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DESCRIPTION

LTR. RE. OUR 8-11-76 LTR.....TRANS THE FOLLOWING:

PLANT NAME: DUANE ARNOLD

ENCLOSURE

RESPONSE TO REQUEST FOR AN EVALUATION OF THE DUANE ARNOLD ENERGY CENTER WITH REGARD TO THE DEGRADED VOLTAGE CONDITION.......

(1 SIGNED CY. RECEIVED)
(27 PAGES)

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ACKNOWLEDGED

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NRC FORM 195 (2-76)

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IOWA ELECTRIC LIGHT AND POWER COMPANY

General Office
CEDAR RAPIDS, IOWA

LEE LIU
VICE PRESIDENT - ENGINEERING

October 19, 1976
IE-76-1590

50-331

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

Dear Mr. Lear:

This letter is in response to your letter of August 11, 1976 requesting an evaluation of the Duane Arnold Energy Center (DAEC) with regard to the degraded voltage condition which occurred at Millstone Unit No. 2 in July, 1976.

Enclosed herewith are the results of our investigation per your Request for Information. The responses are numbered to correspond to the questions included in Enclosure 2 to your August 11 letter.

We are continuing our evaluations. A description of any proposed actions or modifications will be provided upon completion of these evaluations.

Very truly yours,

Lee Liu
Vice President, Engineering

LL/KAM/ms
Enc.
cc: K. Meyer
D. Arnold
L. Root
R. Lowenstein
J. Shea (NRC)
File A-107

10659

1. a) QUESTION

Describe the plant conditions under which the plant auxiliary systems (safety related and non-safety related) will be supplied by offsite power. Include an estimate of the fraction of normal plant operating time in which this is the case.

RESPONSE

The safety related loads are supplied by offsite power at all times except during testing of the diesel generators. Normally the safety related loads are supplied from the 161 kV transmission system through the startup transformer. During maintenance of the startup transformer, the safety related loads are supplied from the 161 kV or the 345 kV transmission system through the standby transformer. The safety related loads are supplied by offsite power for all but an estimated one day per year during diesel generator testing. Refer to the attached Figure 1 and Section 8 of the FSAR for a description of the plant electrical power systems.

The non-safety loads are normally supplied by the station generator through the auxiliary transformer. During startup, shutdown or during maintenance of the auxiliary transformer, the non-safety related loads are supplied by offsite power through the startup transformer. The non-safety related loads are supplied by offsite power for an estimated seven weeks per year; four to six weeks for plant refueling and an estimated one week for startups, shutdowns and auxiliary transformer maintenance.

1. b) QUESTION

The voltage used to describe the grid distribution system is usually a "nominal" value. Define the normal operating range of your grid system voltage and the corresponding voltage values at the safety related buses.

RESPONSE

Transmission system voltage charts show that the 161 kV and the 345 kV transmission system normal operating ranges are from 100 percent to 105 percent of nominal voltage. Usually both transmission systems operate from 103 percent to 104 percent of nominal voltage.

Voltage studies were performed to determine plant bus voltage values for the range of transmission system voltage. These studies were verified by comparing calculated results to actual plant measured values. Table 1 provides the voltage values at the safety related buses corresponding to the maximum and minimum normal operating transmission system voltages with the plant at the full load condition. This Table includes all three plant auxiliary power system configurations that could occur during full load operation.

1. c) QUESTION

The transformers utilized in power systems for providing the required voltage at the various system distribution levels are normally provided with taps to allow voltage adjustment. Provide the results of an analysis of your design to determine if the voltage profiles at the safety-related buses are satisfactory for the full load and no load conditions on the system and the range of grid voltage.

RESPONSE

Table 1 provides the voltage profiles at the safety related buses for a full load condition over the range of normal operating transmission system voltage. Table 2 provides the voltage profiles at the safety related buses for a no load condition over the range of normal operating transmission system voltage. Table 2 includes the two plant auxiliary power system configurations that could occur during a no load condition.

The voltage studies for both the full load and no load conditions over the range of normal operating transmission system voltage indicate that adequate voltage exists at all of the safety related buses.

1. d) QUESTION

Assuming the facility auxiliary loads are being carried by the station generator, provide the voltage profiles at the safety buses for grid voltage at the normal maximum value, the normal minimum value, and the degraded conditions (high or low voltage, current, etc.) which would require generator trip.

RESPONSE

The safety related loads are supplied by offsite power at all times except during testing of the diesel generators. The non-safety related loads are normally supplied by the station generator through the auxiliary transformer. The voltage profiles at the safety related buses for the maximum and minimum normal operating transmission system voltages at full load are contained in Table 1.

The station generator design voltage range at rated power, power factor and frequency is from 95 percent to 105 percent of the rated nameplate voltage. The transmission system design voltage range is from 95 percent to 105 percent of the nominal voltage. Operating above the maximum design transmission system voltage could cause damage to equipment on the transmission system.

Operating below the minimum design transmission system voltage would necessitate a generator trip for generator protection. Thus the maximum and minimum design transmission system voltages are the limits for plant operation. Table 3 provides the voltage profiles at the safety related buses for the maximum and minimum design transmission system voltages. This Table includes all three plant auxiliary power system configurations that could occur during full load operation.

1. e) QUESTION

Identify the sensor location and provide the trip setpoint for your facility's Loss of Offsite Power (undervoltage trip) instrumentation. Include the basis for your trip setpoint selection.

RESPONSE

Separate sensors in safety related 4160 V switchgears 1A3 and 1A4 monitor the startup and the standby transformer voltages to detect the Loss of Offsite Power. Sensors 127-ST11 and 127-ST12 monitor the startup transformer voltage, and sensors 127-SB1, 127-SB11, 127-SB2 and 127-SB12 monitor the standby transformer voltage. Upon a startup transformer voltage of 65 percent or less of nominal, the safety related loads are transferred to the standby transformer. Upon both a startup transformer undervoltage and a standby transformer voltage of 65 percent or less of nominal, the diesel generators are started. Upon a coincident Loss of Coolant Accident, the bus loads are shed.

Additional sensors monitor the safety related 4160 V bus 1A3 and 1A4 voltages to detect the Loss of Offsite Power. Sensors 127-3 and 127-31 monitor bus 1A3, and sensors 127-4 and 127-41 monitor bus 1A4. Upon a bus voltage of 65 percent or less of nominal, the respective diesel generator is started. Upon a bus voltage of 20 percent or less of nominal, the respective bus loads are shed.

UNDERVOLTAGE SENSOR SETPOINTS

Bus 1A3		Bus 1A4	
Sensor	Setpoint (% of nom.)	Sensor	Setpoint (% of nom.)
127-ST11	65%	127-ST12	65%
127-SB1	65%	127-SB2	65%
127-SB11	65%	127-SB12	65%
127-3	20%	127-4	20%
127-31	65%	127-41	65%

The setpoints of the undervoltage sensors are chosen such that potential transients on the transmission system and bus voltage dips due to the starting of large motors will not cause a spurious transfer from the offsite power source to the onsite power source.

1. f) QUESTION

Assuming operation on offsite power and degradation of the grid system voltage, provide the voltage values at the safety related buses corresponding to the maximum value of grid voltage and the degraded grid voltage corresponding to the undervoltage trip setpoint.

RESPONSE

The safety related loads are supplied by offsite power at all times except during testing of the diesel generators. The non-safety related loads are normally supplied by the station generator through the auxiliary transformer. During startup, shutdown or during maintenance of the auxiliary transformer, the non-safety related loads are supplied by offsite power. Tables 1 and 2 include the voltage values at the safety related buses corresponding to the maximum normal operating transmission system voltage for the full load and no load conditions.

The trip setpoint of the undervoltage sensors is 65% of the nominal safety related 4160 V bus voltage. A sustained transmission system voltage corresponding to a safety related bus voltage of 2704 volts is not expected to occur, except during transients. The transmission system voltage should either remain within the design voltage range, or rapidly drop to zero. Transmission system voltage charts indicate that this has been true in the past. Thus the voltage values at the safety related buses for the transmission system voltage corresponding to the undervoltage trip setpoint are not provided.

1. g) QUESTION

Utilizing the safety related bus voltage values identified in (f), evaluate the capability of all safety related loads, including related control circuitry and instrumentation, to perform their safety functions. Include a definition of the voltage range over which the safety related components, and non-safety components, can operate continuously in the performance of their design function.

RESPONSE

Tables 1 and 2 provide the voltage values at the safety related buses corresponding to the maximum and minimum normal operating transmission system voltages.

The safety related loads, including related control circuitry and instrumentation, are capable of performing their safety functions for the full range of voltage at the safety related buses corresponding to the full range of normal operating transmission system voltage. Safety related motors are capable of accelerating their loads at 70 percent of rated motor nameplate voltage (67 percent of nominal bus voltage). Motor starters are guaranteed to operate over the range from 85 percent to 110 percent of the 115 volt base (81 to 105 percent of nominal control circuit voltage). Control circuit fuses are sized to protect against short circuits only, and will not fail at the maximum motor starter pull-in current that occurs at reduced voltage. All other safety related components are designed to operate over a voltage range greater than the full range of voltage at the safety related buses for the full range of normal operating transmission system voltage. The safety related loads are not capable of performing their safety functions at the safety related bus voltage corresponding to the undervoltage trip setpoint.

1. h) QUESTION

Describe the bus voltage monitoring and abnormal voltage alarms available in the control room.

RESPONSE

The following voltage monitors and alarms are available in the control room. Indicating voltmeters provide the generator voltage and the 4160 V bus voltages. Annunciators alarm upon a loss of 4160 V bus voltage, and upon a 120 V Instrument AC bus undervoltage. The 120 V Instrument AC buses are supplied through transformers from safety related 480 V motor control center buses. Since they are the end points of the safety related auxiliary power system, they are a good indication of a degraded voltage condition. The plant computer alarms upon a generator over or undervoltage, a 4160 V bus undervoltage, or a startup or standby transformer undervoltage.

CONTROL ROOM INDICATING VOLTMETERS

Description	Device
Generator Voltage	V-GEN
4160 V Bus 1A1 Voltage	V-A1
4160 V Bus 1A2 Voltage	V-A2
4160 V Bus 1A3 Voltage	V-A3
4160 V Bus 1A4 Voltage	V-A4

CONTROL ROOM ANNUNCIATORS

Description	Device	Setpoint (% of Nom.)
4160 V Bus 1A1 Loss of Voltage	127-1X	20%
4160 V Bus 1A2 Loss of Voltage	127-2X	20%
4160 V Bus 1A3 Loss of Voltage	127-3X	20%
4160 V Bus 1A4 Loss of Voltage	127-4X	20%
120 V Instrument AC Bus 1Y11 Undervoltage	27-Y11	87.5%
120 V Instrument AC Bus 1Y21 Undervoltage	27-Y21	87.5%

COMPUTER ALARMS

Description	Device	Setpoint (% of Nom.)
Generator Overvoltage	VT-G	105%
Generator Undervoltage	VT-G	95%
4160 V Bus 1A1 Undervoltage	VT-A1	91%
4160 V Bus 1A2 Undervoltage	VT-A2	91%
4160 V Bus 1A3 Undervoltage	VT-A3	91%
4160 V Bus 1A4 Undervoltage	VT-A4	91%
Startup Transformer Undervoltage	127-ST11	65%
Standby Transformer Undervoltage	127-SB11	65%
4160 V Bus 1A3 Undervoltage	127-31X	65%
4160 V Bus 1A4 Undervoltage	127-41X	65%

In addition to the control room voltage monitors and alarms, indicating voltmeters are available in all of the 4160 V switchgears and in all of the 480 V load center switchgears. Recording voltmeters are provided in 4160 V switchgears 1A1 and 1A3, and in the switchyard on the 161 kV and 345 kV transmission lines.

2. QUESTION

The functional safety requirement of the undervoltage trip is to detect the loss of offsite (preferred) power system voltage and initiate the necessary actions required to transfer safety related buses to the onsite power system. Describe the load shedding feature of your design (required prior to transferring to the onsite (diesel generator) systems) and the capability of the onsite systems to perform their function if the load shedding feature is maintained after the diesel generators are connected to their respective safety buses. Describe the bases (if any) for retention or reinstatement of the load shedding function after the diesel generators are connected to their respective buses.

RESPONSE

Separate sensors in safety related 4160 V switchgears 1A3 and 1A4 monitor the startup and the standby transformer voltages. Upon a voltage of 65 percent or less of nominal on both transformers, the diesel generators are started. If this undervoltage situation occurs coincident with a Loss of Coolant Accident, the bus loads are shed. This load shedding feature is not maintained.

Additional sensors in the switchgears monitor the safety related 4160 V bus 1A3 and 1A4 voltages. Upon a bus voltage of 65 percent or less of nominal, the respective diesel generator is started. Upon a bus voltage of 20 percent or less of nominal, the respective bus loads are shed. This load shedding feature is maintained. During the sequencing of loads on the diesel generator, the bus voltage will not drop below 72 percent of nominal. Thus a load shed will not reoccur. However, in the unlikely event that the diesel generator voltage should drop to 20 percent or less of nominal for any reason, a load shed will occur. The sequencing of loads on the diesel generator can begin again as soon as the diesel generator voltage returns.

3. QUESTION

Define the facility operating limits (real and reactive power, voltage, frequency and other) established by the grid stability analyses cited in the FSAR. Describe the operating procedures or other provisions presently in effect for assuring that your facility is being operated within these limits.

RESPONSE

The facility generation limit is 589 MW gross at a power factor of 0.9. This limit is an equipment operational limit that is monitored by the plant operators.

The frequency limits are established from the guidelines of the Mid-Continent Area Power Pool. The generator is rated for continuous operation at 60 Hertz. Protective relays alarm at 59.5 Hertz and trip the generator at 58.5 Hertz and 57.0 Hertz after a 3.0 minute and a 0.1 second delay respectively. The transmission system has various automatic load shedding trips beginning at 59.3 Hertz. The basis for trip selection is threefold; to reduce load, to isolate transmission systems, and to prevent plant trips.

The station generator design voltage range at rated power, power factor and frequency is from 95 percent to 105 percent of the rated nameplate voltage. The transmission system design voltage range is from 95 percent to 105 percent of the nominal voltage. The transmission system voltage is normally maintained between 103 percent and 104 percent by generator voltage regulators, VAR generation and switching of other reactive equipment. The procedure for operating the systems is based on recommendations and guidelines developed by the Iowa Electric Planning Department in conjunction with the Mid-Continent Area Power Pool.

Transmission system voltage charts for the entire period of DAEC operation show that the operating objectives are being met. The 161 KV and 345 KV transmission system voltages have remained within their normal operating ranges for more than 99.7 percent of the time. Neither transmission system has operated at or below the minimum design voltage. The lowest voltage ever reached (except during switching transients) was 96.5% of nominal voltage for less than one hour.

4. QUESTION

Provide a description of any proposed actions or modifications to your facility based on the results of the analyses performed in response to items 1-3 above.

RESPONSE

Table 3 provides the voltage profiles at the safety related buses for the maximum and minimum design transmission system voltages. For two of the three plant auxiliary power system configurations with the transmission system at minimum design voltage, the voltages at the safety related buses are close to the minimum required by the safety related loads to perform their safety functions. An investigation will be performed to determine modifications and/or procedures to improve these marginal situations.

The maximum and minimum design transmission system voltages are the limits for plant operation. The transmission system voltage should either remain within this design voltage range, or rapidly drop to zero. Transmission system voltage charts indicate that this has been true in the past. However, an operating procedure will be prepared for the unlikely event of abnormal transmission system voltage.

TABLE 1

SAFETY RELATED BUS VOLTAGES

FOR MAXIMUM AND MINIMUM NORMAL OPERATING TRANSMISSION SYSTEM VOLTAGES

Case Description	Full Load Condition, Safety Related Loads on Startup Xfmr., Non-Safety Related on Aux. Xfmr.		Full Load Condition, Safety Related Loads on Standby Xfmr., Non-Safety Related on Aux. Xfmr.	
161 KV Grid Voltage	105.0%	100.0%	104.4%	102.2%
345 KV Grid Voltage	104.9%	99.0%	105.0%	100.0%
Generator Megawatts	500	500	500	500
Startup Xfmr. Megawatts	4.5	4.5	4.5	4.5
Standby Xfmr. Megawatts	0	0	0	0
Aux. Xfmr. Megawatts	25.7	25.7	25.7	25.7
4160 V Bus 1A3 Voltage	107.2%	102.0%	101.6%	97.8%
4160 V Bus 1A4 Voltage	107.2%	102.0%	101.6%	97.8%
480 V LC 1B3 Voltage	101.8%	96.6%	96.1%	92.3%
480 V LC 1B4 Voltage	101.8%	96.5%	96.1%	92.3%
480 V LC 1B9 Voltage	103.2%	98.0%	97.6%	93.9%
480 V LC 1B20 Voltage	103.1%	98.0%	97.6%	93.9%
480 V MCC 1B21 Voltage	103%	98%	98%	94%
480 V MCC 1B32 Voltage	102%	97%	96%	92%
480 V MCC 1B34 Voltage	101%	96%	95%	92%
480 V MCC 1B34A Voltage	101%	96%	95%	92%
480 V MCC 1B36 Voltage	101%	95%	95%	91%
480 V MCC 1B42 Voltage	101%	96%	96%	92%
480 V MCC 1B44 Voltage	101%	96%	96%	92%
480 V MCC 1B44A Voltage	101%	96%	95%	92%
480 V MCC 1B46 Voltage	100%	95%	95%	91%
480 V MCC 1B91 Voltage	103%	98%	98%	94%

NOTES: All voltages are in percent of nominal voltage.
All bus voltages are calculated values.

TABLE 1 (Continued)

SAFETY RELATED BUS VOLTAGES
FOR MAXIMUM AND MINIMUM NORMAL OPERATING TRANSMISSION SYSTEM VOLTAGES

Case Description	Full Load Condition, Safety Related and Non-Safety Related Loads on Startup Xfmr.	
161 KV Grid Voltage	105.0%	100.0%
345 KV Grid Voltage	104.9%	99.9%
Generator Megawatts	500	500
Startup Xfmr. Megawatts	30.2	30.2
Standby Xfmr. Megawatts	0	0
Aux. Xfmr. Megawatts	0	0
4160 V Bus 1A3 Voltage	102.9%	97.3%
4160 V Bus 1A4 Voltage	102.8%	97.3%
480 V LC 1B3 Voltage	97.4%	91.8%
480 V LC 1B4 Voltage	97.3%	91.7%
480 V LC 1B9 Voltage	98.9%	93.4%
480 V LC 1B20 Voltage	98.8%	93.3%
480 V MCC 1B21 Voltage	99%	93%
480 V MCC 1B32 Voltage	97%	92%
480 V MCC 1B34 Voltage	97%	91%
480 V MCC 1B34A Voltage	97%	91%
480 V MCC 1B36 Voltage	96%	91%
480 V MCC 1B42 Voltage	97%	92%
480 V MCC 1B44 Voltage	97%	92%
480 V MCC 1B44A Voltage	97%	91%
480 V MCC 1B46 Voltage	96%	90%
480 V MCC 1B91 Voltage	99%	93%

NOTES: All voltages are in percent of nominal voltage.
All bus voltages are calculated values.

TABLE 2

SAFETY RELATED BUS VOLTAGES

FOR MAXIMUM AND MINIMUM NORMAL OPERATING TRANSMISSION SYSTEM VOLTAGES

Case Description	No Load Condition, Safety Related and Non-Safety Related Loads on Startup Xfmr.		No Load Condition, Safety Related Loads on Standby Xfmr., Non-Safety Related on Startup Xfmr.	
161 KV Grid Voltage	105.0%	100.0%	103.6%	98.5%
345 KV Grid Voltage	104.9%	99.9%	105.0%	100.0%
Generator Megawatts	0	0	0	0
Startup Xfmr. Megawatts	17.6	17.6	13.3	13.3
Standby Xfmr. Megawatts	0	0	4.2	4.2
Aux. Xfmr. Megawatts	0	0	0	0
4160 V Bus 1A3 Voltage	103.7%	98.3%	101.6%	96.4%
4160 V Bus 1A4 Voltage	105.6%	100.3%	101.6%	96.4%
480 V LC 1B3 Voltage	99.8%	94.7%	98.1%	93.0%
480 V LC 1B4 Voltage	101.7%	96.5%	98.1%	93.0%
480 V LC 1B9 Voltage	97.6%	92.1%	95.5%	90.2%
480 V LC 1B20 Voltage	99.5%	94.1%	95.5%	90.2%
480 V MCC 1B21 Voltage	99%	94%	95%	90%
480 V MCC 1B32 Voltage	100%	95%	98%	93%
480 V MCC 1B34 Voltage	99%	94%	97%	92%
480 V MCC 1B34A Voltage	99%	94%	97%	92%
480 V MCC 1B36 Voltage	99%	94%	97%	92%
480 V MCC 1B42 Voltage	102%	96%	98%	93%
480 V MCC 1B44 Voltage	102%	96%	98%	93%
480 V MCC 1B44A Voltage	99%	94%	97%	92%
480 V MCC 1B46 Voltage	100%	95%	97%	92%
480 V MCC 1B91 Voltage	100%	92%	95%	90%

NOTES: All voltages are in percent of nominal voltage.
All bus voltages are calculated values.

TABLE 3

SAFETY RELATED BUS VOLTAGES

FOR MAXIMUM AND MINIMUM DESIGN TRANSMISSION SYSTEM VOLTAGES

Case Description	Full Load Condition, Safety Related Loads on Startup Xfmr., Non-Safety Related on Aux. Xfmr.		Full Load Condition, Safety Related Loads on Standby Xfmr., Non-Safety Related on Aux. Xfmr.	
161 KV Grid Voltage	105.0%	95.0%	104.4%	99.8%
345 KV Grid Voltage	104.9%	94.8%	105.0%	95.0%
Generator Megawatts	500	500	500	500
Startup Xfmr. Megawatts	4.5	4.5	0	0
Standby Xfmr. Megawatts	0	0	4.5	4.5
Aux. Xfmr. Megawatts	25.7	25.7	25.7	25.7
4160 V Bus 1A3 Voltage	107.2%	96.8%	101.6%	94.0%
4160 V Bus 1A4 Voltage	107.2%	96.8%	101.6%	94.0%
480 V LC 1B3 Voltage	101.8%	91.3%	96.1%	88.4%
480 V LC 1B4 Voltage	101.8%	91.2%	96.1%	88.4%
480 V LC 1B9 Voltage	103.2%	92.9%	97.6%	90.0%
480 V LC 1B20 Voltage	103.1%	92.8%	97.6%	90.0%
480 V MCC 1B21 Voltage	103%	93%	98%	90%
480 V MCC 1B32 Voltage	102%	91%	96%	88%
480 V MCC 1B34 Voltage	101%	91%	95%	88%
480 V MCC 1B34A Voltage	101%	91%	95%	88%
480 V MCC 1B36 Voltage	101%	90%	95%	87%
480 V MCC 1B42 Voltage	101%	91%	96%	88%
480 V MCC 1B44 Voltage	101%	91%	96%	88%
480 V MCC 1B44A Voltage	101%	91%	95%	88%
480 V MCC 1B46 Voltage	100%	90%	95%	87%
480 V MCC 1B91 Voltage	103%	93%	98%	90%

NOTES: All voltages are in percent of nominal voltage.
All bus voltages are calculated values.

TABLE 3 (Continued)

SAFETY RELATED BUS VOLTAGES
FOR MAXIMUM AND MINIMUM DESIGN TRANSMISSION SYSTEM VOLTAGES

Case Description	Full Load Condition, Safety Related and Non-Safety Related Loads on Startup Xfmr.	
161 KV Grid Voltage	105.0%	95.0%
345 KV Grid Voltage	104.9%	94.8%
Generator Megawatts	500	500
Startup Xfmr. Megawatts	30.2	30.2
Standby Xfmr. Megawatts	0	0
Aux. Xfmr. Megawatts	0	0
4160 V Bus 1A3 Voltage	102.9%	91.7%
4160 V Bus 1A4 Voltage	102.8%	91.7%
480 V LC 1B3 Voltage	97.4%	86.1%
480 V LC 1B4 Voltage	97.3%	86.0%
480 V LC 1B9 Voltage	98.9%	87.8%
480 V LC 1B20 Voltage	98.8%	87.7%
480 V MCC 1B21 Voltage	99%	88%
480 V MCC 1B32 Voltage	97%	86%
480 V MCC 1B34 Voltage	97%	86%
480 V MCC 1B34A Voltage	97%	86%
480 V MCC 1B36 Voltage	96%	85%
480 V MCC 1B42 Voltage	97%	86%
480 V MCC 1B44 Voltage	97%	86%
480 V MCC 1B44A Voltage	97%	85%
480 V MCC 1B46 Voltage	96%	85%
480 V MCC 1B91 Voltage	99%	88%

NOTES: All voltages are in percent of nominal voltage.
All bus voltages are calculated values.

FIGURE 1

DAEC ELECTRICAL SYSTEM