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MURLEY,T.E. Office of Nuclear Reactor Regulation, Director (Post 870411

SUBJECT: Forwards revised licensee proposed design mod of low pressure coolant injection swing bus electrical sys.

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Iowa Electric Light and Power Company

November 4, 1988
NG-88-3787

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station PL-137
Washington, DC 20555

Subject: Duane Arnold Energy Center
Docket No: 50-331
OP License No: DPR-49
LPCI Swing Bus Design Modifications

Reference: 1) Letter from W. Rothert (Iowa Electric) to T. Murley (NRC) dated August 31, 1988 (NG-88-2996).
2) Letter from W. Rothert (Iowa Electric) to T. Murley (NRC) dated October 4, 1988 (NG-88-3315).

File: A-107a, A-225, R-10

Dear Dr. Murley:

In Reference 1, we formally advised the staff of a design deficiency in our Low Pressure Coolant Injection (LPCI) swing bus electrical system and stated we would correct the deficiency prior to startup from our current (Cycle 9/10) refueling outage. Reference 2 transmitted our proposed design modifications.

On October 27, 1988, we met with the staff to discuss the proposed design modifications. Based on these discussions, we have reevaluated and revised our proposed design modification. The revised modification is described in Attachment 1 to this letter.

We also discussed related actions which we will take after startup. We will include as a part of the annual update to the Final Safety Analysis Report (FSAR), a more thorough description of the design basis of the LPCI swing bus design, specifically stating that two isolation devices are required to separate the swing bus from the busses that power the Core Spray System components. We will also revise our surveillance procedures to assure that the bus transfer capability is tested for both a loss of AC power and a loss of DC control power. This testing will be conducted once per operating cycle, commencing with Cycle 10 operation.

We also discussed with the Staff, further enhancements to the LPCI swing bus design that could be investigated after startup. Specifically, as part of Phase 3 of our Detailed Control Room Design Review (DCRDR) enhancements, we will investigate relocating control room annunciator windows for the swing bus feeder breakers from their current location to a panel where other LPCI system annunciators are located. We will investigate methods to monitor LPCI swing

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DRAWINGS TO REG FILES

bus voltage directly, as recommended by IEEE-383, instead of monitoring feeder breaker position to indicate power is available to the swing bus. In addition, we will continue efforts to achieve the complete coordination of breakers from load centers 1B3 and 1B4 downstream to the motor control centers powered by the swing bus. Final plans and schedules for any future design enhancements will be provided to you via semi-annual updates to our Integrated Plan.

During the meeting we discussed a short-term enhancement for relabeling our existing annunciator windows for breakers 52-3401, 52-4401, 52-3402, and 52-4402 to specify that a loss of the LPCI swing bus had occurred. We have concluded that relabeling the annunciator windows to more specifically indicate a loss of power to the swing bus is not consistent with the existing DCRDR program conventions for annunciator labeling. Our current Annunciator Response Procedures indicate that a loss of power to the LPCI swing bus may occur if one or more of these annunciators is activated. We, therefore, feel that the existing labeling and associated procedures provide adequate assurance that any loss of the swing bus will be recognized upon alarming of these annunciator windows.

Should you have any additional questions or concerns regarding this matter, please contact this office.

Very truly yours,

William C. Rothert
Manager, Nuclear Division

WCR/NKP/pjv+

Attachment: Revisions to the Proposed Modifications to the LPCI Swing Bus Design at the DAEC.

cc: N. Peterson (w/o drawings)
L. Liu (w/o drawings)
L. root (w/o drawings)
R. McGaughy (w/o drawings)
J. R. Hall (NRC-NRR)
A. Bert Davis (NRC-RIII)
NRC Resident Office
Commitment Control No. 880341, 880365

REVISED DESCRIPTION OF PROPOSED MODIFICATIONS TO THE LPCI SWING BUS DESIGN AT THE DAEC

Our letter dated October 4, 1988 (NG-88-3315) we provided a description of our proposed design to correct the design deficiency in the LPCI swing bus prior to startup from our current refueling outage.

In formulating the LPCI swing bus design modifications, we pursued four goals:

1. Maintain the existing LPCI swing bus transfer features, assuming a loss of one division of 125 VDC control power,

2. Cause no adverse effects on circuit reliability from the addition of a breaker trip function to the transfer breakers (52-3401 and 52-4401),

3. Maintain compliance with 10CFR50, Appendix R requirements, and

4. Provide selective circuit breaker coordination for the affected breakers in the DAEC AC electrical distribution system.

As a result of a meeting with the NRC staff on October 27, 1988, these design goals were modified. Specifically, design goal 4) is now to prevent any single electrical fault on the LPCI swing bus from adversely affecting a Core Spray Sub-system and goal number 2) is modified to be that paralleling of the diesel generators onto the swing bus will not adversely affect the operation of the diesel generators, given the worst case single failure.

The existing LPCI swing bus transfer scheme utilizes two (2) electrically interlocked breakers (52-3401 and 52-4401) to accomplish the transfer of electrical power supplying busses 1B34A and 1B44A (see Fig. 1). These two breakers are designed such that busses 1B34A and 1B44A will be powered from the division of the AC distribution system which has power available (i.e., "power seeking"). If both or no divisions are powered, the breakers will remain in their original positions (i.e., 52-3401 closed and 52-4401 open). In addition, the interlock feature of these breakers senses the actual breaker position of the corresponding transfer breaker and, therefore paralleling of the two divisions of AC power is not possible (i.e., both 52-3401 and 52-4401 cannot be closed simultaneously). Thus, goal 2) is satisfied.

The proposed modification will not defeat any of these existing interlocks and the bus transfer scheme will remain identical to the present design, provided 125 VDC breaker control power is available. However, should a loss of a division of 125 VDC power occur coincident with a LOOP/LOCA, the LPCI swing bus transfer breaker which is powered by the failed division of 125 VDC power must open to allow a swing bus power supply transfer to occur. To accomplish this function, the existing breakers (52-3401 and 52-4401) will be replaced with new breakers equipped with undervoltage trip devices that will trip the breaker open upon a loss of DC control power. The undervoltage trip devices will also utilize a short time delay to minimize the possibility of spurious trips. The undervoltage trip devices trip the breaker using the trip bar linkage which is also used by the breaker overcurrent trip devices.

Because the undervoltage trip devices utilize the same linkage as the overcurrent device, additional relays have been installed which monitor control power while blocking transfer in the event of a fault (see Fig. 2). These additional undervoltage devices are monitored in the main control room and will cause an alarm to sound in the event of a loss of control power or a failure of the undervoltage devices in the deenergized state. Thus, goal 1) is satisfied.

The proposed modification will also revise the existing alternate shutdown capability system (ASCS) control circuits to allow control of the breakers feeding 1B34A (52-3401) and 1B34 (52-303) during shutdown from outside of the Control Room. The ASCS is designed for operation in the event of a fire which leads to control room evacuation and is not intended to be operated during any other plant event. The ASCS changes will allow closing of the Division I swing bus breaker 52-3401 and opening of the 1B34 feeder breaker 52-303 as required by our emergency operating procedure (EOP) for safe shutdown of the DAEC from outside of the main control room. This EOP provides instruction for the momentary repowering of 1B34 with Division II AC power via the swing bus in the event of a control room fire.

Because Division I DC is not protected against the effects of a control room fire, there is no assurance that Division I DC power would be available. In the event of a loss of Division I DC control power, breaker 52-3401 will now trip. The addition of the undervoltage trip device prevents closure of this breaker without DC control power. This design change revises the control circuits associated with Division I breakers 52-3401 and 52-303 to provide Division II power to the control circuits of these breakers when transfer switches located on the remote shutdown panel (1C388) and remote shutdown auxiliary panel (1C390) are both placed in the "EMERGENCY" position. These transfer switches are located in

separate fire areas outside of the main control room. The transfer switches are locked with the keys under the control of the control room operator. Dual isolation devices, which meet the engineering acceptance criteria outlined in existing DAEC design guides, are used to prevent the direct connection of Division I and II DC power supplies. Therefore, the modifications will not adversely affect the normal operation of either AC or DC-powered equipment, even if a single component failure or mis-operation occurs in the ASCS. Thus, goal 3) is satisfied.

The replacement LPCI swing bus supply breakers and associated load center supply breakers will be installed with solid state overcurrent trip devices which will improve circuit breaker coordination. This design modification provides for complete coordination between the individual loads on the swing bus and the swing bus feeder breakers (52-3401 and 52-4401) by replacing molded-case breakers (MCBs) 52-3494 and 52-4494 (LPCI injection valve breakers) with lower rated MCBs.

Because of the existence of maintenance isolation MCBs 52-3402 and 52-4402 the swing bus is not completely coordinated for fault currents. In the event of a fault on an individual load exceeding approximately 300A, MCBs 52-3402 or 52-4402 would probably trip along with the MCB associated with the individual load. Tripping either MCB 52-3402 or 52-4402 would remove power from the swing bus. However, because the Division I and Division II AC power monitoring circuits associated with the LPCI swing bus transfer logic are located on Load Centers 1B3 and 1B4, this loss of power would not be detected by the logic and the swing bus would not transfer. Tripping of 52-3402 and 52-4402 and subsequent loss of LPCI swing bus transfer capability is not desirable in the event of an isolable fault downstream of an individual load breaker.

Complete coordination is not possible without the removal or replacement of 52-3402 and 52-4402. We had intended to solve this problem by replacing 52-3402 and 52-4402 with disconnect switches. This was deemed acceptable by us as the requirement for the maintenance isolation breakers is not well documented in the DAEC design basis documentation. In the October 27, 1988 meeting, the NRC staff indicated that, while the DAEC is not licensed to the Standard Review Plan (SRP), they requested that we consider their interpretation of SRP Section 8.3.1, which requires two overcurrent isolation devices on each swing bus feeder so that no single failure could cause the loss of both the LPCI and a Core Spray Sub-system. Hence, the revision to design goal 4) above.

The DAEC design powers valves associated with the Core Spray System from MCCs 1B34 and 1B44; therefore, the existing ACBs and MCBs are required to separate the swing bus from 1B34 and 1B44 and removal of the MCBs,

originally planned to provide selective coordination, was not acceptable. When it was indicated that complete coordination was not possible with the existing MCBs, the NRC staff indicated that the total loss of the LPCI swing bus was acceptable in the event of a LPCI swing bus fault, provided that such a fault did not result in the loss of either 1B34 or 1B44 as well.

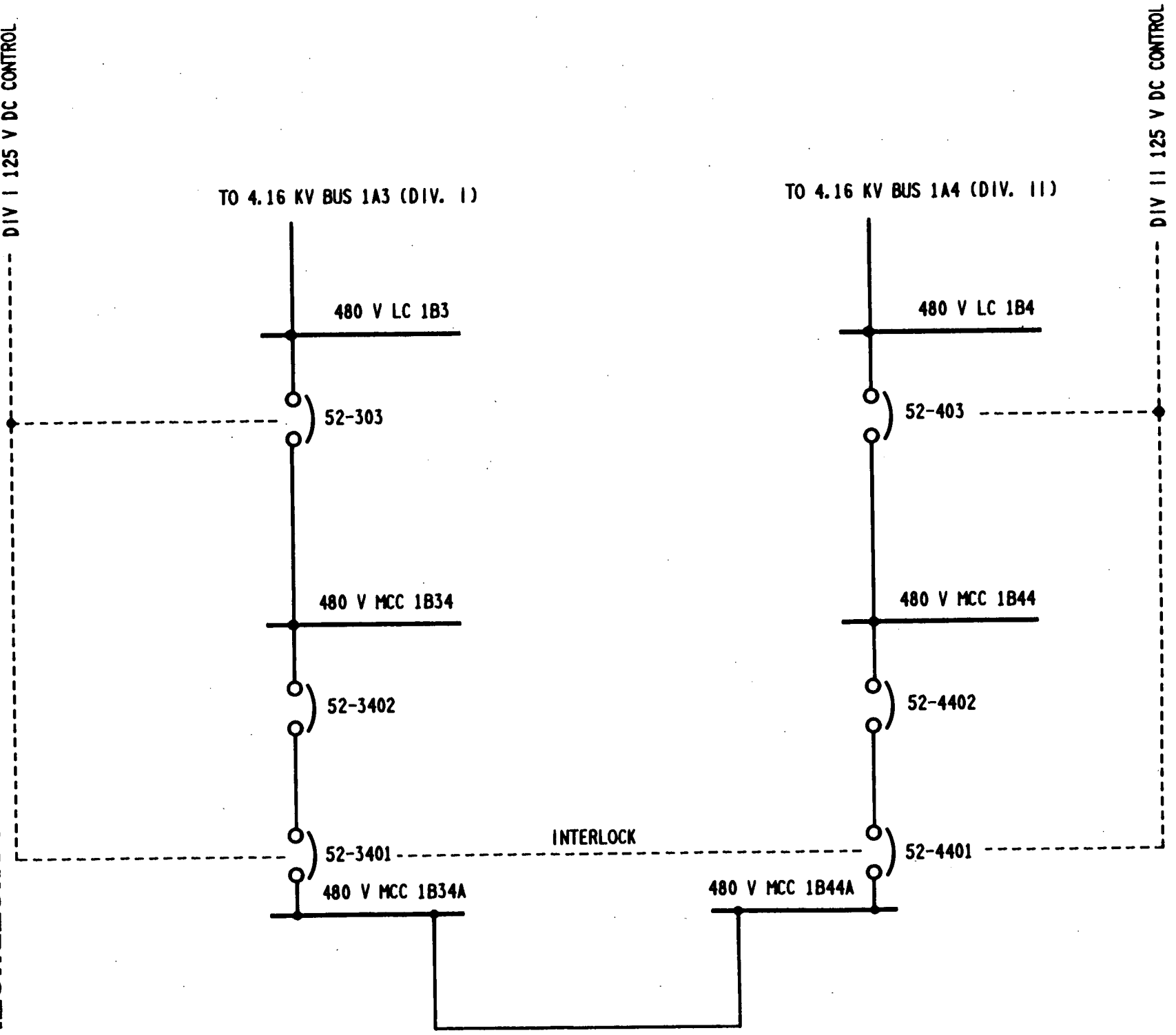
The existing maintenance isolation breakers will not coordinate with either the swing bus feeders (52-3401 or 52-4401) or the load center breakers (52-303 or 52-403). Coordination between the maintenance isolation breakers and the load center breakers (52-303 and 52-403) will be achieved by replacing the existing MCBs (52-3402 and 52-4402) with MCBs having a lower rating. It should be noted that the replacement MCBs will not coordinate with ACBs 52-3401 or 52-4401. Efforts are continuing to locate a breaker which will provide improved coordination. However, as of this date, a suitable nuclear-qualified breaker has not been located. The attached coordination plot indicates the coordination available with this revised design. The coordination plot also indicates that the lower rated MCBs will not trip in the event of multiple valve operations, which are required in the event of a Design Basis Accident (DBA). The swing bus loads, consisting of both "A" and "B" loop Reactor Recirculation System isolation valves and two LPCI inject valves, were modeled on the coordination plot as a single curve, which is identified as "MOVs".

Thus, it was not possible to completely satisfy design goal 4). However, the limited coordination provided by the proposed design will meet the Staffs' interpretation of SRP 8.3.1 and is therefore judged to be an acceptable interim design until such time as optimal breaker coordination can be achieved. We will continue our efforts to improve the breaker coordination after restart from the current refuel outage.

Attached to this description is a list of plant drawings which have been revised as a result of the proposed modification (Design Change Package (DCP) 1430). Those drawings which have been revised as a result of the changes discussed in this letter are annotated as "Rev. 1" in the right-hand column. Copies of these drawings are attached. The remainder of the drawings, which were provided with our earlier transmittal, are unaffected by these changes. In addition, a sketch showing the internal wiring diagram of the replacement ACBs is included in the attached drawings. The vendor has indicated that this sketch accurately represents the wiring of the replacement ACBs.

LIST OF ATTACHED DRAWINGS

BECH-E027, Revision 12, "Construction Delete"	
BECH-E027, Revision 12, "Construction Add"	
BECH-E036, Revision 14, "Construction Add"	Added for Rev 1
BECH-E037, Revision 12, "Construction Add"	Added for Rev 1
BECH-E112, Sheet 31, Revision 0	
BECH-E112, Sheet 32, Revision 0, "Construction Delete"	
BECH-E112, Sheet 32, Revision 0, "Construction Add"	
BECH-E112, Sheet 33, Revision 0, "Construction Add"	
BECH-E121, Sheet 44H, Revision 0	
BECH-E105, Sheet 14, Revision 15	Added for Rev 1
BECH-E105, Sheet 15A, Revision 15	
BECH-E105, Sheet 18, Revision 16	Added for Rev 1
BECH-E105, Sheet 19A, Revision 13	
BECH-E104, Sheet 21, Revision 9	Revised for Rev 1
BECH-E104, Sheet 21B, Revision 0	Revised for Rev 1
BECH-E104, Sheet 17A, Revision 0, "Construction Delete"	
BECH-E104, Sheet 17A, Revision 0, "Construction Add"	
BECH-E001, Sheet 1, Revision 12	Revised for Rev 1
BECH-E006, Sheet 1, Revision 13	Revised for Rev 1
BECH-E112, Sheet 29, Revision 1, "Construction Delete"	
BECH-E112, Sheet 29, Revision 1, "Construction Add"	
BECH-E134, Sheet 30, Revision 1, "Construction Add"	
BECH-E134, Sheet 33, Revision 1, "Construction Add"	
BECH-E134, Sheet 20, Revision 1, "Construction Delete"	
BECH-E134, Sheet 20, Revision 1, "Construction Add"	
E-6-FD, Sheet 3 of 5, Revision 0	
E-009, Sheet 263, Revision 2	
E-009, Sheet 169, Revision 4	
DCP 1430 Sketch E-1 (ACB Internal Wiring Diagram)	Added for Rev 1
Figure 1, DAEC Swing Bus Prior to Modification	Added for Rev 1
Figure 2, DAEC Swing Bus Design Following Modification	Added for Rev 1
Figure 3, Coordination Curve	Added for Rev 1



DAEC SWING BUS PRIOR TO MODIFICATION

FIGURE 1

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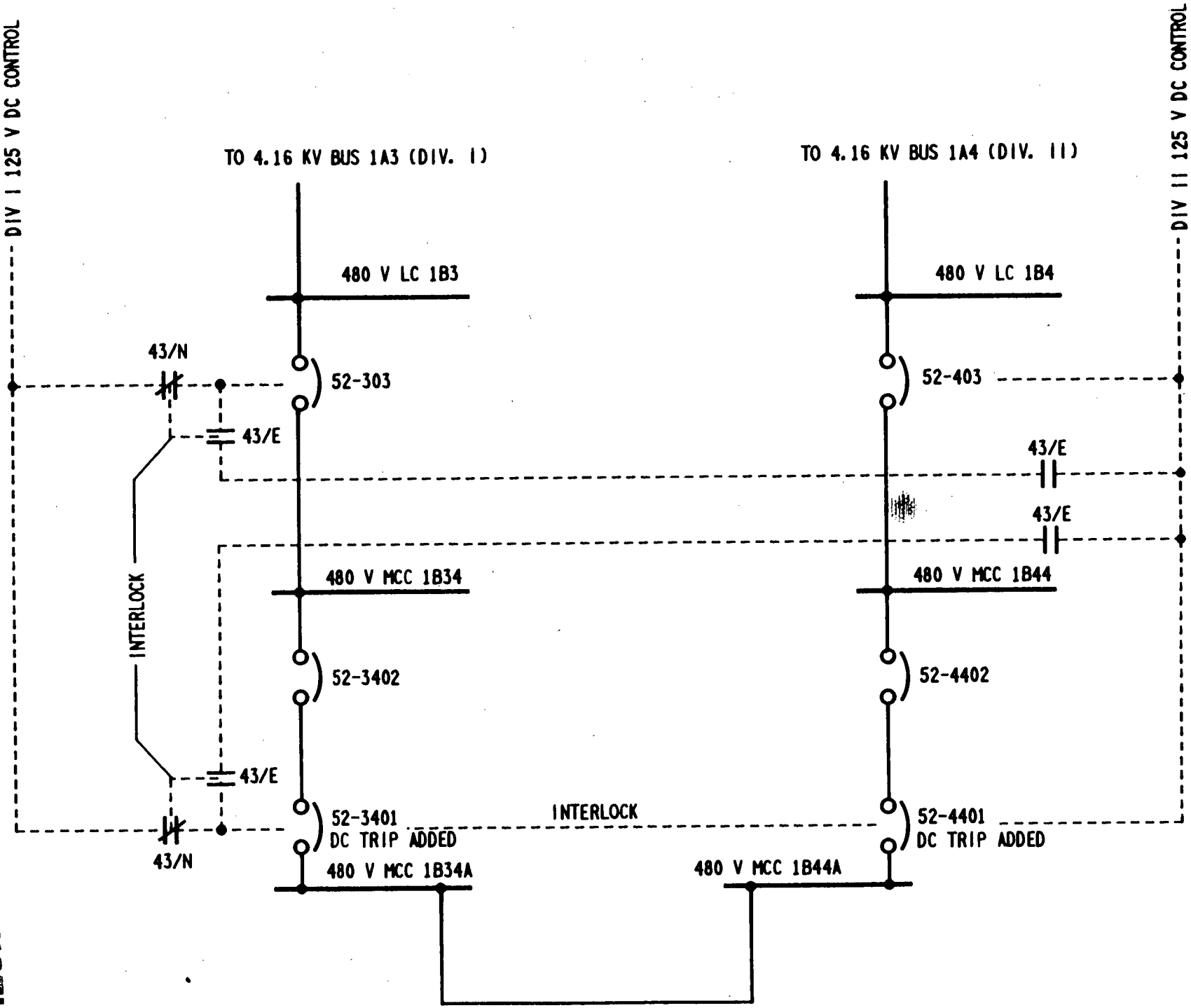

DAEC SWING BUS FOLLOWING MODIFICATIONS

FIGURE 2

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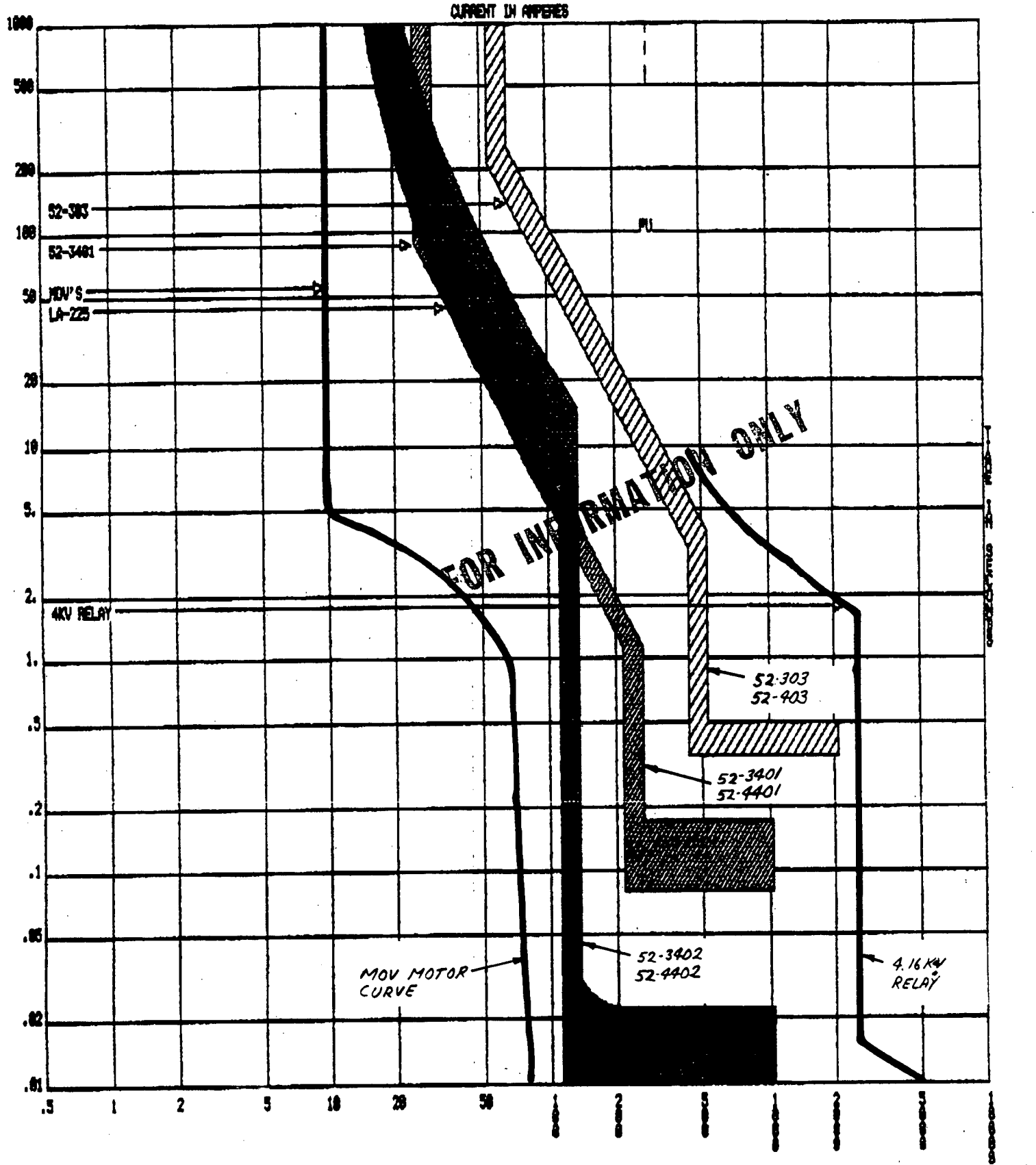
RS-205-01

FIGURE 3



PLOT BLL: 400 SCALE: 10**1

COORDINATION CURVE

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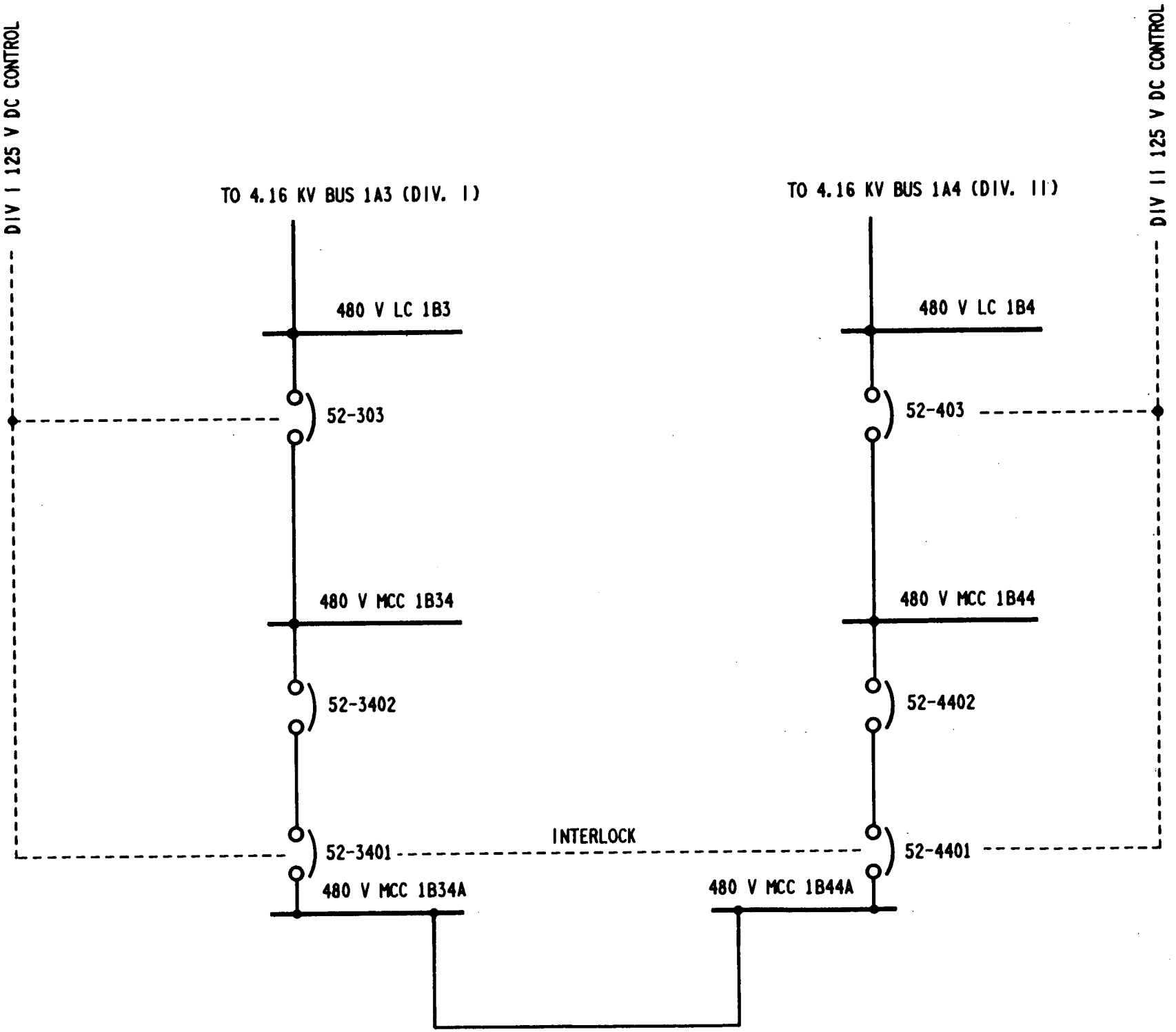
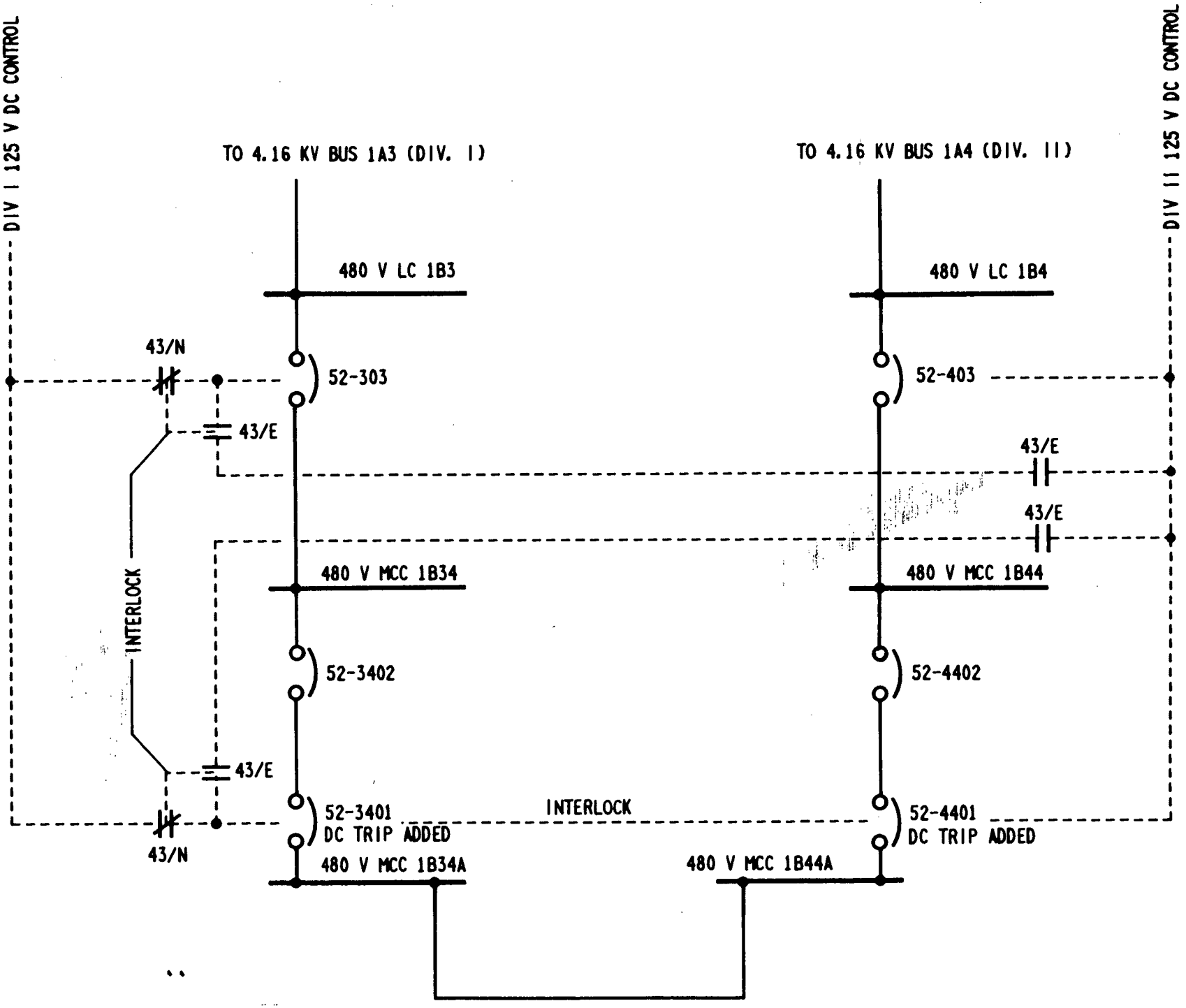


DAEC SWING BUS PRIOR TO MODIFICATION

FIGURE 1



DAEC SWING BUS FOLLOWING MODIFICATIONS

FIGURE 2

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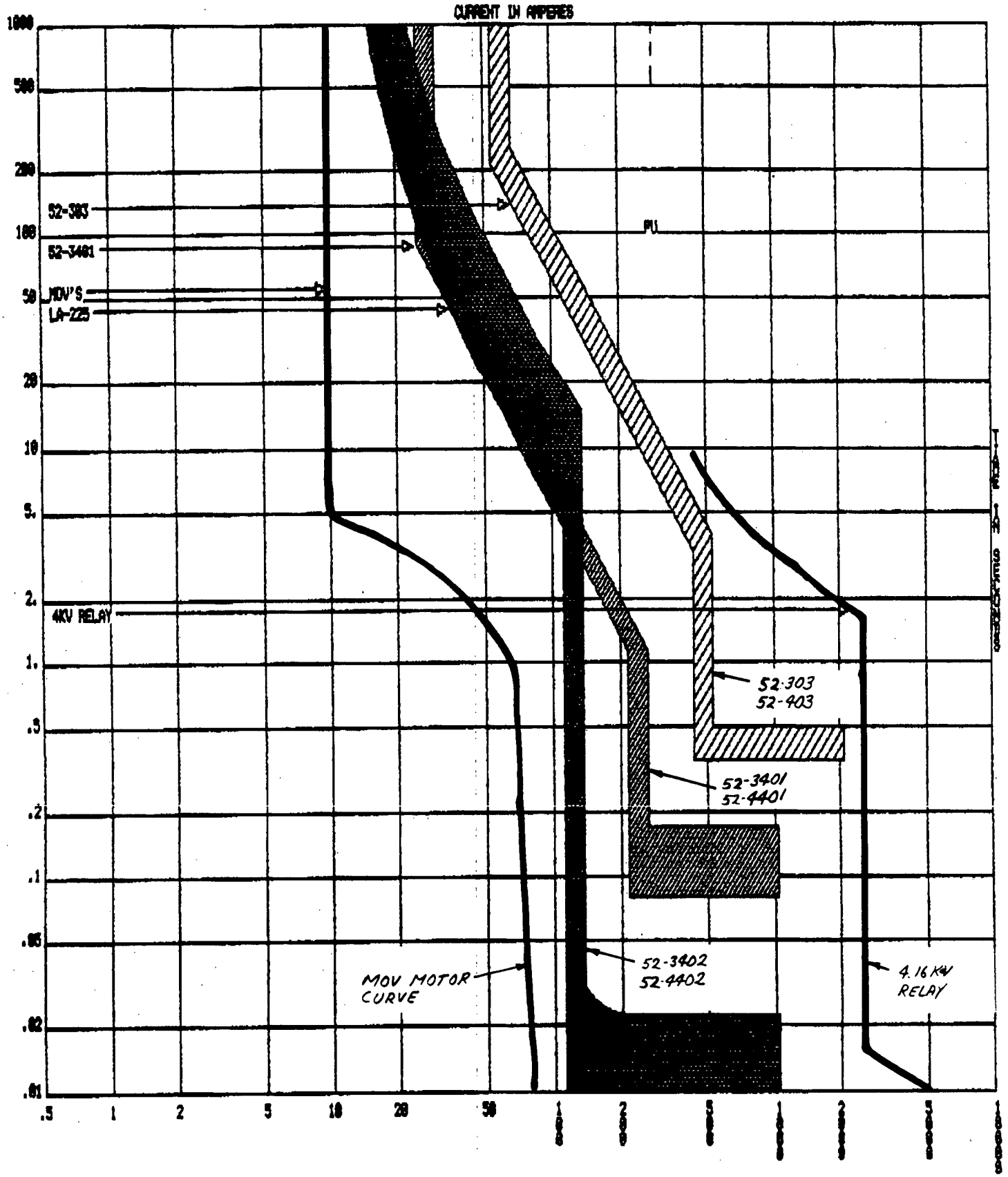
FIGURE 3



COORDINATION CURVE

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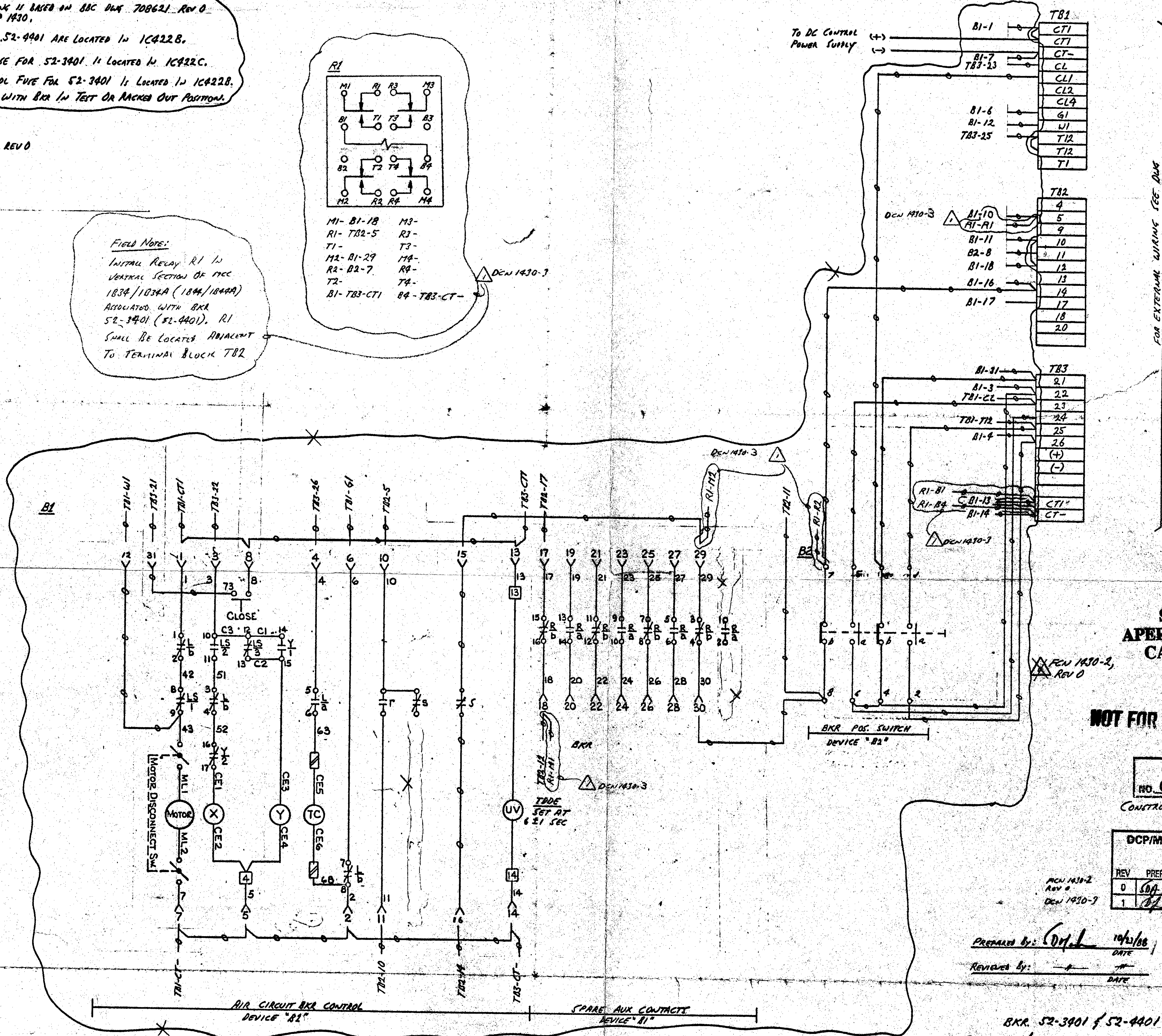
NOTES:
1. BKR INTERNAL WIRING IS BASED ON BBC DWG 708621 REV 0 AS MODIFIED BY DCP 1430.
2. CONTROL FUSES FOR 52-4401 ARE LOCATED IN IC422B.
3. "NORMAL" CONTROL FUSE FOR 52-3401 IS LOCATED IN IC422C.
4. "EMERGENCY" CONTROL FUSE FOR 52-3401 IS LOCATED IN IC422B.
5. BKR. POS SW SHOWN WITH BKR IN TEST OR RACKED OUT POSITION.

FCN 1430-1, REV 0

CONSTRUCTION ADD

DRAFTING NOTE:
CLOUDED WIRES OR -o-o-o- CODED WIRES ARE NEW ADDED WIRES. DO NOT DRAFT THE -o-o-o- ON THIS DWG AT DCP CLOSURE

FIELD NOTE:
INSTALL RELAY R1 IN VERTICAL SECTION OF MCC 1B34/1B34A (1B44/1B44A) ASSOCIATED WITH BKR 52-3401 (52-4401). R1 SHALL BE LOCATED ADJACENT TO TERMINAL BLOCK TB2



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INDEX ITEM NO. 6.5.13

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0	SDA 10/27	
1	10/4/88	

FCN 1430-2 REV 0
DCN 1430-3

PREPARED BY: 10/21/88 DATE
REVIEWED BY: DATE

Docket #50-331
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BKR. 52-3401 & 52-4401
CUBICLE & BKR MECHANISM WIRING DIAGRAM

8811160538-01

DCP 1430 SKETCH E-1

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