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December 30, 1983

Mr. Robert Gilbert
Project Manager
Operating Reactors Branch No. 5
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington D.C. 20555

Subject: Dresden Station Unit 2
SEP Topic VI-7.C.1
Docket No. 50-237

Dear Mr. Gilbert:

The subject IPSAR Section is concerned with the Electrical Instrumentation and Control Systems in terms of performance of their intended safety functions. The section is divided into three subsections:

1) Battery Charger Isolation
2) 125-V DC Automatic Transfer
3) Standby 250V Battery Charger

The attached responds in detail to the concerns of each subsection. With respect to each subsection, the following summarizes our conclusions:

1) Battery Charger Isolation: A fault on the 125V DC System will not cause the loss of redundant AC Motor Control Centers (MCCs) when both chargers are connected to the battery bus.

2) 125-V DC Automatic Transfer: The automatic transfer of a fault on the diesel generator 2/3 feed will not cause a loss of redundant 125V D.C. systems.

3) Stand-by 250V Battery Charger: A fault on the 250V DC system will not cause the loss of redundant AC MCCs when both the regular and standby chargers are connected to the Battery bus.

If you have any questions concerning this please contact this office.



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One (1) signed original and forty (40) copies of this transmittal with its attachment are enclosed for your use.

Sincerely,

B. Rybak

B. Rybak
Nuclear Licensing Administrator

Attachments
cc: Region III Resident Inspector, Dresden (w/a)
Mr. Don Chery, SEP Project Manager (w/a)

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# IPSAR Section 4.21.1
# Breaker Adequacy

## Attached Exhibits

(1) 125V DC System Single Line
(2) 250V DC System Single Line
(3) 480V Breaker Coordination curves for 125V Charger
(4) Breaker Coordination for Diesel Generator 2/3 Excitation Cabinet Feed From Unit 2 MCC
(5) Breaker Coordination for Diesel Generator 2/3 Excitation Cabinet Feed From Unit 3 MCC
(6) 125V DC System Fault Currents
(7) 480V Breaker Coordination for 250V Charger Feed

## Subsection (1): 125V BATTERY CHARGER ISOLATION

### Concern

Division I motor control centers (MCCs) and Division II MCCs can be subjected to common faults and transients that may occur on the dc system if their respective battery charger output breakers are both closed. Individual manually operated circuit breakers connect the outputs of each of the chargers to the single battery and dc loads. The manual aspect of the design meets review guidelines defined in position D.4.d of Regultory Guide 1.6. However, the two ac breakers and two dc breakers per charger plus the isolation characteristics of each charger provide isolation and separation of ac power sources. Thus, there is not direct connection of ac power systems. It is the staff's position that the licensee verify the adequacy of the protective relaying so that operator error will not result in a loss of redundant ac sources.

### Response

As shown in Exhibit 1, each unit's 125V battery bus has two chargers connected to it. Only one of the chargers is required at a time. Therefore, only one of the two charger breakers needs to be closed.

Fault External to the Charger:

When a fault occurs on the dc system external to the charger, the ac short circuit flowing through the charger will be limited after a time lapse of about 3 or 4 cycles to a value not much greater than rated current. The charger control circuitry will automatically reduce the firing angle of the SCRs in response to the low voltage on the bus, thereby reducing the charger current output.

The instantaneous ac fault current which flows through the charger before the current limitation circuitry has time to operate is limited by the transformer impedance to a value of 20 to 25 times the rated ac input current. The rated ac input current of the 125V charger #3A is 48A. Therefore, the maximum ac fault current input to the charger which can be expected is 1200A.

This ac fault current could result in the instantaneous operation of the MCC breaker feeding the charger. The 480V switchgear breaker feeding the MCC will not operate since the instantaneous setting of this breaker is 480A. If the MCC breaker feeding the charger fails to operate, the switchgear breaker will not trip on the long time delay portion of the breaker curve since the charger curent limitation circuitry will reduce the fault current to a value below the breaker pickup after a few cycles.

Refer to Exhibit 3 for the 480V breaker coordination curves for the 125V chargers.

Fault Internal to the Charger:

A fault in the charger between the SCRs and the dc output will probably bypass the current limitation circuitry of the faulted charger. The maximum ac fault current input is 1200A. The MCC breaker feeding the charger will trip before the 480V switchgear breaker feeding the MCC since the instantaneous pickup setting of the switchgear breaker is 4800A. If the MCC breaker fails to open, the switchgear breaker feeding the MCC will eventually trip from the long time delay overcurrent sensing portion of the breaker. The switchgear breaker feeding the MCC with the non-faulted charger will not trip because the current through the non-faulted charger will limited to a value below breaker pickup after a few cycles. Therefore, a single failure will not cause the loss of redundant ac MCCs.

For a fault between the SCRs and the charger transformer, only one ac MCC can be effected since the current cannot flow in the reverse direction through the SCRs.

Subsection (2): 125V DC AUTOMATIC TRANSFER

Concern

The design of the 125-V dc system provides for the automatic transfer of the control and instrument power for the diesel generator (DG 2/3) from the Unit 2, Division I, 125-V dc distribution panel to the Unit 3, Division I, 125-V dc distribution panel. The Unit 3 battery/battery-charger combination is the power source for both Unit 2, Division II, and Unit 3, Division I. Therefore, the diesel generator control and instrument loads are automatically transferred between redundant divisions. This is a deviation from current review criteria.

It is the staff's position that the licensee verify the adequacy of the protective relaying so that a fault in the DG 2/3 control system will not result in a loss of redundant dc souces.

Response

As shown in Exhibit 1, the diesel generator 2/3 excitation cabinet can be fed from either the Unit 2 reactor building distribution panel or from the Unit 3 reactor building panel. The Unit 2 reactor panel is part of Division 1 of Unit 2. The dc source for the Unit 3 reactor panel also feeds Division II of Unit 2. Therefore, whenever excitation cabinet load is automatically transferred from the Unit 2 reactor panel to the Unit 3 panel, this load is connected to a power supply which is feeding Division II of Unit 2. The NRC has questioned whether a fault downstream of the diesel generator 2/3 excitation cabinet transfer switch could cause the loss of redundant dc division of Unit 2.

As indicated by the breaker coordination curves shown in Exhibits 4 and 5, a fault on the feed to the diesel generator 2/3 excitation cabinet will not cause an instantaneous trip of the MP400 main breaker feeding the turbine building Division I bus. The maximum fault level at the reactor building Unit 2 panel is below 1500A, whereas the minimum instantaneous pickup of the MP400 is about 3200A. The cable resistance used to calculate the maximum fault current are indicated in Exhibit 6.

If the EH100 breaker fails to open, the load will be transferred by the undervoltage sensed to the other source after about 1 second. Therefore, the long time portion of the MP400 breaker will not operate. A single failure will, therefore, not cause the loss of redundant dc divisions.

Subsection (3): STANDBY 250V BATTERY CHARGER

Concern

The standby 250-V battery charger (a Division I system) is supplied power from either the Unit 3 or Unit 2, Division II power source through a key-interlock switch. When power is supplied from Division II of Unit 3 to the Unit 2 battery, there is sharing between Units 2 and 3. This sharing is covered by SEP Topic VI-10.B. When power is supplied from Division II of Unit 2 to the Unit 2 battery, there is an interconnection between redundant divisions. It is the staff's position that the licensee verify the adequacy of the protective relaying so that a fault in one dc system would not be transferred to the other dc system.

By letter dated December 6, 1982, the licensee has committed to provide either a short-circuit analysis or a coordination study for the battery charger isolation, 125-V dc automatic transfer, and 250-V battery chargers.

Response

As shown in Exhibit 2, the 250V standby charger 2/3 can be fed from either a Unit 2, Division II or a Unit 3, Division II ac MCC. Battery charger 2 is fed from Division I of Unit 2.

When the swing charger is used to feed the Unit 2 turbine building 250V dc MCC and is itself fed from the Unit 2, Division II ac MCC, and the breaker for battery charger 2 is closed, then both redundant ac divisions would be connected to the same 250V dc MCC. The NRC has questioned whether a fault on the dc MCC under this condition could cause a loss of both redundant ac divisions of Unit 2.

1. Fault External to the Charger:

   The rated ac current input of the charger is 113A. The maximum ac instantaneous fault current which would flow through the charger before the current limitation circuitry takes affect is therefore 2800A. The instantaneous pickup o the 480V switchgear breaker feeding the MCC is 4800A. Therefore, the MCC breaker feeding the charger will trip instead of the switchgear breaker feeding the MCC. If the MCC breaker failed to open, this would not result in the trip of the switchgear breaker after a long time delay because the ac current will be limited to a low value below the breaker pickup after 3 or 4 cycles. The 480V breaker coordination curves for the 250V charger are shown in Exhibit 7.

2. Fault Internal to the Charger:

   A fault in the charger between the SCRs and the dc output would probably bypass the current limitation circuitry of the faulted charger. As was the case for the fault external to the charger, the maximum ac fault current is 2800A. The MCC breaker feeding the charger will trip before the switchgear breaker feeding the MCC since the instantaneous pickup of the switchgear breaker is 4800A. If the MCC breaker fails to open, the switchgear breaker will eventually trip from the long time delay portion of the breaker curve. The switchgear breaker feeding the MCC with the non-faulted charger will not trip because the current through the non-faulted charger will be limited to a low value after a few cycles. Therefore, a single failure will not cause the loss of both redundant ac MCCs.

   For a fault between the SCRs and the charger transformer, only one ac MCC can be effected since the current cannot flow in the reverse direction through the SCRs.

ASSUMPTIONS

A. No. 125V dc motors contribute significantly to the short cirucit current.

B. Breaker resistances are negligible.

C. The long time portion of the curve for an MP400 breaker has the same shape as the long time portion of the curve for an MP800 breaker. The instantaneous range in amperes of the MP400 breaker is the same as the instantaneous range of the MP800 beakers.

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CHICAGO

EXHIBIT 1

# 125V DC SYSTEM SINGLE LINE

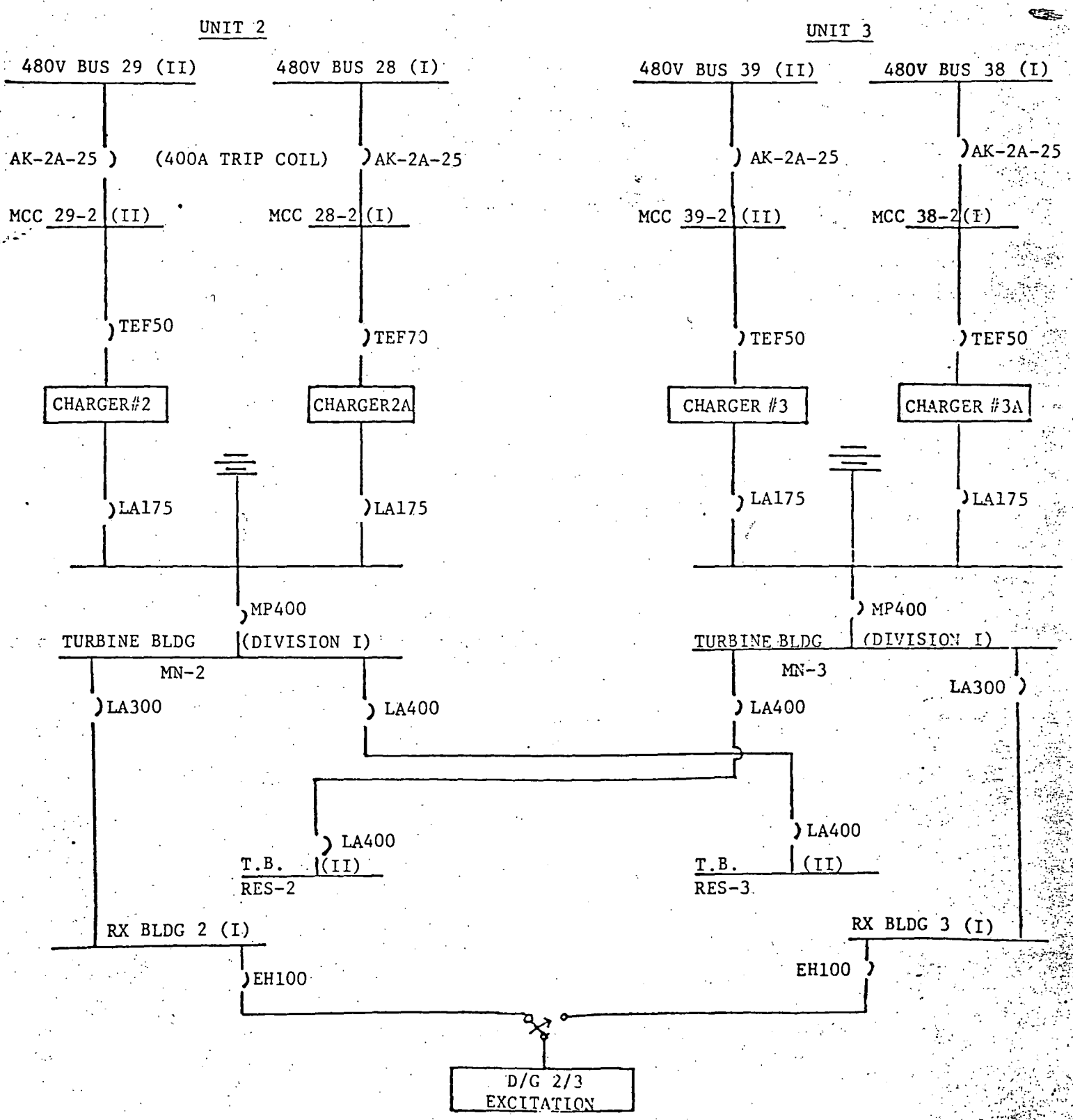

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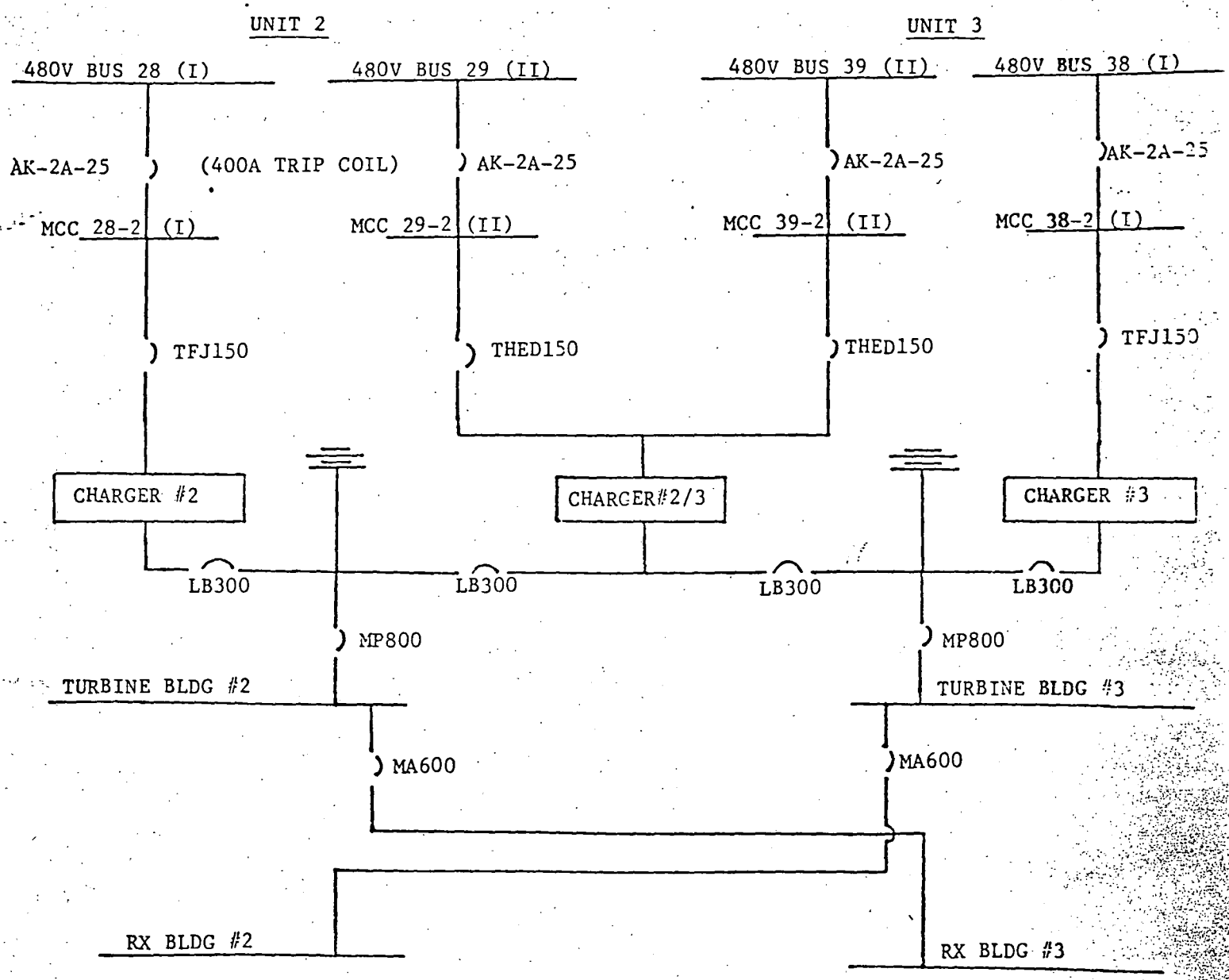
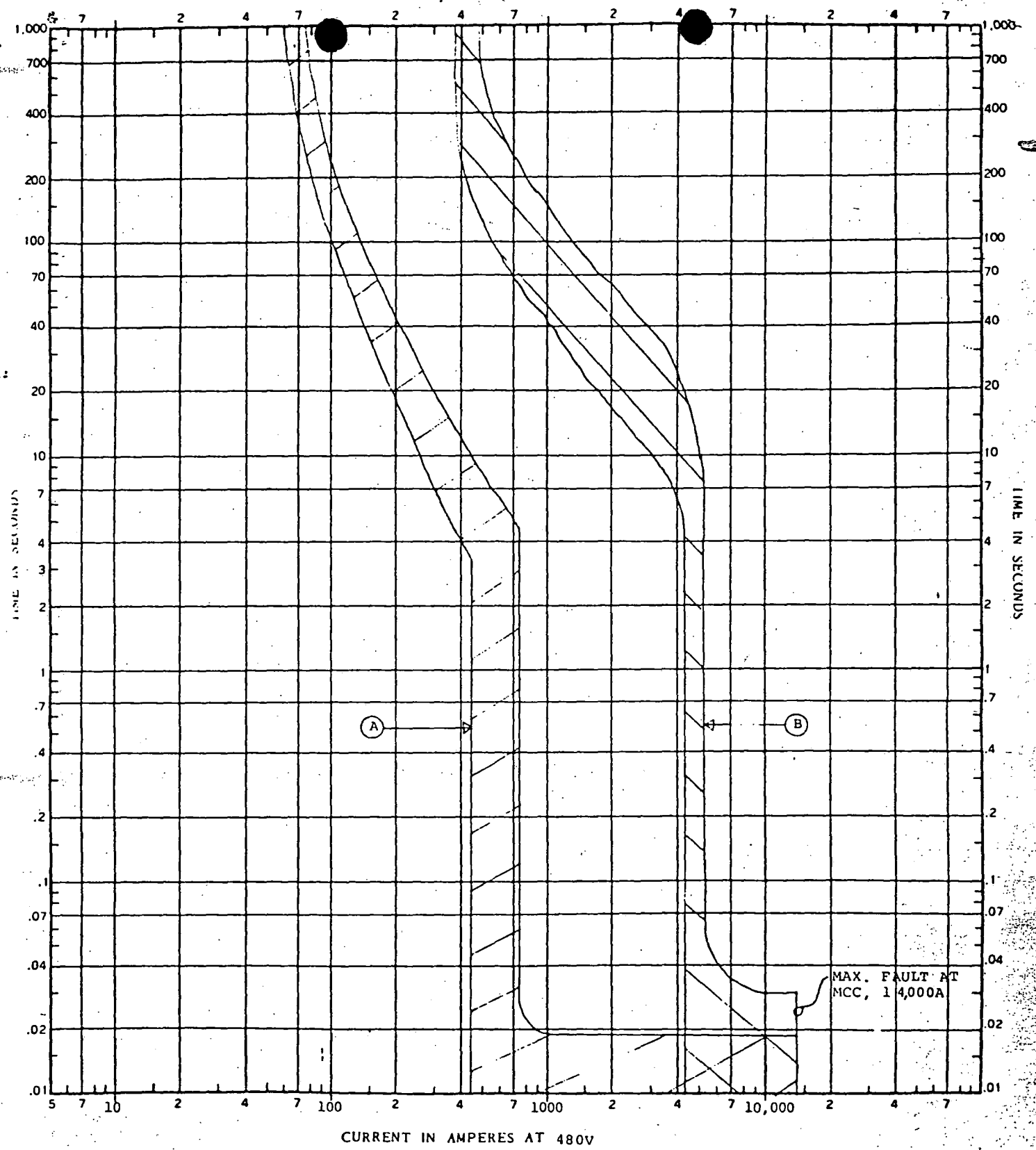
EXHIBIT 2

# 250V DC SYSTEM SINGLE LINE






480V BUS

(B) )AK-25, 400A TRIP COIL, INST. SET AT 12X

480V MCC

(A) )TEF 50

125V CHARGER

EXHIBIT 3

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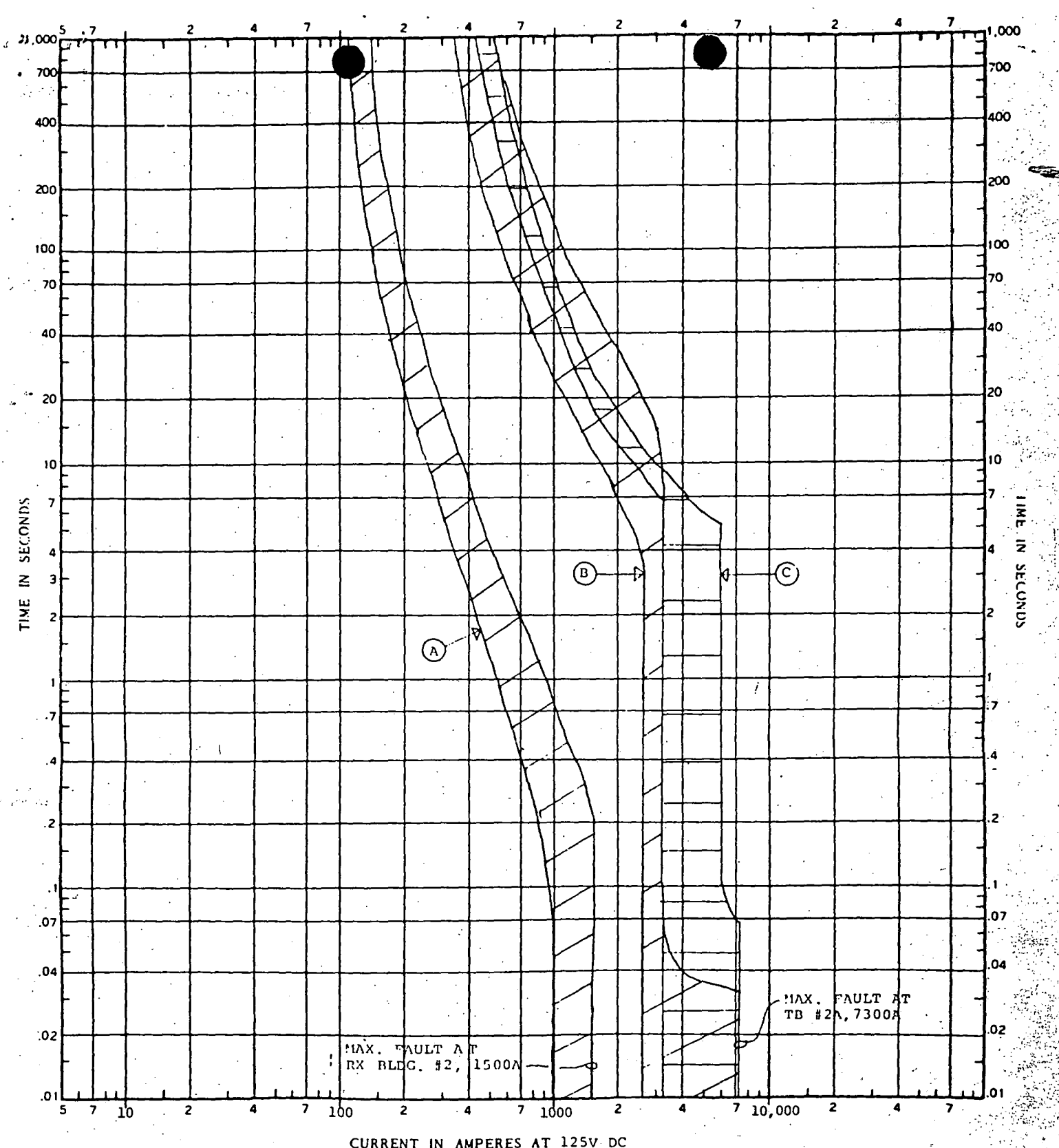
480V BREAKER COORDINATION FOR 125V CHARGER FEED



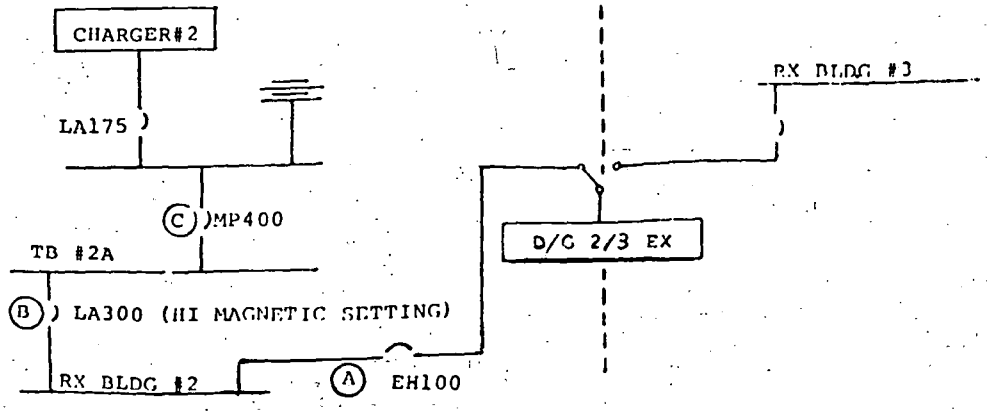




EXHIBIT 4

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BREAKER COORDINATION FOR DIESEL GENERATOR 2/3 EXCITATION CABINET FEED

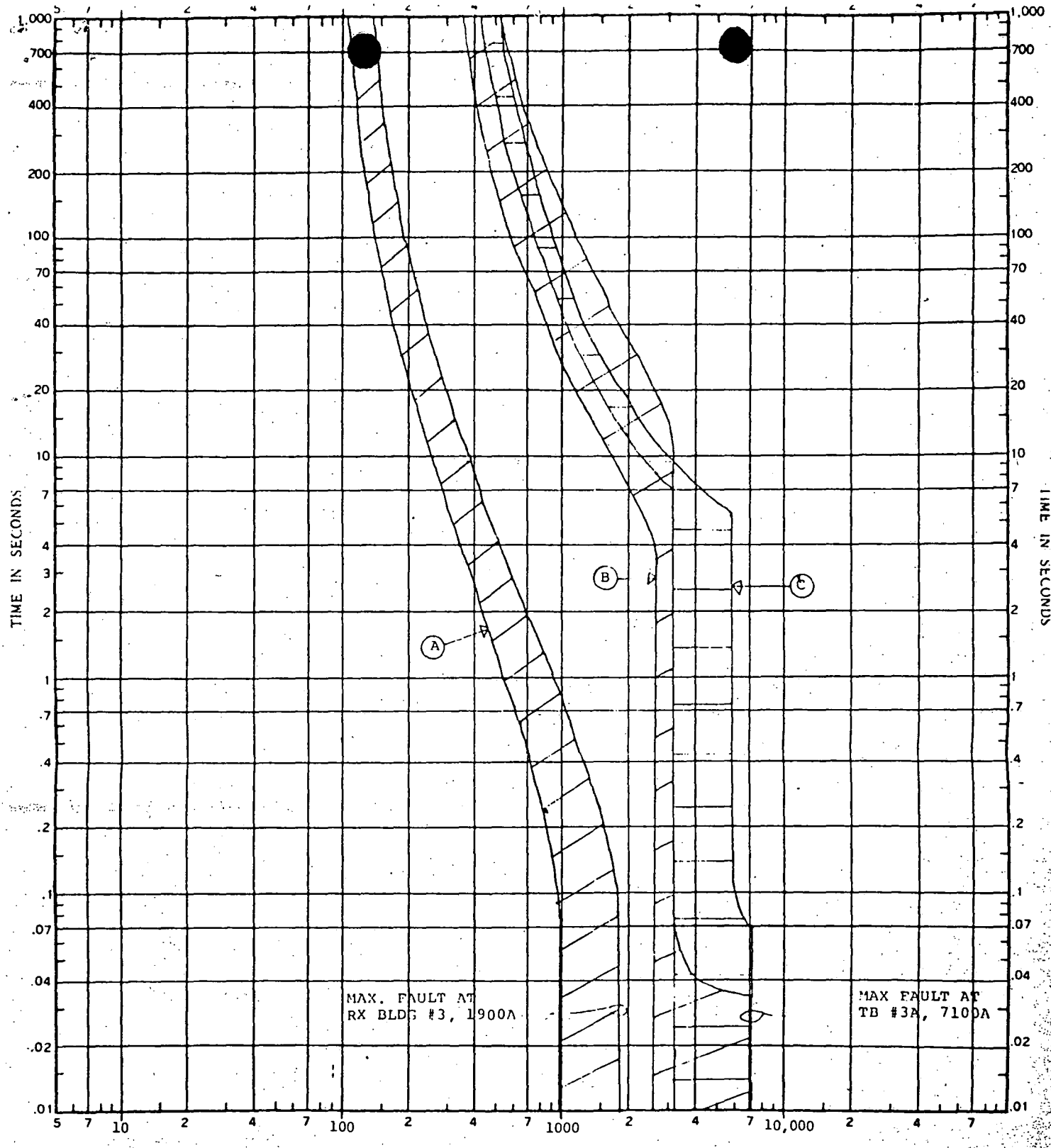
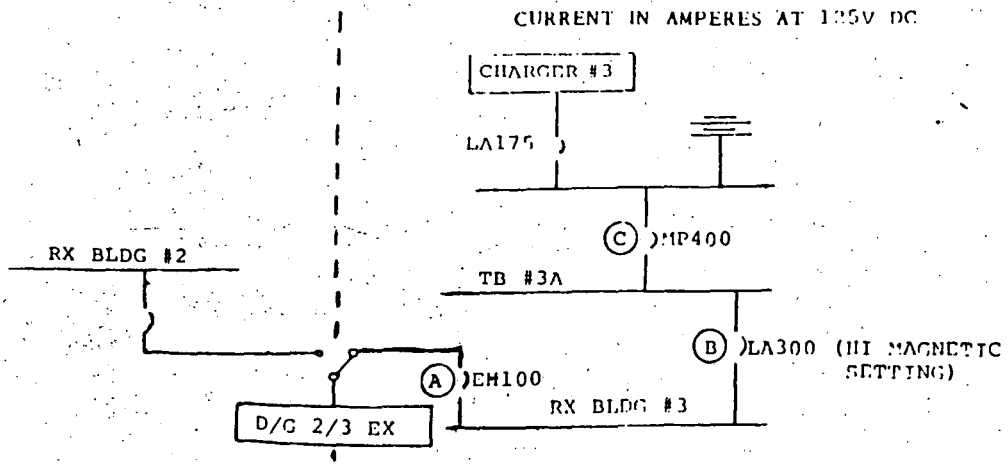



EXHIBIT 5

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BREAKER COORDINATION FOR DIESEL GENERATOR 2/3 EXCITATION CABINET FED FROM UNIT 3 MCC

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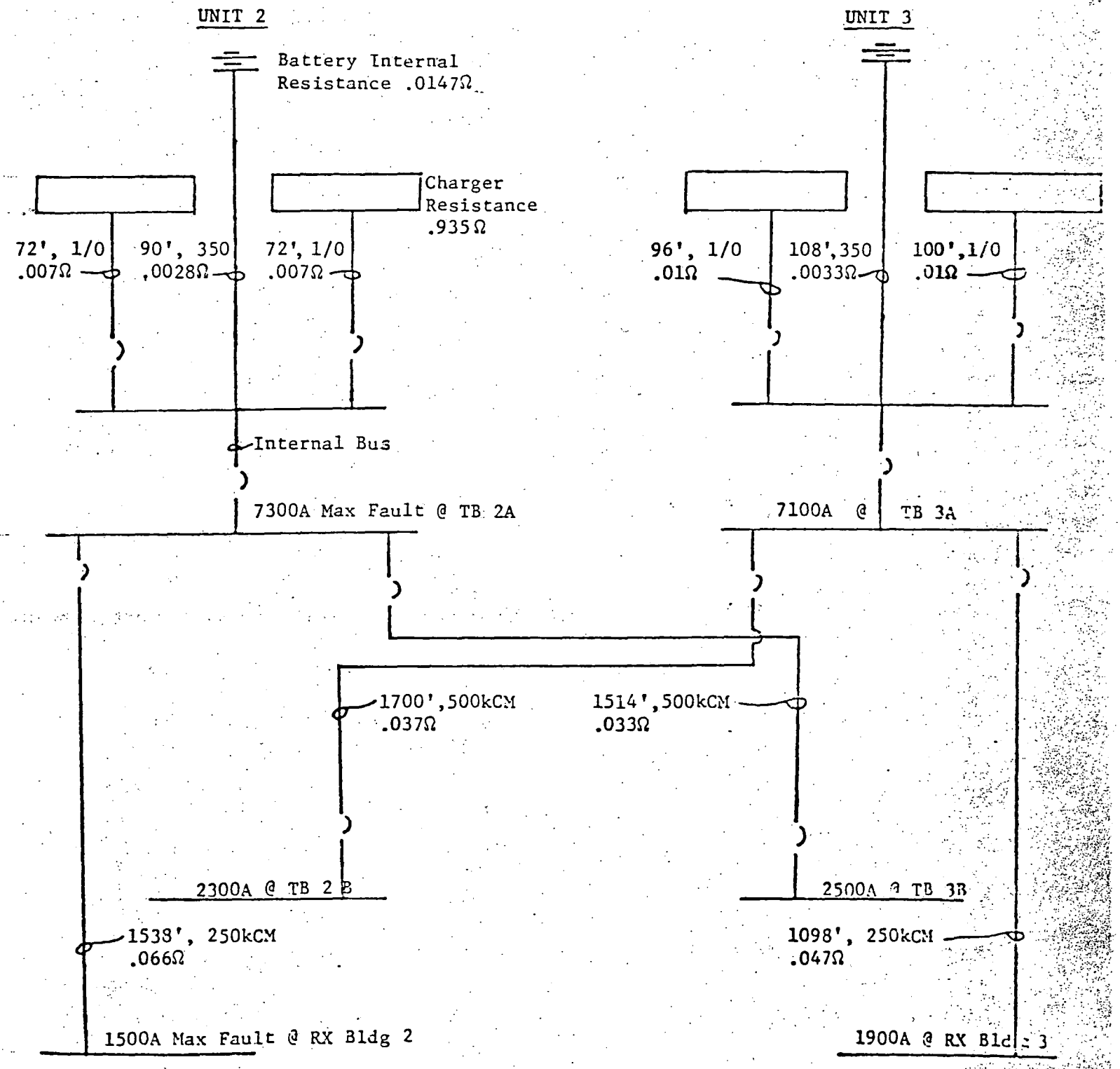
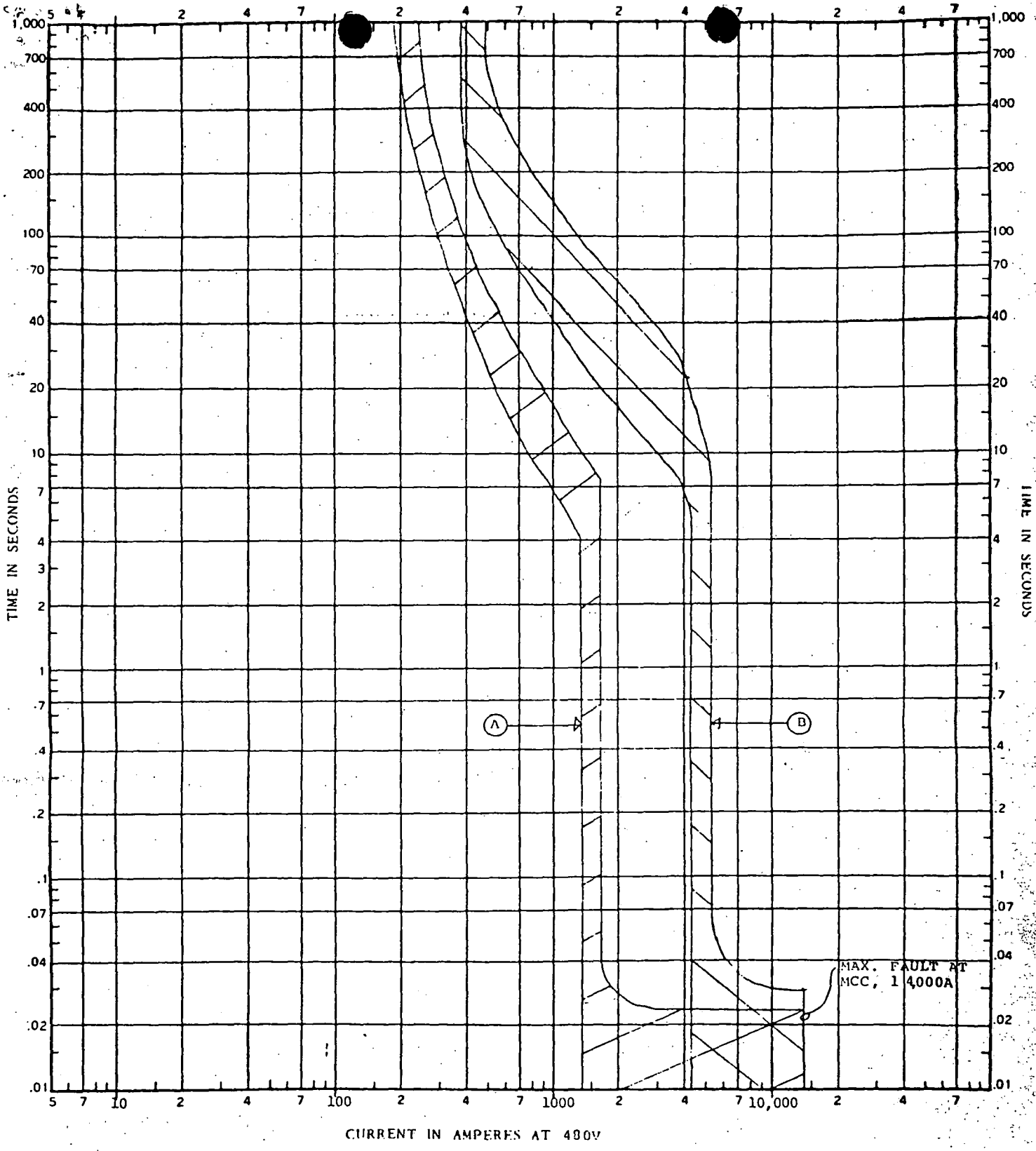
EXHIBIT 6

# 125V DC SYSTEM FAULT CURRENTS




TWO WAY CABLE LENGTHS INDICATED.




480V BUS

(B) AK-25, 400A TRIP COIL, INST. SET AT 12X

480V MCC

(A) TPJ 150

250V CHARGER

EXHIBIT 7

SARGENT & LUNDY ENGINEERS

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480V BREAKER COORDINATION FOR 250V CHARGER FEED