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December 13, 1985

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Dresden Station Units 2 and 3
Compliance with 10 CFR 50
Appendix A - General Design
Criterion No. 17
NRC Docket Nos. 50-237 and 50-249

Reference: Letter from D. L. Farrar to H. R. Denton
dated August 22, 1985.

Dear Mr. Denton:

As a result of the August 16, 1985 event on Dresden Unit 2 where the normal supply of off-site AC power was lost, questions were raised by your staff and by Region III regarding compliance with 10 CFR 50, Appendix A, General Design Criterion (GDC) 17. In the referenced letter Commonwealth Edison committed to review the electrical distribution system and related Technical Specifications for Dresden Units 2 and 3 to assess compliance with GDC-17. This transmittal provides the results of our review.

During the August 16 event, normal off-site AC power was lost due to tripping of the Reserve Auxiliary Transformer (RAT) which is fed by our 138 kV switchyard. Due to a transfer circuit deficiency, the two auxiliary power busses normally fed by this transformer failed to automatically transfer to the Unit Auxiliary Transformer (UAT) which is the second normal supply of AC power (fed by the Main Generator). This failure to transfer ultimately led to a reactor scram and loss of AC power feed to the UAT. This constituted a complete loss of normal supply of AC power. As designed, both diesel generators automatically started providing AC power feed to essential equipment. The unit was brought to a safe shutdown condition and remained on diesel generator power until normal off-site power through the Reserve Auxiliary Transformer was restored. During this time, a second source of off-site power as required by GDC-17 was available as described below, but was not utilized since uninterrupted AC power feed was being supplied by the diesel generator. The circuitry deficiency which resulted in failure of the automatic bus transfer (and determined subsequently to have existed on Unit 3 also) has been corrected on both Dresden units.

The questions regarding compliance with GDC-17 centered on the availability of two sources of off-site power. As described previously, the normal supply of off-site power is the 138 kV switchyard feed to the Reserve Auxiliary Transformer (345 kV switchyard for Unit 3). The second source of off-site power required by GDC-17 consists of a 4kV cross-tie between the two units' reserve auxiliary transformers (Bustie 24-1/34-1). This reserve power feed can be quickly activated from the control room via two control switches



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and was available if needed during the August 16, Dresden 2 event. We have evaluated the load carrying capability of this bustie and found it to be adequate to support the emergency loads necessary. We believe this capability fully complies with the requirement for a second source of off-site power in GDC-17.

Attachment 1 to this letter provides a summary of our review of the Dresden Unit 2 Off-Site Electrical Power System against GDC-17. The adequacy of the electrical distribution system was also addressed previously in a letter from R. F. Janecek to W. Gammill dated November 1, 1979. An excerpt from that letter addressing Dresden Units 2 and 3 is provided in Attachment 2. Both of these documents conclude that the design of the electrical distribution system at Dresden fully complies with GDC-17, therefore, no modifications to the system are required.

We have also conducted a review of the Dresden Updated FSAR and Technical Specifications with respect to GDC-17 compliance. We believe the updated FSAR accurately reflects the system design and appropriately describes the Unit 2/3 cross-tie on page 8.2.1-2. We have also noted that the first sentence in paragraph 4 of page 8.2.2-6 appears to contradict page 8.2.1-2 regarding redundancy of off-site power. This paragraph describes the redundancy in switchyard lines feeding the reserve auxiliary transformer and will be clarified with the next scheduled revision to the UFSAR.

Our review of the Technical Specifications has determined that the current specification would allow the Unit 2/3 4kV cross-tie to be inoperable providing redundant switchyard lines feeding the reserve auxiliary transformer are available (Specification 3.9.A.3.(a)). In response to the concerns raised by your Staff regarding this provision, we will submit a Technical Specification amendment deleting the provision thereby enforcing operability of the unit cross-tie.

The referenced letter also indicated we were performing an evaluation of the preferred power feed (bus sections 1 or 3) for the Unit 2 Reserve Auxiliary Transformer (TR22). The results of that evaluation are described in Attachment 3. The reliability of bus sections 1 and 3 was determined to be essentially the same with the exception of Transformer 12 (TR12) which represents an additional source of potential outages on bus section 3. Due to a lack of appropriate data on 138 kV transformers, a failure rate of 0.166 outages per year for TR12 was identified based on 345kV outage data. As noted in Attachment 3, this outage rate is an overly conservative estimate for TR12 reliability. Although the existence of TR12 on bus section 3 results in a somewhat lower reliability than bus section 1, we believe this is offset by other considerations. Specifically, if the Unit 2 Reserve Auxiliary Transformer is being fed by bus 1, and bus 2 is lost for any reason, a low voltage condition on bus 1 would be expected. This would necessitate transferring power feed for TR22 to bus section 3 whenever bus section 2 was disconnected due to unplanned outages, repair work or preventative maintenance on the associated breakers. Performing this transfer with Unit 2 on line represents a risk of a scram and the resultant transient which we believe offsets any reliability advantage of bus 1 over bus 3.

It is also important to understand that the Dresden 2 event on August 16, although initiated by TR12, was actually the result of a circuitry deficiency which prevented automatic transfer of loads to the Unit Auixiliary Transformer. Since this deficiency has been corrected, a recurrence of this event is not expected regardless of the reliability of bus sections feeding the Reserve Auxiliary Transformer. As such, we feel it is not necessary nor appropriate to modify our electrical distribution system nor to restrict sources of power feed to the transformer. We therefore believe that the choice of utilizing bus section 1 versus 3 should be at the discretion of station management in consultation with Power Supply personnel as was originally provided in the FSAR (i.e., no preferred alignment indicated). We will revise the Updated FSAR to reflect this with the next scheduled revision. Dresden 1 Transformer 12 is currently disconnected from bus section 3. As previously agreed, we will contact Region III prior to reconnecting it.

In summary, our review of the off-site power system at Dresden has determined that it fully complies with General Design Criterion 17 and no modifications are required. The updated FSAR appropriately reflects the system with the exception of the previously identified changes to be provided with the next scheduled update. To assure availability of the 4 kV cross-tie as an alternative source of AC power, we will submit a Technical Specification amendment imposing operability requirements on the cross-tie. The above conclusion and commitment regarding the Technical Specification change applies to Dresden Units 2 and 3 and Quad Cities Units 1 and 2.

At this time we believe that with completion of the actions described in this letter, all of our commitments regarding the August 16, 1985 Dresden 2 event will be fulfilled.

If you have any further questions regarding this issue, please contact this office.

Very truly yours,

M. S. Turbak

M. S. Turbak
Operating Plant Licensing Director

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cc: J. Streeter - Region III
R. Gilbert - NRR
R. Bevan - NRR
NRC Resident Inspector - Dresden
NRC Resident Inspector - Quad Cities

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ATTACHMENT 1

Prepared by: B. G. Treece
Date: August 22, 1985
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Commonwealth Edison Company
Dresden Unit 2

Offsite Electrical Power System - Compliance With GDC-17

The following is a subjective discussion/appraisal of the compliance of the Dresden - Unit 2 Offsite Electrical Power System with the requirements of Criterion 17 of 10CFR50 Appendix A - General Design Criteria for Nuclear Power Plants (GDC-17):

I. GDC-17 requires that an offsite electric power system be provided for items important to safety.

Dresden - Unit 2 Response:

As shown in Figures 8.2.1:1 and 8.2.2:3 (copies attached), Unit 2 is provided with two sources of offsite power.

The primary source (Source #1) of offsite power is the 138kV switchyard. The power flow is from the 138kV bus to Reserve Auxiliary Power Transformer 22, to 4kV Buses 23 and 24, and then to 4kV Buses 23-1 and 24-1 from which the 4kV Engineered Safety Feature (ESF) loads are supplied.

The backup source (Source #2) of offsite power is the 345kV switchyard. The power flow is from the 345kV bus to Unit 3 Reserve Auxiliary Power Transformer 32, to Unit 3 4kV Bus 34, to Unit 3 4kV ESF Bus 34-1 and then to Unit 2 4kV ESF Bus 24-1.

Transformer 22 is connected to the 138kV bus by means of duplicate conductors permitting connection to either of two 138kV bus sections. The two connections are separated by two manually operated bus sectionalizing disconnect switches. A failure in a single bus section or the failure of a single circuit breaker will affect only one of the reserve auxiliary power transformer connections.

The 138kV bus supplies five 138kV transmission circuits (See Figure 8.3.1:1: Note: it shows six circuits with one being a load circuit.) The five 138kV transmission lines leave the station on four different rights of way. Two lines to Joliet Station are on double circuited towers.

I. (cont'd)

The 345kV ring bus receives the output of Units 2 & 3 and supplies six 345kV transmission circuits (See Figure 8.2.1:1). The six 345kV transmission lines leave Dresden on four separate rights of way. Two lines to Electric Junction and two lines to Gooding's Grove are on double circuited towers.

The 138kV and 345kV switchyards are interconnected by two 138kV-345kV auto-transformers (TR 81 & TR 83), which are connected to separate sections of the 138kV bus. There are also transformers between the 138kV and 345kV systems at Electric Junction, Lombard, and Gooding's Grove.

Dresden - Unit 2 is thus provided with an offsite electric power system for items important to safety.

II. GDC-17 requires that the offsite electric power system, assuming a failure of the onsite system, provide sufficient capacity and capability to assure (a) that the design limits (for the fuel and for the reactor coolant pressure boundary) are not exceeded for anticipated operational occurences and (b) that core cooling, containment integrity, and vital functions are maintained for postulated accidents.

Dresden - Unit 2 Response:

As shown in Figure 8.2.2:3, the reserve auxiliary transformers (22 and 32) step the transmission voltage down to the station 4160 volt system. Each reserve auxiliary transformer is sized to provide the total auxiliary load of one unit plus one division of engineered safeguards auxiliary power for the other unit. There are two breakers to allow Unit 2 4160 volt Bus 24-1 and Unit 3 4160 volt Bus 34-1 to be tied in an emergency. This configuration provides availability of redundant sources of offsite power.

As shown in Figure 8.2.1:1, the auxiliary power supplies from the 138 and 345kV transmission systems are protected against the effect of unplanned outages by the diversity of six separate 345kV circuits and five 138kV circuits and two major generating units feeding into the two switchyards at the Dresden site.

II. (cont'd)

The offsite electric power system thus provides sufficient capability to assure (a) that the design limits are not exceeded for anticipated operational occurences and (b) that the core cooling, containment integrity, and vital functions are maintained for postulated accidents.

III. GDC-17 requires that electric power from the transmission network be supplied by two physically independent circuits (a) designed so as to minimize, insofar as practical, common mode failure, (b) designed so that each will be available in sufficient time to assure that specified design limits are not exceeded following a loss of all ac onsite power and the other offsite ac power circuit, and (c) one of the circuits shall be available within a few seconds following a LOCA.

Dresden - Unit 2 Response:

(a) A detailed description of the two physically independent circuits (sources of offsite power) is provided in the response to Section I above. Common modes of failure are minimized insofar as practical by the use of different (but not totally independent) offsite power sources (138kV switchyard and 345kV switchyard) and by routing the two power circuits to the Unit 2 4kV ESF bus (24-1) by two physically separated routes and with no electrical equipment common to the two offsite circuits.

(b) Each circuit is designed so that it will be available in sufficient time to assure that specified design limits are not exceeded. The primary circuit (via Reserve Auxiliary Transformer 22) is immediately available because it is already in service, during all normal operating modes, continuously supplying power to the safety-related and non-safety-related Unit 2 auxiliaries. The backup source (via Unit 3 Reserve Auxiliary Transformer 32) can be connected to Unit 2 4kV ESF Bus 24-1 is a very short time - the time required to manually close two 4kV ABCs (Nos. 3421 and 2432) and thus complete the cross-tie between Unit 3 Bus 34-1 and Unit 2 Bus 24-1.

(c) As noted in (b) above, the primary circuit (via Reserve Auxiliary Transformer 22) is immediately available.

IV. GDC-17 requires that provisions be included to minimize the probability of losing electric power from any of the remaining sources as a result of, or coincident with, the loss of power from the main generator, the loss of power from the transmission network, or the loss of power from the onsite electric power sources.

Dresden - Unit 2 Response:

Each of the three power sources (the main generating unit, the offsite/transmission network power system, and the onsite/diesel-generator power system) have been individually designed to be very reliable. They have also been designed to be reasonably independent from each other so as to minimize the probability that loss of one power system would disable either of the other two. This is accomplished by the application of long established and conservative design principles, including the following:

1. The three power systems are electrically and physically isolated/separated from each other to the maximum extent practical with few interconnections.

2. Although the 138kV switchyard (offsite power system) and the 345kV switchyard (main generator power system) are purposely interconnected (via two auto transformers) to improve the reliability and stability of the 138kV system, adequate switching equipment, protective relays, and controls are provided to automatically and quickly separate the two power systems if a disabling fault occurs on one of the two systems.

   Although the two switchyards are not designed to seismic Category I requirements, nor are they "tornado proof", the two switchyards (transformers, breakers, buses, switches, etc.) are physically separated so as to reduce the probability that one environmental event would disable both power systems/switchyards.

3. The auxiliary power distribution in the plant is accomplished by a relatively simple radial system with inherently good fault clearing characteristics.

4. Electrical equipment is dedicated, insofar as practical, to only one of the three power systems; i.e., the use of equipment that is common to two systems in minimized.

IV. <u>(cont'd)</u>

5. Reliable electrical equipment is purposely selected with adequate capacity rating so that the normal switching of load buses can usually be accomplished (automatically or manually) without concern for overloads.

6. Protective devices (relays, circuit breakers, fuses, etc.) are selected and designed so as to quickly detect and isolate electrical faults in equipment, buses, and circuits with minimum effect on unfaulted circuits.

7. The controls for transfer of loads between the three electric power systems are selective; i.e., they are designed so as to effect an automatic transfer of loaded buses (block load transfer) for faults (such as short circuits) which are quickly (cycles) detected and cleared, but purposely do not automatically initiate block load transfers for degraded voltage conditions (e.g., bus under-voltage). Such transfers are undesirable because the high inrush currents (which may accompany such "slow" transfers) may disable the second power system. Instead, a degraded voltage condition initiates load shedding, the <u>unloaded</u> bus is transferred to the backup source, and then the loads are reapplied to the bus in small increments (e.g., one load at a time).

8. Control circuits utilizing auxiliary relays are designed, whenever possible, so that the auxiliary relay will be normally de-energized. This arrangement minimizes the number of spurious actuations (e.g., auto transfers) which unnecessarily challenge the controls, equipment, and protection systems and may unnecessarily trip one of the backup power systems.

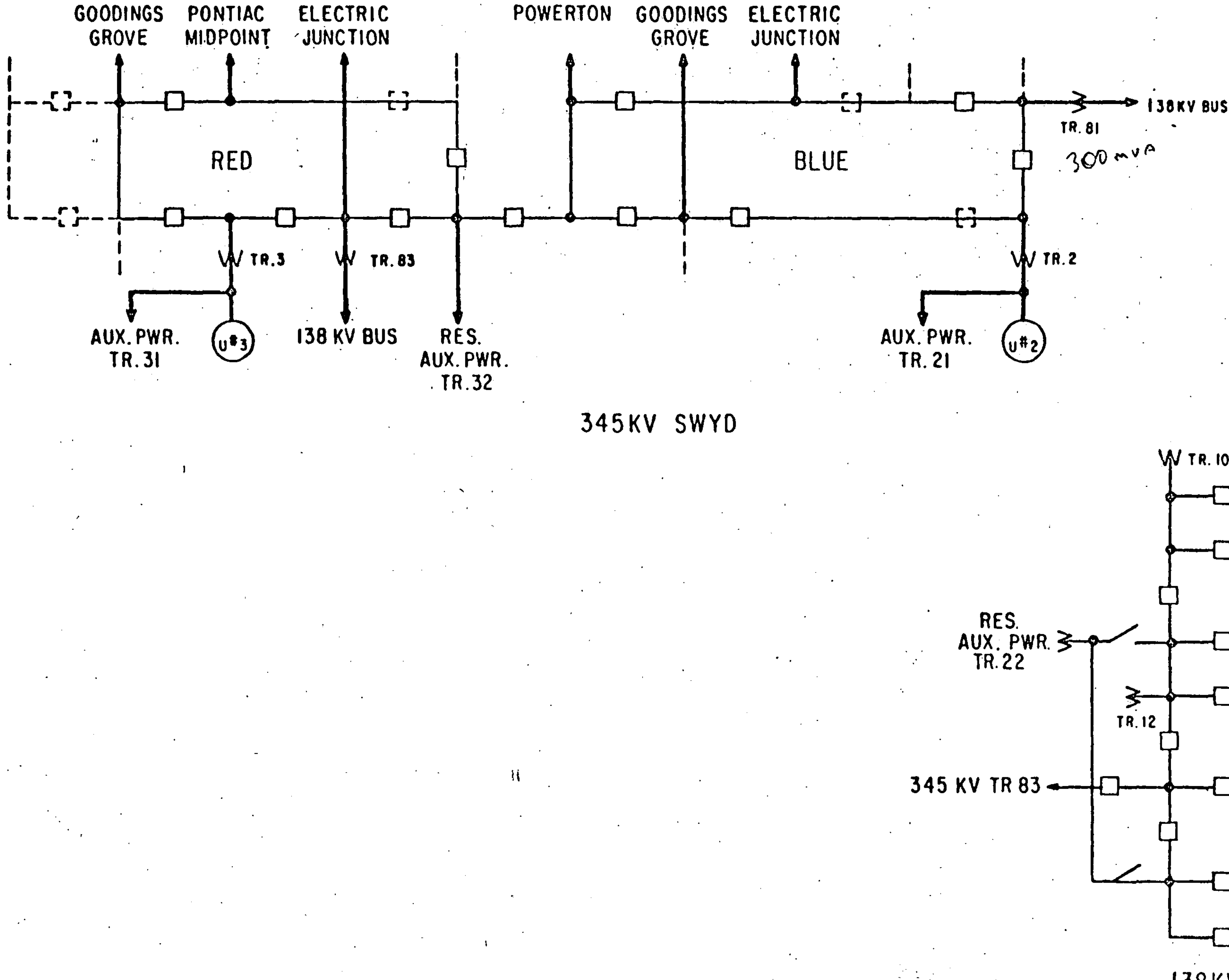


FIGURE 8.2.1:1 SINGLE LINE DIAGRAM 345KV, 138KV SWYD'S

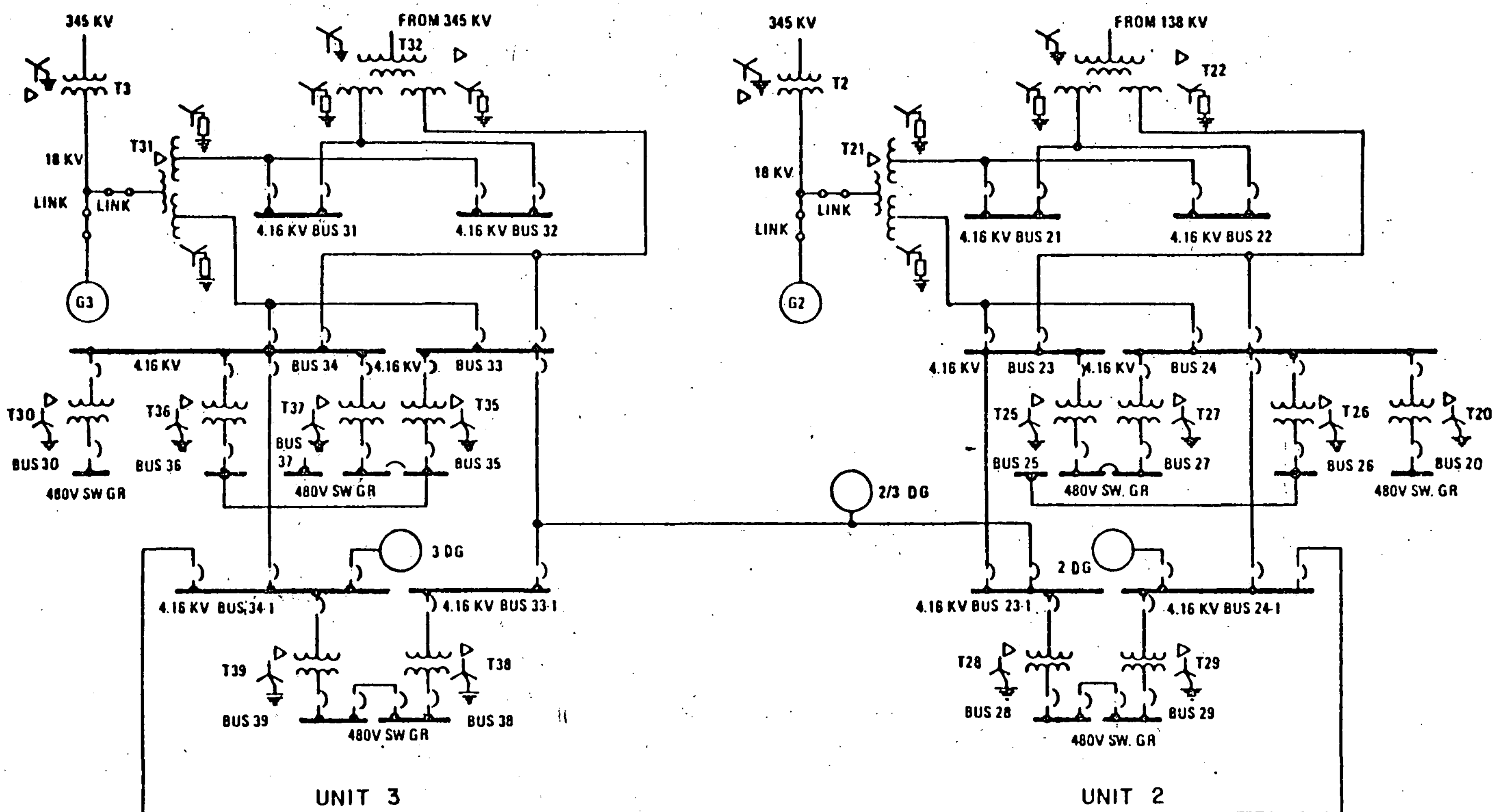


FIGURE 8.2.2:3 AUXILIARY ELECTRICAL SYSTEM - 4160 VOLT AND 480 VOLT