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RA-19-0116

February 26, 2019

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Duke Energy Carolinas, LLC (Duke Energy)
Oconee Nuclear Station (ONS), Units 1, 2, and 3
Docket Numbers 50-269, 50-270, 50-287
Renewed License Numbers DPR-38, DPR-47, DPR-55

Subject: Duke Energy Response to NRC Request for Additional Information (RAI) Related to Oconee License Amendment Request 2017-05

References:

1. Duke Energy Letter to USNRC, *License Amendment Request to Add a Surveillance Requirement to Technical Specification 3.8.1, AC Sources – Operating, License Amendment Request No. 2017-05,* dated May 17, 2018 (ML18144A788).
2. NRC Email, A. Klett (NRC) to A. Zaremba (Duke Energy), *NRC Request for Additional Information for Oconee LAR 2017-05 (L-2018-LLA-0149),* dated January 24, 2019.

By letter dated May 17, 2018, Duke Energy submitted a License Amendment Request (LAR) to the U.S. Nuclear Regulatory Commission (NRC) proposing the addition of a Surveillance Requirement to Technical Specification 3.8.1 (Reference 1). By email dated January 24, 2019 (Reference 2), the NRC requested additional information associated with the Reference 1 LAR. The NRC request for additional information (RAI) and the Duke Energy responses are provided in the enclosure to this letter.

The responses to the RAIs do not affect the conclusions of the No Significant Hazards Consideration provided in the Reference 1 LAR.

This letter contains no new or revised commitments. Should you have any questions regarding this submittal, please contact Mr. Art Zaremba, Fleet Nuclear Licensing Manager, at (980) 373-2062.

I declare under penalty of perjury that the foregoing is true and correct. Executed on February 26, 2019.

Sincerely,

J. Ed Burchfield, Jr.
Vice President
Oconee Nuclear Station

Enclosure: Duke Energy Response to NRC Request for Additional Information (RAI)

Cc (w/enclosure):

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Duke Energy Response to NRC Request for Additional Information (RAI)

Background

By letter RA-18-0023 dated May 17, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18144A788), Duke Energy Carolinas, LLC (the licensee) applied for license amendments to Renewed Facility Operating Licenses DPR-38, DPR-47, and DPR 55, for the Oconee Nuclear Station, Units 1, 2, and 3 (Oconee), respectively. In order to complete its review, the staff developed draft requests for additional information (RAIs). On January 22, 2019, licensee and NRC staff held a clarification call to discuss the draft RAIs. As a result of the call, the staff made clarifying and editorial changes to the RAIs. Per electronic mail dated January 23, 2019 from Mr. Chris Wasik of the licensee's staff, the NRC staff requests the licensee to respond to the RAI below within 30 calendar days from the date of this request.

RAI-1

Section 6 of the Enclosure to the licensee's application listed several references. Reference 3 is a letter from the licensee to the NRC dated May 17, 1993, titled, "Alignment of Keowee Hydro Station Auxiliary Power." Page 2 of the Enclosure to Reference 3 states:

> The one minute delay will ensure that, without a failure, the load center will remain powered from its normal power source, and also ensure power is restored to the auxiliaries in a timely manner if a failure removes the normal power source (the Keowee Units can operate for approximately **1 hour** *[emphasis added]* without auxiliary power).

Reference 4 is a letter from the licensee to the NRC dated December 6, 1993, titled, "Response to NRC Question #10 on Technical Specification 3.7 Revision." Reference 4 states:

> Since the Keowee Units are designed to start and run for greater than 30 minutes without AC power to the auxiliaries, credit is taken for operator action to ensure that power is restored to the Keowee auxiliaries after a Design Basis Accident [DBA].

Section 2.3 of the Enclosure to the licensee's application dated May 17, 2018, states:

> A recent review initiated by Duke Energy determined that for events where a KHU is initially in commercial generation mode, following an emergency start signal, the governor oil accumulators would be exhausted and governor oil pumps would be required to start within **a few minutes** [emphasis added]. More time is available if the KHU is initially in standby, as less wicket gate movement is required to bring a KHU to rated speed from standby compared with recovering from load rejection that occurs on receipt of an emergency start if operating for commercial generation.
>
> Duke Energy, as a result of recent analysis reviews, determined that existing procedures and staffing requirements could challenge the ability to manually realign auxiliary power in the short timeframe necessary to support accident

> mitigation (i.e., within a few minutes of receipt of emergency start signal). The issue was entered into the Duke Energy corrective action program. TS 3.8.1 does not contain requirements to ensure the automatic auxiliary power transfer logic is operable to support Keowee operability. As such, this is considered a non-conservative Technical Specification. Immediate action taken was to restrict the underground assigned KHU from commercial generation to meet the guidance in NRC Administrative Letter 98-10, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant safety," dated December 29, 1988.

Based on the above, it appears that the time within which power needs to be restored to the auxiliaries has evolved since 1993 from a maximum of 1 hour to a minimum of "a few minutes." Section 50.36(b) of 10 CFR requires that the TSs be derived from the analyses and evaluation included in the safety analysis report. The staff requests the licensee to explain how the licensee determined the current available time of "a few minutes" for completion of necessary operator action with emphasis on the governor oil accumulator exhaustion rate, including its relation with the KHU power generation (with and without commercial generation) at the time of a design basis accident (i.e., a loss-of-coolant accident with a loss of offsite power).

Duke Energy Response to RAI-1

A general description of Keowee governor oil system operation is provided in the response to RAI-5.b below. The amount of governor oil used depends, in large part, on the amount of movement required of the wicket gates in order to obtain the required generator output. The worst-case scenarios involve a loss of auxiliary power to the Keowee unit during startup or load rejection. For a Keowee unit starting from a standstill (i.e., not commercially generating) after losing auxiliary power, wicket gate movement is less than that of a Keowee unit that is commercially generating immediately prior to the emergency power start. For an emergency power start, a commercially generating Keowee unit must first load reject, returning to an unloaded condition. This event consumes the most governor oil since it requires the wicket gates to go from an open condition (sufficient for the commercial generation load) to a closed or almost closed position and then back to the position for either a no-load (not supplying emergency loads) or lightly loaded (supplying emergency loads) condition.

The apparent "evolution" of the time needed for the restoration of auxiliary power is attributed to the extent of Keowee operating experience and analysis at the time of the referenced statements. The 1993 statements cited in the RAI regarding "a maximum of 1 hour" and "greater than 30 minutes" appear to have been based on Keowee battery capacity and operating experience.

During the recent development of actions needed in support of the Keowee stator replacement outages, it was recognized that, under the most limiting scenario, the time available to manually re-align power to the Keowee auxiliaries would be less than the "approximately 1 hour" and the "greater than 30 minutes" stated in the noted correspondence. The limiting scenario assumed worst-case conditions and did not credit the automatic transfer of auxiliary power because there is no current technical specification surveillance requirement to validate that design feature. The analysis was performed to determine the time available for manual operator actions to restore power to the AC hydraulic oil pumps.

Governor oil usage was conservatively analyzed to ensure adequate oil is available to meet the design basis conditions of a LOCA/LOOP and associated load rejection of a commercially generating Keowee unit. During a design basis event, auxiliary power is automatically restored to a Keowee unit once the required Keowee generator achieves proper frequency and voltage and required breakers close. During preparation of the license amendment request (LAR), limiting time for operator manual response was based on the minimum expected initial oil level and the amount of time that oil volume would allow for unit operation without the AC oil pumps operating. This analysis provided only "a few minutes" for manual operator actions as noted in the LAR. Since the LAR was submitted, procedure changes have been implemented that place tighter controls on oil pressure/level acceptance criteria that result in more margin and thus provide more time for operator action. The new calculated time for operator action is ~13 minutes.

RAI-2

Oconee Updated Final safety Analysis Report (UFSAR), Section 6.3.3.3, "Loss of Normal Power Source," states:

> Following a loss-of-coolant accident assuming a simultaneous loss of normal power sources to the LOCA unit, the emergency power source and the Low Pressure Injection Systems will be in full operation within 74 seconds after actuation, even assuming a single failure, and the High Pressure Injection System will be in full operation within 48 seconds after actuation. The electrical power system design is based on the assumption that engineered safeguards actuation in one unit occurs simultaneously with a loss of offsite power to all three units. However, accident scenarios in FSAR Section Chapter 15 assume loss of offsite power to the LOCA unit only. Except for large break LOCA (as described in UFSAR Section 15.14.3.3.6), all calculations for Oconee Units have assumed a 48 second delay from receipt of the actuation signal to start flow for the HPI system and a 7 second delay for the LPI system. Upon loss of normal power sources including the startup source and initiation of an engineered safeguards signal, the 4160 volt engineered safeguards powerline is connected to the underground feeder from Keowee hydro (Section 8.3.1). The Keowee hydro unit will start up and accelerate to full speed in 23 seconds or less. An analysis has shown that by energizing the HPI and LPI valves (which have opening times of 14 seconds to deliver required flow, and 36 seconds respectively at normal bus voltage) and pumps after a 10 second swapover time (required by the single failure), the design injection flow rate ate (HPI - 450 gal/min, LPI - 3000 gal/min) will be obtained within 48 and 74 seconds, respectively.

Oconee UFSAR, Section 15.14.4.3.6, "ECCS Performance and Single Failure Assumption," states in part:

> The Keowee hydro unit will start up and accelerate to full speed in 23 seconds or less (Section 6.3.3.3). The failure of transformer CT-4 results in an additional 10 second delay before power is available to the ECCS pumps. The time delay between breaker closure and valve/pump motors operating at rated

> voltage/speed is 5 seconds. Thus, for the large break LOCA analyses performed with the RELAP5-based evaluation model (Reference 40), the LPI valves will begin to open at 38 seconds with a stroke time of 36 seconds or less. Credit is taken in the analysis for flow through the LPI valves while the valves are traveling to their full open position. Full LPI flow will be obtained within 74 seconds. Two ECCS trains are available with the single failure of transformer CT-4. However, only one train of LPI flow is credited in the actual large break LOCA analyses (Reference 42).

Section 50.36(b) of 10 CFR requires that the TSs be derived from the analyses and evaluation included in the safety analysis report. The staff requests the licensee to confirm whether it considered the potential loss of power to the KHU auxiliaries and the subsequent restoration of power, either by manual switchover or the automatic switchover, generally in the accident analysis and in UFSAR Sections 6.3.3.3 and 15.14.4.3.6. If the licensee made any changes to the analyses, the staff requests the licensee to provide a summary those changes.

Duke Energy Response to RAI-2

No changes are being proposed to the accident analyses detailed in UFSAR Sections 6.3.3.3 and 15.14.4.3.6. The Keowee units are capable of starting, accelerating and powering required loads without AC power to either of its unit's auxiliaries. The ability to restore auxiliary power to a Keowee unit is only required for single failure scenarios involving commercial generation of the Keowee unit aligned to the underground power path. In this case, the ability to automatically transfer power is required. See the response to RAI-3.a.ii.

RAI-3

In Section 2.1 of the application's enclosure, the licensee states:

> [T]he current licensing basis (CLB) includes allowances for using [KHUs] for commercial generation in addition to their TS 3.8.1 required function of onsite emergency power sources. TS 3.8.1 and SLC [Selected License Commitment] 16.8.4, Keowee Operational Restrictions, include requirements for certain features and operational restrictions to ensure that KHUs can transition from commercial operation mode to onsite emergency power mode and meet all accident analysis assumptions. One such feature is the Zone Overlap Protection Circuitry (TS LCO 3.8.1.c)."

In Section 2.3, the licensee states:

> A recent review initiated by Duke Energy determined that for events where a KHU is initially in commercial generation mode, following an emergency start signal, the governor oil accumulators would be exhausted and governor oil pumps would be required to start within a few minutes. More time is available if the KHU is initially in standby, as less wicket gate movement is required to bring a KHU to rated speed from standby compared with recovering from load rejection that occurs on receipt of an emergency start signal if operating for commercial generation.

Duke Energy, as a result of recent analysis reviews, determined that existing procedures and staffing requirements could challenge the ability to manually realign auxiliary power in the short time which is necessary to support accident mitigation (i.e., within a few minutes of receipt of emergency start signal). This issue was entered into the licensee corrective action program. TS 3.8.1 does not contain requirements to ensure the automatic auxiliary power transfer logic is operable to support Keowee operability. As such, this is considered a non-Conservative TS. *Immediate action was taken to restrict the underground assigned KHU from commercial generation to meet the guidance in NRC Administrative Letter 98-10, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant Safety," date December 29, 1998 [emphasis added]*.

Section 50.36(b) of 10 CFR requires that the TSs be derived from the analyses and evaluation included in the safety analysis report.

a. The staff requests the licensee to:

   i. Describe if or when both KHUs can be in commercial generation mode and under what conditions one KHU can be in standby while the other is in commercial mode.
   ii. Confirm whether these modes have been analyzed for design basis event (DBE) mitigation, including clarification of how long it takes to manually align the KHU auxiliary power sources to mitigate a DBE and how long it takes for auxiliary power alignment using the auto transfer logic to mitigate a DBE.
   iii. Specify the allowable time to start powering the safety loads to mitigate an accident or plant transient from the time the emergency start signal is received.
   iv. Please confirm whether the licensing basis allows both KHUs to be operated in commercial generation mode.

b. The staff requests the licensee to confirm whether it intends to use both KHUs to generate to the grid after the licensing action is approved and whether the auto position of the auto/manual switch for power transfer would become the design basis position whenever one or more of the Oconee 1, 2, and 3 units are in power operation.

Duke Energy Response to RAI-3 (NRC request repeated below in italics)

a.i Describe if or when both KHUs can be in commercial generation mode and under what conditions one KHU can be in standby while the other is in commercial mode.

Both KHUs are capable of being in commercial generation mode under normal conditions. Administrative restrictions are currently in place that prevent the aligned Underground KHU from commercial generation due to not having the automatic auxiliary power transfer logic in TS 3.8.1 to support Keowee operability. Due to this, the aligned Overhead KHU can be in commercial generation mode at any time and the aligned Underground KHU will be shutdown in standby, ready to start in the event emergency power is required.

a.ii Confirm whether these modes have been analyzed for design basis event (DBE) mitigation, including clarification of how long it takes to manually align the KHU auxiliary power sources to mitigate a DBE and how long it takes for auxiliary power alignment using the auto transfer logic to mitigate a DBE.

Both the commercial generation mode and standby mode have been analyzed for design basis event (DBE) mitigation. For DBE mitigation a Keowee unit must be running and have adequate voltage and frequency in 23 seconds or less.

Auxiliary (AC) power to a Keowee unit is not required for initial DBE mitigation. The Keowee units are capable of a "black start" (no AC power available) and will provide their own auxiliary AC power through either (1) the Overhead Unit through ACB-1 or ACB-2 to transformer 1X or 2X, or (2) the Underground Unit though 1TC switchgear (once re-powered) to transformer CX. For most emergency power system single failure scenarios, the loss of auxiliary power to a Keowee unit is bounded by the loss of that Keowee unit (for any reason) and is mitigated by the availability of the other Keowee unit, with no transfer of auxiliary power required. For single failure scenarios involving a Keowee unit aligned to the underground power path and initially commercially generating, the ability to automatically transfer auxiliary power is required to maintain one operable and available Keowee unit and power path. Because the automatic transfer feature is not currently included in station technical specifications, no credit can be taken for its operation. This is the reason for the current Keowee operating restriction and for the license amendment request.

Manual Action to re-establish auxiliary power was credited in the design of the emergency power system as discussed in Section 2.3 of the LAR and the correspondence referenced therein. Manual restoration of auxiliary power was step-timed by Keowee Operations and is documented to have taken just over 27 minutes.

The auto transfer logic will re-establish auxiliary power within 36 seconds. This auto transfer logic is already installed and is tested on an 18-month frequency. The normal position for the auto/manual switch for power transfer is "auto" allowing this transfer to occur in the event of an auxiliary power loss.

a.iii Specify the allowable time to start powering the safety loads to mitigate an accident or plant transient from the time the emergency start signal is received.

The design basis requirement is for the KHUs to start up and accelerate to full speed in 23 seconds or less from the time the emergency start signal is received. This is described in UFSAR Section 8.3.1.1.1 and is verified via technical specification surveillance 3.8.1.9.

a.iv Please confirm whether the licensing basis allows both KHUs to be operated in commercial generation mode.

The licensing basis allows both KHUs to be operated in commercial generation mode (individually or simultaneously). UFSAR Section 8.3.1.1.1 describes the Keowee units' response to a demand for emergency power: "If the units are already operating…they

are separated from the network…" and the "Applicability" statement for Selected Licensee Commitment 16.8.4, Keowee Operational Restrictions, includes "during periods of commercial generation by one or both Keowee Hydro Units." There are current administrative restrictions placed on the aligned KHU Underground Unit which prohibits it from commercially generating.

b. The staff requests the licensee to confirm whether it intends to use both KHUs to generate to the grid after the licensing action is approved and whether the auto position of the auto/manual switch for power transfer would become the design basis position whenever one or more of the Oconee 1, 2, and 3 units are in power operation.

Oconee intends to use both KHUs to generate to the grid for peak power purposes after the licensing action for automatic auxiliary power swap is approved.

The normal position for the auto/manual switch for the 1X and 2X load centers is "AUTO" and it will become the design basis position as shown on the marked-up TS Bases (Pg. B 3.8.1-2) provided with the LAR submittal.

RAI-4

In Section 2.3 of the application enclosure, the licensee states, "[T]he automatic logic was defense in depth, was installed QA-1, would be maintained QA-1, and would be periodically tested. The NRC accepted this position in a September 4, 1998, Safety Evaluation (Reference 5)." In Section 3.1.1.1.6, "Second Category, Oconee QA-1 SSCs" of the UFSAR, Item 13 states, "[T]he maintenance and test procedures for certain 6.9 kV and 4 kV switchgear breakers are QA-1. Components that are used in future maintenance on these breakers that may impact the ability to shed non-safety loads are also QA-1." In order to confirm the reliability of the zone protection circuitry, the staff requests the licensee to identify any breakers involved in the auto transfer logic and confirm whether they are covered by QA-1 maintenance procedures, and to describe any operating experience regarding automatic transfer logic failures caused by a circuitry malfunction.

Duke Energy Response to RAI-4

The breakers involved in the Keowee auxiliary power auto transfer logic are ACB-5, 6, 7 & 8. These breakers are 600V breakers that are fed from the secondary side of transformers 1X, 2X or CX and are located in the 1X or 2X 600V load centers. Maintenance on these breakers is performed under QA-1 maintenance procedures. The surveillance procedure has been performed 17 times since 1995, the most recent being 1/9/19. The circuitry worked as designed during each of these surveillances.

RAI-5

Section 50.36(b) of 10 CFR requires that the TSs be derived from the analyses and evaluation included in the safety analysis report. The staff requests the licensee to provide the following information:

a. Logic and/or electrical diagrams showing breaker alignment for normal and alternate auxiliary power sources, including associated breakers and buses fed from these auxiliary power sources, and a comparison of these diagrams to Figure 1 of the application with respect to Zone Overlap Circuitry.

b. The staff requests the licensee to provide high-level system descriptions of: (1) the governor oil system, including the breaker alignment for normal and alternate power sources that feed the accumulators; and (2) the normal and auxiliary power swaps to the load centers.

c. Legible versions of UFSAR figures 8.1, 8.3 (page 1 of 2), and 8.4 (all three pages).

Duke Energy Response to RAI-5

a. An annotated version of LAR Figure 1 has been prepared to demonstrate the logic and breakers involved in the auxiliary power circuitry. See the RAI-5 Supplemental Response Information that follows.

   Each Keowee unit has one load center which supplies two motor control centers (MCC). The table below summarizes this arrangement.

Unit	Load Center	MCC
KHU-1	1X	1XA, 1XS
KHU-2	2X	2XA, 2XS

   Plant drawing K-702 provides a comprehensive list of breakers and loads supplied by the load centers and MCCs and is provided in the RAI-5 Supplemental Response Information that follows.

b. The governor oil system is required to be operable during all modes of unit operation. There are three governor oil pumps with the same capacity and only one is required for the governor to be operable. Governor oil volume is maintained in the governor oil pressure tank (GOPT). The oil in the GOPT is blanketed with pressurized air. The governor oil pumps are needed to maintain a level in the GOPT such that proper oil pressure exists for unit operation.

   Governor oil is depleted during unit operation and when in standby, resulting in a decrease in GOPT oil level and thus a lower oil pressure. Although there are several oil loads internal to the governor, the largest load during unit operation is the gate servomotor. This

mechanism controls the KHU wicket gates. The depleted oil returns to the governor oil sump. Oil depletion is made-up by the governor oil pumps. One pump, the lead pump, maintains the normal operating pressures. The governor oil pumps are powered from three different breakers at the unit motor control centers. The breakers are listed below. The associated load centers have normal and alternate power supplies that feed their downstream loads, including the governor oil pumps.

Governor Oil Pump Power Sources:
1A - MCC 1XA, breaker 1XA1D fed from Load Center 1X, breaker 1X2C
1B - MCC 1XA, breaker 1XA2E fed from Load Center 1X, breaker 1X2C
1C - MCC 1XA, breaker 1XA4D fed from Load Center 1X, breaker 1X2C

2A - MCC 2XA, breaker 2XA1D fed from Load Center 2X, breaker 2X2B
2B - MCC 2XA, breaker 2XA2E fed from Load Center 2X, breaker 2X2B
2C - MCC 2XA, breaker 2XA4D fed from Load Center 2X, breaker 2X2B

c. UFSAR Figure 8.1 is not associated with a controlled plant drawing; however, a clean copy has been obtained from the source file and is provided in the RAI-5 Supplemental Response Information that follows. The remaining requested UFSAR figures are associated with controlled plant drawings as noted in the list below. Copies of these drawings are provided in the RAI-5 Supplemental Response Information that follows.

- UFSAR Figure 8.3, Page 1 – Drawing O-0702
- UFSAR Figure 8.4, Page 1 – Drawing O-0703-G
- UFSAR Figure 8.4, Page 2 – Drawing O-1703-G
- UFSAR Figure 8.4, Page 3 – Drawing O-1703-I

RAI-5 Supplemental Response Information

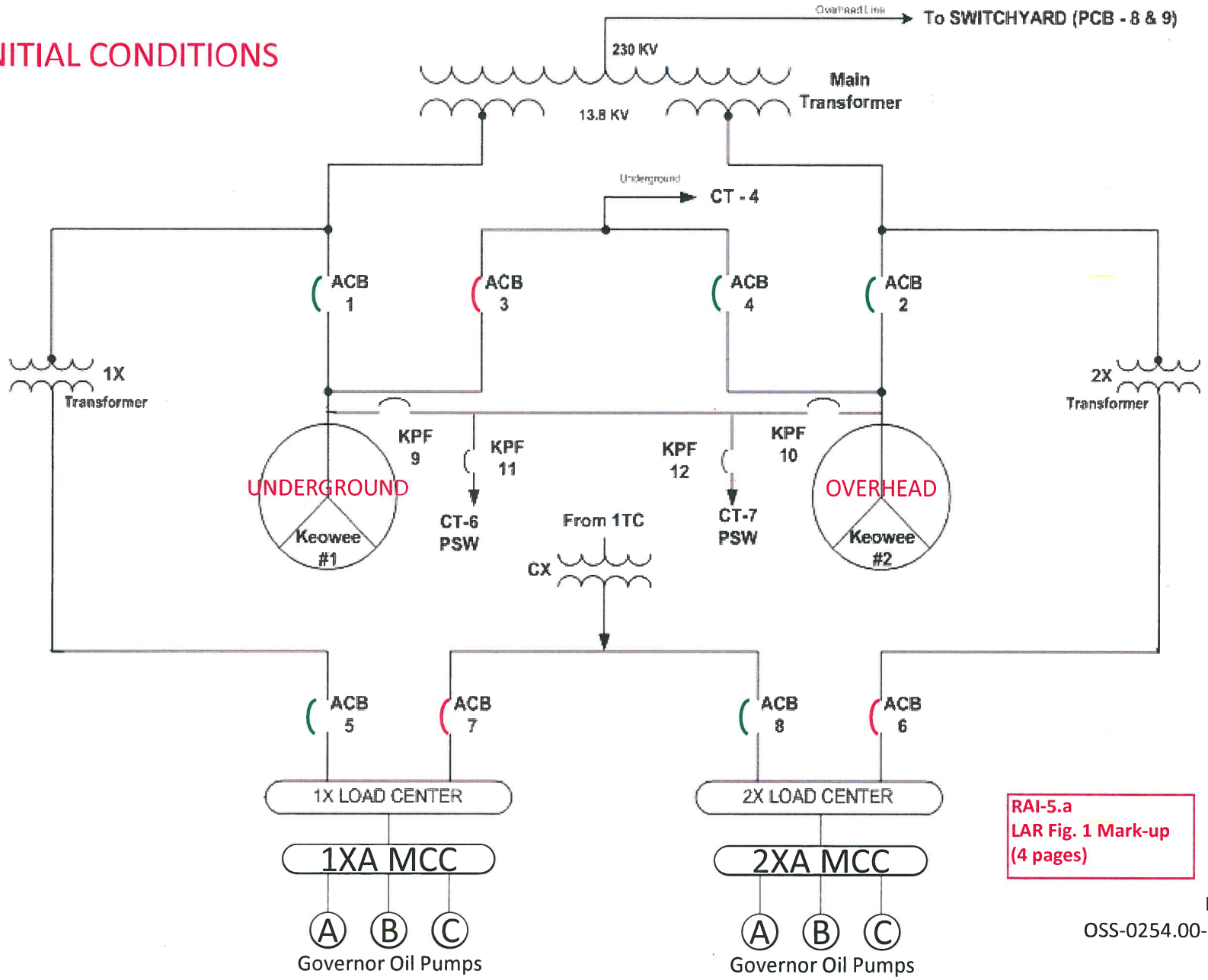
The following information is attached to this enclosure as a part of the response to RAI-5:

- RAI-5.a (total of 5 pages)
  - LAR Figure 1 Mark-up
  - Drawing K-702

- RAI-5.c (total of 5 pages)
  - UFSAR Figure 8.1
  - UFSAR Figure 8.3, Page 1 – Drawing O-0702
  - UFSAR Figure 8.4, Page 1 – Drawing O-0703-G
  - UFSAR Figure 8.4, Page 2 – Drawing O-1703-G
  - UFSAR Figure 8.4, Page 3 – Drawing O-1703-I

KEOWEE ELECTRICAL DISTRIBUTION

INITIAL CONDITIONS

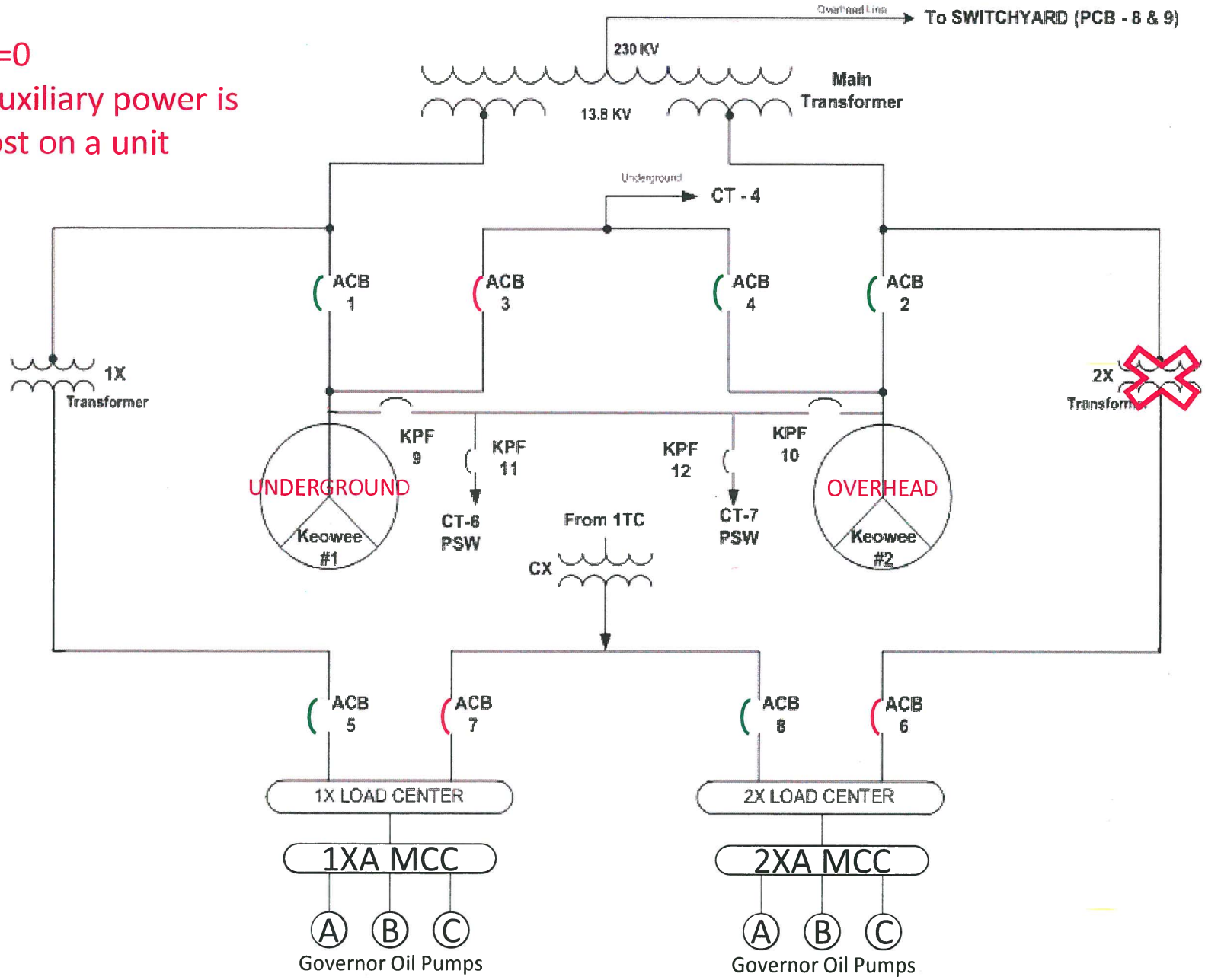


RAI-5.a
LAR Fig. 1 Mark-up
(4 pages)

References:
K-700
K-702
KEE-27-03
KEE-27-03-01
OSS-0254.00-00-2005, p47

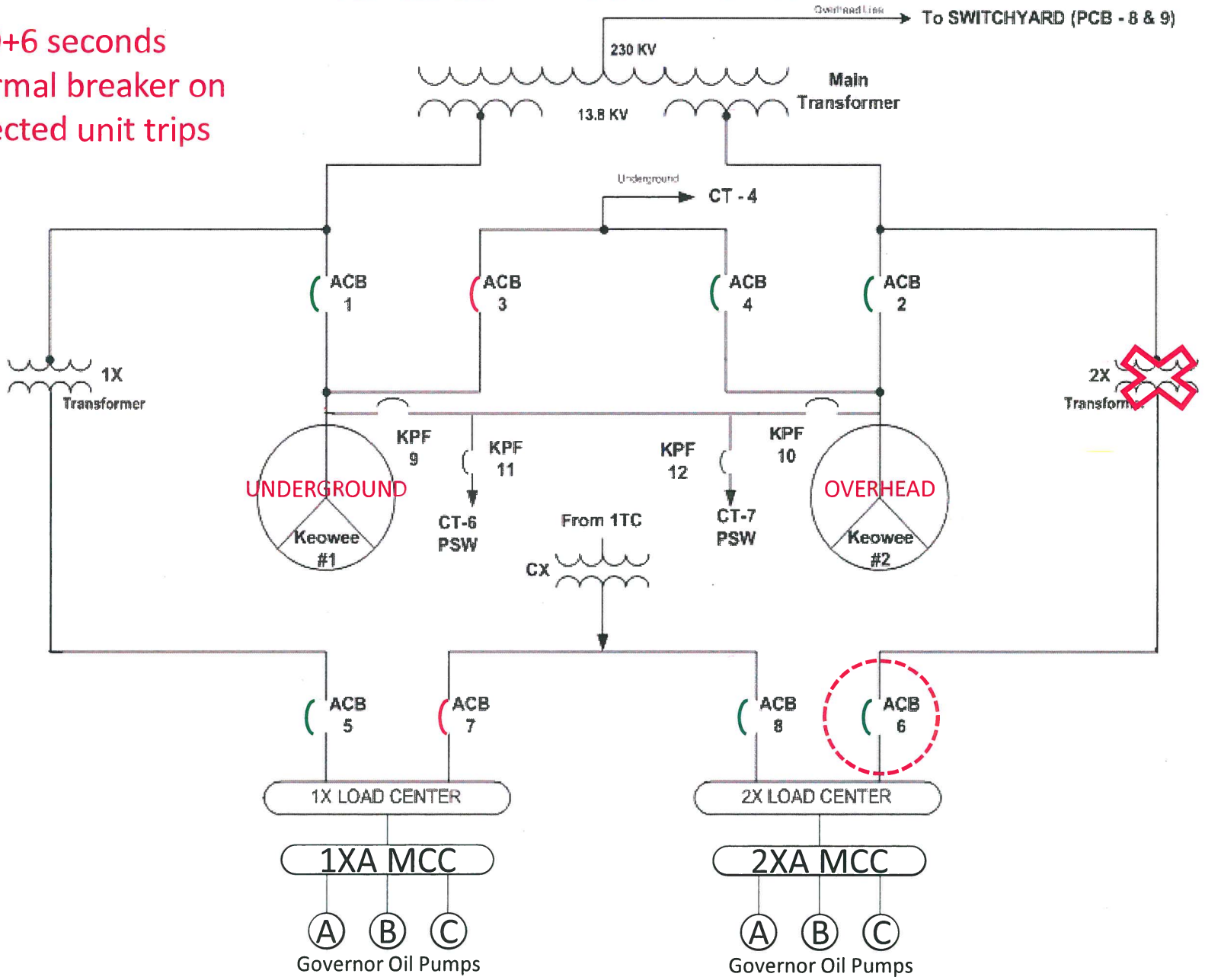
KEOWEE ELECTRICAL DISTRIBUTION

T=0
Auxiliary power is lost on a unit

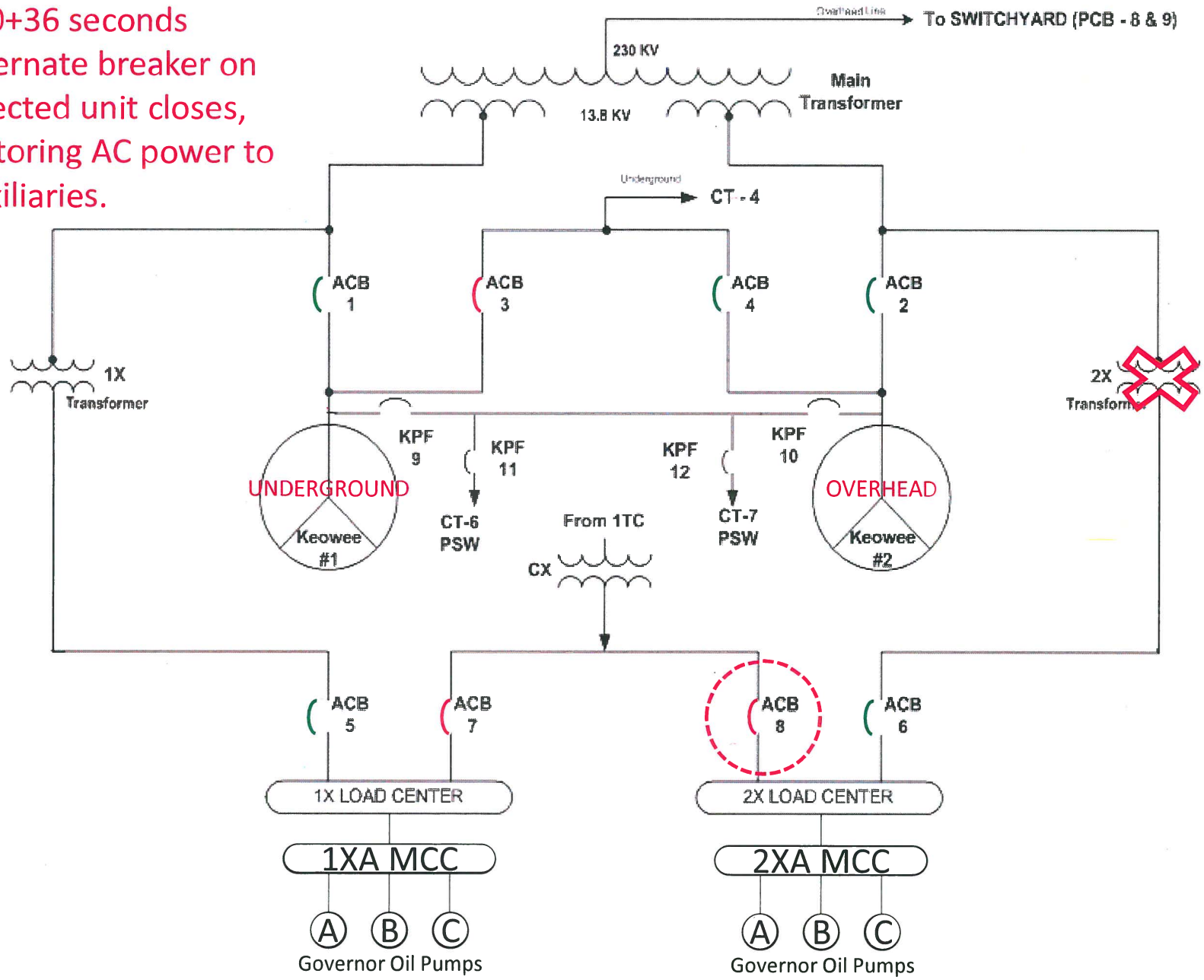


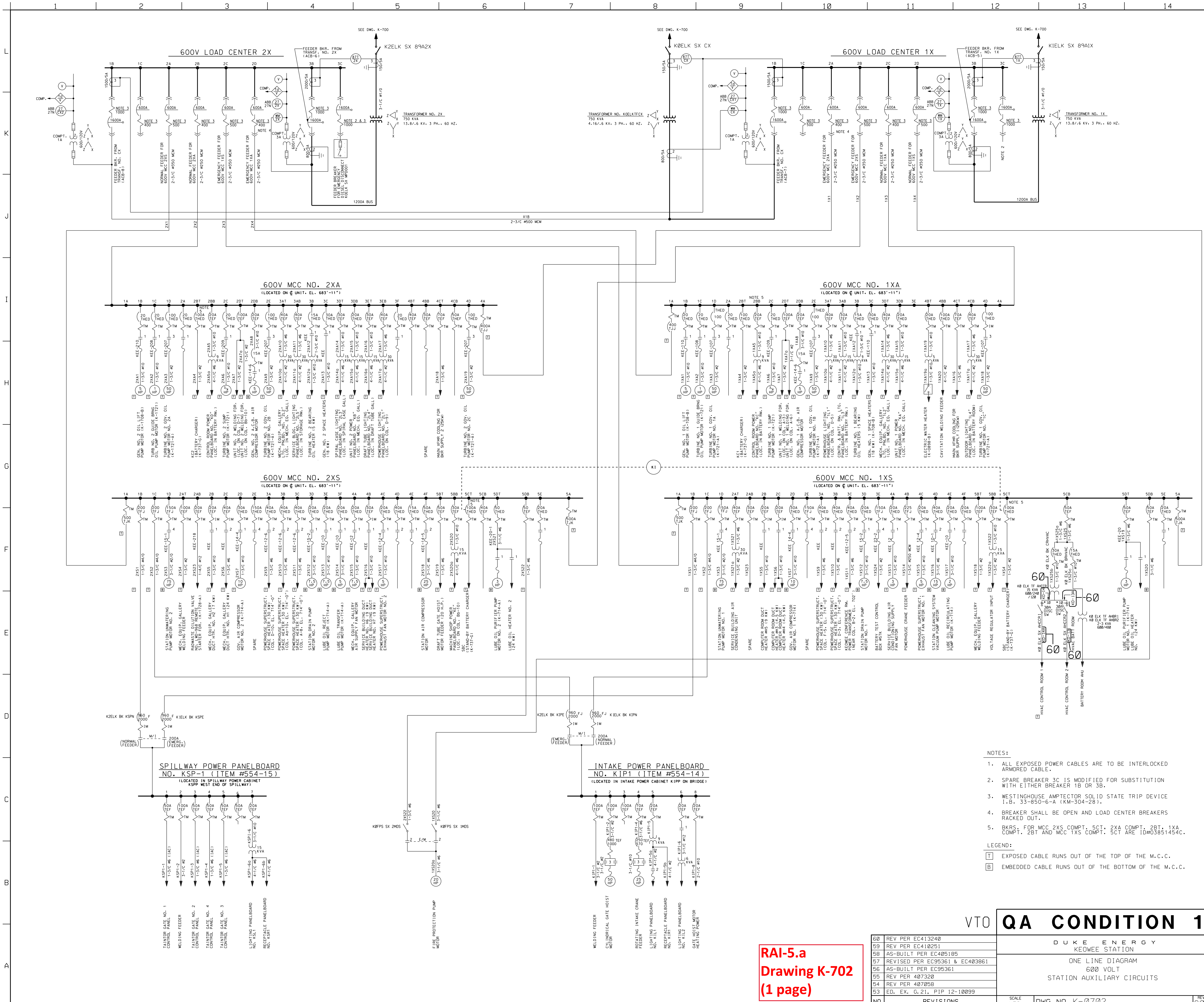
KEOWEE ELECTRICAL DISTRIBUTION

T=0+6 seconds
Normal breaker on affected unit trips



T=0+36 seconds
Alternate breaker on affected unit closes, restoring AC power to auxiliaries.





NOTES:

1. ALL EXPOSED POWER CABLES ARE TO BE INTERLOCKED ARMORED CABLE.
2. SPARE BREAKER 3C IS MODIFIED FOR SUBSTITUTION WITH EITHER BREAKER 1B OR 3B.
3. WESTINGHOUSE AMPTECTOR SOLID STATE TRIP DEVICE I.B. 33-850-6-A (KM-304-28).
4. BREAKER SHALL BE OPEN AND LOAD CENTER BREAKERS RACKED OUT.
5. BKRS. FOR MCC 2XS COMPT. 5CT, 2XA COMPT. 2BT, 1XA COMPT. 2BT AND MCC 1XS COMPT. 5CT ARE ID#03851454C.

LEGEND:

T EXPOSED CABLE RUNS OUT OF THE TOP OF THE M.C.C.

B EMBEDDED CABLE RUNS OUT OF THE BOTTOM OF THE M.C.C.

NO.	REVISIONS
60	REV PER EC413240
59	REV PER EC410251
58	AS-BUILT PER EC405185
57	REVISED PER EC95361 & EC403861
56	AS-BUILT PER EC95361
55	REV PER 407320
54	REV PER 407058
53	ED. EX. G.21, PIP 12-10099

VTO **QA CONDITION 1**

DUKE ENERGY
KEOWEE STATION

ONE LINE DIAGRAM
600 VOLT
STATION AUXILIARY CIRCUITS

SCALE NTS | DWG. NO. K-0702 | REV. 60

RAI-5.a
Drawing K-702
(1 page)

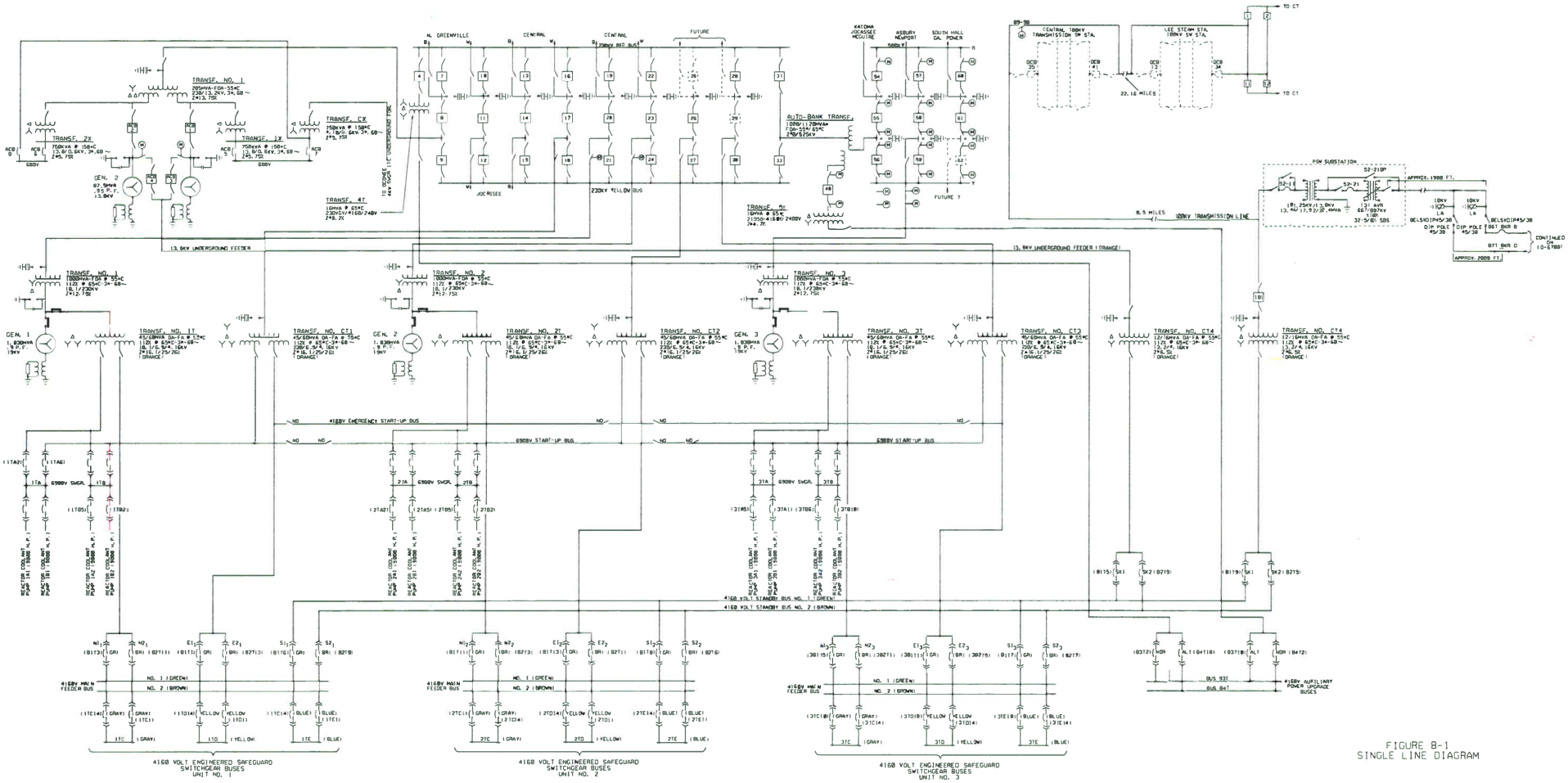
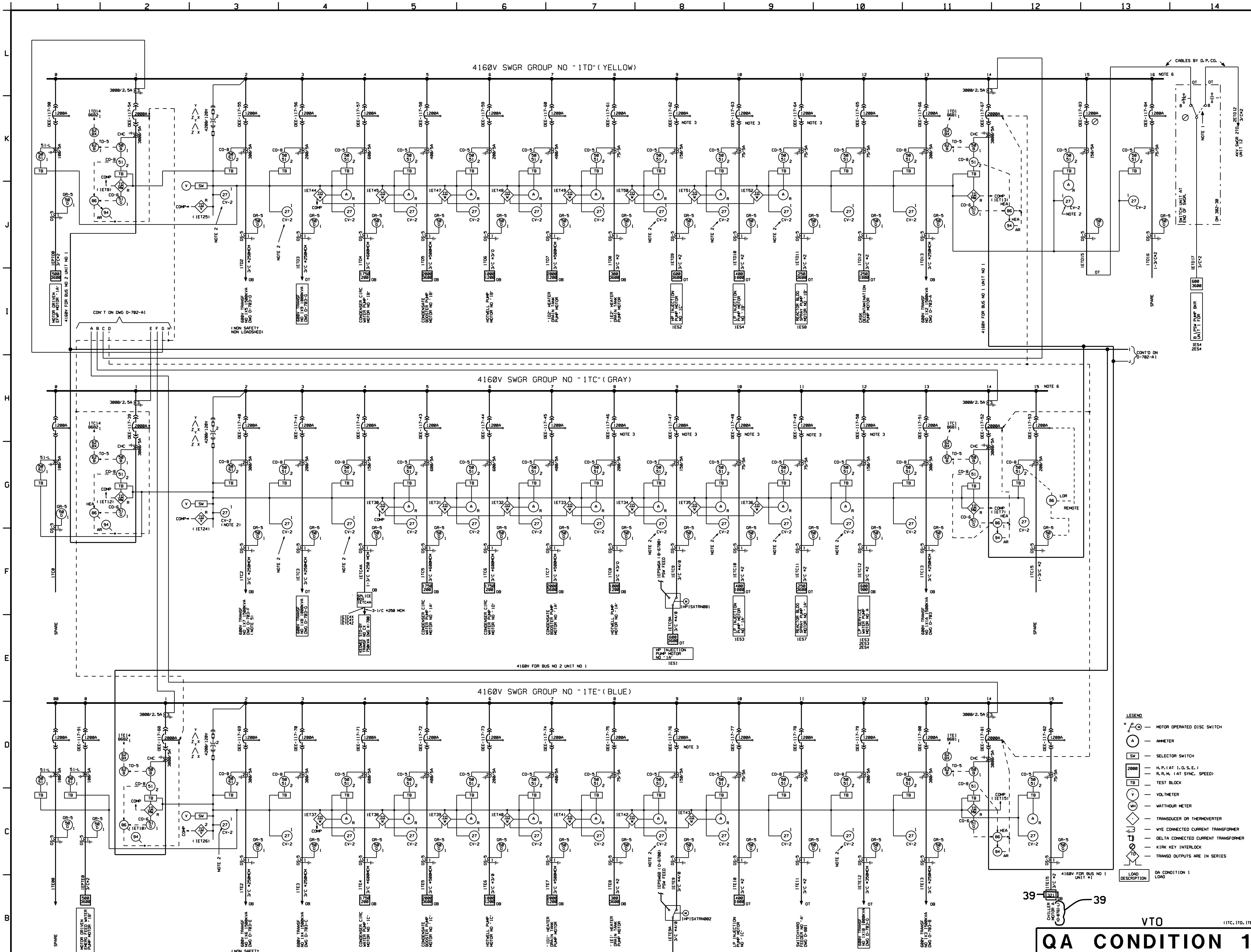


FIGURE 8-1
SINGLE LINE DIAGRAM

RAI-5.c
UFSAR Figure 8.1
(1 page)



REFERENCE DRAWINGS:

O-6700 —— ONE LINE DIAG. SWGR. B6T

NOTES:

1. THE NO LOAD MANUAL TRANSFER SWITCH IS EQUIPPED WITH KIRK INTERLOCK ARRANGEMENT SUCH THAT BREAKERS 1TD-15 & 2TD-12 (DWG O-1702) MUST BE IN OPEN POSITION BEFORE TRANSFER SWITCH CAN BE OPERATED
2. UNDERVOLTAGE RELAYS REMOVED AND TRIP CIRCUIT DISCONNECTED FROM CASE.
3. ALL 4KV 1200A BKRS. ARE INTERCHANGABLE WITH THE EXCEPTION OF 1TC UNITS 9, 10, 11 & 12 1TD UNITS 9, 10, 11 1TE UNITS 9 THESE BREAKERS ARE ONLY INTERCHANGABLE AMONG THEMSELVES BECAUSE THEY HAVE INTERNAL RESISTORS FOR PROPER OPERATION OF THEIR COIL MONITOR RELAYS.

NOTES CONT'D

4.
5. BREAKER WILL AUTOMATICALLY RECLOSE FOLLOWING LOAD SHED AND SET TIME DELAY.
6. IN COMPARTMENT 1TC-15 AND 1TD-16 CABLE LANDING ADAPTER PLATES MAY NOT BE SUPPLIED IN COMPARTMENT. PERFORM FIELD WALKDOWN BEFORE UTILIZING SPARE COMPARTMENT.
7. NOT USED

RAI-5.c
Drawing for
UFSAR Fig. 8.3, Pg. 1

NO.	REVISIONS
39	AS BUILT PER EC114675
38	REV PER EC409724
37	ISSUED PER EC400077
36	PIP #14-3899, ED. EX. G.21

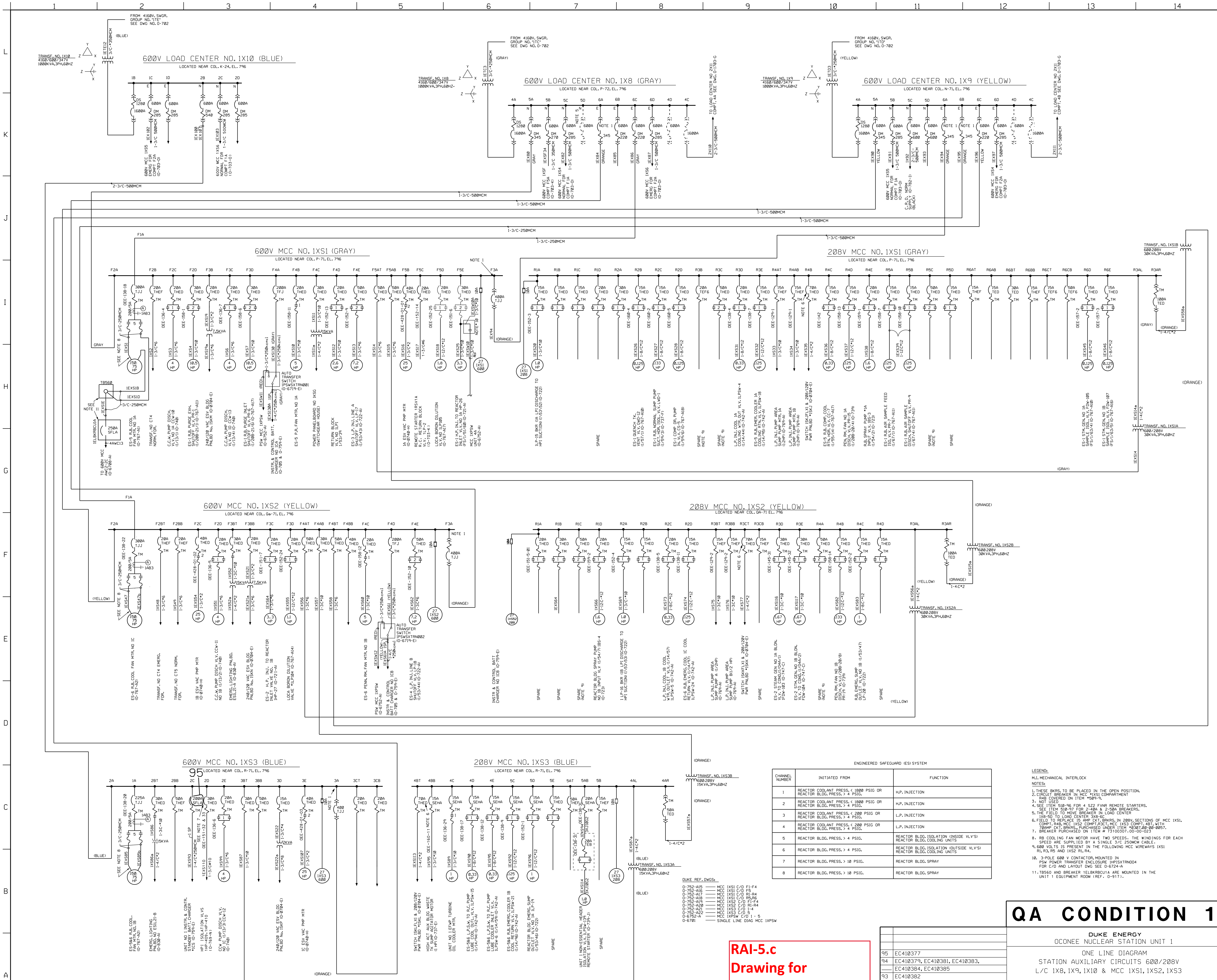
VTO (1TC, 1TD, 1TE)

QA CONDITION 1

DUKE POWER COMPANY
OCONEE NUCLEAR STATION UNIT 1

ONE LINE DIAGRAM
6900V & 4160V STA AUXILIARY SYS

SCALE | DWG. NO. O-0702 | REV. 39



ENGINEERED SAFEGUARD (ES) SYSTEM

CHANNEL NUMBER	INITIATED FROM	FUNCTION
1	REACTOR COOLANT PRESS. < 1800 PSIG OR REACTOR BLDG. PRESS. > 4 PSIG.	H.P. INJECTION
2	REACTOR COOLANT PRESS. < 1800 PSIG OR REACTOR BLDG. PRESS. > 4 PSIG.	H.P. INJECTION
3	REACTOR COOLANT PRESS. < 200 PSIG OR REACTOR BLDG. PRESS. > 4 PSIG.	L.P. INJECTION
4	REACTOR COOLANT PRESS. < 200 PSIG OR REACTOR BLDG. PRESS. > 4 PSIG.	L.P. INJECTION
5	REACTOR BLDG. PRESS. > 4 PSIG.	REACTOR BLDG. ISOLATION (INSIDE VLV'S) REACTOR BLDG. COOLING UNITS
6	REACTOR BLDG. PRESS. > 4 PSIG.	REACTOR BLDG. ISOLATION (OUTSIDE VLV'S) REACTOR BLDG. COOLING UNITS
7	REACTOR BLDG. PRESS. > 10 PSIG.	REACTOR BLDG. SPRAY
8	REACTOR BLDG. PRESS. > 10 PSIG.	REACTOR BLDG. SPRAY

LEGEND:

M.I. MECHANICAL INTERLOCK

NOTES:

1. THESE BKRS. TO BE PLACED IN THE OPEN POSITION.
2. CIRCUIT BREAKER IN MCC #1XS1 COMPARTMENT R4B COVERED ON ITEM #509-9.
3. NOT USED
4. SEE ITEM 510-96 FOR 4 SZ2 FVNR REMOTE STARTERS. SEE ITEM 510-97 FOR 2-40A & 2-50A BREAKERS.
5. THE FIELD TO MOVE BREAKER IN LOAD CENTER 1X8-5D TO LOAD CENTER 3X8-6C
6. FIELD TO REPLACE 15 AMP CKT. BRKRS. IN 208V, SECTIONS OF MCC 1XS1, COMPT. R4B, MCC 1XS2 COMPT.R3CT, MCC 1XS3 COMPT. 4BT, WITH 70AMP CKT. BRKRS., PURCHASED UNDER ITEM #0307.00-00-0057.
7. BREAKER PURCHASED ON ITEM # 73100307.00-00-023
8. RB COOLING FAN MOTOR HAVE TWO SPEEDS. THE WINDINGS FOR EACH SPEED ARE SUPPLIED BY A SINGLE 3/C 250MCM CABLE.
9. 600 VOLTS IS PRESENT IN THE FOLLOWING MCC WIREWAYS 1XS1 R1, R3, R5 AND 1XS2 R1, R4.
10. 3-POLE 600 V CONTACTOR, MOUNTED IN PSW POWER TRANSFER ENCLOSURE 1HPISXTRN004 FOR C/D AND LAYOUT DWG SEE 0-6724-A
11. TB560 AND BREAKER 1ELBKRBCU1A ARE MOUNTED IN THE UNIT 1 EQUIPMENT ROOM (REF. 0-917).

QA CONDITION 1

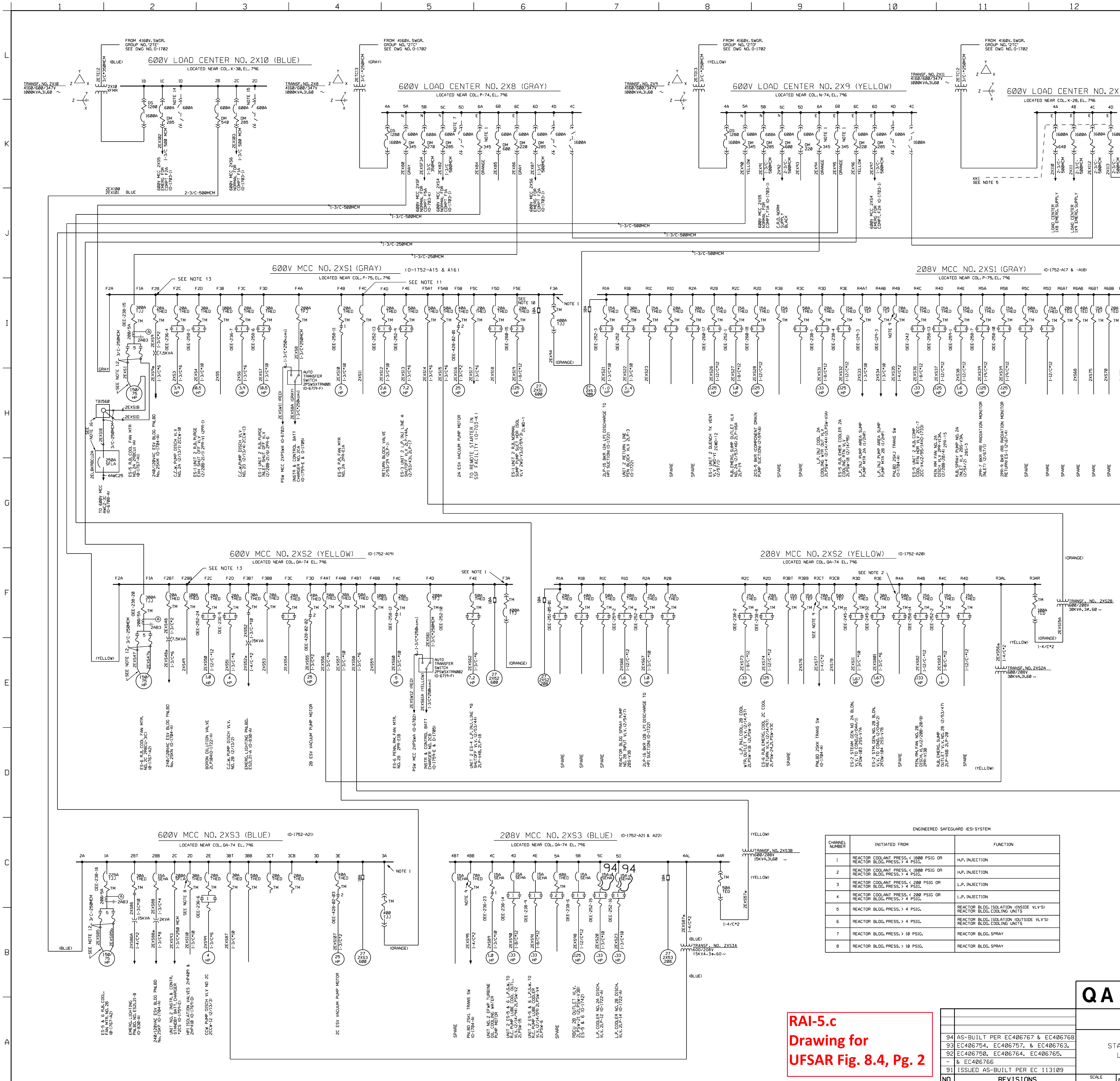
NO.	REVISIONS
95	EC410377
94	EC410379, EC410381, EC410383,
—	EC410384, EC410385
93	EC410382
92	EC410380
91	EC114827
90	ISSUED AS-BUILT PER EC 91826

DUKE ENERGY
OCONEE NUCLEAR STATION UNIT 1

ONE LINE DIAGRAM
STATION AUXILIARY CIRCUITS 600/208V
L/C 1X8, 1X9, 1X10 & MCC 1XS1, 1XS2, 1XS3

SCALE | DWG. NO. 0-0703-G | REV. 95

RAI-5.c
Drawing for
UFSAR Fig. 8.4, Pg. 1



NOTES:

1. THESE BKRS. TO BE PLACED IN THE OPEN POSITON.
2. FIELD TO REPLACE PRESENTLY MOUNTED 20A CIRCUIT BREAKER IN COMPT. R4A OF MCC #2XS2 WITH A 50A CIRCUIT BREAKER AS ORDERED ON ITEM 509-40.
3. NOT USED
4. NOT USED
5. KIRK KEY INTLK SCHEME ALLOWS BREAKER TO BE INSERTED IN:
   (a) COMPT. 4A ONLY IF THERE IS NO BREAKER IN COMPTS. 4B,4C,4D
   (b) COMPT. 4B ONLY IF THERE IS NO BREAKER IN COMPTS. 4A,4C,4D
   (c) COMPT. 4C ONLY IF THERE IS NO BREAKER IN COMPTS. 4A,4B,4D
   (d) COMPT. 4D ONLY IF THERE IS NO BREAKER IN COMPTS. 4A,4B,4C
6. KIRK KEY INTLK. SCHEME ALLOWS BREAKER TO BE INSERTED IN:
   (a) COMPT. 1A ONLY IF THERE IS NO BREAKER IN COMPTS. 1B,1C,1D
   (b) COMPT. 1B ONLY IF THERE IS NO BREAKER IN COMPTS. 1A,1C,1D
   (c) COMPT. 1C ONLY IF THERE IS NO BREAKER IN COMPTS. 1A,1B,1D
   (d) COMPT. 1D ONLY IF THERE IS NO BREAKER IN COMPTS. 1A,1B,1C
7. FIELD TO MOVE BREAKER FROM LC #2X8-5D TO LC #3X4-6C
8. BREAKER PURCHASED ON ITEM #7310-0307-00-00-00-0023
9. FIELD TO REPLACE 50A CKT BKRS IN 208V SECTIONS OF MCC 2XS1, COMPT R4B & MCC 2XS2, COMPT R3CT & 40A CKT BKR IN MCC 2XS3, COMPT 4BB WITH 70A CKT BKRS PURCHASED UNDER ITEM #0307.00-00-0057.
10. FIELD TO REPLACE 40A THED BKR IN 2XS1 COMPT #F5E WITH 20A THED BKR. FROM QA STOCK PURCHASED UNDER MPSCO NO J8108
11. 70 AMP BKR REMOVED FROM MCC 2XS-1, COMPT. F4C IS BEING USED AS A APPENDIX "R" BKR IN MCC XSF. REPLACEMENT BKRS PURCHASED BY DESIGN.
12. RB COOLING FAN MOTORS HAVE TWO SPEEDS. THE WINDINGS FOR EACH SPEED ARE SUPPLIED BY A SINGLE 3/C 250MCM CABLE.
13. THE EXTENSION ARM OF THE BREAKER OPERATING MECHANISM WAS REMOVED FROM BREAKER F2BB (SPARE) IN MCC 2XS2 AND INSTALLED ON BREAKER OPERATING MECHANISM ON BREAKER F2B IN MCC 2XS1. REPLACEMENT OF THE EXTENSION ARM FOR THE BREAKER OPERATING MECHANISM IN MCC 2XS2 BREAKER F2BB WILL BE BY ELECTRICAL MODIFICATION ENGINEERING.
14. FIELD TO MOVE BREAKER FROM LC #2X10-1D TO LC #3X9-5B.
15. FIELD TO MOVE BREAKER FROM LC #2X10-2D TO LC #3X9-6D.
16. TB1560 AND BREAKER 2ELBKRBCU2A ARE MOUNTED IN THE UNIT 2 EQUIPMENT ROOM (REF. O-917).

LEGEND:

KKI - KIRK KEY INTERLOCK
M.I. - MECHANICAL INTERLOCK

REFERENCE DRAWINGS:

O-1705 ———— ONE LINE DIA 120VAC & 125VDC STATION AUX CIRCUITS INSTRUMENTAION VITAL BUSES

ENGINEERED SAFEGUARD (ES) SYSTEM

CHANNEL NUMBER	INITIATED FROM	FUNCTION
1	REACTOR COOLANT PRESS. < 1800 PSIG OR REACTOR BLDG. PRESS. > 4 PSIG.	H.P. INJECTION
2	REACTOR COOLANT PRESS. < 1800 PSIG OR REACTOR BLDG. PRESS. > 4 PSIG.	H.P. INJECTION
3	REACTOR COOLANT PRESS. < 200 PSIG OR REACTOR BLDG. PRESS. > 4 PSIG.	L.P. INJECTION
4	REACTOR COOLANT PRESS. < 200 PSIG OR REACTOR BLDG. PRESS. > 4 PSIG.	L.P. INJECTION
5	REACTOR BLDG. PRESS. > 4 PSIG.	REACTOR BLDG. ISOLATION (INSIDE VLV'S) REACTOR BLDG. COOLING UNITS
6	REACTOR BLDG. PRESS. > 4 PSIG.	REACTOR BLDG. ISOLATION (OUTSIDE VLV'S) REACTOR BLDG. COOLING UNITS
7	REACTOR BLDG. PRESS. > 10 PSIG.	REACTOR BLDG. SPRAY
8	REACTOR BLDG. PRESS. > 10 PSIG.	REACTOR BLDG. SPRAY

RAI-5.c
Drawing for
UFSAR Fig. 8.4, Pg. 2

VTO

QA CONDITION 1

NO.	REVISIONS
94	AS-BUILT PER EC406767 & EC406768
93	EC406754, EC406757, & EC406763,
92	EC406750, EC406764, EC406765,
-	& EC406766
91	ISSUED AS-BUILT PER EC 113109

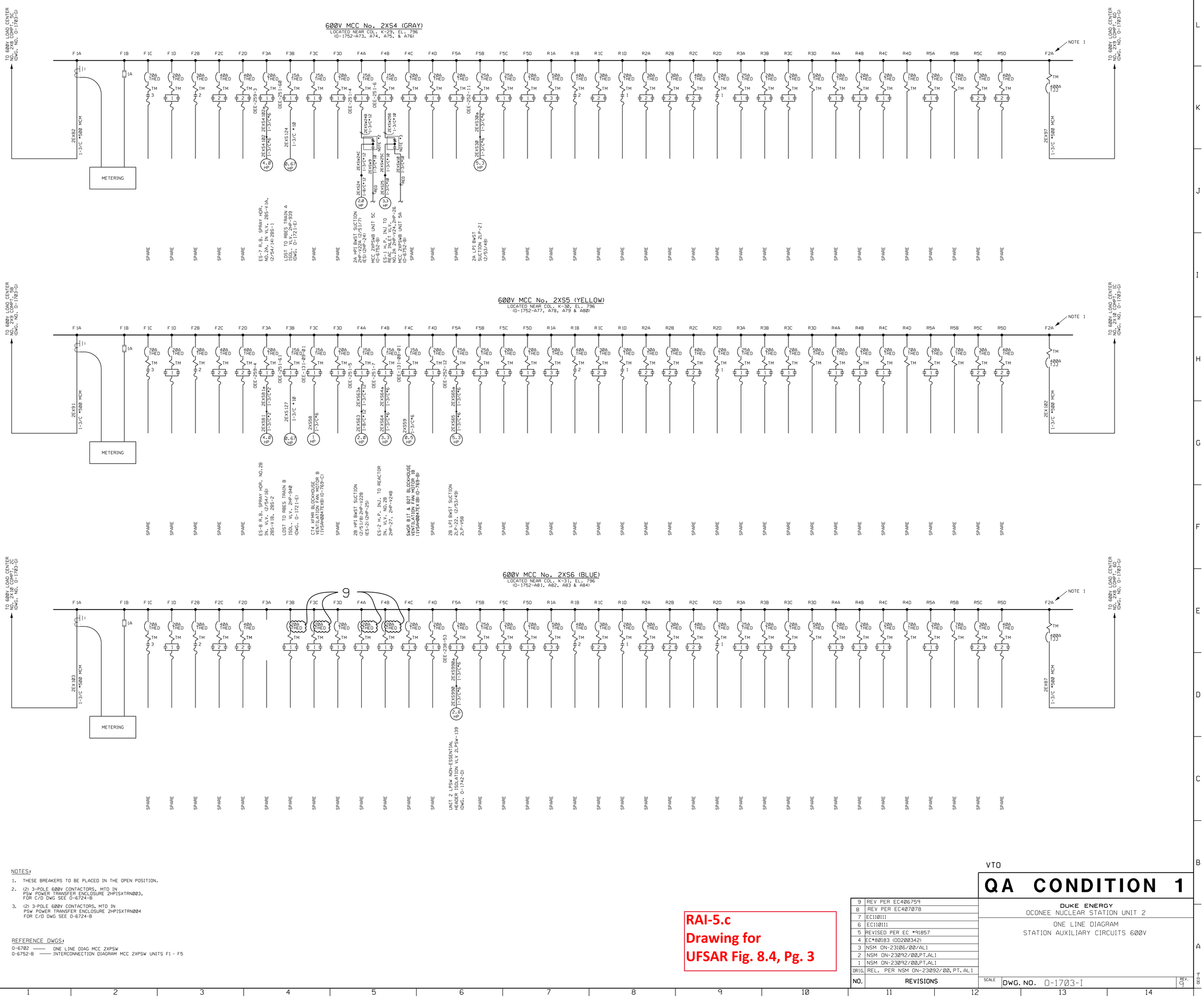
DUKE ENERGY
OCONEE NUCLEAR STATION UNIT 2

ONE LINE DIAGRAM
STATION AUXILIARY CIRCUITS 600V/208V
L/C 2X8, 2X9, 2X10, 2X11, 2X11A,
& MCC 2XS1, 2XS2, 2XS3

SCALE

DWG. NO. O-1703-G

REV. 94



VTO

QA CONDITION 1

RAI-5.c
Drawing for
UFSAR Fig. 8.4, Pg. 3

NO.	REVISIONS
9	REV PER EC406759
8	REV PER EC407078
7	EC110111
6	EC110111
5	REVISED PER EC *91857
4	EC*80183 (OD200342)
3	NSM ON-23106/00/AL1
2	NSM ON-23092/00,PT.AL1
1	NSM ON-23092/00,PT.AL1
ORIG.	REL. PER NSM ON-23092/00, PT. AL1

DUKE ENERGY
OCONEE NUCLEAR STATION UNIT 2

ONE LINE DIAGRAM
STATION AUXILIARY CIRCUITS 600V

SCALE | DWG. NO. O-1703-I | REV. 9

OED-6