TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
5N 157B Lookout Place

April 30, 1986

Director of Nuclear Reactor Regulation
Attention: Mr. B. J. Youngblood, Project Director
PWR Project Directorate No. 4
Division of Pressurized Water Reactor (PWR)
Licensing A
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Youngblood:

In the Matter of the Application of) Docket Nos. 50-390
Tennessee Valley Authority) 50-391

Please refer to J. A. Domer's letter to you dated January 16, 1986 concerning a fifth vital battery system presently being installed at Watts Bar Nuclear Plant. Enclosed for your review are marked-up changes to the FSAR describing the fifth vital battery system.

These changes will be incorporated in the next amendment to the FSAR.

If there are any questions, please get in touch with K. P. Parr at FTS 858-2681.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

R. Gridley, Director
Nuclear Safety and Licensing

Enclosure
cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attention: Dr. J. Nelson Grace, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

A001
1/1

Enclosure

Fifth Vital Battery FSAR Revision

Affected FSAR pages, tables, and figures:

Pages: 8.1-7 (Insert 8A), 8.1-14, 8.3-36A, 8.3-45, 8..3-47B (Insert 8B), 8.3-53 (Insert 8C), 8.3-54 (Inserts 8D, 8E), 8.3-56, 8.3-59, 8.3-60 (Insert 8F), 8.3-60A, 8.3-62 (Inserts 8G, 8H), 8.3-63, 8.3-64 (Insert 8I), 8.3-65

Table: 14.2-1 (Sheets 123, 144A (2 pages))

Figures: 8.1-3 (R5), 8.3-2 (R6), 8.3-39 (R17), 8.3-40 (R16), 8.3-47 (R18), 8.3-48 (R19), 8.3-49 (R17), 8.3-50 (R15), 8.3-56 (R1), 8.3-57 (R3)

(F)

Regulatory Guide 1.63, 'Electric Penetration Assemblies in Containment Structures for Water-Cooled Nuclear Power Plants.' (F)(1) | 48

Regulatory Guide 1.73, 'Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants.' (F)

Regulatory Guide 1.75, 'Physical Independence of Electric Systems.' (2)

Regulatory Guide 1.81, 'Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants.' (3)

Regulatory Guide 1.89, 'Qualification of Class IE Equipment for Nuclear Power Plants.' (4)

Regulatory Guide 1.93, 'Availability of Electric Power Sources. (F)

Regulatory Guide 1.100, 'Seismic Qualification of Electric Equipment for Nuclear Power Plants.' (5)

Regulatory Guide 1.106, Rev. 1, 'Thermal Overload Protection for Electric Motors on Motor Operated Valves.' (F) | 35 | 52

Regulatory Guide 1.108, Rev. 1, 'Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants.' (6)

Regulatory Guide 1.118, Rev. 2, 'Periodic Testing of the Electric Power and Protection Systems.' (8) | 48

IEEE Trial-Use Std 338-1971, 'Criteria for the Periodic Testing of Nuclear Power Generating Station Protection Systems.' (F) | 52

IEEE Std 344-1971, 'Guide for Seismic Qualification of Class I Electrical Equipment for Nuclear Power Generating Stations.' (F)

IEEE Std 387-1977, 'Criteria for Diesel Generator Units Applied as Standby Power Supplies for Nuclear Power Stations.' (See Appendix 8D).

INSERT 8A →

Notes:

1. RG-1.63

C.1 Full Compliance: The electric penetrations have been designed to withstand the maximum fault current for the time duration of the backup protective device. A redundant | 52

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Insert 8A

IEEE 484-1975, 'IEEE Recommended Practice For Installation Design and Installation of Large Lead Storage Batteries for Generating Stations and Sub-Stations.' (9)

IEEE 485-1978, 'IEEE Recommended Practice For Sizing Large Lead Storage Batteries for Generating Stations and Substations.' (9)

IEEE 535-1979, 'IEEE Standard for Qualification of Class 1E Lead Storage Batteries for Nuclear Power Generating Stations.' (9)

IEEE 450-1980, 'IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations' (F)

8. The Watts Bar design complies with all of the positions of Regulatory Guide 1.118, Rev. 2 except as follows: 52 54

Position C.6(a) - Where feasible test switches or other necessary equipment will be installed permanently to minimize the use of temporary jumpers in testing.

9. Full compliance for Fifth Vital Battery Only.

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alternating current high voltage and water adsorption tests, and have demonstrated their ability to meet performance requirements. 35 40.58

Each manhole or cable pull point is accessible for periodic visual inspection of cables during normal operations or preflood conditions for the life of the plant. The duct runs are designed such that inundated testing of redundant cables can be conducted. 24

TVA does not use directly buried conduit for any Class 1E cable installation, which precludes the practice mentioned in item 7. 30.19

8.3.1.3 Physical Identification of Safety-Related Equipment in A.C. Power Systems

The onsite power system equipment and associated field wiring is identified so that two factors are physically apparent to plant operating and maintenance personnel:

1. That equipment and wiring is safety-related, and

2. That equipment and wiring is properly identified as part of a particular division of separation.

The scheme used to physically identify major safety-related a.c. electrical equipment employs a suffix label. The suffix label added to the equipment name is -A, or -B, which represents train A or train B diesel-generator power source. For example, 6900-volt shutdown board 1A-A is safety-related equipment, where the 1 indicates Unit 1, the A represents board A, and the -A is assigned to train A.

The 125-volt d.c. vital system is shared between both units and divided into four channels. The 125-volt vital charger, 125volt vital battery board, and 125-volt vital battery of each channel is physically identified in its label by I, II, III, or IV, ~~respectively~~.

In addition, 125-volt vital battery V, physically identified in its label by "S" may serve as a temporary replacement for either battery I, II, III, or IV.

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Vital battery V which serves as a temporary replacement for any of the other four vital batteries during their testing, WBNP-46 maintenance, and other outages is also located in the Auxiliary Building on El. 772

redundant trains. The 480-volt shutdown board transformers associated with each power train are separated from the transformers associated with other power trains by a 8-inch-thick, 8-foot-tall reinforced concrete wall. The 480-volt equipment is located in the Auxiliary Building on elevation 757 and 772. The location of these boards is shown in Figure 8.3-2. 46

125-Volt D.C. Equipment

The 125-volt vital batteries I, II, III, and IV are located in the Auxiliary Building on elevation 772 and are divided into four divisions (channels I, II, III, and IV) of separation. Each 125-volt vital battery is separated from all other 125-volt vital batteries by providing individual rooms for each battery with 8-inch reinforced concrete walls extending to the ceiling. The ventilation system is designed to remove and dissipate the hydrogen given off by the batteries (see Section 9.4 for ventilation system I, II, III and IV description). ~~The 125 volt~~ Vital battery boards are located in the Auxiliary Building on elevation 757 and are also divided into four divisions of separation. Each 125-volt vital battery board (I, II, III and IV) is separated from all other 125-volt vital battery boards by 8-inch reinforced concrete wall extending to the ceiling. The location of these batteries and boards is shown in Figure 8.3-36.

120-Volt A.C. Equipment

The vital inverters are located in the Auxiliary Building on elevation 772 and are divided into four divisions (channels I, II, III, and IV) of separation. The channels I and II inverters are located in the Unit 1 area while the channels III and IV inverters are located in the Unit 2 area. The channels I and II inverters are separated from the channels III and IV inverters by an 8-inch reinforced concrete wall extending to the ceiling. The channel I and the channel III inverters are separated from the channel II and the channel IV inverters, respectively, by a distance of 60 feet. The location of the inverters is shown in Figure 8.3-36.

Electrical Penetrations of Primary Containment

Redundant essential cables enter the containment via separate electrical penetrations. Where possible, redundant essential cables utilize electrical penetrations spaced horizontally instead of vertically. Where redundant essential cables are installed in electrical penetrations spaced vertically, power

Vital battery board V is located on elevation 772 in the same room as vital battery V and is separated from the battery by a 7 ft. high, 8 in. thick seismic wall (figure 8.3-57).

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associated and non-Class IE cables provides a reliable means of meeting the intent of Regulatory Guide 1.75 to not degrade Class IE cables:

1. A circuit breaker and fuse in series
2. Two circuit breakers in series
3. A single fuse

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All of the installed protective devices and those added to further protect the associated and Non-Class IE cables are of a high quality commensurate with their importance to safety.

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A majority of the associated circuits analyzed have either two protective devices provided or the calculated short-circuit current is effectively limited to a value less than the conductor's continuous current rating. The remaining eighteen associated circuits have only one protective device. Of these circuits, sixteen are protected by a fuse and two by a circuit breaker. Where practical, an additional protective device has been added to these two circuits protected by a single circuit breaker; otherwise the single circuit breaker is being tested in accordance with the plant's technical specifications.

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Non-Class IE power and control cables routed in nondivisional tray, not meeting Regulatory Guide 1.75 separation requirements, similarly have one of the protective schemes described above. Otherwise, the single circuit breaker that protects each non-Class IE power or control cable is tested in accordance with the plant's technical specifications.

INSERT 8B

~~There are certain safety-related components which may be powered from one of two redundant divisions (channels or trains) through manual transfer devices. These components include the component cooling system pump C-S, the spent fuel pit pump C-S, and the steam turbine driven auxiliary feedwater pumps 1A-S and 2A-S.~~ In addition, there are certain safety-related components, such as the additional diesel generator unit (ADGU), and the fifth vital battery which are capable of supplying power to redundant divisions (channels or trains) through manual transfer devices. The cables from the transfer device to the component require special separation and are routed in separate raceways with no other circuits with the following exception. Cables with a suffix S may be routed together provided the following two conditions are satisfied: (1) voltage levels are compatible, and (2) circuits are designed such that under any design basis event all cables in the raceway will always be of the same divisions (channel or train) where energized. These circuits are identified by a

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These components will have suffix S added to their labels. A suffix S will be added to their respective raceway and cable designations.

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Insert 8B

There are certain safety-related components, such as the component cooling water pump C-S and the steam turbine-driven auxiliary feedwater pumps 1A-S and 2A-S, which receive power from redundant divisions (channels or trains) through manual transfer devices.

8.3.1.4.7 Fire Barriers and Separation Between Redundant Trays

The criteria for separation between redundant trays for various zones or areas of the plant is described in Section 8.3.1.4.2. These criteria for separation between redundant trays are based on engineering judgment. Where the physical separation between redundant trays could not be attained, fire barriers have been provided. These fire barriers for various zones or areas of the plant are also described in Section 8.3.1.4.2.

Cable fire stops for redunant cable tray runs through openings in floors and openings in walls between buildings have been provided. Also, fire barriers have been installed in floor openings for redundant cables entering the Main Control Room. These barriers are described in Section 8.3.1.4.4.

8.3.2 D.C. Power System

8.3.2.1 Description

8.3.2.1.1 Vital 125V D.C. Control Power System

The vital 125-volt d.c. control power system is a Class IE system whose safety function is to provide control power for engineered safety features equipment, emergency lighting, vital inverters, and other safety-related d.c. powered equipment for the entire plant. The system capacity is sufficient to supply these loads during normal operation and to permit safe shutdown and isolation of the reactor for the "loss of all a.c. power" condition. The system is designed to perform its safety function subject to a single failure.

INSERT 8C →

System Design Requirements

The requirements described below were implemented in the design of the Vital D.C. Power System.

Redundancy

The system is composed of four redundant channels. These four channels are used to provide emergency power to the four vital ~~125V a.c.~~ inverters per unit which supply control power to the reactor protection system. Other loads are either two divisional or nondivisional loads. No automatic connections are used between the four redundant channels.

120V ac

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INSERT 8C

The fifth 125 V Vital Battery System is intended to serve as a temporary replacement for any one of the four 125-V dc vital batteries during their testing, maintenance, and outages with no loss of system reliability under any mode of operation. See figure 8.3-56

The procedure for the substitution of the fifth vital battery for a primary vital battery is as follows: First, the fifth charger must be disconnected from the fifth vital battery board via the charger breaker; second, the selected primary vital battery board must be aligned to its spare battery charger (1-S or 2-S) via the spare charger transfer switch (1-S or 2-S); third, the primary vital battery/primary vital battery board intertie breaker must be opened; fourth, the fifth vital battery board manual transfer switch must be aligned to the appropriate distribution panel feeder (A for batteries I and III, B for II and IV); fifth, the selected distribution panel manual transfer switch must be aligned to the appropriate primary vital battery board feeder; and sixth, the selected primary vital battery board/fifth vital battery intertie breaker must be closed.

In this mode of operation the fifth vital battery shall be maintained at the required nominal voltage level by the appropriate spare vital battery charger and shall be available, as needed, to supply all loads connected to the primary vital battery board. The substitution of vital battery V for a primary vital battery shall in no manner degrade either the reliability or the capacity of the 125-V dc vital power system: all system requirements shall be satisfied and all parameters unchanged. (Note: to fulfill this requirements, the fifth vital battery and all associated cabling shall be sized such that the minimum primary vital battery board voltage with fifth vital battery connected is, under all circumstances, greater than or equal to the primary battery board voltage with the primary vital battery connected.)

Separations

The four channels are electrically and physically separated so that a single failure in one channel will not cause a failure in another channel. Each channel has a charger, a battery, and a load distribution board.

INSERT 8D →

Capacity

(712 amperes for vital battery V)

The system has the capacity to continuously supply all steady state loads and maintain the battery in a fully charged condition. With the batteries in the fully charged condition, the system has the capacity to supply the connected loads for a minimum of two hours with a loss of all ac power. The battery rating stated by the manufacturer is a minimum 2-hour discharge rating of 686 amperes at 60°F when discharged to a minimum terminal voltage of 105 volts. This rating will be confirmed by TVA acceptance tests, and the batteries will be retested periodically, in accordance with the technical specifications, to assure that they maintain adequate capacity.

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(108.5 volts for vital battery V)

Charging

I, II, III and IV

~~The~~ Chargers have the capacity to continuously supply the steady state loads and maintain the batteries in the design maximum charged state or to recharge the batteries from the design discharge state within an acceptable time interval irrespective of the status of the plant during which these demands occur. ~~Each~~ Chargers may be replaced by a spare charger. One spare charger is provided for each two normal chargers.

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INSERT 8E →

I, II, III and IV

Ventilation

Each battery room has redundant ventilation systems to prevent the accumulation of explosive gases. In addition to the ventilation systems provided to prevent accumulation of the hydrogen produced by the battery, there are voltmeters, high voltage alarms, and administrative procedures for control of equalizing charges that will provide additional protection. Also, as an added precaution, all cells are of the sealed type and have a special safety vent that prevents the ignition of gases within the cell from a spark or flame outside the cell.

Loading

Loads are assigned according to their divisional requirements. Loads requiring four divisions of separation are assigned to the four channels. Loads requring two divisions of separation are assigned to Channels I or III and II or IV. Two-divisional

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INSERT 8D

P Electrical separation for the fifth vital battery system is maintained through a series of interlocking breakers and through their administrative controls to prevent a single failure from accidentally connecting vital battery systems I, II, III, or IV to the fifth vital battery system. Physical separation of the fifth vital battery system is maintained to the same standards as vital battery systems I, II, III, and IV. Each group of actions needed to replace one of the four vital batteries with the fifth vital battery is annunciated in the main control room. Cables and conduits between the fifth vital battery board and its distribution panels A and B are designated as S (see FSAR section 8.3.1.4.3).

INSERT 8E

H The sole function of Seismic Category 1(L) Charger V is to recharge and maintain proper voltage level to Battery V while it is in a standby mode. The charger is isolated from the fifth vital system when the system is replacing one of the four vital batteries. Isolation is accomplished by manually opening the charger load and supply breakers located on fifth vital battery board and 480-volt Auxiliary Building Common Motor Control C, respectively.

Vital battery V is located in the same room with vital battery board V. This room has a dedicated heating and ventilation system with a backup.

separations to prevent common mode failures. The analysis verifying the adequancy of independence appears in Section 8.3.2.2.

The specific arrangement of components is discussed below.

125-Volt Vital Batteries I, II, III, ~~and~~ IV, and V

Reference: Figures 8.3-36 and 8.3-57

These batteries are located in individual rooms on elevation 772.0 of the Auxiliary Building. Each battery room is equipped with its own heating and ventilating system separate from the systems of all other rooms. The heating and ventilating systems are designed to provide an ambient room temperature between 60°F and 104 F and a maximum relative humidity of 98 percent. (10 percent to 95 percent for vital battery V).

125-Volt Vital Battery Boards I, II, III, ~~and~~ IV, and V

Reference: Figures 8.3-36 and 8.3-57

~~These~~ Boards I, II, III, and IV are located in individual rooms on elevation 757.0 of the Auxiliary Building. Battery board rooms I and II have a common heating and air conditioning system that is independent from the common system for rooms III and IV. Each heating and ventilating system has a backup. Heating and ventilating systems are designed to provide an ambient room temperature between 60°F and 104° F and a maximum relative humidity of 50 percent. Board V is located in the fifth vital battery room on elevation 772.0 of the Auxiliary Building. This room has a dedicated heating and ventilation system (and backup system) designed to provide an ambient temperature between 60° and 104°F and a maximum relative humidity of 95 percent.

Loads

Each channel supplies the following types of loads: control circuits for the shutdown boards, relay panels, solenoid valve fuse panels, emergency lighting cabinets, inverters, annunciators, and panels associated with reactor instrumentation and control systems. Tables 8.3-19 through 8.3-22 list the loads on each battery board and identify the safety and non-safety-related loads. Loads shown on these four tables represent nominal values of load at 125 volts. These values are intended to show the total load on the battery bus during normal conditions (with 480 volts a.c. available) and during abnormal condition (480 volts a.c. unavailable). Tables 8.3-23 through 8.3-26 list the actual loads expected on each vital battery system. The three headings 135V, 120V, and 105V indicate the

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operates in the float mode at 135 volts, but can be switched to the equalize mode with an output of 140 volts, (3) a current-limit feature which limits continuous overload operation to 125 percent of rated output, (4) protective devices which prevent a failed charger from discharging its associated battery and protect the charger from external overloads, (5) metering and alarm circuits to monitor the charger output, (6) parallel-operation capability.

Emergency D.C. Supply

The emergency supply of d.c. current to each distribution board is from its associated vital battery. There are ~~four~~ five vital batteries for the plant--one associated with each channel. These batteries are physically and electrically independent. The vital batteries supply the entire plant d.c. load in the event the normal power source is unavailable. With normal power unavailable, ~~and one battery out of service, the~~ three ~~remaining~~ vital batteries are capable of supplying continuously for 30 minutes all loads required for safe shutdown of both units. The batteries also have the capability to supply the essential loads required to maintain the plant in a safe shutdown condition for two hours following a loss of all normal and standby a-c power, but no accident. Each battery is normally required to supply loads only during the time interval between loss of normal feed to its charger and the receipt of emergency power to the charger from the standby diesel generator.

Vital Battery Boards

~~The~~ Battery boards I, II, III and IV consist of four metal-enclosed panels. Mounted on these panels are the main distribution bus, battery and charger input buses, load group fuses, load group buses, subdistribution circuit breakers, and various instruments for monitoring board loading.

Each subdistribution circuit breaker is coordinated to its load group fuse. Each load group fuse is coordinated to the 1000-ampere battery supply breaker which, in turn, is coordinated to the 1600-ampere battery supply fuse. The charger input breakers and fuses are considered a load group and are coordinated to the battery supply protective devices. The purpose of this coordination scheme is to prevent a fault on one subdistribution or charging feeder causing a loss of the emergency supply.

All of the subdistribution circuit breakers are 150-ampere frame molded-case types with the exception of the charger input, emergency lighting, and inverter breakers, which are 400-ampere frame molded-case types. The load groups are connected to the main distribution bus with fuses sized from 60 to 400 amperes. The variation in fuses is based on the individual circuit breaker trip settings, or ratings for all devices, which are listed in Figures 8.3-47 through 8.3-50.

All circuit breakers have trip alarm contacts for vital batteries I, II, III, and IV to alert the control room operator of a tripped breaker. The ground indicator has an alarm contact to warn the operator of a distribution system ground. Metering on the distribution board includes battery current, bus voltage, main and spare charger voltage, board charging current, and ground current. Metering for battery current and bus voltage are also located on the main control board for vital batteries I, II, III, and IV.

INSERT 8F →

Tests and Inspections

Prior to placing the vital d.c. system in operation, the system components will be tested to ensure their proper operation.

The batteries are tested during preoperational testing by discharging them with a load which simulates their loading during an a.c. power outage. The test is performed in accordance with IEEE-450-1980, 'Recommended Practice for Maintenance, Testing and Replacement of Large Stationary Type Power Plant and Substation Lead Storage Batteries,' Sections 4.1 and 4.2. A variable load is connected to the batteries, and a constant current drain is maintained until conclusion of the tests. The battery capacity is then determined using the procedure outlined in IEEE-450-1980, Section 5.5. | 26 | 56 | 56

A battery service test, conducted in accordance with the procedures of section 5.6 of IEEE-450-1980, is also used to test the batteries under conditions as close to design as practical. The batteries are discharged through the simulated design loads for a two-hour period, and then discharged to the design minimum terminal voltage of 105 (108.5 for vital battery V) so that the battery capacity margin can be calculated. The time required to return to normal conditions is established by recharging the batteries from the two-hour discharged condition to a nominally fully charged state. The design loads will be confirmed by field measurements as part of the preoperational testing program. | 56 | 52 | 24 | 56

Insert 8F

¶ The class 1E vital battery board V consists of two metal-enclosed panels containing the main distribution bus, battery and charger input buses, battery main circuit breaker, charger main circuit breaker, sub-distribution - interlocking - load circuit breakers, and various instruments for monitoring board loading.

¶ Battery Board V contains metering for battery current, bus voltage, and ground current which indicates the fifth vital battery system parameters in the standby or replacement mode. The main control room battery ammeter of the replaced battery system will be manually switched to indicate battery V current. The main control room bus voltmeter of the replaced battery system will continue to indicate the bus voltage of the replaced battery system.

The charger will be checked for normal and equalizing voltage adjustability, 100 percent output capability, specified regulation with and without the battery connected, and panel instruments calibration. For the distribution board, circuit breakers will be tested for proper trip operation, fuses will be checked to verify that the sizes and types specified on the single-line diagram (see Figures 8.3-47 through 8.3-50 and figure 8.3-56) have been installed, and the board instruments will be calibrated.

Vital D.C. Power System Load Data

Tables 8.3-19 through 8.3-26 delineate the safety-related loads and specify the load current values. The basis for each load current value is indicated in the tables. Capacity and capability of the vital power system are verified in Section 8.3.2.2.

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250-Volt D.C. Power System

This system provides power for non-safety-related loads such as turbine auxiliaries, computer, and switchyard control and relaying equipment. The circuits supplying power for switchyard control are discussed in Section 8.2.1.4.

8.3.2.2 Analysis of Vital 125-Volt D.C. Control Power Supply System

The 125-volt d.c. Class IE electrical systems were designed, components fabricated, and are or will be installed meeting the requirements of the NRC 10CFR50 Appendix A General Design Criteria, IEEE Standard 308-1971, NRC Regulatory Guides 1.6, 1.9, and 1.32, and other applicable criteria as enumerated herein. | 52

The I, II, III, and IV vital battery system consists of four lead-acid-calcium batteries, six 200-ampere battery chargers, four distribution boards, cable, and hardware. Each distribution board is supplied from its own battery and charger. However, there are two spare chargers for supplemental and/or backup capacity. Each spare charger is connected so as to be available for use on either of two of the distribution boards for supplying load or charging the batteries. A manually operated switch transfers the spare charger from one board to another, and it is interlocked to prevent accidental parallel connection of the vital power systems.

INSERT 8G →

The distribution boards I, II, III and IV are each located in separate rooms at elevation 757 of the Auxiliary Building, which is designed as a seismic Category I structure, and they are protected from potential missile hazards. The batteries are located in separate rooms, and the chargers are located in groups of three in separate room at elevation 772 of this same building. Therefore, this equipment will not be exposed to hostile environments and, since it is outside the primary containment area, it will not be exposed to significant radiation due to a LOCA.

INSERT 8H →

Thus, the system design, equipment location, separation, and redundancy assure ability to meet the requirements for the applicable accident events described and evaluated in Chapter 15 and is in full compliance with NRC General Design Criteria 17 and Regulatory Guide 1.6. | 52

The normal or preferred power source to each distribution board is from the battery charger which is supplied from either one of two 480-volt a.c. shutdown distribution boards. The battery

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INSERT 8G

P The fifth vital battery system consists of 125-V Vital Battery V, Vital Battery Board V, Charger V, Distribution Panel A, Distribution Panel B, and four Panels O (one each for vital battery boards I, II, III and IV).

INSERT 8H

P The Fifth Vital Battery System components are located as follows:

Component	Location
Battery V	Auxiliary Bldg, A4-U, El 772
Charger V	Auxiliary Bldg, A5-S, El 772
Vital Distribution Board V	Auxiliary Bldg, A5-T, El 772
125V Vital Distribution Panel A	Auxiliary Bldg, A5-R, El 757
125V Vital Distribution Panel B	Auxiliary Bldg, A11-R, El 757
Panel O, Battery Board I	Auxiliary Bldg, A5-R, El 757
Panel O, Battery Board II	Auxiliary Bldg, A5-R, El 757
Panel O, Battery Board III	Auxiliary Bldg, A11-R, El 757
Panel O, Battery Board IV	Auxiliary Bldg, A12-R, El 757

(712 amperes for vital battery I)

serves as an emergency source in the event the battery charger source is lost or is inadequate for the load required. The total design load for each board with 480-volt a.c. available is shown by Tables 8.3-19 through 8.3-22. The primary charger supplying each board is of more than ample capacity to supply load currents and maintain full charge on the battery. The total design load for each board with the 480-volt a.c. unavailable is shown in Tables 8.3-19 through 8.3-22. Since each battery has an emergency 2-hour rating of 686 amperes at 60°F with a minimum of 105 volts d.c. at the battery terminals and the starup time on the diesels is less than 30 minutes, the battery capacity far exceeds the maximum design load requirements for each board. 52 41 52

(108.5 volts for vital battery I)

Each essential load has a redundant supply which is electrically separate from its first supply. The supply cables are routed so as to provide complete physical separation from the two supplies to each load. The overall design of the system (including batteries, chargers, distribution boards, and cabling) incorporates sufficient capacity and capability to deliver the maximum design load currents required at each remote point and also to clear any possible short-circuit fault currents.

The load demand from ~~each of the four~~ I, II, III and IV battery boards can be grouped into essentially three categories for analysis purposes. These are (1) the vital inverters, (2) 6900- and 480- volt shutdown board control power, and (3) miscellaneous control and instrumentation loads. The output fuse and breaker trip ratings and trip times are coordinated to provide protection and isolation for the cables leaving the board. 52

Referring to Figure 8.1-3, it can be seen that each of the three groups of loads are supplied from the main bus through a fuse to a stub bus from which the power is delivered to each load circuit via a molded-case automatic circuit breaker. Each stub bus may supply one or more breakers. Figures 8.3-37 through 8.3-40 show the exact circuit distribution. Each breaker and fuse has a current interrupting rating greater than the maximum short-circuit current capability of the battery and charger combined. Each breaker and fuse is sized in accordance with circuit requirement. The interposing fuse between the main and stub buses not only provides high-speed clearing for a very severe close-in feeder fault, but it also provides redundant protection of the feeder in the event an

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associated breaker fails to operate, thus preventing a single feeder fault resulting in the loss of the entire bus. The fuse is likewise coordinated with the main bus supply protective devices. The one panel of the distribution board that is devoted entirely to fused load circuits is powered from the main bus through a molded-case breaker which provides redundant protection and serves as an isolating disconnect switch.

~~The~~ Chargers I, II III and IV are all identical and are rated for a load duty as dictated by the battery board distribution and battery charging requirements. The output load of the charger is delivered through a 2-pole molded-case breaker that is capable of interrupting the battery backfeed into the charger as necessary. The trip setting of the breaker is chosen to permit the charger to operate at its maximum output capability without experiencing a false trip. The electrical characteristics of the charger provide the necessary output power regulated and filtered as required by the load for the worst maximum and minimum input power conditions. The charging capacity exceeds that required to restore the battery from the design minimum charge state to the fully-charged state under worse case load conditions in compliance with Regulatory Guide 1.32. The input circuit of the charger is protected from the source power by a molded-case breaker that also serves as an isolating or disconnect switch. The input power is derived from either one of two 480-volt shutdown distribution boards. The manually-operated transfer switch through which the power is delivered is interlocked in such a manner so as not to parallel the two shutdown boards in compliance with Regulatory Guide 1.6.

INSERT 8I →

Surveillance and Monitoring

Each distribution board and charger is equipped with the proper instruments to provide visual indication of the necessary electrical quantities. An alarm contact is provided on all circuit breakers and on all fuses located on the fuse distribution board that closes for a blown fuse or automatic opening of the breaker. Undervoltage alarm relays provide annunciation for loss of power on the buses or power input to the chargers. Relays which detect a no-charge condition are provided on the chargers to detect a charger failure. Closure of any contact provides annunciation in the Main Control Room (MCR). Overvoltage alarm relays in charger provide annunciation for protection of the batteries. A ground indication alarm meter provides annunciation in the MCR. Also, a battery current ammeter (charge/discharge) and a battery bus voltmeter are provided in the MCR and locally to verify proper operation of each system. 48

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INSERT 8I

Seismic Category 1(L) battery charger V is intended solely to maintain vital battery V in its fully charged state and to recharge it following its use or testing : at no time will battery charger V be used to supply vital battery system loads. Battery charger V has sufficient capacity to restore vital battery V from design minimum charge state to the fully charged state in approximately 40 hours. The output load of the charger is delivered through a 2-pole molded-case breaker capable of interrupting battery backfeed current into the charger as necessary. The breaker trip setting is chosen to permit maximum charger output without experiencing false trip. The electrical characteristics of the charger provide the necessary filtered and regulated output power for battery recharge. The input circuit of the charger is protected from the source power by a molded-case breaker which serves also as an isolating or disconnect switch. The input power is from the 480V Auxiliary Building Common MCC C.

Insert to page 8.3-64

For Vital Battery Boards I, II, III, and IV,

The overall system design--including function requirements, redundancy, capability, availability, surveillance, and energy storage capacity--is in full conformance with IEEE 308-1971, Criteria for Class IE Systems.

Seismic Qualification

for vital battery boards I, II, III, and IV and chargers I, II, III & IV

One complete board assembly and one complete battery charger assembly have been subjected to the safe shutdown earthquake (SSE) conditions stipulated in the design criteria for the particular elevation at which they are installed. (Refer to Section 3.10.) The tests were performed in conformance to IEEE Standard 344-1971, Guide for Seismic Qualification of Class I Electric Equipment. One breaker of each type used on the equipment was operated under simulated fault conditions at the same time the assembly was experiencing the sesmic forces. The seismic test results assure that the complete assembly will continue to function properly and continue to deliver the required power during and after any expected SSE condition.

[Charger I is seismic category 1 (L)]

Design Test

All battery chargers were electrically tested to assure that each unit is capable of performing all requirements as specified. All boards were subjected to and satisfactorily passed the following tests as specified under the indicated paragraphs of section 20-5 of ANSI C37.20-1969 (ANSI C37.20-1974 for fifth vital battery system):

20-5.2.8 - Flame Resistance for Barrier, Bus, and Wire Insulation
20-5.3.2 - Mechanical Operation
20-5.3.4.1 - Control Wiring Continuity
20-5.3.4.2 - Control Wiring Insulation

(AB-1-1975 for fifth vital battery system)

All molded-case circuit breakers comply with NEMA Publication No. AB-1-1964 requirements, and all drawout low-voltage circuit breakers comply with NEMA Publication No. SG3-1965. All control circuit wiring has self-extinguishing insulation rated 600 volts in accordance with paragraph 6.1.3.1 of ANSI C37.20-1969. All equipment is certified to operate within the environmental requirement called for in the Design Criteria. (Refer to Section 3.11.)

(ANSI C37.20-1974 for fifth vital battery system).

P A seismic test was performed on Vital Battery Board IV and distribution panels A, B, and O in accordance with IEEE 344-1975. The board and panels were verified to maintain electrical function and structural integrity before, during, and after the test. No malfunctions of equipment were exhibited.

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TABLE 14.2-1

LIST OF PREOPERATIONAL TESTS
(Sheet 123)

Title of Test No. TVA-9C	Test Prerequisites	Test Objectives Summary of Testing and Acceptance Criteria
		Conditioning System d. CRD Room Air Conditioning Units e. Additional Equipment Building Air Conditioning Units f. Cask Decontamination Room Exhaust Fan and Cask Decontamination Area Fan g. Main Steam Valve Vault Ventilation h. Condensate Demineralizer Waste Evaporator Building Air Conditioning i. Equipment Decontamination Room Supply and Exhaust Fan j. Fifth Vital Battery Room 7. Turbine Driven Auxiliary Feedwater Pump Room Ventilation Subsystem 8. Verification of Auxiliary Building Air Preheater System 9. Operation of Auxiliary Building Filter Room Exhaust Fan 10. Verification of Emergency Cooling to the Shutdown Board Room for the Main Control Room

Revised by Amendment 55

487

TENNESSEE VALLEY AUTHORITY SUBJECT PROJECT SHEET OF
COMPUTED BY DATE CHECKED BY DATE
TVA 4890 (EN DES-2-78)

NEW

Table 14.2-1
(Sheet 144A)

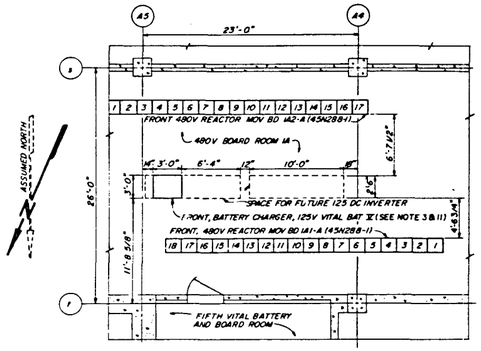
Title of Test No. TVA 16C	Test Prerequisites	Test Objectives, Summary Of Testing and Acceptance Criteria
125-V Fifth Vital Battery System	Construction checks and testing of the Fifth Vital Battery System shall be completed before this test is performed. The system alarms, instrumentation, and interlocks shall be calibrated and operational prior to starting this test.	The test will verify: (1) Adequate fifth vital battery capacity per manufacturer's rating. In addition, TVA-16C will provide data necessary to determine the fifth vital battery capacity margin, (2) The ability to supply each primary vital battery board (I, II, III and IV) from its dedicated primary vital battery and charger, (3) The ability to supply each primary vital battery board from its associated spare vital battery charger, (4) The ability to electrically isolate each primary vital battery board from its dedicated primary vital battery, vital battery charger, and associated spare vital battery charger, (5) The ability to supply each primary vital battery board from the fifth vital battery, to monitor the vital battery system alignment via MCR annunciations, and to

TVA 16C continued

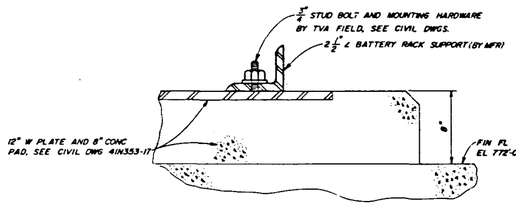
P The discharge test will be conducted as an IEEE 450-1980 acceptance test. All acceptance criteria is as stated above

Test Objectives, Summary Of Testing and Acceptance Criteria

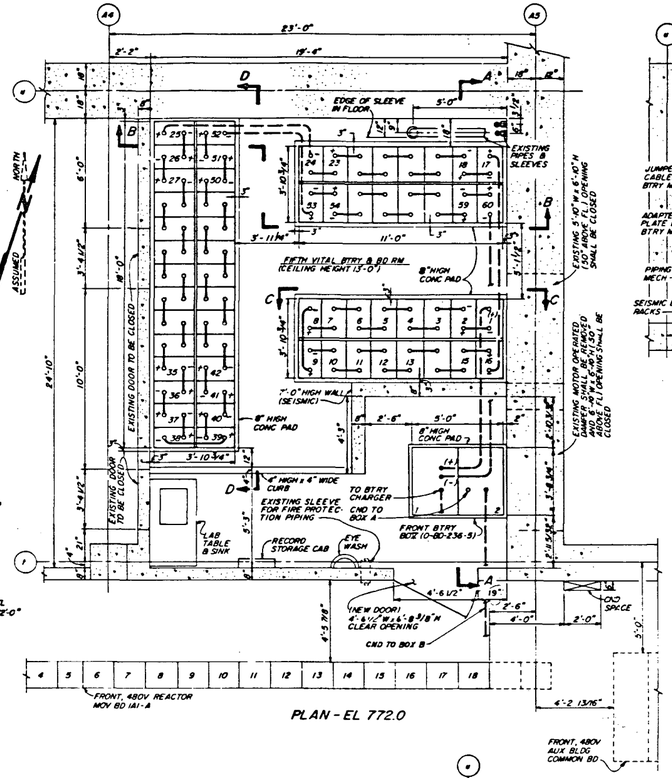
transfer all required primary vital battery board and associated MCR instrumentation to measure fifth vital battery parameters, (6) The ability to maintain electrical isolation between redundant divisions of the 125-V DC Control Power System with the fifth vital battery substituting for each primary vital battery, (7) The ability of the fifth vital battery to maintain 105 V DC at each primary vital battery board following a 2-hour discharge at manufacturer's rated current (battery terminal voltage equals 108.5 V DC), (8) The ability to recharge the fifth vital battery from a spare vital battery charger while supplying the worst case (480-V AC available) loading of the primary vital battery board to which it is connected, (9) The ability of the fifth charger to recharge the fifth vital battery (following a 2-hour discharge test) in approximately 40 hours.



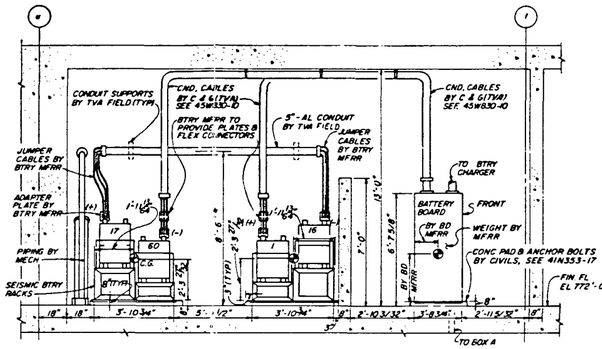
PLAN-EL 772'-0"
SCALE: 3/16"=1'-0"



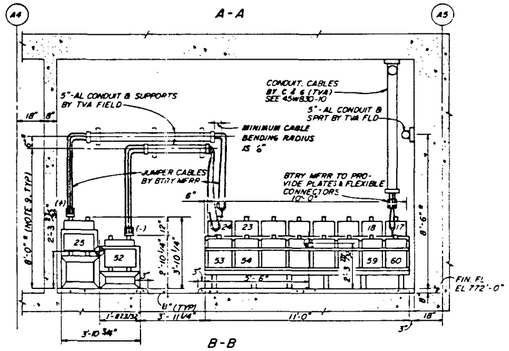
DETAIL E
NTS



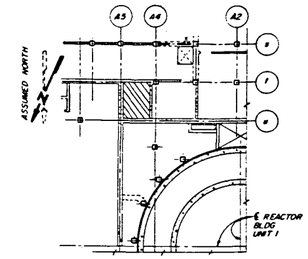
PLAN - EL 772.0



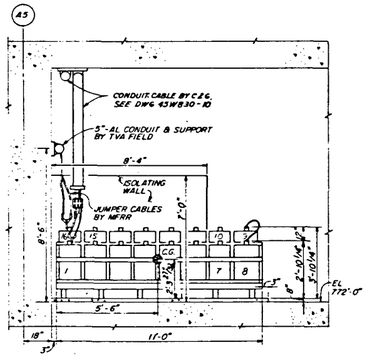
A-A



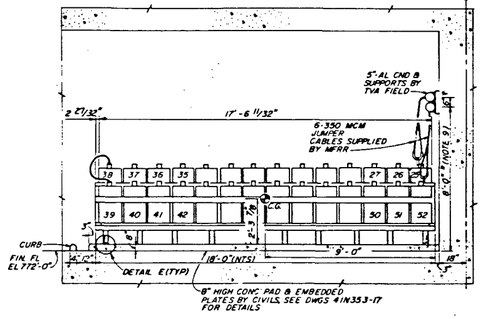
B-B



KEY PLAN
EL 772.0
NTS



C-C



D-D

EQPT	WEIGHT
16 CELL RACK	1100 LBS
WITH CELLS	9435 LBS
28 CELL RACK	11800 LBS
WITH CELLS	16382 LBS

NOTES:

1. 125V VITAL BATTERY 'X' AND BATTERY BOARD ARE CLASS 1E ELECTRIC EQUIPMENT LOCATED IN CATEGORY I STRUCTURE. THEY WILL REMAIN FUNCTIONAL DURING AND AFTER AN EARTHQUAKE. SEE CIVIL DWG 41N333-1 FOR DETAILS OF SEISMIC ANCHORING OF EQUIPMENT TO FLOOR.
2. FOR MANUFACTURER'S DETAILS OF BATTERY, RACKS, AND INTERCELL CONNECTIONS REFER TO GOULD DWGS, TVA CONTRACT 84X8-832101.
3. CHARGER FOR THE BATTERY SYSTEM IS CLASS 1L AND LOCATED IN 480V ELECTRICAL BOARD RM 1A. FOR EXACT LOCATION AND SEISMIC ANCHORING DETAILS SEE STRUCT ST DWGS 48W1227-4 & 6 RESPECTIVELY.
4. 125V VITAL BATTERY 'X' SYSTEM IS BEING ADDED TO REPLACE ANY OF THE EXISTING FOUR 125V VITAL BATTERY SYSTEMS AND SIZED TO SUPPLY EMERGENCY LOADS FOR 2 HOURS WITH A MINIMUM AMBIENT TEMPERATURE OF 60°F AND A MINIMUM BATTERY TERMINAL VOLTAGE OF 105.6 VOLTS.
5. EXISTING PORTABLE BATTERY DISCHARGE TEST SET IS USED TO TEST THE BATTERY.
6. FOR SINGLE LINE DIAGRAM OF 125V VITAL BATTERY BOARD AND TRANSFER SCHEME SEE DWGS 45W705-1,-2, & -3.
7. ALL INTERCELL CONNECTIONS AND JUMPER CABLES BETWEEN THE BATTERY RACKS INCLUDING NECESSARY CABLE TERMINALS, TERMINAL PADS AND HARDWARE SHALL BE FURNISHED BY BATTERY MANUFACTURER. TVA WILL FURNISH SEISMICALLY ANCHORED CONDUITS AS RECOMMENDED BY BATTERY MANUFACTURER FOR SIZE AND LOCATION TO SUIT THE JUMPER CABLE NEEDS.
8. TVA WILL FURNISH CABLE AND CABLE TERMINALS AND CONDUIT FOR CONNECTING BATTERY TO BATTERY BOARD. NECESSARY PAD AND FLEXIBLE CONNECTOR AND HARDWARE FOR BOLTING TVA'S CABLE TERMINALS TO BATTERY TERMINALS FURNISHED BY BATTERY MANUFACTURER TO SUIT MANUFACTURER'S DESIGN.
9. DIMENSIONS SHOWN WITH (R) ARE APPROXIMATE. SHOWN ONLY TO GIVE SOME IDEA ABOUT CABLE LENGTHS. THE INTER-RACK CABLING WILL BE SUPPLIED AS ONE CABLE LENGTH AND CUT TO THE REQUIRED LENGTHS BY TVA FIELD.
10. FOR 125V VITAL BATTERY BOARD MANUFACTURER'S DRAWINGS SEE TVA CONTRACT NO. 85K8-836724.
11. BATTERY CHARGER FOR 125V VITAL BATTERY 'X' WAS BOUGHT ON HARTSVILLE-PHIPPS BEND CONTRACT NO. 79-823245 AND TRANSFERRED TO WATTS BAR ON TRANSFER REQN NO. 833485.

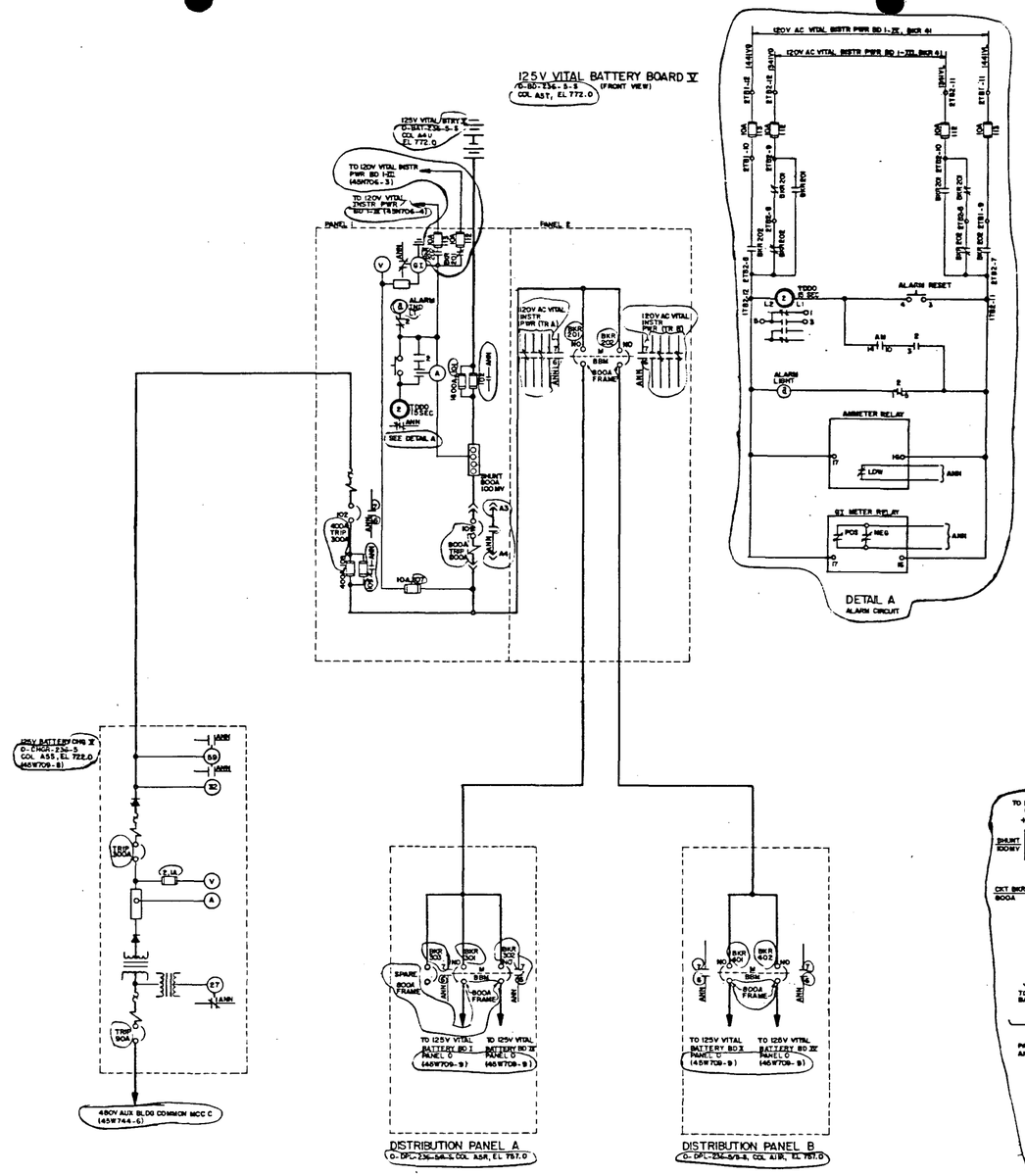
FIRST ISSUED FOR ECN 2519

TI APERTURE CARD

8605060218-01

WATTS BAR NUCLEAR PLANT
FINAL SAFETY ANALYSIS REPORT

AUXILIARY BUILDING
UNITS 1 & 2
ELECTRICAL EQUIPMENT
125V VITAL BATTERY V-EL 772.0
PLANS & DETAILS
TVA DRAWING NO. 45W217-1 R3
FIGURE 8.3-57



CIRCUIT SCHEDULE						
PNL	BKR	FRAME	TRIP	CABLE	CIRCUIT	SAFETY CLASS
1	109/	800	800	——	125V VITAL BATTERY V TIE TO VITAL BATTERY BOARD V	S
——	102	400	300	B2006	125V VITAL BD V TIE TO BTRY CHGR V	NS
2	201	800	NA	1 B2015	VITAL BTRY BD V TIE TO DISTR PNL A/	S
2	202	800	NA	B2025	VITAL BTRY BD V TIE TO VITAL PNL B	S
A	303	800	NA		SPARE	
A	301	800	NA	B2050	VITAL BTRY BD V TIE TO VITAL BTRY BD I	S
A	302	800	NA	B2159	VITAL BTRY BD V TIE TO VITAL BTRY BD III	S
B	401	800	NA	B2106	VITAL BTRY BD V TIE TO VITAL BTRY BD II	S
B	402	800	NA	B2206	VITAL BTRY BD V TIE TO VITAL BTRY BD IV	S

CONTACTS (HANDLE END)		POSITION (TV) BTRY I	BTRY V
	1	X	O
	2	O	X
	3	O	X
	4	X	O
	5	X	O
	6	O	X
	7	X	O
	8	O	X

INSTRUMENTATION XFRS
D-XS-236-I/O TYPICAL
(MAINTAINED)

NOTES:

1. ALL ELECTRICAL EQUIPMENT IS CLASS 1E EXCEPT CHARGER V WHICH IS CATEGORY I (LL).
2. ALL BREAKER AND KA2 ACTUATOR ALARM CONTACTS SHALL BE WIRED TO TERMINAL BLOCKS AT THE REAR OF THEIR ASSOCIATED BOARDS OR PANELS.
3. BATTERY BOARD MAIN FEEDER BREAKER (101) IS SET AS FOLLOWS:

LONG DELAY ------- 100% PICKUP AND 1A MAX LONG DELAY SETTING
SHORT DELAY ------- 5X OF TRIP UNIT RATING WITH 2C MIN DELAY

4. BATTERY AMMETER RELAY IS SET TO ALARM FOR DISCHARGE LONGER THAN 15 SECONDS.
5. GROUND INDICATOR ALARM TO BE SET BY FIELD.
6. PANELS I,E, A, AND B ARE PURCHASED UNDER T.V.A. CONTRACT (85K8-836724)
7. CHARGER V IS TRANSFERED FROM HARTSVILLE TO WATTS BAR UNDER TRANSFER REQUISITION (633-465)
8. BATTERY BD MAIN CABLE ARE 8805 (POS BUS), AND 8885 (NEG BUS).
9. CIRCUIT SAFETY CLASSIFICATION WILL BE IDENTIFIED AS S-SAFETY RELATED, NS - NON-SAFETY RELATED. SAFETY AND NON-SAFETY WIRING IS TO BE SEPARATED BY A 6" AIR SPACE, METAL BARRIER AND/OR CONDUIT.
10. FOR PANEL I, E, A AND B INSTRUMENTATION WIRING, SEE 45W708-8.
11. UNIQUE FUSE NUMBER IS THE UNIQUE DEVICE NUMBER / FUSE NUMBER, WHERE THE FUNCTION DESIGNATION IS CHANGED TO "FU" (D-FU-236-5/101, TYPICAL).
12. THE BATTERY BUS FUSES ARE 1600A BOLTED BUSWAY TYPE A-6BT.
13. BATTERY CHARGER FEEDER BUSS FUSES ARE BUSSMAN TYPE FRS 400A, 600V DC.
14. PANEL V AND CHARGER INSTRUMENT FUSES ARE 10A, 250V, NON-DETERIORATING.
15. THE 125V BATTERY SYSTEM VOLTAGE IS NORMALLY 130V & 105V WHEN THE BATTERY IS DISCHARGED.

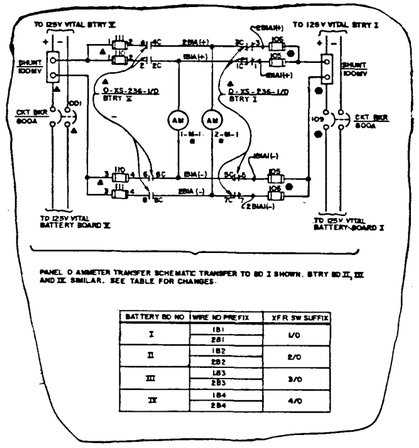
SYMBOLS:

MANUAL BREAK BEFORE MAKE TRANSFER SWITCH

A --------- LOCATED ON MAIN CONTROL ROOM PANEL
A --------- LOCATED ON PANEL O OF BATTERY BOARDS I, II, III, OR IV.
● --------- LOCATED ON PANEL I OF BATTERY BOARDS I, II, III, OR IV.

REFERENCE DRAWINGS:

45K82 R-W	125V DC VITAL BTRY BD & DIST PNL SCHEMATICS & WIRING DIAGRAMS	TVA CONTRACT (85K8-836724)
45K82R-DL	125V DC VITAL BTRY BD & DIST PNL WIRING DIAGRAM	
45W700-L	125V DC VITAL PLANT CONTROL POWER SYSTEM	
WB-DC-80-2.1	125V FIFTH VITAL BATTERY SYSTEM DESIGN CRITERIA	



PANEL O AMMETER TRANSFER SCHEMATIC TRANSFER TO BD I SHOWN. BTRY BD II, III AND IV SIMILAR. SEE TABLE FOR CHANGES.

BATTERY BD NO.	WIRE NO. PREFIX	XFR SW SUFFIX
I	181	I/O
	281	
II	182	2/O
	282	
III	183	3/O
	283	
IV	184	4/O
	284	

FIRST ISSUE FOR ECN 2919

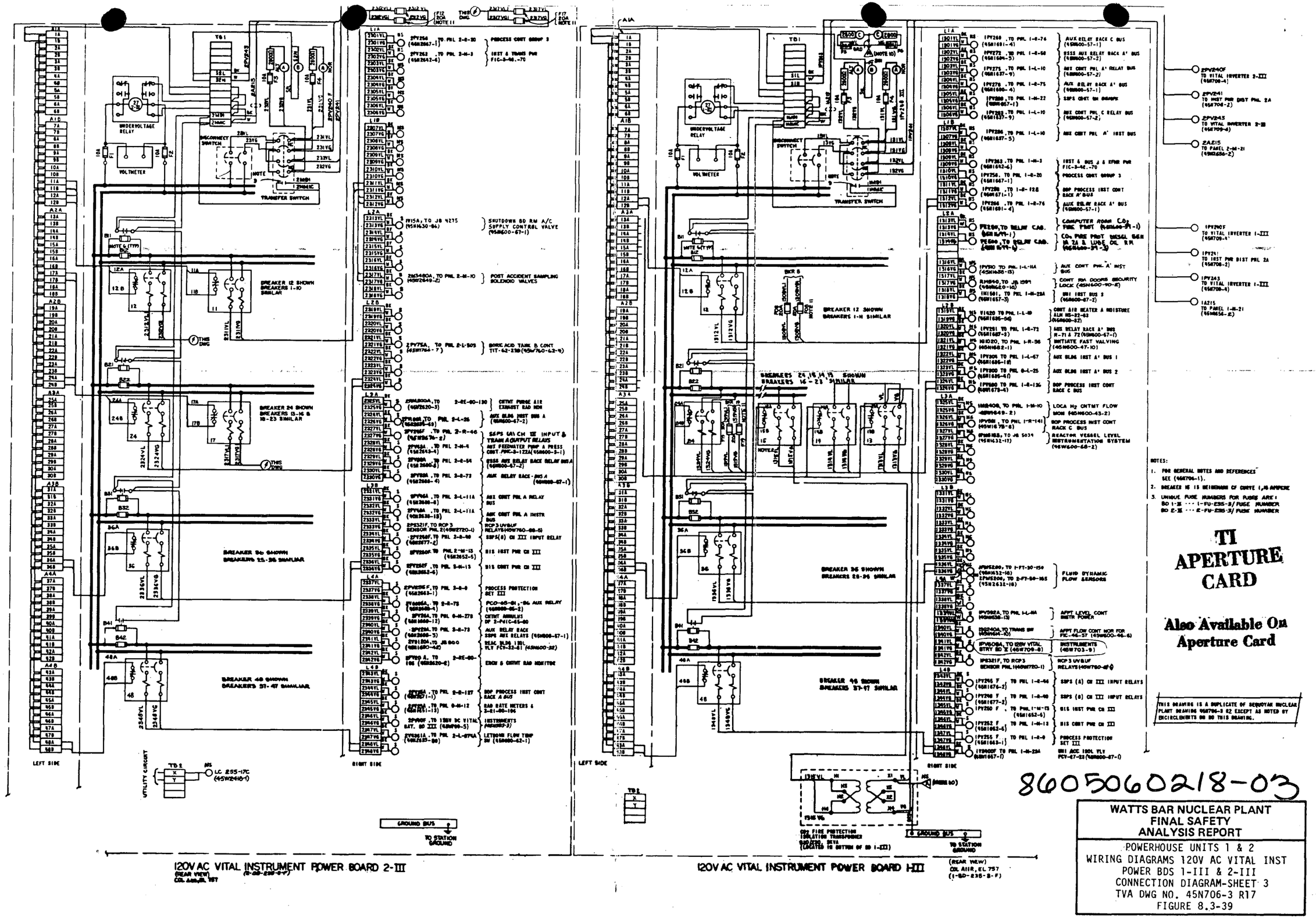
COMPANION DRAWING 45W703-1 THRU-8

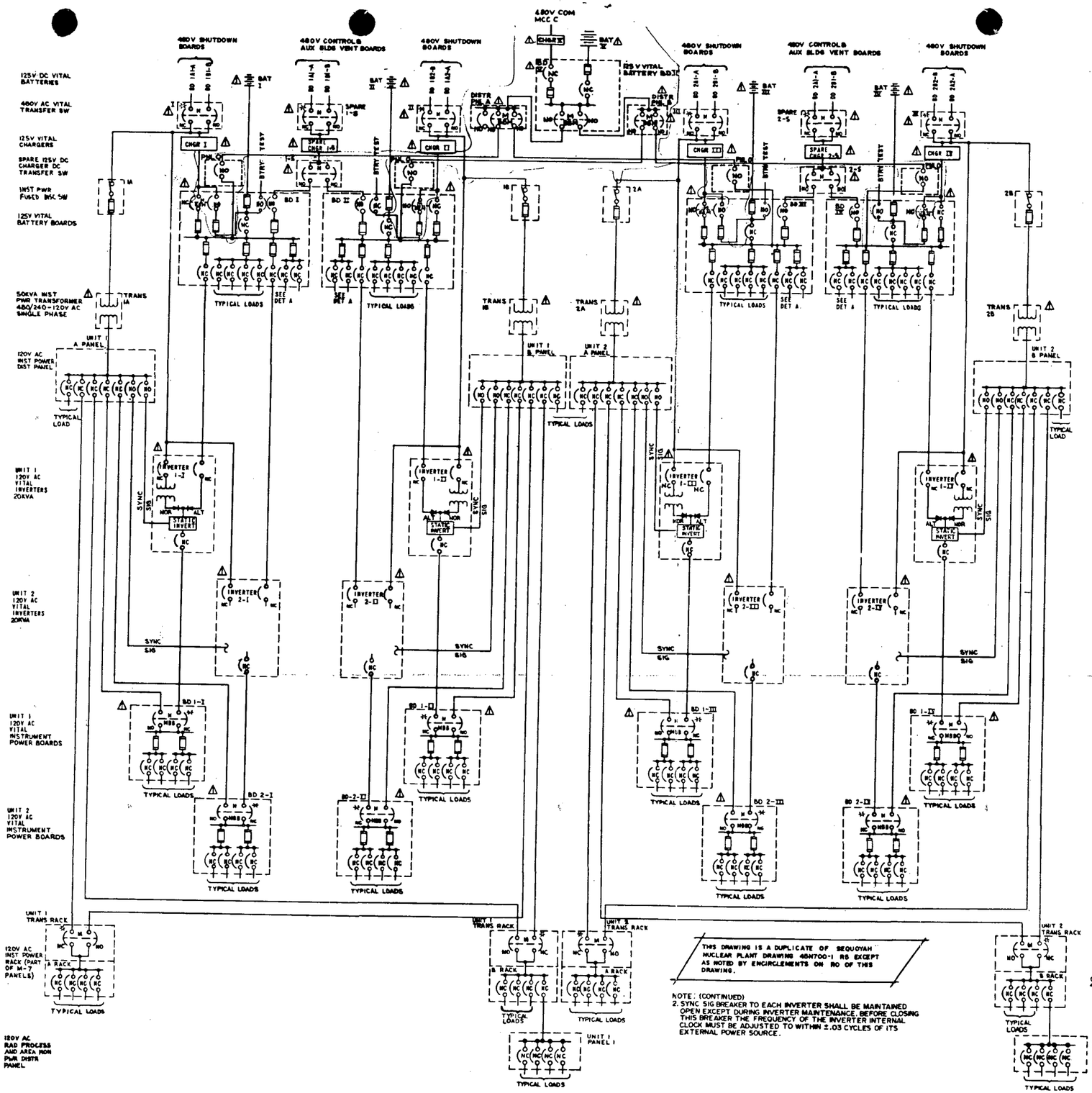
TI APERTURE CARD

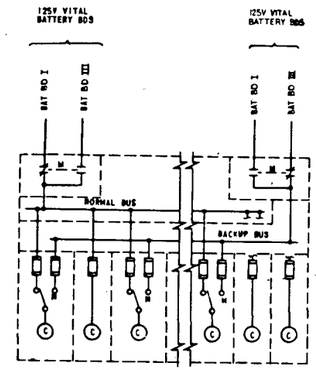
8605060218-02

WATTS BAR NUCLEAR PLANT
FINAL SAFETY
ANALYSIS REPORT

POWERHOUSE
UNITS 1 & 2
WIRING DIAGRAMS
125V VITAL BATTERY BD V
SINGLE LINE-SHEET 9
TVA DRAWING NO. 45W703-9 R1
FIGURE 8.3-56


120V AC VITAL INSTRUMENT POWER BOARD 2-III
(REAR VIEW)
120V AC VITAL INSTRUMENT POWER BOARD 1-III
(REAR VIEW)
LEFT SIDE
RIGHT SIDE
UNDERVOLTAGE RELAY
VOLTMETER
DISCONNECT SWITCH
TRANSFER SWITCH
BREAKER 12 SHOWN
BREAKERS 1-10 SIMILAR
BREAKER 24 SHOWN
BREAKERS 13-16 & 18-23 SIMILAR
BREAKER 36 SHOWN
BREAKERS 25-35 SIMILAR
BREAKER 48 SHOWN
BREAKERS 37-47 SIMILAR
BREAKERS 24, 16, 14, 13 SHOWN
BREAKERS 16 - 23 SIMILAR
UTILITY CIRCUIT
GROUND BUS
TO STATION GROUND
NOTES:
1. FOR GENERAL NOTES AND REFERENCES SEE (45N706-1).
2. BREAKER NS IS INSTANTANEOUS OF CURVE 1, 15 AMPERE
3. UNIQUE FUSE NUMBERS FOR FUSES ARE:
BD 1-III ···· 1-FU-235-8/ FUSE NUMBER
BD 2-III ···· 2-FU-235-3/ FUSE NUMBER
TI APERTURE CARD
Also Available On Aperture Card
THIS DRAWING IS A DUPLICATE OF SEQUOYAH NUCLEAR PLANT DRAWING 45N706-3 R2 EXCEPT AS NOTED BY ENCIRCLEMENTS ON SO THIS DRAWING.
8605060218-03
WATTS BAR NUCLEAR PLANT
FINAL SAFETY
ANALYSIS REPORT
POWERHOUSE UNITS 1 & 2
WIRING DIAGRAMS 120V AC VITAL INST
POWER BDS 1-III & 2-III
CONNECTION DIAGRAM-SHEET 3
TVA DWG NO. 45N706-3 R17
FIGURE 8.3-39





DETAIL A

SHUTDOWN BOARD	NORMAL BUS		BACKUP BUS	
	NOR	ALT	NOR	ALT
6900V 1A - A	I	III	II	IV
480V 1A1-A	I	III	II	IV
480V 1A2-A	I	III	II	IV
6900V 2A-A	II	IV	I	III
480V 2A1-A	II	IV	I	III
480V 2A2-A	II	IV	I	III
6900V 1B - B	III	I	IV	II
480V 1B1 - B	III	I	IV	II
480V 1B2 - B	III	I	IV	II
6900V 2B - B	IV	II	III	I
480V 2B1 - B	IV	II	III	I
480V 2B2 - B	IV	II	III	I

FSAR COLOR LEGEND

CHANNEL I
CHANNEL II
CHANNEL III
CHANNEL IV

SYMBOLS:

- NC — NORMALLY CLOSED BREAKER
- NO — NORMALLY OPEN BREAKER
- MANUALLY OPERATED TRANSFER SWITCH (INTERLOCKED BREAKERS)
- MBB — MAKE BEFORE BREAK SWITCH
- BBM — BREAK BEFORE MAKE SWITCH
- MANUALLY OPERATED TRANSFER SWITCH
- TRANSFER SWITCHES SAFETY WIRED IN NORMAL CLOSED POSITION
- AUTOMATIC TRANSFER SWITCH

THIS DRAWING IS A DUPLICATE OF SEQUOYAH NUCLEAR PLANT DRAWING 48N700-1 R8 EXCEPT AS NOTED BY ENCIRCLEMENTS ON RO OF THIS DRAWING.

NOTE: (CONTINUED)
2. SYNC SIG BREAKER TO EACH INVERTER SHALL BE MAINTAINED OPEN EXCEPT DURING INVERTER MAINTENANCE. BEFORE CLOSING THIS BREAKER THE FREQUENCY OF THE INVERTER INTERNAL CLOCK MUST BE ADJUSTED TO WITHIN ±.03 CYCLES OF ITS EXTERNAL POWER SOURCE.

NOTES:
1. FOR PHYSICAL ARRANGEMENT OF EQUIPMENT SHOWN WITH A ⚠ ON THIS DWG REFER TO TVA DRAWING 45N218 OR 45N217-1

REFERENCE DWGS:
45N703-1 THRU 4 - - - - 125V VITAL BATTERY BOARD SINGLE LINE
45N706-1 THRU 4 - - - - 120V AC VITAL INST POWER BOARD CONNECTION DIAGRAMS
45N709-1 THRU 5 - - - - CHARGERS INVERTERS & MISC EQUIPMENT CONNECTION DIAGRAMS
45N1646-1,-3 & -4 - - - PANEL 1-M-7 CONNECTION DIAGRAMS
45N708-1 & -2 - - - - INSTRUMENT POWER DISTRIBUTION PANELS CONNECTION DIAGRAMS

COMPANION DWG: 45N700-2 --- KEY DIAGRAM

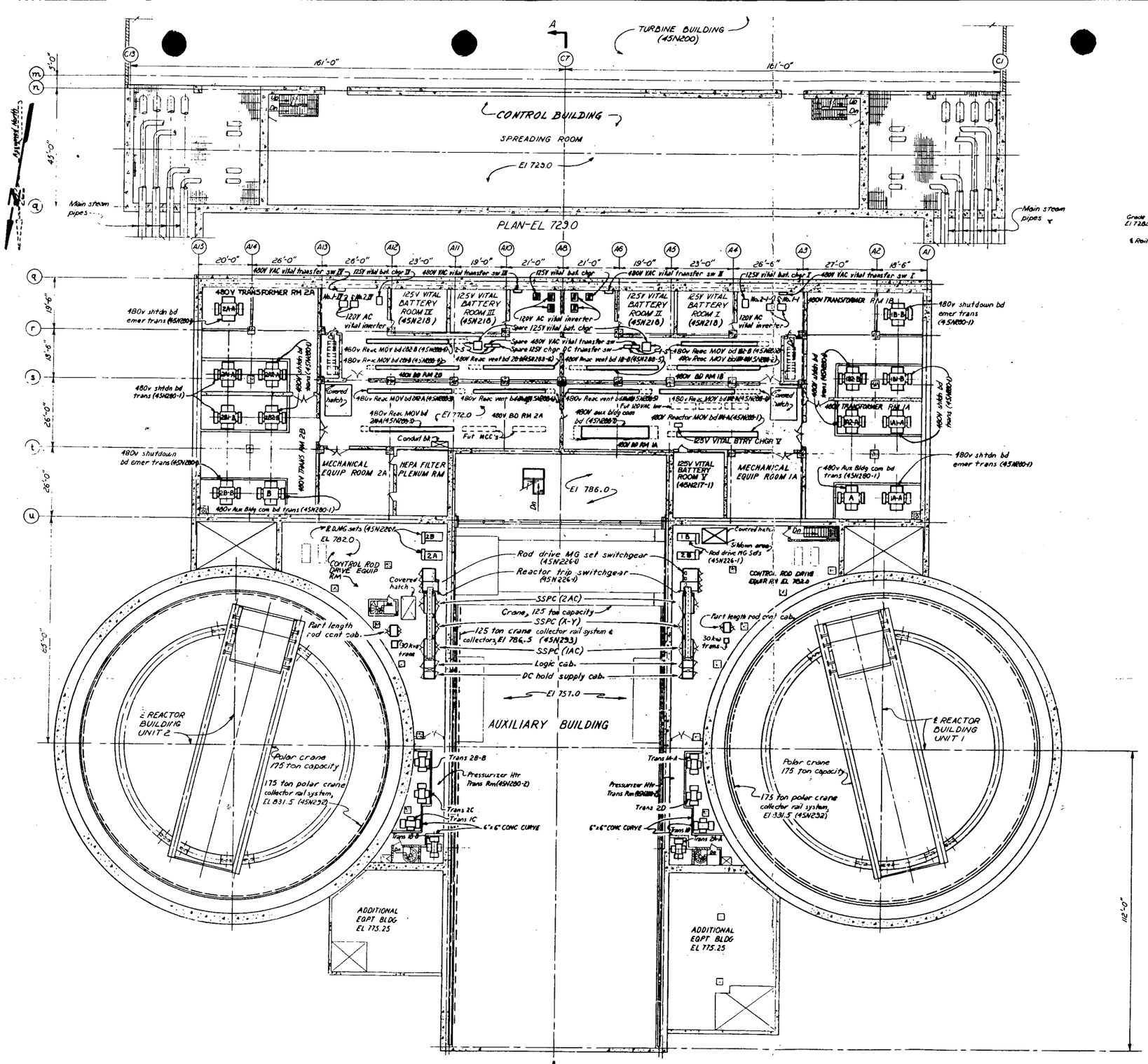
TI APERTURE CARD

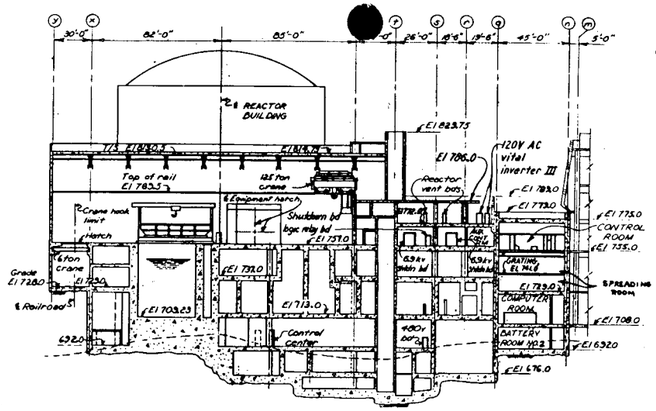
Also Available On Aperture Card

8605060218-04

WATTS BAR NUCLEAR PLANT
FINAL SAFETY ANALYSIS REPORT

POWERHOUSE UNITS 1 & 2
KEY DIAGRAM
120V AC & 125V DC VITAL PLANT
CONTROL POWER SYSTEM
TVA DWG NO. 45N700-1 R5
FIGURE 8.1-3





A-A
Scale: 1"=40'-0"

TI APERTURE CARD

Also Available On Aperture Card

This drawing is a duplicate of Sequoyah drawing 45N202 R1 except as noted by encirclements on R0 issue. Elevations not encircled are Sequoyah elevations revised by +23 feet. Encircled elevations on R0 issue have been changed to otherwise satisfy design requirements.

8605060218-05

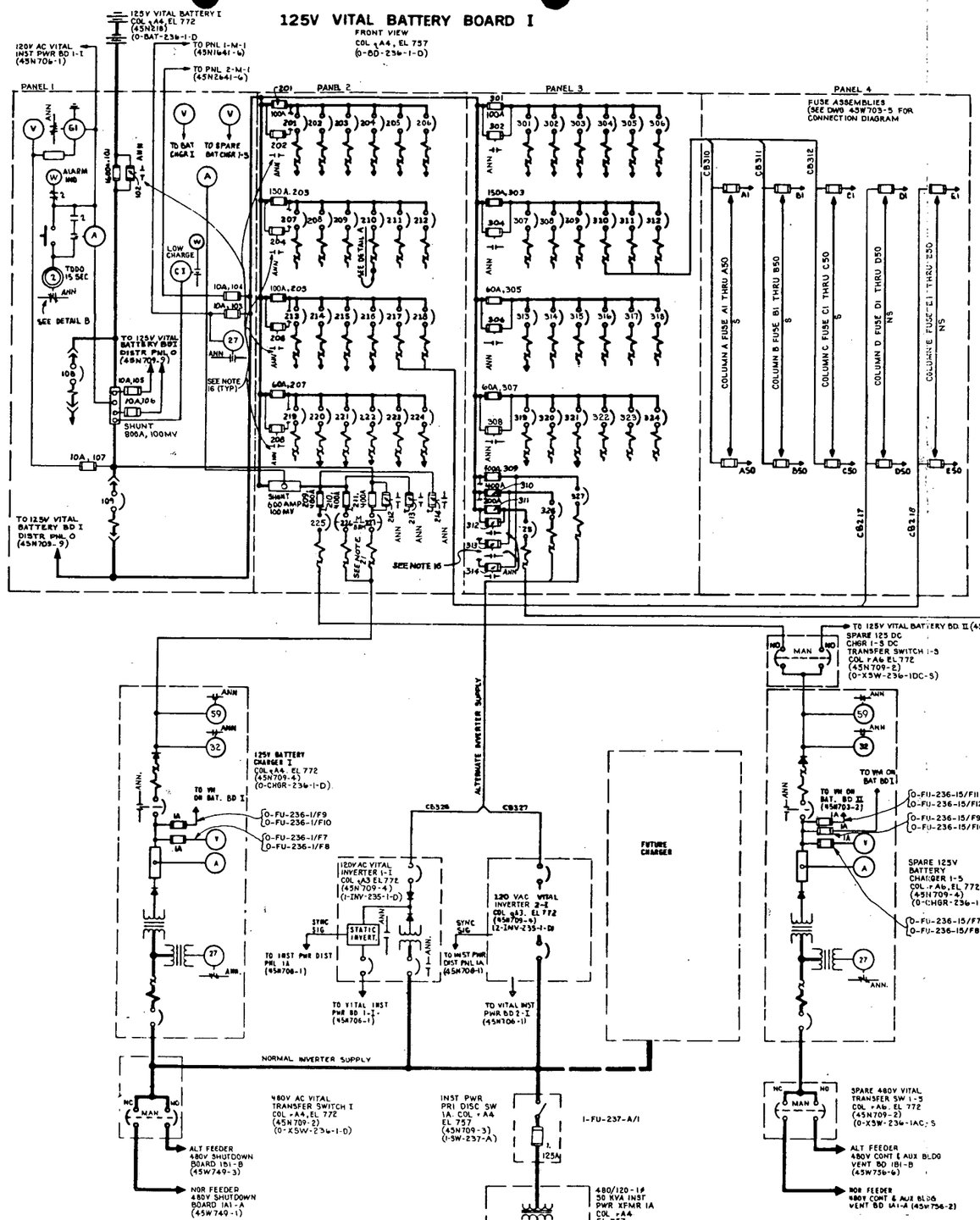
WATTS BAR NUCLEAR PLANT
FINAL SAFETY
ANALYSIS REPORT

CONTROL, AUXILIARY & REACTOR BLDG UNITS 1 & 2
ELECTRICAL EQUIPMENT
GENERAL ARRANGEMENT
PLAN EL 729.0, 772.0 & SECTION
TVA DWG NO. 45N202 R6
FIG. 8.3-2

Scale 1/8"=1'-0"
Except as noted

125V VITAL BATTERY BOARD I

FRONT VIEW
COL +A4, EL 757
(0-BD-236-1-D)



CIRCUIT SCHEDULE

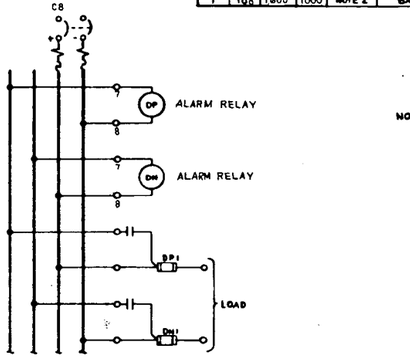
PNL	BKR	FRAME	TRIP	CABLE	CIRCUIT	SAFETY CLASS	TEST LOAD I MAX	TEST LOAD I NOR
1	109	1600	1600	(NOTE 17)	125V VITAL BATTERY I TIE TO 125V VITAL BAT BD I (NOTE 3)			
2	201	150	50	1B1D	6.9KV SHUTDOWN BOARD 1A-A B/U BUS ALT FDR	S	10	0
2	202	150	30	1B11D	480V SHUTDOWN BOARD 1A1-A NOR BUS NOR FDR	S	3	2
2	203	150	30	1B14D	480V SHUTDOWN BOARD 1A2-A NOR BUS NOR FDR	S	3	2
2	204	150	50	1B16D	6.9KV SHUTDOWN BOARD 1A-A NOR BUS NOR FDR	S	10	6-7
2	205	150	30	1B11AD	480V SHUTDOWN BOARD 1A1-A BACKUP BUS ALT FDR	S	3	0
2	206	150	30	1B13D	480V SHUTDOWN BOARD 1A2-A BACKUP BUS ALT FDR	S	3	0
2	207	150	50			NS		
2	208	150	50			NS		
2	209	150	50			NS		
2	210	150	40	——	125V VITAL BATTERY BOARD I BUS FILTER	NS	0	0
2	211	150	30			NS		
2	212	150	50			NS		
2	213	150	30	B23	480V AUX BLDG COM BOARD NOR FDR	NS	3	2
2	214	150	30	B20	GAS ANALYZER O-L-2B6	NS	3	3
2	215	150	30	1B44	UNIT 1 ROD DRIVE POWER SUPPLY SWITCH GEAR BKR 1A 1-L-MG-A	NS	3	3
2	216	150	50	B45	GAS WASTE DISPOSAL PNL O-L-2C	NS	8	8
2	217	150	30	——	UNIT 1 FUSE ASSEMBLIES COLUMN D	NS	7	7
2	218	150	50	——	UNIT 1 FUSE ASSEMBLIES COLUMN E	NS	7	7
2	219	150	15			NS		
2	220	150	15	1M2468	RESPONSE TIME TESTING	NS	1	1
2	221	150	15	1B47	UNIT 1 GENERATOR AUXILIARIES PANEL ANNUNCIATOR 1-L-39	NS	2	2
2	222	150	15	B1	AUX BOIL ACID EVAPORATION PACKAGE O-L-1B	NS	2	2
2	223	150	15	B501R	COMMON STATION SWITCHGEAR C-NOR FDR	NS	1	1
2	224	150	15			NS		
2	225	400	300	B16Q	SPARE 125V DC CHA. I-B TRANSFER SWITCH 1-S	S	-200	0
2	226	400	300	B10R	125V BATTERY CHARGER I	S	-200	-200
2	227	400	300	——	INTER TIE TO BREAKER 226.	——	——	——
3	301	150	30	2B2D	6.9KV SHUTDOWN BOARD 2A-A B/U BUS NOR FDR	S	10	0
3	302	150	30	2B11D	480V SHUTDOWN BOARD 2A1-A NOR BUS ALT FDR	S	3	0
3	303	150	30	2B14D	480V SHUTDOWN BOARD 2A2-A NOR BUS ALT FDR	S	3	0
3	304	150	30	2B3D	6.9KV SHUTDOWN BOARD 2A-A NOR BUS ALT FDR	S	10	0
3	305	150	30	2B13D	480V SHUTDOWN BOARD 2A1-A BACKUP BUS NOR FDR	S	3	0
3	306	150	30	2B16D	480V SHUTDOWN BOARD 2A2-A BACKUP BUS NOR FDR	S	3	0
3	307	150	50			S		7
3	308	150	30			S		
3	309	150	30			S		
3	310	150	30	——	UNIT 1 FUSE ASSEMBLIES COLUMN A	S	7	7
3	311	150	30	——	UNIT 1 FUSE ASSEMBLIES COLUMN B	S	7	7
3	312	150	30	——	UNIT 1 FUSE ASSEMBLIES COLUMN C	S	7	7
3	313	150	15	1B40A	UNIT 1 AUXILIARY RELAY RACK 1-B-54	S	5	5
3	314	150	15			S		
3	315	150	15			S		
3	316	150	15			S		
3	317	150	20			S		
3	318	150	20			S		
3	319	150	15	1B36A	UNIT 1 REACTOR TRIP SWITCH GEAR TRAIN A 1-L-11G	S	2	2
3	320	150	15			S		
3	321	150	15	2B6220A	UNIT 2 AUXILIARY FEED PUMP TURBINE NOR FDR	S	10	10
3	322	150	15			S		
3	323	150	15			S		
3	324	150	15			S		
3	325	400	125	B5A	EMERGENCY DC LIGHTING CABINET LD-I	S	7.4	0
3	326	400	300	B30D	120 VAC VITAL INSTRUMENT INVERTER 1-I	S	238	0
3	327	400	300	B3D	120 VAC VITAL INSTRUMENT INVERTER 2-I	S	238	0
1	108	1600	1000	NOTE 2	BATTERY DISCHARGE TEST (NOTE 5)	NS	—	0

NOTES CONTINUED:

18. ALL FUSE BLOCKS IN PANEL 4 OF EACH BOARD WERE REPLACED UNDER CONTRACT 79H17-825445.
20. FOR FURTHER DETAILS ON BTRY CHARGERS SEE PCP DRAWINGS ON TVA CONTR 74-852SI
21. BREAKERS 226 AND 227 ARE MECHANICALLY INTERLOCKED TO PREVENT BOTH BREAKERS FROM BEING CLOSED CONCURRENTLY. (BBM)

NOTES:

1. BATTERY BD BREAKERS ARE PROVIDED WITH ALARM CONTACTS WHICH CLOSE WHEN BREAKER TRIPS DUE TO OVERLOAD OR SHORT CIRCUIT. CONTACTS ARE WIRED OUT TO TERMINAL BLOCKS IN REAR OF EACH PANEL AND ARE TO BE CONNECTED IN PARALLEL FOR COMMON ANNUNCIATION.
2. BATTERY TEST CABLES ARE B83 (POS BUS). B84 (NEG BUS).
3. THE BATTERY BUS FUSES ARE 1600 AMP CHASE-SHAWMUT. AMP TRAP. FORM 480.
4. ALL FUSES IN PANELS 2 AND 3 ARE BUSS TYPE FRN. 250V.
5. BATTERY BOARD BREAKERS 108 AND 109 SHALL BE SET AS FOLLOWS:
   LONG DELAY - - - -100% PICKUP AND 1A MAX LONG DELAY SETTING
   SHORT DELAY- - - -5X OF TRIP UNIT RATING WITH 2C MIN DELAY.
6. CIRCUIT BREAKERS 225, 226, 227, 325, 326 AND 327 ADJUSTABLE MAGNETIC TRIPS TO BE SET AT THE LOW SETTING.
7. PANEL 4 DEVICES ARE BUSS, TYPE KAZ ACTUATOR, PROVIDED WITH ALARM CONTACTS WHICH CLOSE WHEN DEVICE OPENS DUE TO OVERLOAD OR SHORT CIRCUIT. CONTACT OF EACH DEVICE IS WIRED TO COMMON COLUMN ALARM BUSSES FOR ANNUNCIATION.
8. PANEL 1 INSTRUMENT FUSES ARE 10 AMP NON-DETERIORATING.
9. BATTERY AMMETER-RELAY TO BE SET TO ALARM FOR A DISCHARGE OCURRING FOR GREATER THAN 15 SECONDS.
10. GROUND INDICATOR ALARM TO BE SET BY FIELD
11. BATTERY BOARDS ARE CLASS 1 AS DEFINED IN IEEE 308 AND TVA PROCUREMENT SPECIFICATION 1337.
12. BATTERY BOARD MAIN CABLES ARE B55D (POS BUS). B56D (NEG BUS). B57D (CELL INTER-TIE).
13. CIRCUIT SAFETY CLASSIFICATION WILL BE IDENTIFIED AS S-SAFETY RELATED. NS-NON-SAFETY RELATED. SAFETY AND NON-SAFETY WIRING TO BE SEPARATED BY 6" AIR SPACE, METAL BARRIER AND/OR CONDUIT.
14. FOR PANELS 1 2 3, & 4 INSTRUMENTATION WIRING SEE 45N709-5.
15. BATTERY BOARDS ARE PURCHASED UNDER TVA CONTRACT NO. 75C2-85281.
16. MAIN FUSE AND FUSES IN PANELS 2 AND 3 ARE PROVIDED WITH KAZ ACTUATORS AND WIRED OUT TO TERMINALS ON REAR OF PANELS WITH BREAKER ALARM CONTACTS.
17. THE 125 BATTERY SYSTEM VOLTAGE WILL NORMALLY BE 135V OR 105V WHEN BATTERY IS DISCHARGED
18. UNIQUE FUSE NUMBER IS THE UNIQUE DEVICE NUMBER/FUSE NUMBER, WHERE THE FUNCTION DESIGNATION IS CHANGED TO FUNC-FU-236-1 (101 TYPICAL).



DETAIL C
ALARM & SUPPLY BUS
(TYPICAL PNL 1, 2, 3, 4)

COMPANION DRAWINGS
45N703-2 THRU -9

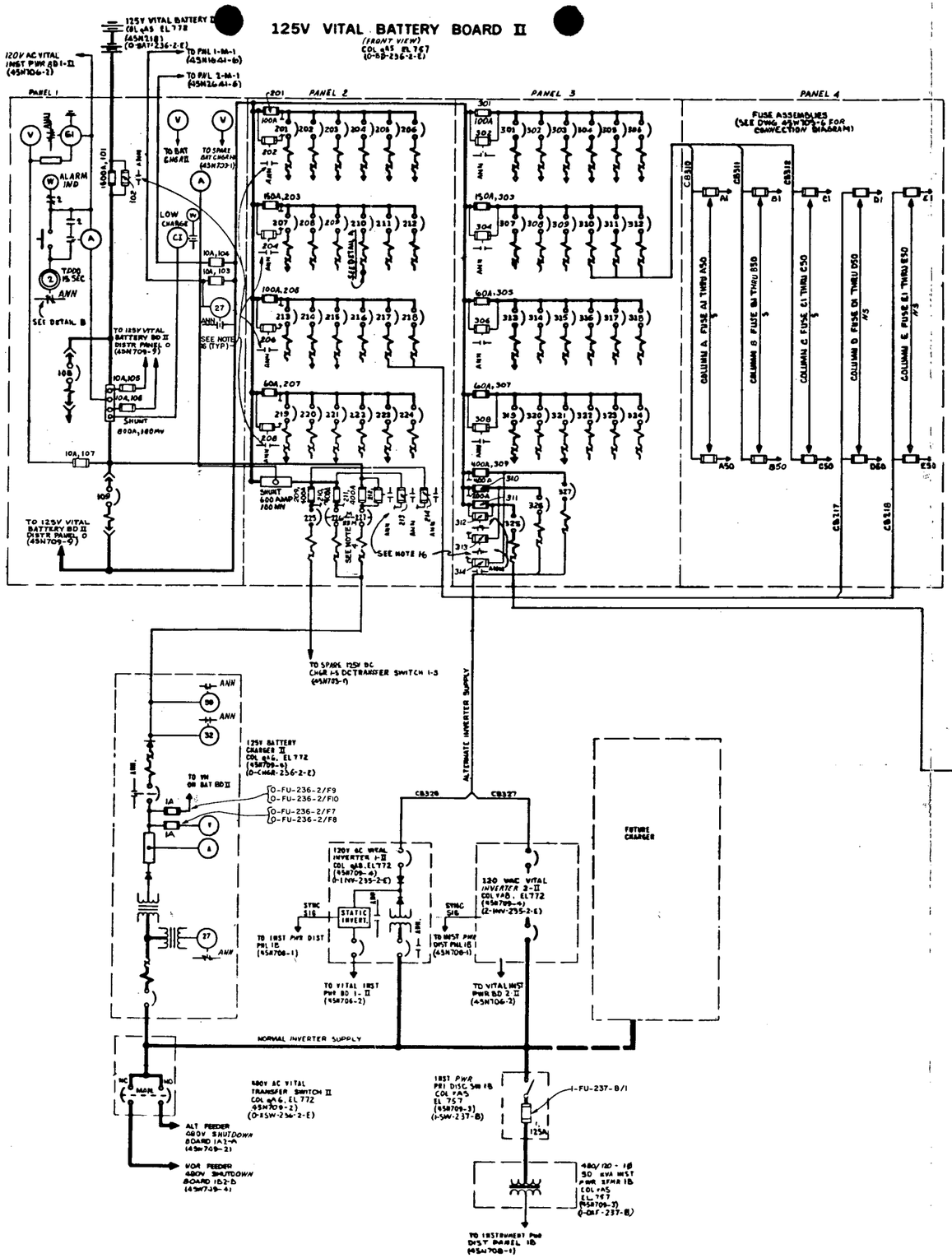
THIS DRAWING IS A DUPLICATE OF SEQUOYAH NUCLEAR PLANT DRAWING 45N703-1 R3 EXCEPT AS NOTED BY ENCIRCLEMENTS ON R0 OF THIS DRAWING.

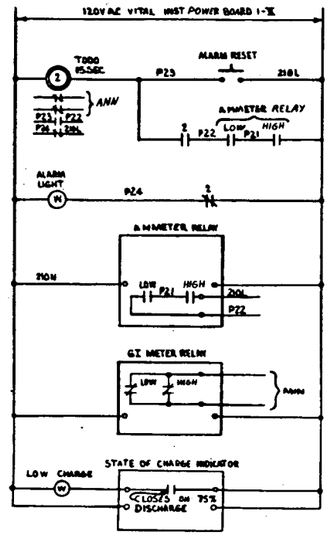
WATTS BAR NUCLEAR PLANT
FINAL SAFETY ANALYSIS REPORT

POWERHOUSE UNITS 1-2
WIRING DIAGRAMS
125V VITAL BATTERY BOARD I
SINGLE LINE - SHEET 1
TVA DWG NO. 45N703-1 R18
FIG. 8.3-47

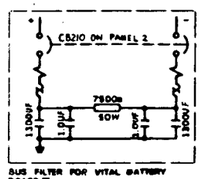
125V VITAL BATTERY BOARD II

(FRONT VIEW)
COL 445 EL 767
(0-BD-236-2-E)



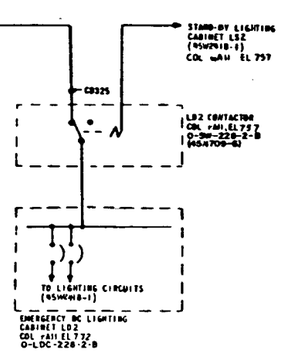


DETAIL B
ALARM CIRCUIT



BUS FILTER FOR VITAL BATTERY BOARD II

DETAIL A



CIRCUIT SCHEDULE

PNL	BKR	FRAME	TRIP	CABLE	CIRCUIT	SAFETY CLASS	EST LOAD AMPS	EST LOAD KW
1	101	600	1000	(NOTE 2)	125V VITAL BATTERY II TIE TO 125V VITAL BAT BD II (NOTE 5)	S		
2	201	150	30	1B5E	6.9KV SHUTDOWN BOARD 1B-B B/U BUS ALT FDR	S	10	0
2	202	150	30	1B3E	480V SHUTDOWN BOARD 1B1-B NOR BUS ALT FDR	S	3	2
2	203	150	50	1B3DE	480V SHUTDOWN BOARD 1B2-B NOR BUS NOR FDR	S	3	2
2	204	150	30	1B9E	6.9KV SHUTDOWN BOARD 1B-B NOR BUS NOR FDR	S	10	6.7
2	205	150	50	1B2BE	480V SHUTDOWN BOARD 1B1-B BACKUP BUS ALT FDR	S	3	0
2	206	150	50	1B3BE	480V SHUTDOWN BOARD 1B2-B BACKUP BUS ALT FDR	S	3	0
2	207	150	50	890	ELECTRIC VENT HEATER	NS	12	0
2	208	150	50			NS		
2	209	150	50			NS		
2	210	150	40	——	125V VITAL BATTERY BOARD II 20PS FILTER	NS	0	0
2	211	150	50			NS		
2	212	150	50			NS		
2	213	150	30			NS		
2	214	150	30	846	WASTE DISPOSAL PANEL 0-L-28	NS	5	5
2	215	150	30	1B4B	UNIT 1 ROD DRIVE POWER SUPPLY SWITCH GEAR BD 1-L-116B	NS	3	3
2	216	150	30			NS		
2	217	150	50	——	UNIT 1 FUSE ASSEMBLIES COLUMN D	NS	7	7
2	218	150	50	——	UNIT 1 FUSE ASSEMBLIES COLUMN E	NS	7	7
2	219	150	5	18920	UNIT 1 CLAD STEAM SPILLOVER TO CONDENSER	NS	1.8	.2
2	220	150	15			NS		
2	221	150	15	883	COMMON CONTROL AND SERVICE AIR COMPRESSORS -NOR FDR	NS	4	4
2	222	150	15			NS		
2	223	150	15	8503P	COMMON STATION SWITCHGEAR D-NOR FDR	NS	1	1
2	224	150	15			NS		
2	225	400	300	84E	SPARE 125V DC CHARGER 1-B TRANSFER SWITCH 1-B	S	-200	0
2	226	400	300	81E	125V BATTERY CHARGER II	S	-200	-200
2	227	400	300		TIE & TIE TO BREAKER 226			
3	301	150	30	2B7E	6.9KV SHUTDOWN BOARD 2B-B B/U BUS NOR FDR	S	10	0
3	302	150	30	2B3BE	480V SHUTDOWN BOARD 2B1-B NOR BUS ALT FDR	S	3	0
3	303	150	30	2B3IE	480V SHUTDOWN BOARD 2B2-B NOR BUS ALT FDR	S	3	0
3	304	150	30	2B8E	6.9KV SHUTDOWN BOARD 2B-B NOR BUS ALT FDR	S	10	0
3	305	150	30	2B2BE	480V SHUTDOWN BOARD 2B1-B BACKUP BUS NOR FDR	S	3	0
3	306	150	30	2B3BE	480V SHUTDOWN BOARD 2B2-B BACKUP BUS NOR FDR	S	3	0
3	307	150	50			S		
3	308	150	30			S		
3	309	150	30			S		
3	310	150	30	——	UNIT 1 FUSE ASSEMBLIES COLUMN A	S	7	7
3	311	150	30	——	UNIT 1 FUSE ASSEMBLIES COLUMN B	S	7	7
3	312	150	30	——	UNIT 1 FUSE ASSEMBLIES COLUMN C	S	7	7
3	313	150	15	1B4/B	UNIT 1 AUXILIARY RELAY RACK 1-L-55	S	5	5
3	314	150	15			S		
3	315	150	15			S		
3	316	150	15			S		
3	317	150	20			S		
3	318	150	20			S		
3	319	150	15	1B37B	UNIT 1 REACTOR TRIP SWITCH GEAR TRAIN B 1-L-116	S	2	2
3	320	150	15			S		
3	321	150	15	2B822B	UNIT 2 AUXILIARY FEED PUMP TURBINE ALT FDR	S	10	10
3	322	150	15			S		
3	323	150	15			S		
3	32	150	15			S		
3	325	400	125	868	EMERGENCY DC LIGHTING CABINET LD-2	S	70	0
3	326	400	300	834E	120 VAC VITAL INSTRUMENT INVERTER 1-II	S	238	0
3	327	400	300	899E	120 VAC VITAL INSTRUMENT INVERTER 2-II	S	238	0
1	108	1600	1000	NOTE 3	BATTERY DISCHARGE TEST (NOTE 5)	NS	——	0

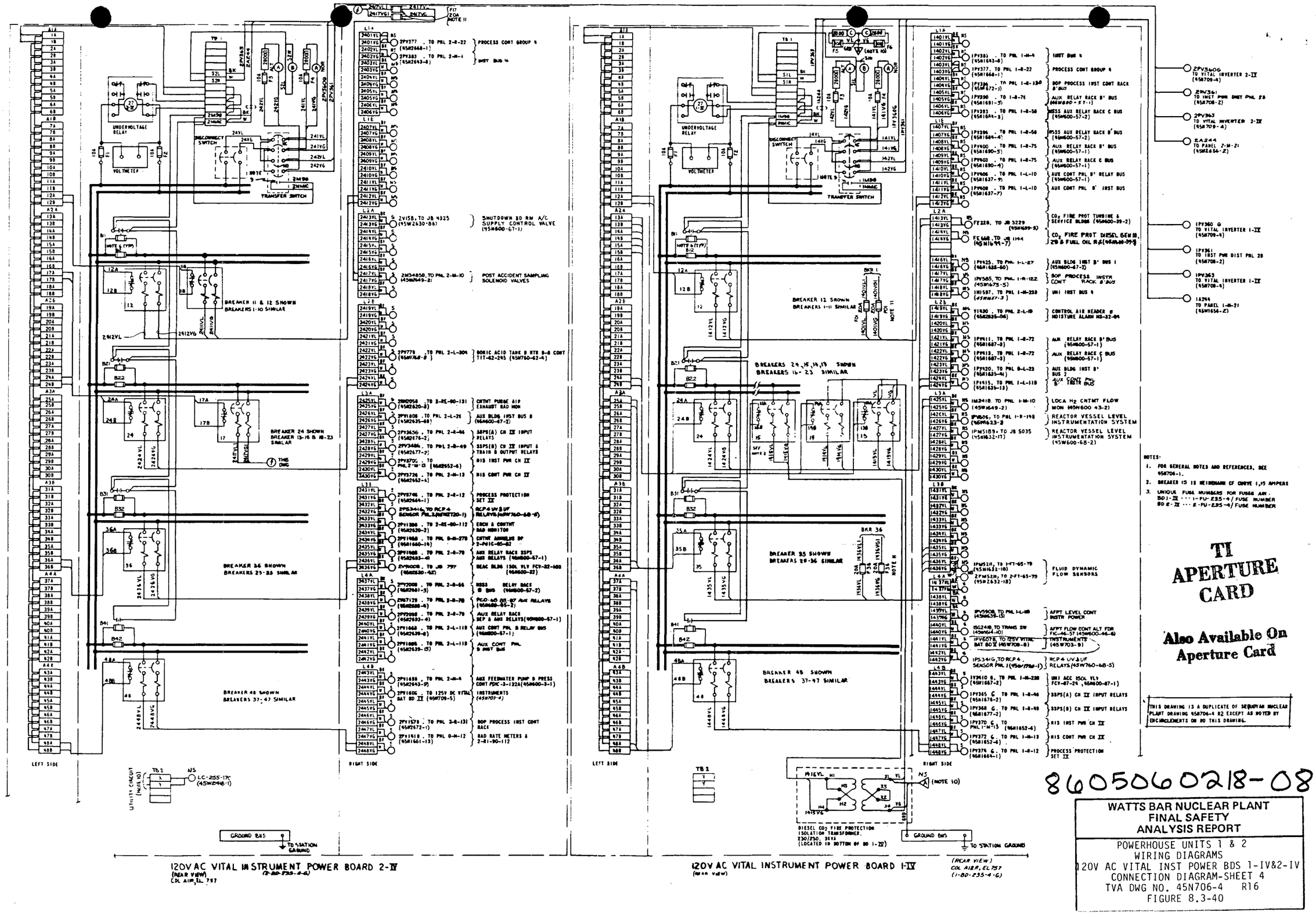
NOTES:

1. FOR GENERAL NOTES AND REFERENCE DRAWINGS SEE 45N703-1.
2. BATTERY BOARD MAIN CABLES ARE 868E (POS BUS), 868E (NEG BUS), 882E (CELL INTER-TIE).
3. BATTERY TEST CABLES ARE 868 (POS BUS), 869 (NEG BUS).
4. BREAKERS 226 & 227 ARE MECHANICALLY INTERLOCKED TO PREVENT BOTH BREAKERS FROM BEING CLOSED CONCURRENTLY. (BB84)

WATTS BAR NUCLEAR PLANT
FINAL SAFETY ANALYSIS REPORT

POWERHOUSE UNITS 1 & 2
WIRING DIAGRAMS
125V VITAL BATTERY BOARD II
SINGLE LINE - SHEET 2
TVA DWG NO. 45N703-2 R19
FIG. 8.3-48

THIS DRAWING IS A DUPLICATE OF SEQUOYAH DRAWING 45N703-2 R3 EXCEPT AS NOTED BY ENCIRCLEMENTS ON RO OF THIS DRAWING.



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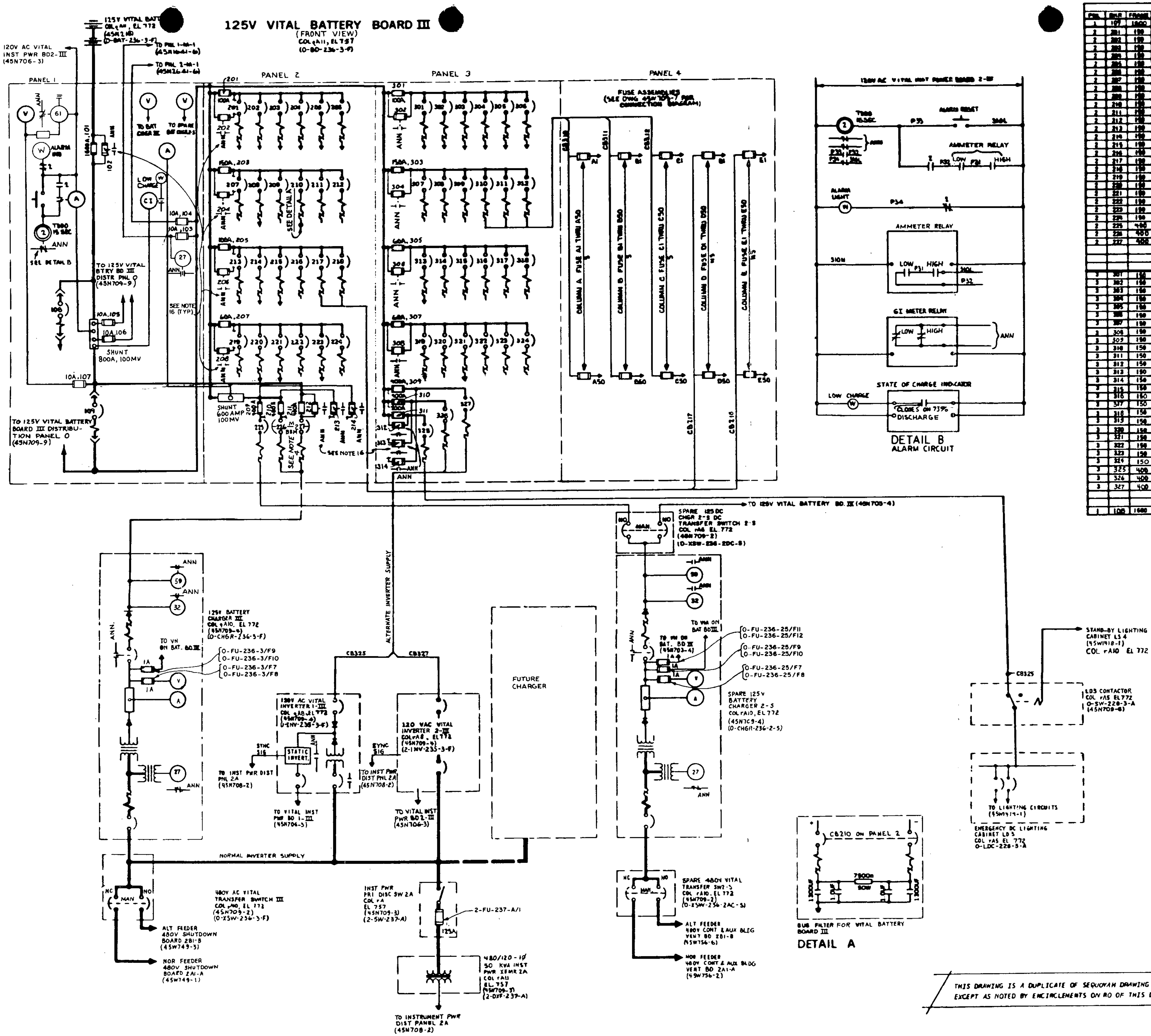
WATTS BAR NUCLEAR PLANT
FINAL SAFETY ANALYSIS REPORT

POWERHOUSE UNITS 1 & 2
WIRING DIAGRAMS
120V AC VITAL INST POWER BDS 1-IV&2-IV
CONNECTION DIAGRAM-SHEET 4
TVA DWG NO. 45N706-4 R16
FIGURE 8.3-40



CIRCUIT SCHEDULE								
PNL	BKR	FRAME	TRIP	CABLE (NOTE 2)	CIRCUIT	SAFETY CLASS	EST LOAD I MAX	EST LOAD I NOR
1	107	1600	1000	(NOTE 2)	125V VITAL BATTERY III TIE TO [illegible] VITAL BAT BD (NOTE 3)			
2	201	150	30	[illegible]	6.9KV SHUTDOWN BOARD 1A-A B/U BUS ALT FDR	S	10	0
2	202	150	30	[illegible]	480V SHUTDOWN BOARD 1A1-A B/U BUS ALT FDR	S	3	0
2	203	150	30	[illegible]	480V SHUTDOWN BOARD 1A2-A NOR BUS ALT FDR	S	3	0
2	204	150	30	[illegible]	6.9KV SHUTDOWN BOARD 1A-A NOR BUS ALT FDR	S	10	0
2	205	150	30	[illegible]	480V SHUTDOWN BOARD 1A1-A BACKUP BUS NOR FDR	S	3	0
2	206	150	30	[illegible]	480V SHUTDOWN BOARD 1A2-A BACKUP BUS NOR FDR	S	3	0
2	207	150	30			NS		
2	208	150	100	[illegible]	UNIT 1 ANNUNCIATOR	NS	61	0
2	209	150	30			NS		
2	210	150	40	——	125V VITAL BATTERY BOARD II BUS FILTER	NS	0	0
2	211	150	30			NS		
2	212	150	30			NS		
2	213	150	30	[illegible]	480V AUX BLDG COM BOARD A FDR	NS	3	0
2	214	150	30	[illegible]	WASTE DISPOSAL PANEL 0-L-2A	NS	5	5
2	215	150	30	[illegible]	UNIT 2 ROD DRIVE POWER SUPPLY SWITCH GEAR [illegible]	NS	4	4
2	216	150	30			NS		
2	217	150	30	——	UNIT 2 FUSE ASSEMBLIES COLUMN D	NS	7	7
2	218	150	30	——	UNIT 2 FUSE ASSEMBLIES COLUMN E	NS	7	7
2	219	150	15			NS		
2	220	150	15	[illegible]	RESPONSE TIME TESTING	NS	1	1
2	221	150	15	2947	UNIT 2 GENERATOR AUXILIARIES PANEL ANNUNCIATOR [illegible]	NS		
2	222	150	15			NS		
2	223	150	15	8800	COMMON STATION SWITCHGEAR C-ALT FDR	NS	1	0
2	224	150	15			NS		
2	225	400	300	B17F	SPARE 125V DC CHARGER 2-S TRANSFER SWITCH 2-S	S	-200	0
2	226	400	300	B12F	125 V BATTERY CHARGER III	S	-200	-200
2	227	400	300		INTERTIE TO BREAKER 226		—	—
3	301	150	30	2B1F	6.9KV SHUTDOWN BOARD 2A-A B/U BUS ALT FDR	S	10	[illegible]
3	302	150	30	[illegible]	480V SHUTDOWN BOARD 2A1-A NOR BUS NOR FDR	S	3	2
3	303	150	30	2B10F	480V SHUTDOWN BOARD 2A2-A NOR BUS NOR FDR	S	3	2
3	304	150	30	2B4F	6.9KV SHUTDOWN BOARD 2A-A NOR BUS NOR FDR	S	10	0
3	305	150	30	2B14F	480V SHUTDOWN BOARD 2A1-A BACKUP BUS ALT FDR	S	3	0
3	306	150	30	2B19F	480V SHUTDOWN BOARD 2A2-A BACKUP BUS ALT FDR	S	3	0
3	307	150	50			S		
3	308	150	30			S		
3	309	150	30			S		
3	310	150	30	——	UNIT 2 FUSE ASSEMBLIES COLUMN A	S	7	7
3	311	150	30	——	UNIT 2 FUSE ASSEMBLIES COLUMN B	S	7	7
3	312	150	30	——	UNIT 2 FUSE ASSEMBLIES COLUMN C	S	7	7
3	313	150	15	2B40A	UNIT 2 AUXILIARY RELAY RACK 2-R-54	S	5	5
3	314	150	15			S		
3	315	150	15			S		
3	316	150	15			S		
3	317	150	20			S		
3	318	150	20			S		
3	319	150	15	2B36A	UNIT 2 REACTOR TRIP SWITCH GEAR TRAIN A2-[illegible]-116	S	2	2
3	320	150	15			S		
3	321	150	15	1SG220A	UNIT 1 AUXILIARY FEED PUMP TURBINE NOR FDR	S	10	10
3	322	150	15			S		
3	323	150	15			S		
3	324	150	15			S		
3	325	400	125	B7A	EMERGENCY DC LIGHTING CABINET LD-3	S	64.4	0
3	326	400	300	B38F	120 VAC VITAL INSTRUMENT INVERTER 1-III	S	238	0
3	327	400	300	B39F	120 VAC VITAL INSTRUMENT INVERTER 2-III	S	238	0
1	100	1600	1000	NOTE 3	BATTERY DISCHARGE TEST (NOTE 5)	NS	—	0

NOTES:
1. FOR GENERAL NOTES AND REFERENCE DRAWINGS SEE 45N703-1.
2. BATTERY BOARD MAIN CABLES ARE B65F (POS BUS), B66F (NEG BUS) B67F (CELL INTER-TIE).
3. BATTERY TEST CABLES ARE B93 (POS BUS), B94 (NEG BUS).
4. BKRS 226 AND 227 ARE MECHANICALLY INTERLOCKED TO PREVENT BOTH BREAKERS FROM BEING CLOSED CONCURRENTLY. (BBM).

THIS DRAWING IS A DUPLICATE OF SEQUOYAH DRAWING 45N703-3 R3 EXCEPT AS NOTED BY ENCIRCLEMENTS ON R0 OF THIS DRAWING

TI APERTURE CARD

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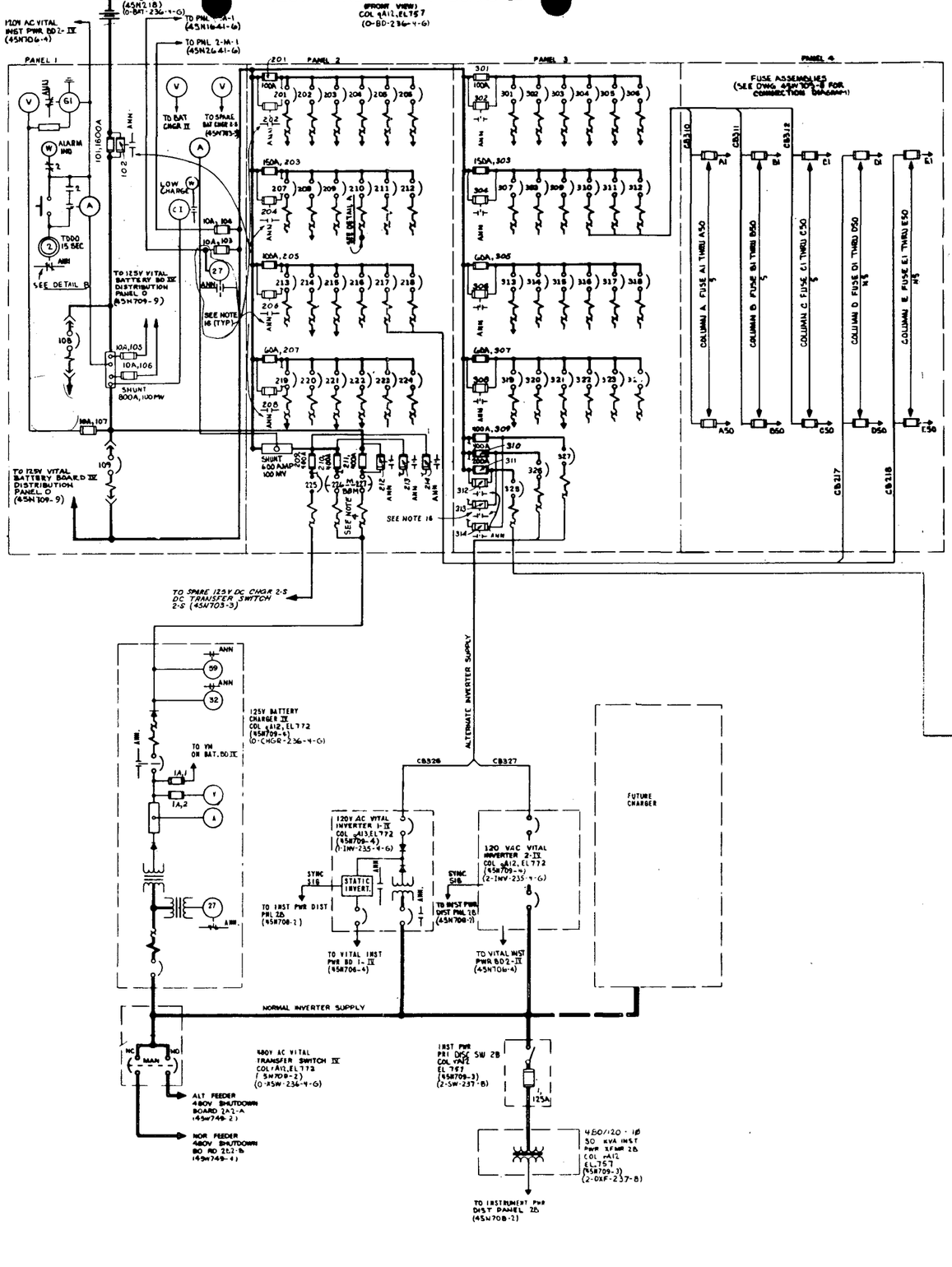
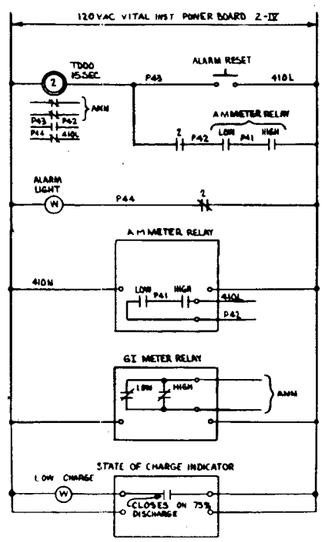
WATTS BAR NUCLEAR PLANT
FINAL SAFETY
ANALYSIS REPORT

POWERHOUSE UNITS 1 & 2
WIRING DIAGRAMS
125V VITAL BATTERY BOARD III
SINGLE LINE-SHEET 3
TVA DWG NO. 45N703-3 R17
FIGURE 8.3-49

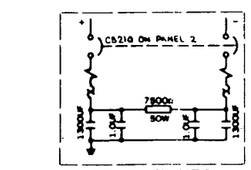
125V VITAL BATTERY BOARD IV

(FRONT VIEW)
COL 9A12, EL757
(0-BD-236-4-G)



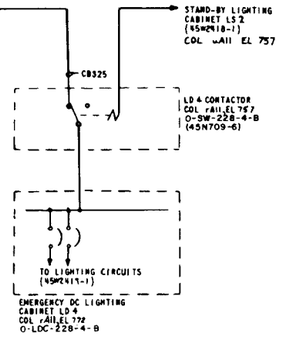


DETAIL B
ALARM CIRCUIT



BUS FILTER FOR VITAL BATTERY BOARD IV

DETAIL A



CIRCUIT SCHEDULE								
PNL	BKR	FRAME	TRIP	CABLE	CIRCUIT	SAFETY CLASS	LOAD - KW MAX	LOAD - KW NOR
1	109	1600	1000	(NOTE 2)	125V VITAL BATTERY IV TIE TO 125V VITAL BAT BD IV (NOTE 5)	1E	—	—
2	201	150	30	18278	6.9kV SHUTDOWN BOARD 1B-B B/U BUS ALT FDR	S	10	0
2	202	150	30	18286	480V SHUTDOWN BOARD 1B1-B NOR BUS NOR FDR	S	3	0
2	203	150	30	18318	480V SHUTDOWN BOARD 1B2-B NOR BUS ALT FDR	S	3	0
2	204	150	30	18288	6.9kV SHUTDOWN BOARD 2B-B NOR BUS ALT FDR	S	10	0
2	205	150	30	18278	480V SHUTDOWN BOARD 1B-B BACKUP BUS NOR FDR	S	3	0
2	206	150	30	18328	480V SHUTDOWN BOARD 1B2-B BACKUP BUS NOR FDR	S	3	0
2	207	150	50			NS		
2	208	150	60	2822	UNIT 2 ANNUNCIATOR	NS	24	0
2	209	150	50			NS		
2	210	150	40	——	125V VITAL BATTERY BOARD IV BUS FILTER	NS	0	0
2	211	150	50			NS		
2	212	150	50			NS		
2	213	150	30			NS		
2	214	150	30	851	CALIBRATING ROOM PANEL 0-L-151	NS	2	2
2	215	150	30	2840	UNIT 2 ROD DRIVE POWER SUPPLY SWITCH GEAR BKR 2B 2-L-M5 B	NS	4	4
2	216	150	50			NS		
2	217	150	50	——	UNIT 2 FUSE ASSEMBLIES COLUMN D	NS	7	7
2	218	150	30	——	UNIT 2 FUSE ASSEMBLIES COLUMN E	NS	7	7
2	219	150	15	29920	UNIT 2 BLAND STEAM SPILLOVER TO CONDENSER	NS	1.8	2
2	220	150	15			NS		
2	221	150	15	864	COMMON CONTROL AND SERVICE AIR COMPRESSORS - ALT FDR	NS	4	4
2	222	150	15	82	BORIC ACID EVAPORATOR PACKAGE B 0-L-18	NS	2	2
2	223	150	15	8502	COMMON STATION SWITCHGEAR D-ALT FDR	NS	1	0
2	224	150	15			NS		
2	225	400	300	8198	SPARE 125V DC CHGR 2-S DC TRANSFER SWITCH 2S	S	-200	0
2	226	400	300	8108	125V BATTERY CHARGER I	S	-200	-200
2	227	400	300		INTERTIE TO BKR 226		—	—
3	301	150	30	2869	6.9kV SHUTDOWN BOARD 2A-B B/U BUS ALT FDR	S	10	6.7
3	302	150	30	28259	480V SHUTDOWN BOARD 2B1-B NOR BUS NOR FDR	S	3	2
3	303	150	30	28309	480V SHUTDOWN BOARD 2B2-B NOR BUS NOR FDR	S	3	2
3	304	150	30	2899	6.9kV SHUTDOWN BOARD 2B-B NOR BUS NOR FDR	S	10	0
3	305	150	30	28289	480V SHUTDOWN BOARD 2B1-B BACKUP BUS ALT FDR	S	3	0
3	306	150	30	28339	480V SHUTDOWN BOARD 2B2-B BACKUP BUS ALT FDR	S	3	0
3	307	150	50			S		
3	308	150	30			S		
3	309	150	30			S		
3	310	150	30	——	UNIT 2 FUSE ASSEMBLIES COLUMN A	S	7	7
3	311	150	30	——	UNIT 2 FUSE ASSEMBLIES COLUMN B	S	7	7
3	312	150	30	——	UNIT 2 FUSE ASSEMBLIES COLUMN C	S	7	7
3	313	150	15	28418	UNIT 2 AUXILIARY RELAY RACK 2-R-55	S	5	5
3	314	150	15			S		
3	315	150	15			S		
3	316	150	15			S		
3	317	150	20			S		
3	318	150	20			S		
3	319	150	15	28378	UNIT 2 REACTOR TRIP SWITCH GEAR TRAIN B 2-L-116	S	2	2
3	320	150	15			S		
3	321	150	15	1502210	UNIT 1 AUXILIARY FEED PUMP TURBINE ALT FDR	S	10	10
3	322	150	15			S		
3	323	150	15			S		
3	324	150	15			S		
3	325	400	125	888	EMERGENCY DC LIGHTING CABINET LD-4	S	66	0
3	326	400	300	8429	120 VAC VITAL INSTRUMENT INVERTER 1-IV	S	238	0
3	327	400	300	8439	120 VAC VITAL INSTRUMENT INVERTER 2-IV	S	238	0
1	108	1600	1000	NOTE 3	BATTERY DISCHARGE TEST (NOTE 5)	NS	—	0

NOTES:

1. FOR GENERAL NOTES AND REFERENCE DRAWINGS SEE 45N703-1.
2. BATTERY BOARD MAIN CABLES ARE B708 (POS BUS), B718 (NEG BUS), B720 (CELL INTER-TIE).
3. BATTERY TEST CABLES ARE B98 (POS BUS), B99 (NEG BUS).
4. BKRS 226 AND 227 ARE MECHANICALLY INTERLOCKED TO PREVENT BOTH BKRS FROM BEING CLOSED CONCURRENTLY. (B&M)

THIS DRAWING IS A DUPLICATE OF SEQUOYAH DRAWING 45N703-4 R3 EXCEPT AS NOTED BY ENCIRCLEMENTS ON RO OF THIS DRAWING.

WATTS BAR NUCLEAR PLANT
FINAL SAFETY ANALYSIS REPORT

POWERHOUSE UNITS 1 & 2
WIRING DIAGRAMS
125V VITAL BATTERY BOARD IV
SINGLE LINE-SHEET 4
TVA DWG NO. 45N703-4 R15
FIGURE 8.3-50