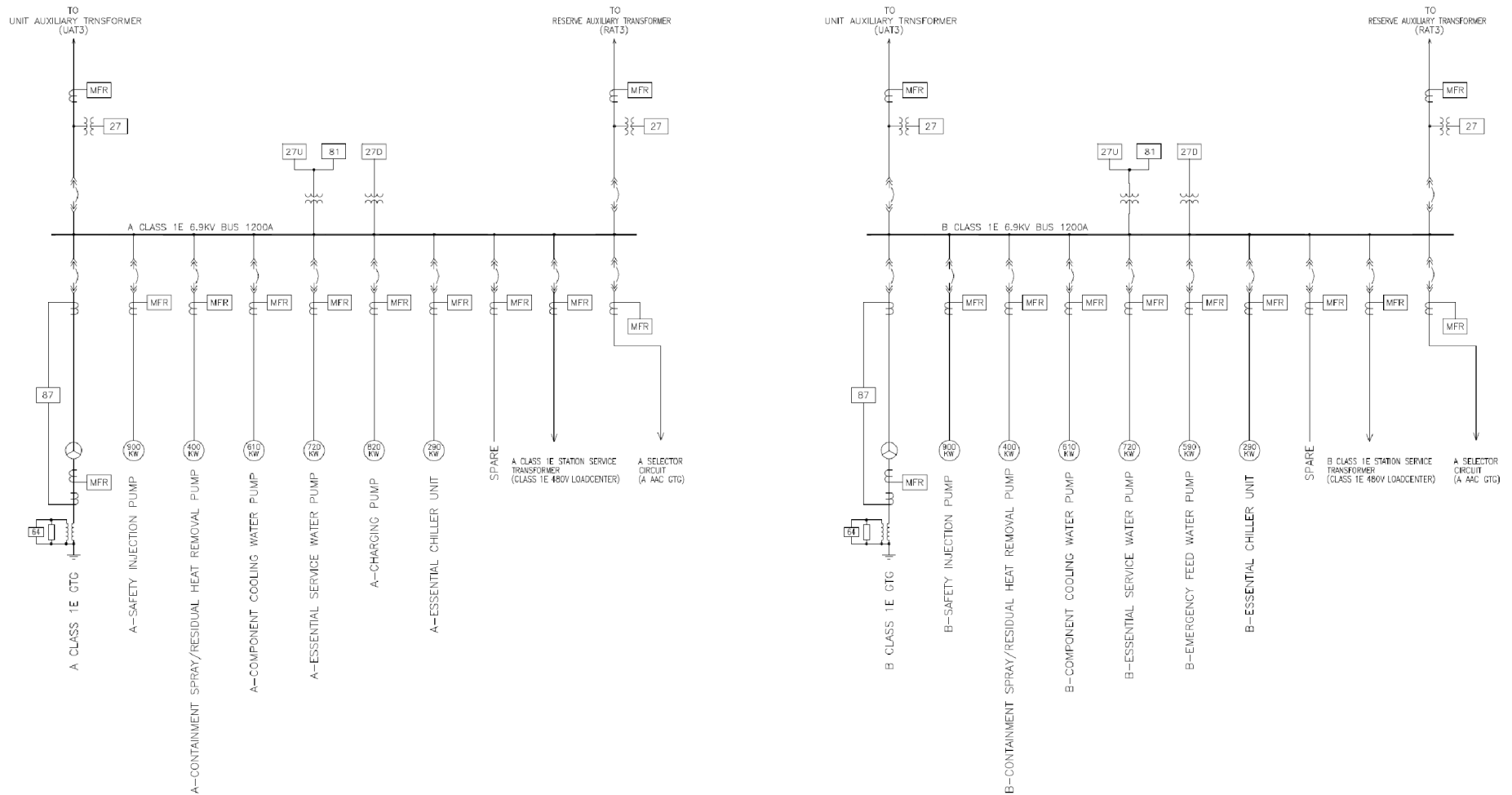
# Physical Arrangement – Fig. 9-2

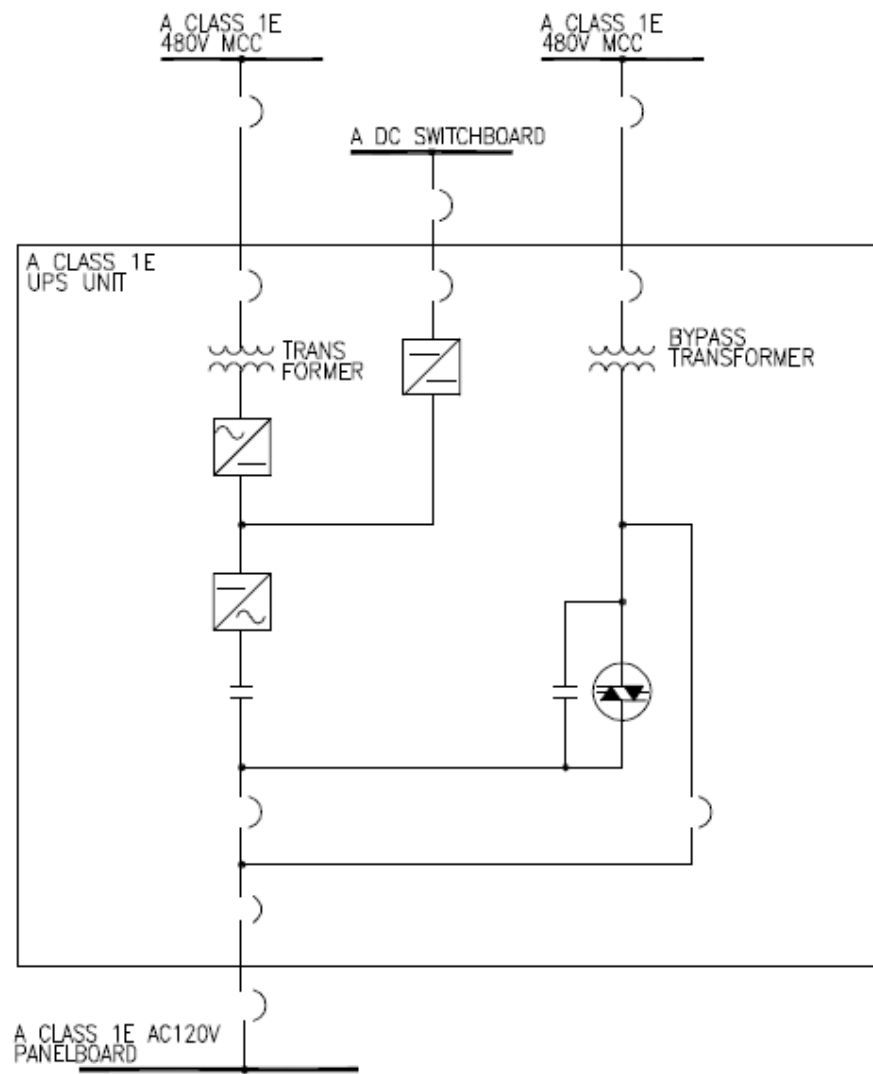


# P1, P2 Loads – Fig. 9-3



# Class 1E Buses – Fig. 9-4

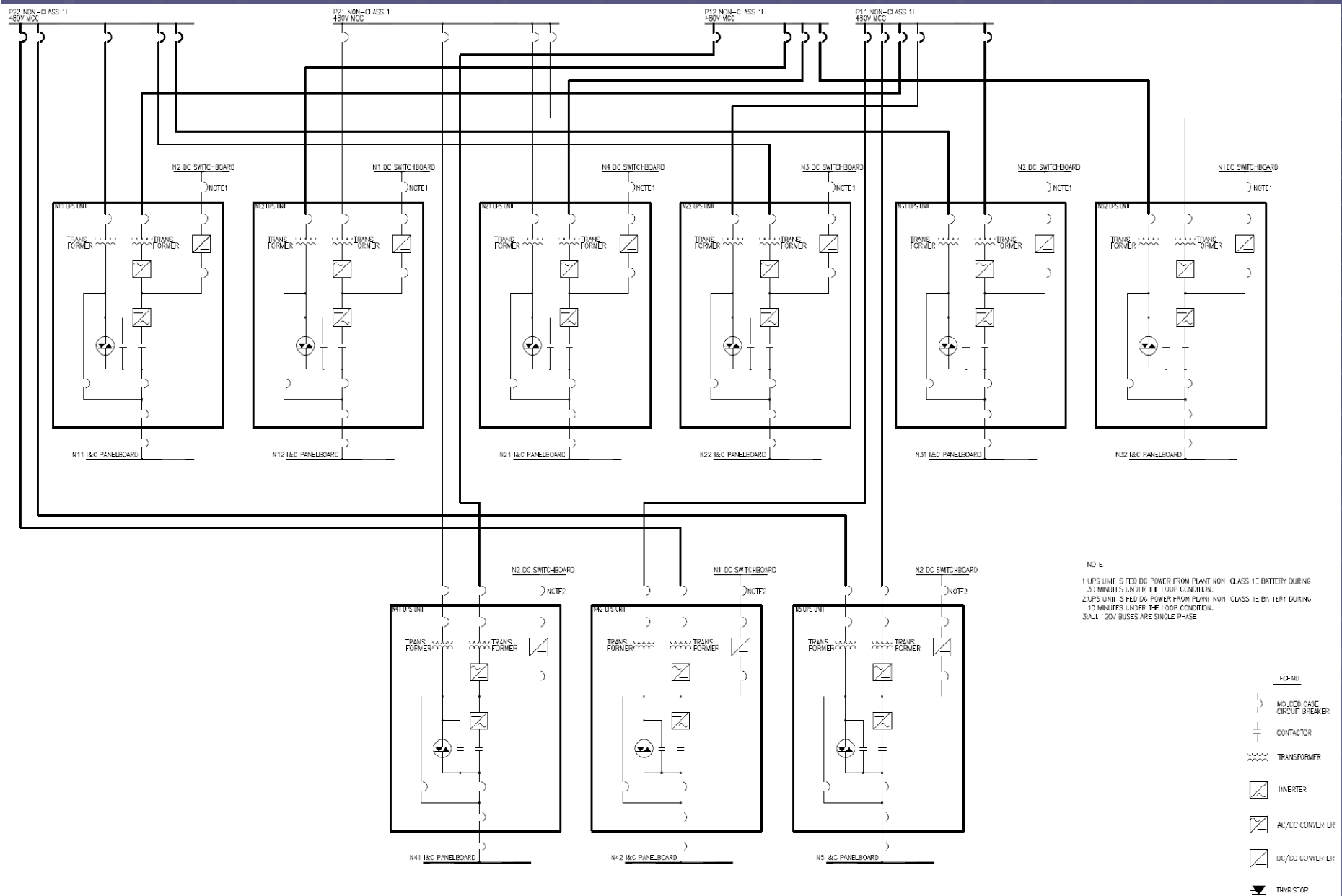




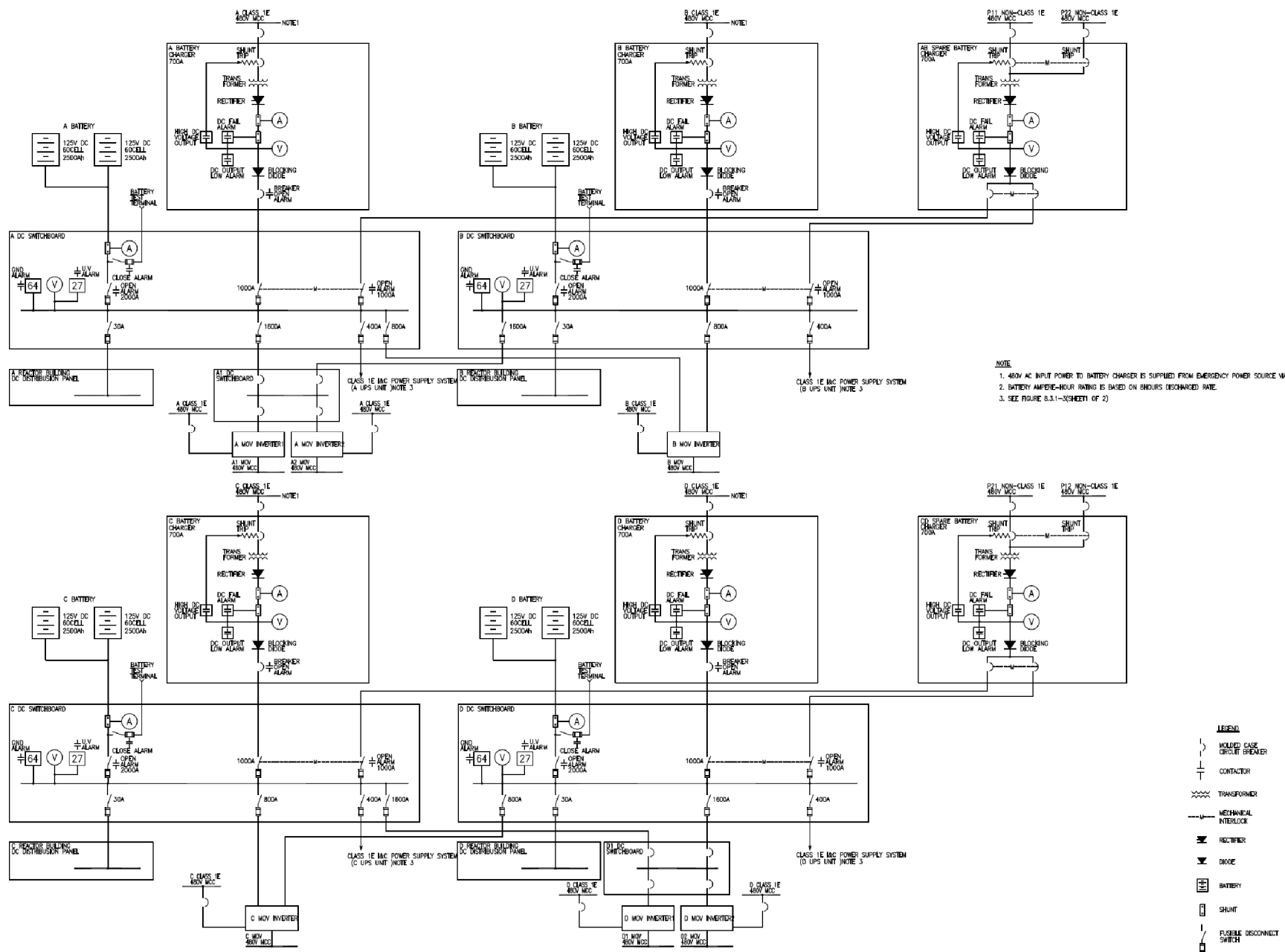
TRAIN A

# Class 1E 120-V AC – Fig. 9-5 (Typical of all trains)

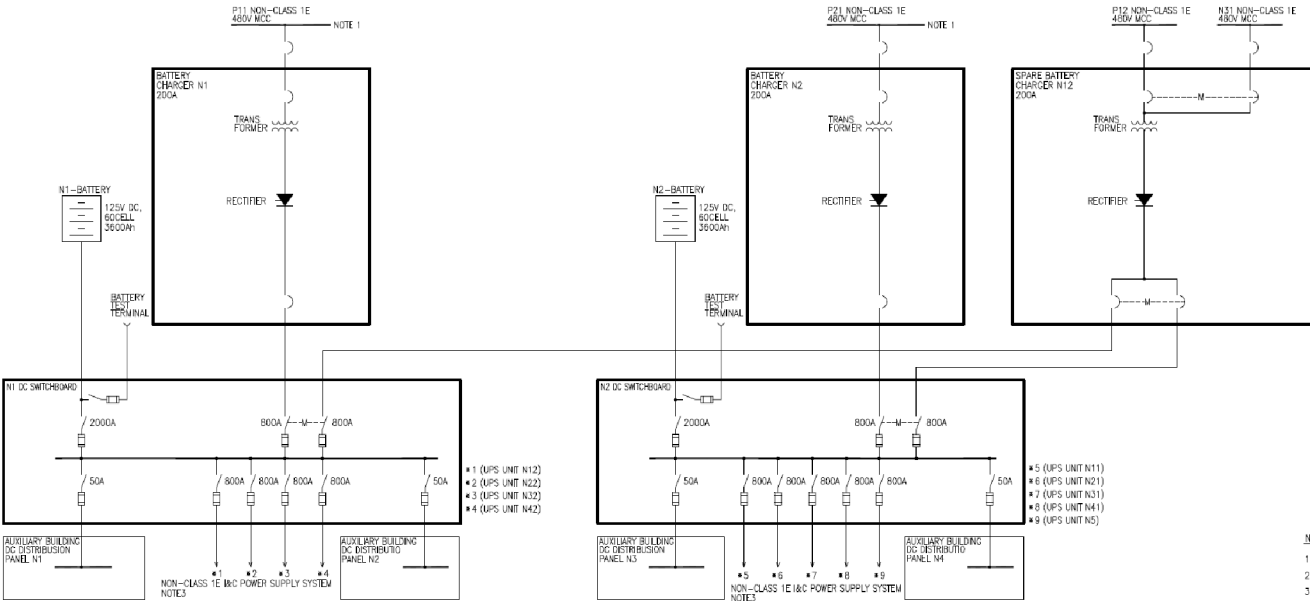
# Non-Class 1E 120-V AC – Fig. 9-6



# Class 1E DC Power – Fig. 9-7



# Non-Class 1E DC Power



**NOTE**  
 1. 480V AC INPUT POWER TO BATTERY CHARGER IS SUPPLIED FROM ALTERNATIVE AC POWER SOURCE.  
 2. BATTERY AMPERE-HOUR RATING IS BASED ON 8-HOURS DISCHARGED RATE.  
 3. SEE FIGURE 8.3.1-3 (SHEET 2 OF 2)

