Iowa Electric Light and Power Company

General Office

Cedar Rapids, Iowa

Lee Liu
Vice President – Engineering

August 30, 1977
IE-77-1624

Mr. George Lear, Chief
Operating Reactors Branch 3
Division of Operating Reactors
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RTS - 95

Dear Mr. Lear:

Transmitted herewith in accordance with the requirements of 10CFR50.59 and 50.90 is an application for amendment of DPR49 to incorporate proposed changes to the Technical Specifications (Appendix A to License) for the Duane Arnold Energy Center (DAEC).

Your letter of June 2, 1977, concerning on-site emergency power systems requested information as it pertains to the Duane Arnold Energy Center. This transmittal includes responses to your June 2, 1977, letter, and proposed technical specifications change RTS-95. The enclosed proposed modifications are scheduled to be installed during the 1978 refueling outage.

This application has been reviewed and approved by the DAEC Operations Committee and the DAEC Safety Committee. This application does not involve a significant hazards consideration.

Three signed and notarized originals and 37 additional copies of this application are transmitted herewith. This application, consisting of the foregoing letter and enclosures hereto, is true and accurate to the best of my knowledge and belief.

IOWA ELECTRIC LIGHT AND POWER COMPANY

BY: ______________________
Lee Liu
Vice President, Engineering

Subscribed and Sworn to before me on this 30th day of August, 1977.

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Notary Public in and for the State of Iowa

Jean R. Smith
NOTARY PUBLIC
STATE OF IOWA
Commission Expires
September 2, 197[illegible]

LL/KAM/bja
Enc.
cc: D. Arnold
R. Lowenstein
R. Clark (NRC)
L. Root
File A-117, A-107
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PROPOSED CHANGE RTS-95 TO DAEC TECHNICAL SPECIFICATIONS

I. Affected Technical Specifications

Appendix A of the Technical Specifications for the DAEC (DPR-49) provides as follows:

Table 3.2-B, "Instrumentation that Initiates or Controls the Core and Containment Cooling Systems," provides, among other trip level settings, the 4 KV emergency power system voltage relay trip level settings.

Specification 4.8.A.1.b provides the surveillance requirement for testing the diesel-generators once per operating cycle. The test includes simulating the condition under which the diesel-generator is required and verifying that it will start and accept the emergency load within the specified time sequence.

The bases for Specification 4.8 (page 3.8-12) includes a description of the test specified in Specification 4.8.A.1.b.

II. Proposed Changes in Technical Specifications

The licensees of DPR-49 propose the following changes in the Technical Specifications set forth in I above:

To Table 3.2-B, delete the trip level setting of 20 percent of rated voltage for the 4 KV emergency bus undervoltage relay. Replace it with a trip level setting of 20 $\leq$ V $\leq$ 28 volts.

On Table 3.2-B, list the additional undervoltage relays that are proposed for the 4 KV emergency buses. Complete the columns of the Table as follows. Minimum number of operable instrument channels per trip system: 1 per 4 KV bus (7). Trip function: 4 KV emergency bus degraded voltage relay. Trip level setting: 108 $\leq$ V $\leq$ 111 volts, 8.0 $\leq$ T.D. $\leq$ 8.5 seconds. Number of instrument channels provided by design: 1 matrix per bus. Remarks: 1. Trips 4 KV emergency bus incoming breakers; 2. Starts diesel; 3. Permits sequencing of vital loads.

To the Notes for Table 3.2-B, add Note 7. The note should read: Four undervoltage relays with integral timers per 4 KV bus. The relay output contacts are connected to form a one-out-of-two-twice coincidence logic matrix. With one relay inoperable, operation may proceed provided that the inoperable relay is placed in the tripped condition within one hour.

To Specification 4.8.A.1.b, expand the surveillance requirement for functionally testing the diesel-generators. Add the following two sentences after the first sentence of paragraph b. The diesel-generator shall be operated for a minimum of 5 minutes. An interruption of the diesel-generator will then be simulated to demonstrate that upon subsequent reconnection, it will again accept the emergency load within the specified time sequence.

To the Bases for Specification 4.8 (page 3.8-13), expand the description of the test specified in Specification 4.8.A.1.b. Add the following two sentences after the fourth sentence of the second paragraph. After operating for a minimum of 5 minutes, an interruption of the diesel-generator will be simulated. After a load shed, the subsequent reconnection will be checked to assure that loading of the diesel-generator is again through the load sequencer in the time required.

III. Justification for Proposed Changes

Existing undervoltage relays automatically perform the required function of switching the essential buses from off-site power to the redundant diesel-generators when the monitored voltage drops below 65.6 percent of nominal voltage. These undervoltage relays are designed to function on a complete loss of off-site power.

With a cover letter dated June 2, 1977, the NRC sent Iowa Electric a copy of their document "Safety Evaluation and Statement of Staff Positions Relative to the Emergency Power Systems for Operating Reactors". Summarizing, this paper stated that whenever the off-site essential bus power sources degraded to a point where the reliability of the emergency power system was reduced, the essential buses should be transferred to the on-site power sources. The proposed changes to the Technical Specifications will bring the latter document into agreement with the three positions of the NRC paper.

The feature for automatically load shedding the essential buses at 20.2 percent of nominal voltage is retained when the loads are energized by the diesel-generators. Because this feature is retained, Position 2 requires that Technical Specifications Table 3.2-B be amended to specify a load shed setpoint having maximum and minimum limits.

Position 1 requires that a second level of voltage protection for the on-site power system be provided. As part of this requirement, Technical Specifications Table 3.2-B should be changed to include the limiting conditions for operation and the trip setpoints with maximum and minimum limits for this second level voltage protection.

Position 3 requires a more extensive functional test of the diesel-generators than is presently being performed at DAEC. Thus, Technical Specification 4.8.A.1.B should be changed to include the additional steps to comply with Position 3. The Bases for Specification 4.8 (page 3.8-12) should also be amended to include the expanded test.

IV. Review Procedures

These proposed changes have been reviewed by the DAEC Operations Committee and Safety Committee which have found that these proposed changes do not involve a significant hazards consideration.

TABLE 3.2-B (Continued)

INSTRUMENTATION THAT INITIATES OR CONTROLS THE CORE AND CONTAINMENT COOLING SYSTEMS

Minimum No. of Operable Instrument Channels Per Trip System (1)	Trip Function	Trip Level Setting	Number of Instrument Channels Provided by Design	Remarks
1	RCIC Leak Detection Time Delay	30 min.	2 Inst.	
2 (5)	HPCI Steam Line Low Pressure	$100 > P > 50$ psig (3)	4 Inst.	
2	HPCI Equipment Room High Ambient Temperature	$\leq$ 175 deg. F	4 Inst.	
2	HPCI Equipment Room High Diff. Temperature	$\leq \Delta$ 50 deg. F (3)	4 Inst.	
1 per 4 KV Bus	4 kV Emergency Bus Undervoltage	$20 \leq V \leq 28$ Volts		1. Trips all loaded breakers 2. Fast transfer permissive 3. Dead bus start of diesel
1 per 4kV Bus	4 kV Emergency Bus Sequential Loading Relay	65% of Rated Voltage		Permits sequential of vital loads
2 per 4kV Bus	Emergency Transformer Undervoltage	65% of Rated Voltage		1. Trips emergency transformer feed to 4KV emergency bus 2. Fast transfer permissive
1 per 4 KV Bus (7)	4 KV Emergency Bus Degraded Voltage	$108 \leq V \leq 111$ Volts $8.0 \leq T.D. \leq 8.5$ Sec.	1 Matrix Per 4 KV Bus	1. Trips 4 KV emergency bus incoming breakers 2. Starts diesel 3. Permits sequencing of vital loads

NOTES FOR TABLE 3.2-B

1. Whenever any CSCS subsystem is required by Subsection 3.5 to be operable, there shall be two operable trip systems. If the first column cannot be met for one of the trip systems, that trip system shall be placed in the tripped condition or the reactor shall be placed in the Cold Shutdown Condition within 24 hours.

2. Close isolation valves in RCIC subsystem.

3. Close isolation valves in HPCI subsystem.

4. Instrument setpoint corresponds to 18.5" above the top of active fuel.

5. HPCI has only one trip system for these sensors.

6. The relay drop-out voltage will be measured once per operating cycle and the data examined for evidence of relay deterioration.

7. Four undervoltage relays with integral timers per 4 KV bus. The relay output contacts are connected to form a one-out-of-two-twice coincident logic matrix. With one relay inoperable, operation may proceed provided that the inoperable relay is placed in the tripped condition within one hour.

LIMITING CONDITIONS FOR OPERATION	SURVEILLANCE REQUIREMENTS
chargers for the 125 volt station batteries, and one of the two 250 volt battery chargers shall be operable.	b. Once per operating cycle the condition under which the diesel-generator is required will be simulated and a test conducted to demonstrate that it will start and accept the emergency load within the specified time sequence. The diesel-generator shall be operated for a minimum of 5 minutes. An interruption of the diesel-generator will then be simulated to demonstrate that upon subsequent reconnection, it will again accept the emergency load within the specified time sequence. The results shall be logged.
4. The emergency 4160 volt buses 1A3 and 1A4, and 480 volt buses 1B3, 1B4, 1B9 and 1B20 shall be energized and operable.	c. The quantity of diesel fuel available shall be logged monthly and after each use of the diesels.
	d. Once a month a sample of diesel fuel shall be checked for viscosity, water and sediment. The values for viscosity, water and sediment shall be within the acceptable limits specified in Table 1 of ASTM D975-68 and logged.
	e. Each diesel-generator shall be given an annual inspection in accordance with instructions based on the manufacturer's recommendations.
	f. A sample test and record shall be made of each oil delivery before it is placed in the storage tank.
	2. Unit Batteries
	a. Every week the specific gravity, the voltage and temperature of the pilot cell and overall battery voltage shall be measured and logged.

At the end of the monthly loads test of the diesel-generator, the fuel oil transfer pump will be operated to refill the day tank and to check the operation of this pump. The day tank level indicator and alarm switches and fuel oil transfer pump control switches will be checked at this time.

The test of the diesels once each operating cycle will be more comprehensive in that it will functionally test the system; i.e., it will check starting and closure of breakers and sequencing of loads. The units will be started by simulation of a loss-of-coolant accident. In addition, a loss of normal power condition will be imposed to simulate a loss of off-site power. The timing sequence will be checked to assure proper loading in the time required. After operating for a minimum of 5 minutes, an interruption of the diesel-generator will be simulated. After a load shed, the subsequent reconnection will be checked to assure that loading of the diesel-generator is again through the load sequencer in the time required. Periodic tests check the capability of the units to start in the required time and to deliver the expected emergency load requirements. Periodic testing of the various components plus a functional test each operating cycle are sufficient to maintain adequate reliability.

Logging the diesel fuel supply after each operation (at least monthly) assures that the minimum fuel supply requirements will be

POSITION 1: <u>Second Level of Under-or-Over Voltage Protection with a Time Delay</u>

RESPONSE: Iowa Electric proposes to provide a second level of voltage protection as required by Position 1.

Safety related motors are capable of accelerating their loads at 67 percent of nominal bus voltage (70 percent of rated motor voltage). Low voltage motor starters are guaranteed to operate at 86 percent of nominal bus voltage (90 percent of rated motor starter voltage; see NEMA ICS2-110.41). All other control power is derived from the station batteries and is not affected by transmission system voltage degradation.

On the basis of the above, the minimum permissible voltage for the safety related loads to perform their safety functions is 86 percent of nominal bus voltage at the 480 volt level. We will comply with Position 1 by transferring the essential buses to onsite power whenever the minimum voltage at any essential motor control center drops to 86 percent of nominal or less, and stays at that level or below for 8.5 seconds.

This 86 percent level is extremely conservative. Tests by the motor control center manufacturer indicate that the motor starters are capable of operating at control voltages down to approximately 67 percent of nominal control voltage. Tests performed by Iowa Electric on sample motor starters verify the manufacturer's test results. Assuming a motor starter control power transformer regulation of 5 percent, the tests indicate that the motor starters are operable at 72 percent of nominal motor control center bus voltage.

According to the voltage profile tables sent with our response of October 19, 1976 to your generic questions of August 11, 1976, essential motor control centers 1B36 and 1B46 consistently maintain the lowest voltage levels and may be considered the worst case. The voltage calculations made to prepare our previous response show that 86 percent of nominal voltage at MCC's 1B36 and 1B46 corresponds to a voltage level of 92.2 percent at 4.16 kV essential buses 1A3 and 1A4. We propose to establish the second level of undervoltage protection at 92.2 percent of nominal voltage on buses 1A3 and 1A4 by installing four additional single phase undervoltage relays to each of the essential 4.16 kV buses. Refer to Figure 1.

Each of the undervoltage relays will include an integral timer set to actuate 8.5 seconds after drop out of the undervoltage relay. This proposed time delay will not be added to the time delay stated in the FSAR for transfer to onsite emergency power upon a loss of offsite power (LOOP) or upon a LOOP coincident with a loss of coolant accident (LOCA). The time delay will preclude short duration disturbances from reducing the availability of the offsite power sources. A degraded voltage condition of 8.5 seconds duration will not result in the failure of any safety related equipment.

The output contacts of the four undervoltage relays on each bus will be connected in series parallel to form a one-out-of-two-twice coincidence logic matrix. Refer to Figure 2. The one-out-of-two-twice coincidence logic is already used in the Reactor Protection System. The coincidence logic precludes a single blown Potential Transformer (P.T.) fuse or malfunctioning relay from either preventing a safety action when it is required or causing a spurious trip of an offsite power source. The coincidence logic permits relay testing and calibration during power operation. The coincidence logic is fail safe.

Existing undervoltage relays meant to detect loss of outside power start the diesel generators at voltages below 65 percent and shed the loads on the essential buses at voltages below 20 percent.

The proposed undervoltage relays will work in parallel with existing relays to monitor the essential bus voltages. If the essential 4160 V buses are being fed by offsite power, degraded bus voltages below 92.2 percent of nominal for 8.5 seconds will actuate the proposed coincidence logic. This will cause the bus incoming breakers to trip and the diesel generators to start. Due to the consequent total decay of the bus voltage, existing bus undervoltage relays (set at 20 percent of nominal bus voltage) will initiate a loss of offsite power (LOOP) load shed and prepare the safety related loads for energization by the diesel generators. When the diesel generator output voltage reaches 80.8 percent of nominal 4160 V bus voltage, existing relays will close the diesel generator breakers. Power available signals will then be sent to the sequencer logic.

The proposed time delay will not delay the existing logic from performing the safety functions described in the FSAR. If a loss of offsite power occurs during the timing period of the proposed logic, the proposed logic will be locked out and the existing logic will start the diesel generators and trip the incoming feeders. If a loss of offsite power occurs after the timing period of the proposed logic, the bus incoming breakers will already have been tripped and the diesel generators will already have been started. If a LOCA occurs after the timing period of the proposed logic or if a degraded voltage conditions occurs after a LOCA, the existing logic will initiate a LOCA load shed and sequence the emergency loads on the diesel generators.

The proposed logic is designed to meet IEEE Std. 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations." The logic for each bus is completely independent and separated from the logic for the other bus. Coincidence logic is used so that no single blown P.T. fuse or malfunctioning relay will prevent a safety action when it is required. All of the equipment is seismically qualified. The logic is capable of being tested and calibrated during power operation.

POSITION 2: Interaction of Onsite Power Sources with Load Shed Features

RESPONSE: Existing undervoltage relays 127-ST11, 127-ST12, 127-SB11, and 127-SB12 monitor the two offsite power sources to each of the two essential 4.16 kV buses. They trip any given essential bus incoming breaker whenever its corresponding supply voltage drops below 65 percent of nominal. If both offsite power sources of an essential bus drop below 65 percent, the relays will start the corresponding diesel generator and signal a loss of offsite power (LOOP) to the corresponding safety actuation system channel.

Existing undervoltage relays 127-31 and 127-41 monitor the voltage of the two essential 4.16 kV buses. A voltage below 65 percent on either essential bus will cause the relay to start the corresponding diesel generator and cease sending a power available signal to the corresponding safety actuation channel. The proposed degraded voltage relay matrices 127-32 and 127-42 will monitor the 4.16 kV essential bus voltages and when a voltage below 92.2 percent of nominal persists for 8.5 seconds on either bus, the respective bus incoming breakers will be tripped, the corresponding diesel generator will be started, and a loss of power signal will be sent to the appropriate safety actuation channel.

If a loss of coolant accident (LOCA) signal occurs coincident with either a timed degraded voltage signal from the proposed relay matrices or a signal from the existing undervoltage relays monitoring the two offsite power sources, a LOCA load shed will occur. This load shedding feature will not cause an additional load shed once the onsite sources are supplying power to the essential buses.

Whenever there is a voltage of 20.2 percent or less of nominal on the buses, a loss of offsite power (LOOP) load shed will occur. During the sequencing of loads on the diesel generators, the bus voltages will not drop below 72 percent of nominal. Thus a load shed will not recur due to motor starting inrush currents. But if a diesel generator breaker trips or a diesel generator voltage drops below 20.2 percent for any reasons, a load shed of the respective bus will recur. Thus the diesel generator breaker can close again and the sequencing of loads on the diesel generator can begin again when the diesel generator voltage returns.

POSITION 3: <u>Onsite Power Source Testing</u>

RESPONSE: The DAEC Technical Specifications provide for testing the functional operability and independence of the onsite power sources once each operating cycle. The test consists of simulating the loss of offsite power (LOOP) in conjunction with a loss of coolant accident (LOCA). Proper operation is determined by verifying that the following actions occur in the listed sequence:

1. The bus incoming breakers from the offsite power sources trip.

2. The diesel generators start and accelerate within the required time.

3. The appropriate loads are shed from the safety related buses.

4. The diesel generator breakers close, energizing the permanently connected loads.

5. The remaining emergency loads are connected to the buses by the sequencing logic within the required time.

After the diesel generators have operated for a minimum of five minutes while loaded with the emergency loads, the diesel generator breakers will be tripped. Proper operation of the system is determined by verifying that the following actions occur in the listed sequence:

6. The appropriate loads are again shed from the safety related buses.

7. The diesel generator breakers close again, reenergizing the permanently connected loads.

8. The remaining emergency loads are again connected to the buses by the sequencing logic within the required time.

The above expanded test will demonstrate the capability of the onsite power sources to perform their required function. The tests will also identify any undesirable interactions between the offsite and the onsite emergency power systems.

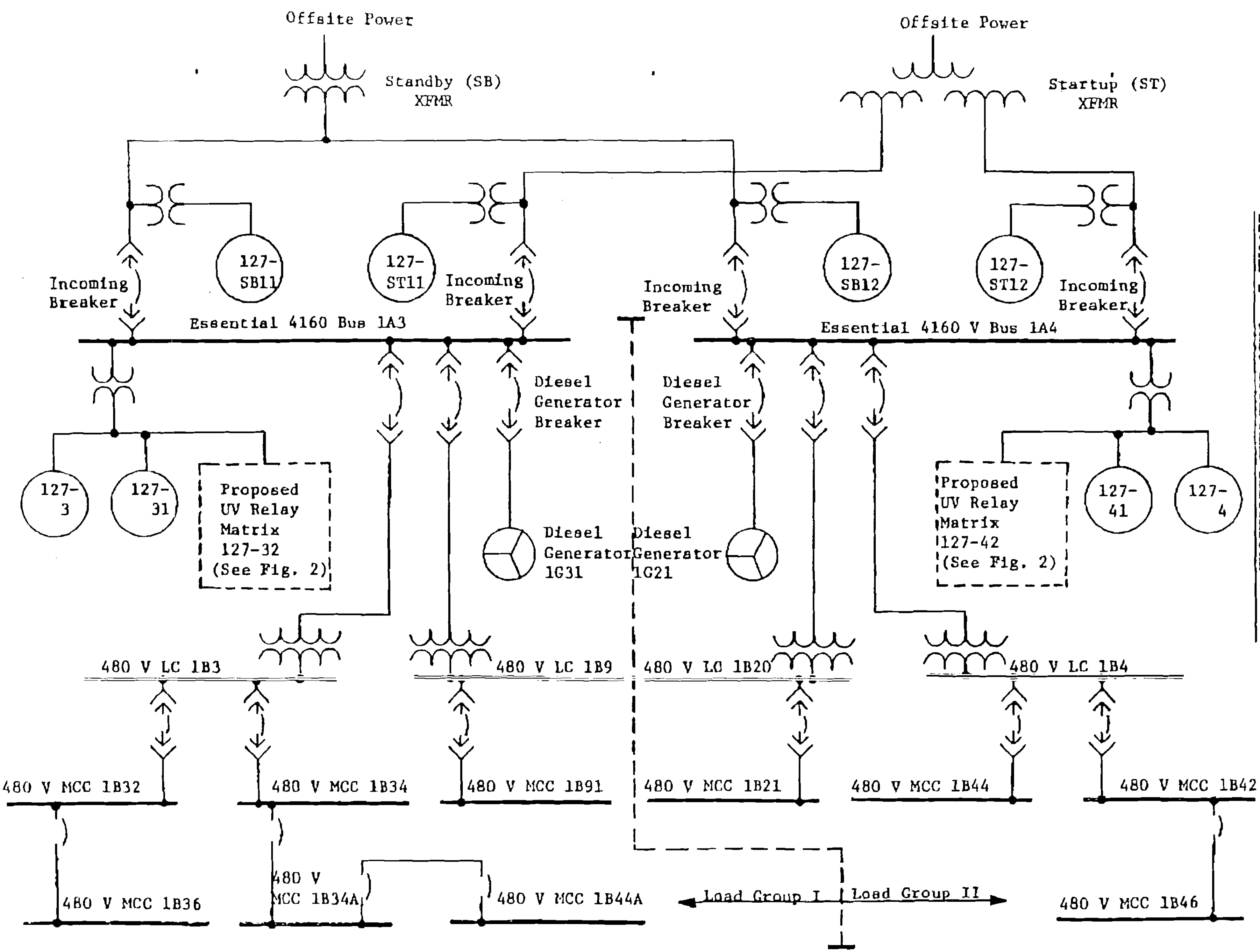
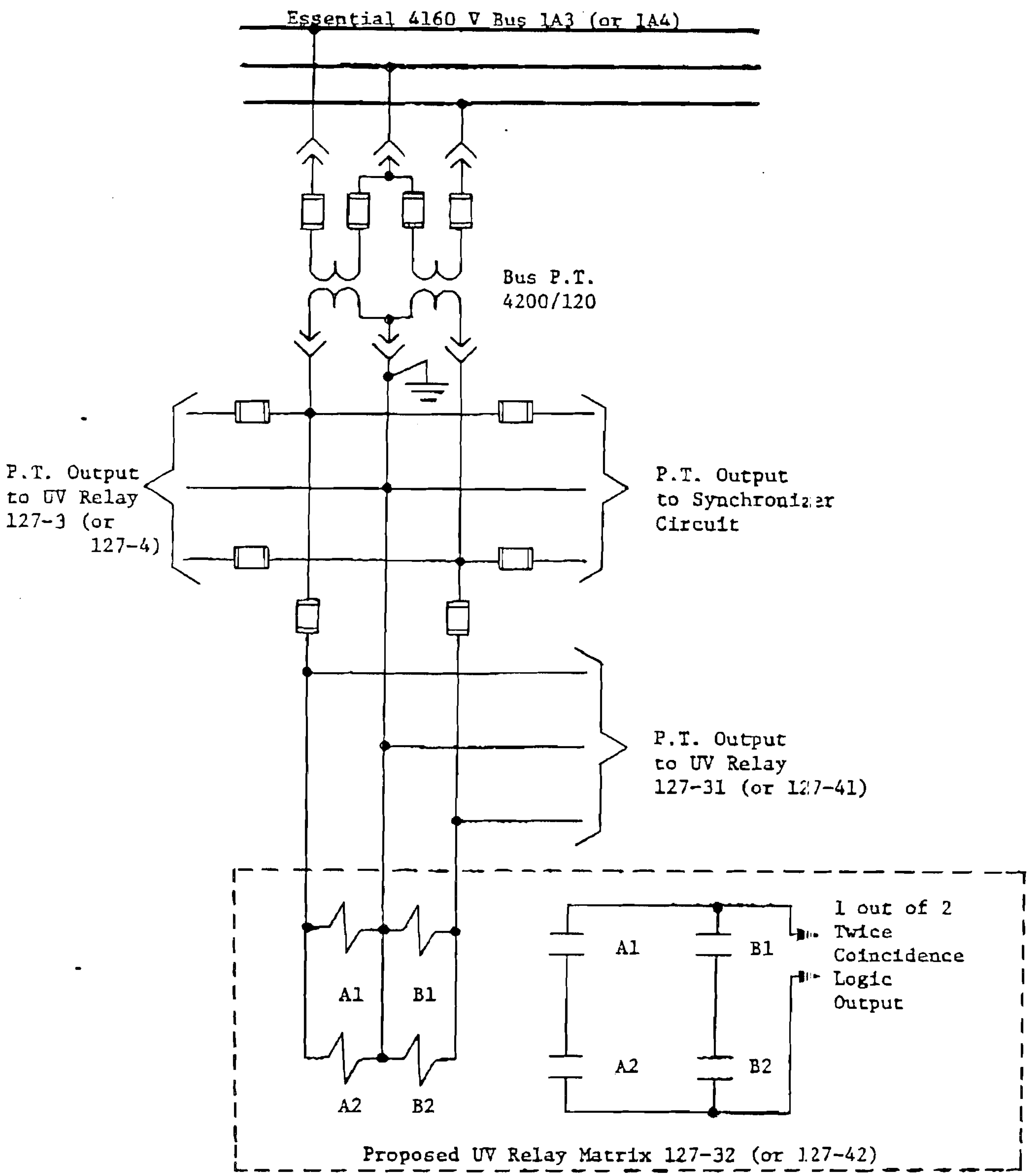


FIGURE 1 - DAEC ESSENTIAL ELECTRICAL SYSTEM

FIGURE 2 - UNDERVOLTAGE RELAY COINCIDENCE LOGIC



Notes:

1. The proposed relays are instantaneous undervoltage relays with integral timers. The relay output contacts open if the monitored voltage drops below the voltage setpoint for the length of the time delay. The logic is fail safe.

2. The bus and relay numbers listed first are for Load Group I. The numbers in parentheses are for Load Group II.