Proposed Technical Specifications Section 3.7.1 "AC Sources - Operating"

1. The revised technical specifications do provide the indicated Duke Power Company proposal to change the technical specifications to limit the use of a startup transformer to one unit. The voltage adequacy concerns raised in the EG&G Technical Evaluation were identified by Duke in the response to the NRC letter dated August 8, 1979. The NRC letter required that all licensees review the electric power systems to determine if sufficient capacity existed to start and operate all required safety loads under degraded grid conditions. In the NRC's Safety Evaluation dated March 21, 1983 of Duke's electric power system analysis, the analysis was found "to be acceptable with respect to the adequacy of station electric distribution system voltages subject to the implementation of technical specifications change prohibiting the use of one startup transformer for more than one unit." The Tech Spec revision that implemented the requirements in the EG&G Technical Evaluation and the NRC's Safety Evaluation was submitted on March 17, 1983. This Tech Spec amendment was approved on March 2, 1984. In the coverletter that accompanied the Amendments Nos 127, 127, and 124 to Facility Operating Licenses Nos DPR-38, DPR-47 and DPR-55, it states that "the open issue identified in my March 21, 1983 letter to you, namely the distribution of voltages at the safety buses when one unit startup transformer is shared between two units, is considered closed with the issuance of these amendments." The summary of the safety evaluation that accompanied the amendments 127, 127, and 124 indicates the "proposed Tech Spec changes, when implemented, will assure adequate distribution of voltages at the Class 1E buses in the event of loss of a startup transformer.

   Amendments Nos 127, 127, and 124 are included in the current Tech Specs which allow the sharing of the Startup Transformer by two units under Limited Conditions of Operation. As discussed in the bases section for 3.7.1, the sharing of the startup transformer is done in order to shutdown a unit that has an inoperable Startup transformer. Shutting down with an operable startup transformer will allow the use of the reactor coolant pumps for the preferred shutdown path rather than natural circulation for the limited time described in the Tech Spec.

2. The change in emergency power path operability verification from 8 hours to 12 hours is done for the following reasons. The first reason is that it would align with the current operating shift schedules which are 12 hour shifts. When the original Tech Spec limit of 8 hours was written, the operators were working 8 hour shifts. The second reason for the change is that it will reduce unnecessary testing requirements.

   During the October 7th meeting in Washington, the NRC commented that the repetitive testing of Keowee is unnecessary given the fact that Keowee generates to the Duke grid on a regular basis which demonstrates the reliability of the Keowee units to start. Based on this conversation with the NRC, the Tech Spec will be revised to allow the operability verification of the operable Keowee unit to be within 24 hours of the determination that a Keowee unit is inoperable. The standard technical specification has a testing requirement for verification of diesel generator operability within 24 hours of determining that the redundant

diesel generator is inoperable. This Tech Spec change will eliminate the unnecessary testing requirements in the current Tech Specs. Also, the Bases section 3.8.1 in the standard technical specification states that verification of diesel generator operability without testing is allowed to avoid unnecessary testing of operable diesel generator(s). However, operability of the Keowee unit will be determined by test rather than allowing the option for verification without testing.

3. A 28 day allowed outage time (AOT) for the Keowee Main Step-up transformer is not a change from the current Technical Specification. In order to replace the Keowee Main Step-up Transformer, the Jocassee Main Step-up Transformer will be transported to Keowee and installed as the replacement transformer. The necessary modification to perform this replacement is established and ready to use if the need arises. Current estimates for implementation of the modification indicate that 28 days would allow a reasonable period of time for installation and testing of the replacement transformer. The activities that will be performed during the transformer replacement are summarized in the following list.

   - Assessment of the damage to the Keowee Main Step-up Transformer by the manufacturer's Service Representative. Based on this assessment, arrangements will be made to repair or replace the transformer.

   - The failed transformer is to be disassembled for shipment or placed in its storage location if it is to be scrapped.

   - Remove Jocassee Unit 2 Main Step-up (MSU) Transformer.

   - Move Jocassee MSU transformer by truck and trailer to West Union (approx. 25 miles). It will then be moved by rail to Courtnay. From Courtnay, it would be moved by truck and trailer to Keowee (approx. 8 miles). This truck and train combination is necessary due to the weight restrictions of the bridges between Jocassee and Keowee Hydro Stations.

   - Install Jocassee MSU transformer as replacement for failed Keowee MSU transformer

   - Modify Seismic Brackets for the replacement MSU transformer at Keowee.

   - Modify the auxiliary power supplies since the replacement MSU transformer requires 480V and the damaged Keowee MSU transformer used 600V for the auxiliaries.

   - Install mulsifyre system on the replacement MSU transformer and provide support bases.

   - Perform tests on the replacement MSU transformer to verify operability.

   It is expected that work to replace the transformer would be around the clock, 7 days a week. Even at this rate, it is expected that most if

not all of the 28 day time period would be necessary.

4. When one of two E breakers is operable and the startup transformer is operable, the overhead path is declared inoperable. This situation is covered in the proposed Technical Specifications bases section for 3.7.1. A list of overhead emergency power path components indicates that both E breakers are required for an operable overhead emergency power path. The overhead path is functional during the conditions mentioned above. However, the E breaker logic would be susceptible to a single failure when only one E breaker was operable. In this condition, the startup transformer operability is not a consideration.

5. In the situation of one E breaker inoperable on one Main Feeder Bus and one S breaker inoperable on the other Main Feeder Bus, the overhead path and the underground path would be declared inoperable. This scenario is identified in the proposed Bases for Technical Specification section 3.7.1. Tables in the Bases indicate that both E breakers are need for overhead power path operability and both S breakers are need for underground power path operability. This is not a change from the current Tech Specs.

6. Current Technical Specifications provide an allowed outage time (AOT) of 24 hours if both emergency power paths are inoperable due to an unplanned situation. However, a planned outage of both emergency power paths has an AOT of 72 hours in the current Tech Specs. The combination of these two situations into one requirement is needed to eliminate the determination of what is planned and unplanned. In the past, a resident inspector has questioned the classification of an activity as a planned outage. Also, the risk concerns for a planned or unplanned outage of the emergency power paths are identical. Technical Justification #61 discusses the need to combine planned and unplanned outage requirements. It also elaborates on the use of Lee to energize the standby buses during an outage of a Keowee unit.

7. When one Keowee unit has been removed from service to perform turbine and generator maintenance, it is necessary to make one Keowee unit inoperable in order to restore both Keowee hydro units. This is due to the sharing of the intake structure and a common penstock.

   In order to perform the turbine and generator maintenance on a Keowee unit, a plug must be installed in the penstock for the Keowee unit. This is done by closing the intake and dewatering both Keowee units. After the dewatering, a plug is installed at the inlet of the penstock for the Keowee unit which will undergo maintenance. The intake plug is removed which opens the intake and restores to service the Keowee unit that is not in a turbine/generator maintenance outage. The Tech Specs (current and proposed) allow 24 hours to complete this activity. A maintenance outage of this type is allowed for a maximum of 45 days.

   When restoring the inoperable Keowee unit to service from the maintenance outage, the operable Keowee unit will be made inoperable while the penstock plug for the inoperable Keowee unit is removed. This activity is performed by first closing the intake and dewatering the operable Keowee unit. Following the dewatering, the penstock plug is

removed from the Keowee unit that was in a maintenance outage. After this is complete, the intake plug is removed which opens the intake structure and makes both Keowee units operable. This activity requires 12 hours to complete and makes both Keowee units inoperable while it is being performed.

8. The use of Lee as a backup power source has not changed from the current Tech Specs. The details pertaining to powering the standby bus from Lee have been moved to the bases section. Under the proposed specification, the connection of Lee to the standby bus will be the same as in the current specification. Connection of the Lee gas turbine to the standby bus via a path that is electrically separate from the system grid and all offsite loads will be added to the Specifications sections where Lee is required by the Tech Specs.

9. If one Keowee unit is inoperable for more than 72 hours, then the current Tech Specs require Lee to energize the standby bus. Also, the operable Keowee unit must be aligned to the underground path and available to the overhead path. The proposed Tech Specs for this scenario change the requirement to have the operable Keowee unit available to the overhead path. This change is less restrictive than the current Technical Specification.

   The requirement for the operable Keowee unit to be aligned to the underground and available to the overhead means successive LCOs must be entered into when a Keowee unit is out for maintenance for more then 72 hours and the Keowee MSU transformer needs to be taken out of service for maintenance. With one Keowee unit in an extended outage, this would be the best time to do major work on other overhead power path components. Each activity cannot be done simultaneously under the current Tech Specs. The proposed Tech Specs would permit the maintenance be done concurrently and thereby reduce the overall length of the LCOs associated with Keowee during these maintenance activities.

   The scenario for needing the overhead path would require an ES event, a LOOP, failure of the Lee CT power path, and the underground power path excluding the Keowee unit. This scenario goes beyond the single failure criterion.

   The probabilistic risk assessment of loss of offsite power events (the event of most interest for Keowee operability in terms of core damage risk) indicate the following results:

   - The risk of core damage from a loss of offsite power event during a 72-hour period is approximately 3.0E-08, assuming normal availability of the Keowee overhead and underground path components.

   - With the overhead path and an associated Keowee unit inoperable, the increase in risk is approximately 3.0E-08.

   These results can be compared to a nominal risk of core damage of approximately 1.0E-04 per reactor year, considering all accident initiators. Thus, the proposed 72-hour inoperability time seems

reasonable.

10. The response for this item will be provided on December 6, 1993.

11. The isolation of the yellow bus in order to establish the overhead emergency power path does not require the operation of the 230kV switchyard differential relaying circuitry or the attendant bus sensors. Switchyard isolation takes place from sensors and relays that are independent of the differential relaying circuitry and the attendant bus sensors.

12. Testing of the Keowee underground feeder breaker interlock and the underground to overhead breaker interlock has not identified any failures in the past. During the past 5 years, the interlocks on the underground power path between ACB 3 and ACB 4 have not failed during any of the surveillances. Also, the underground to overhead power path breaker interlocks have not failed during past surveillances. Due to the reliable history of these interlock, the testing frequency for the interlocks was changed from a monthly surveillance to a semiannual surveillance in the proposed Tech Specs. Reliability of the interlocks is due to their type and manufacturing. The control interlocks preventing one Keowee underground breaker from closing if the other breaker and associated disconnects is closed are made up of breaker and disconnect auxiliary "b" contacts. These contacts are a part of the breaker and disconnects which are both located within the Keowee breaker vault.

13. Surveillance requirement for the External Grid Trouble Protection System (EGTPS) logic was removed from the Tech Specs because the 230kV Degraded Grid Protection circuitry is credited for the switchyard isolation in DBA scenarios. The Degraded Grid circuit has a required surveillance in the Tech Specs. Switchyard isolation can be initiated by the undervoltage or underfrequency relays in the EGTPS. Degraded Grid protection replaced the function of the undervoltage portion of the EGTPS; however, the undervoltage circuitry has not been disabled since it provides a backup source of switchyard isolation. The frequency portion is contained in a Selected Licensee Commitment (SLC) because it provides a function that was not replaced by the Degraded Grid circuit. The frequency and voltage portions of the EGTPS are safety-related and will be maintained as safety-related. During the meeting on October 7th, a decision was made to include the voltage portion of the EGTPS in a SLC.

14. Allowed Outage Time (AOT) for one emergency power path in the proposed Tech Specs is 72 hours. The Keowee 125VDC system consists of two separate and independent power strings (one per unit). Inoperability of a string or single component in the Keowee 125VDC power system will make the associated Keowee unit inoperable and has no affect on the other Keowee unit. The Keowee Battery System will not impair the ability of the Degraded Grid Protection system or External Grid Protection system to operate (powered by 230kV Switchyard Battery System). Also, the Keowee Battery System cannot impair the ability of the Emergency Power System Logic (EPSL) to function and seek alternate power sources (powered by Oconee Vital Battery systems). Therefore, one emergency

power path is inoperable and has an AOT of 72 hours. An AOT of 72 hours will align the time restriction for an inoperable emergency path and the Keowee 125 VDC power system.

15. Switchyard isolation complete circuitry is a support system for the overhead emergency power path. The overhead power path is listed in the Tech Specs with requirements for limited conditions of operation. The bases section of the Tech Specs listed the components required for an operable overhead power path. Therefore, switchyard isolation complete circuitry inoperability will result in the declaration of the overhead power path as inoperable. In the bases section, a statement indicates overhead power path operability can be maintained by using alternative components that are described in the DBD. This statement will be removed. Also, SR 3.7.7.2 will be added to the Tech Spec for verification of an isolated power path through the yellow bus. This will verify that the switchyard isolation complete circuitry is operable.

16. The info that is moved to the bases section of the Tech Specs is considered part of the Emergency power path. There are two tables in the bases which indicate the components that are required for the overhead and underground power paths to be operable. If a condition in the table does not exist, then the appropriate power path will be considered inoperable.

    For the conditions listed in the question, the following indicates the Tech Spec requirement that covers the conditions.

    a. One startup transformer may not be aligned to supply power to more than one unit. The need to share a startup transformer would occur when a unit's startup transformer is inoperable. This will place Oconee in Tech Spec section 3.7.1 Condition A where the offsite sources and overhead emergency power path are inoperable due to an inoperable startup transformer.

    b. Both of the 125VDC Keowee batteries (Bank 1 & 2) with associated chargers and distribution centers (1DA & 2DA) shall be operable. If a Keowee battery, battery charger or distribution center is inoperable, then the associated emergency power path is inoperable. This will place Oconee in Tech Spec section 3.7.1 Condition C.

    c. The level of Keowee Reservoir shall be at least 775 feet above sea level. When the lake level gets below 775 feet above sea level, then both emergency power paths will be inoperable. This will place Oconee in Tech Spec section 3.7.1 Condition E.

    d. The Keowee station auxiliary transformers (1X and 2X) and the Keowee station backup auxiliary transformer (CX) shall be operable. If the auxiliary transformers (1X or 2X) for the Keowee unit aligned to the overhead power path is inoperable, then the overhead power path is inoperable. If the backup auxiliary transformer (CX) is inoperable, then the underground power path is inoperable. This will place Oconee in Tech Spec section 3.7.1

Condition C.

Oconee lists these support systems in the bases because the inoperability of these support systems can be linked directly back to the operability of the associated emergency power path. Therefore, the appropriate emergency power path is declared inoperable and Oconee enters the appropriate LCO. This provides less confusion to the operator and ensures that increased surveillances are performed on the operable emergency power path.

17. The current Tech Spec surveillance for the Keowee units requires that one Keowee unit be tested to the overhead path and the other unit tested to the underground path. After completion of this part of the test, the breaker connecting the Keowee unit to the underground path will be manually opened. The interlock between the underground breakers will then allow the underground breaker to the unit that had just been tested to the overhead path to be manually closed. The auxiliaries will have to be aligned so that they are powered by the appropriate Keowee unit. At this point, the test will be repeated for the new alignment of the Keowee units. The first part of the test proves the operability of the overhead path and the underground path with that particular alignment of the Keowee units. Once this part of the test is complete, the emergency power paths are operable until the alignment of the Keowee units to the overhead and underground power paths is changed.

    The monthly tests of the emergency power paths have been retained as SR 3.7.1.2 and SR 3.7.1.3. The tests verify the operability of the Keowee unit to its preselected emergency power path. Verification that an individual Keowee unit can meet the surveillance requirement for both emergency power paths is not specified, as this function is not required for emergency power path operability.

18. Tech Spec surveillances SR 3.7.1.2, 3, 4, 5, 6, 8, 9, 3.7.4.1, 3.7.7.1, 3.7.8.1 cumulatively test the necessary power source paths and control logic paths required for Design Basis scenarios. Many other redundant paths though not required by Design Basis are also covered in these surveillances. During the preparation of Design Basis documents for these systems, a review of periodic testing is conducted to verify adequacy and completeness.

19. The standard tech specs list Diesel Fuel Oil, Lube Oil and Starting Air as the required support systems for the diesel generator. At Keowee, there is no equivalent support system to the Lube Oil or Starting Air system for Keowee starting and coming up to speed. The Diesel Fuel Oil level for operability is analogous to the lake level requirement for Keowee Emergency power path operability. The lake level requirements are addressed in the Bases section for Tech Spec 3.7.1. The normal start surveillances of Keowee verify the operability of the Keowee support systems.

20. Generation to the grid via the overhead from both Keowee units simultaneously is allowed under our current Tech Specs. A single failure analysis of the Keowee emergency power system was performed to analyze the possibility of a single failure resulting in the loss of

both Keowee units. The single failure analysis identified three areas of concern that were documented in LER 269/92-11, LER 269/92-16 and LER 269/92-19. The single failure that was described in LER 269/92-16 is still possible in the ACB zone protection relays; however, this is precluded by keeping the overhead power path ACB disconnects open on the Keowee unit that is aligned to the underground. A modification is being prepared to correct the ACB zone protection relay concern.

Proposed Technical Specifications Sections 3.7.7 and 3.7.8. "Emergency Power Switching Logic (EPSL) Degraded Grid Voltage Protection" and "Emergency Power Switching Logic (EPSL) CT-5 Degraded Grid Voltage Protection". Respectively

1. **Item 1.d** The setpoints are listed in calcs which are reviewed on a periodic basis. Changes in the setpoints as a result of these reviews are possible. The trip setpoints and the allowable limits are not in the Tech Specs because changes in the setpoints will require Tech Spec revisions which is an unnecessary burden on the NRC and Duke. Requirements for operability and surveillance of EPSL Degraded Grid Voltage Protection and CT5 Degraded Grid Voltage Protection are included in the Tech Spec section 3.7.7 and 3.7.8. During the surveillances, verification of the associated logic, setpoints, and time delays is performed.

   For the 230kV switchyard degraded grid protection system, the undervoltage relays are set to dropout at 222.5kV. When the relay tolerances are included, a minimum switchyard voltage of 219.9kV may be experienced. If the voltage drops below the setpoint for nine (9) seconds, switchyard isolation will be initiated following an ES actuation signal.

   For the CT-5 Degraded Grid protection system, two levels of protection are provided. The first level of protection provides an alarm to the control room if the voltage drops below 4171.29V for more than nine (9) seconds on the 4160V bus. Also, the first level of protection arms the trip logic which results in immediate breaker tripping anytime the setpoint for the second protection level is reached. The setpoint for the second level corresponds to a 4160V bus voltage of 3889.29V.

   Item 2 Load sequencing as discussed in Branch Technical Position Number 1 does not apply to Oconee since all of the safety loads are block loaded on the Keowee units.

2. A seven day completion time for restoring an inoperable voltage sensing relay or one channel of actuation logic to operable status is based on engineering judgement. Engineering judgement takes into consideration the infrequency of actual Grid system voltage degradation, the probability of a simultaneous ES actuation, and the availability of the other Unit's sensing relays or the availability of the operable actuation channel.

   A PRA analysis was performed on the Degraded Grid protection completion times to return an inoperable voltage sensing relay or one channel of actuation logic to operable status. The PRA reviewed the condition where one voltage sensing relay or one channel of actuation logic was inoperable for 7 days. A target value for the reliability of the Degraded Grid Protection System (DGPS) was established such that accident sequences involving the initiating events of interest and failure of the system are of very low probabilistic significance. The frequency of challenge for the DGPS is the product of the concurrent initiators' frequencies. To account for possible future changes in grid behavior a conservative value for the proportion of time the grid is at less than 219kV is used. 1.14E-03 is the value, which is approximately

10 hours of a one year period. The ES actuation frequency used is 1.0E-02. The challenge frequency is then about 1.0E-05. From this it was determined that the DGPS should exhibit a failure rate of no more than 1.0E-02. For the condition of one voltage sensing relay inoperable for 7 days, the DGPS failure rate was determined to be 1.0E-03. With one channel of actuation logic inoperable for 7 days, the DGPS failure rate was determined to be 1.2E-03. It should be noted that the DGPS failure rate with no inoperable components was 1.0E-03. The PRA conclusion stated that "the probability of accident sequences involving degraded grid conditions and failure of the DGPS, including the suggested inoperability contributions, is insignificant."

Proposed Technical Specifications Section 3.7.9. "Vital I&C DC Sources and Distribution - Operating".

1. An IEEE Standard 450-1975 battery discharge test for the Vital I&C batteries is performed on a 5 year cycle. This is described in a Design Basis Document; however, it is not committed to in the licensing basis for Oconee. The results of the test do not indicate the operability of the batteries. The test is done to assist in the predictive maintenance of the batteries and to indicate the need for new batteries in the future. IEEE 450-1975 provides guidance that recommends the replacement of the batteries within a year if the battery falls below certain criteria of the discharge test. Since Tech Spec surveillances indicate the operability of the components, this IEEE 450-1975 performance test should not be included in Tech Spec 3.7.

2. Cell to cell resistance testing of batteries per IEEE 450-1975 is included in the PM program. The PM program checks the torque value of the cell to cell connections and the resistance values for the cell to cell connections. This is done to satisfy Tech Spec requirement for cell to cell connection tightness. A sample procedure for one of these tests is attached to this response.

3. Currently, a test is performed on the 125 VDC I&C Panelboard diode monitors. The test indicates the operability of the diode monitoring failure lamps and remote alarms but does not indicate the operability of the diodes or the monitoring circuit. The diode monitoring circuit test provides a lamp and alarm test only and provides no indication of the functioning of the diodes. Tech Spec Surveillance 3.7.9.2 (measure peak inverse voltage capability of each diode) is the test of the diodes that ensures operability. Therefore, the surveillance for the diode monitoring circuit has been removed from the proposed Tech Specs. However, testing of the diode monitoring circuit will continue to be performed as part of the PM program.

4. Two inoperable required 125 VDC Vital Power sources are not specifically addressed in the Tech Specs because this condition will put Oconee in Tech Spec 3.0 (equivalent to Standard Tech Spec 3.0).

Proposed Technical Specifications Section 3.7.10. "230kV Switchyard DC Source Distribution"

1. Current Tech Specs allow a complete single string or single component of the 125VDC 230kV Switching Station to be inoperable. This could consist of an inoperable battery, charger, distribution center and all associated panelboards. In this condition, the redundant function of the other string is relied upon to provide the safety function of the system. The bases section of the proposed Tech Specs indicates that DC panelboard DYA is redundant to DYE; DYB is redundant to DYF, and DYC is redundant to DYG. Under the current Tech Specs, DC panelboards DYA, DYB, and DYC can be inoperable at the same time since they are in the same string and are not redundant to each other. The accident analysis acceptance criteria can be met with panelboards from both distribution centers inoperable provided that redundant panelboards are not inoperable. For example, simultaneous inoperability of panelboard DYA (power by SY-DC1) and DYF (powered by SY-DC2) is acceptable since the required safety functions would be supported. Simultaneous inoperability of DYA and DYE is prohibited since these panelboards support redundant safety related loads. Thus, appropriate restrictions on panelboard operability have been retained consistent with single failure criteria.

2. The battery discharge tests and the cell to cell resistance tests for the 230kV switchyard batteries are the same as 125VDC I&C Vital Batteries. Reference the previous discussions on the topics for Tech Spec section 3.7.9.

3. Excessive battery charger output voltage ripple and/or other minor charger abnormalities are not operability concerns. The output voltage of the charger needs to be at a certain level to charge the batteries. Charger output voltage is monitored by a Tech Spec surveillance. Charger output voltage ripple and other parameters are checked in the annual PM to verify that they are within the vendor specs.

Proposed Technical Specifications Section 3.7.12. "Battery Cell Parameters"

1. The 90 days completion time for the battery cell parameters that are listed in Conditions E, F, and G for the proposed Tech Spec section 3.7.12 is required to procure a replacement cell. During the completion time for Conditions E, F, and G, the battery is degraded, but not inoperable. Also, this is not a change from the current Tech Spec requirements.

   Condition D of Tech Spec 3.7.12 has a 90 day completion time for electrolyte level correction. During the October 7th meeting, the 90 day completion time for the correction of electrolyte level was questioned by the NRR staff. Since the electrolyte level corrections are desired to be coordinated with scheduled equalize charging whenever possible, the 90 day completion time is needed. Also, the electrolyte level may rise above the full level mark following the discharge test recharge on equalize charge due to gassing and will require time to stabilize. The electrolyte level below the low level mark is not an operability concern. If the level gets below the top of the cell plates, then the associated DC source will be declared inoperable immediately per Tech Spec 3.7.12. The surveillance of the electrolyte level is done on a weekly basis and would identify any level concerns in the batteries in a timely manner. Also, any noncritical electrolyte level adjustments would be handled through the work request system which requires time for planning and scheduling. It should be noted that IEEE-450 lists electrolyte level as a parameter which should be checked quarterly and corrected as necessary before the next quarterly surveillance.

Identified Inconsistencies Between the Provided Markup of Current Technical Specifications and the Proposed Technical Specifications

1. Corrections to the proposed Tech Specs are attached that correct the inconsistencies between the markup of the current Tech Specs and the proposed Tech Specs.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.3.1 Restore startup transformer to OPERABLE status. OR A.3.2 Designate shared startup transformer to one Unit.	36 hours 36 hours
B. Startup transformer designated to another Unit. OR Required Actions and associated Completion Times not met for Condition A.	B.1 Be in HOT SHUTDOWN AND B.2 Be in COLD SHUTDOWN	12 hours 36 hours
C. One emergency power path inoperable due to reasons other than an inoperable startup transformer (Condition A).	C.1 Verify the remaining emergency power path OPERABLE. AND C.2.1 Restore emergency power path to OPERABLE status. OR C.2.2 Enter TS 3.7.1 Condition G ——NOTE—— Required Actions G.1 and G.2 must be completed prior to exceeding 72 hours.	——NOTE—— May be performed during preceding 12 hour period. 1 hour AND Once per 12 hours thereafter unless two standby buses are energized by a Lee gas turbine. 72 hours 72 hours

(continued)

3.7 ELECTRICAL POWER SYSTEMS

3.7.12 Battery Cell Parameters

TS 3.7.12 Battery cell parameters shall be within specified limits.

APPLICABILITY: When associated DC sources are required OPERABLE.

———NOTE———
TS 3.7.0 does not apply.
———————

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Electrolyte level below top of cell plates.	A.1 Declare associated DC source inoperable.	Immediately
B. Battery cell float voltage < 2.07 volts.	B.1 Declare associated DC source inoperable.	Immediately
C. Electrolyte temperature < 60°F.	C.1 Declare associated DC source inoperable.	Immediately
D. Electrolyte level < minimum or > maximum level indication marks.	D.1 Restore electrolyte level to within limits.	90 days
E. Battery cell float voltage < 2.13 volts and 2.07 volts.	E.1 Restore cell float voltage to within limits.	90 days
F. Electrolyte specific gravity < 1.200.	F.1 Restore specific gravity to within limits.	90 days
G. Electrolyte specific gravity > 0.010 below the average specific gravity of all cells measured.	G.1 Restore specific gravity to within limits.	90 days

(continued)

4.6 EMERGENCY POWER PERIODIC TESTING

Applicability

Applies to the periodic testing surveillance of the emergency power sources.

Objective

To verify that the emergency power sources and equipment will respond promptly and properly when required.

Specification

(80) SR 3.7.1.2 + SR 3.7.1.3

4.6.1 Monthly, a test of the Keowee Hydro units shall be performed to verify proper operation of these emergency power sources and associated equipment. This test shall assure that:

a. Each hydro unit can be automatically started from the Unit 1 and 2 control room.

b. Each hydro unit can be synchronized through the 230 kV overhead circuit to the startup transformers.

c. Each hydro unit can energize the 13.8 kV underground feeder.

(81) ~~SR 3.7.1.3~~ SR 3.7.1.4 d. The 4160 volt startup transformer main feeder bus breakers and standby bus breaker shall be exercised.

(82) SR ~~3.7.1.7~~ 3.7.1.8

4.6.2 a. Annually, the Keowee Hydro units will be started using the emergency start circuits in each control room to verify that each hydro unit and associated equipment is available to carry load within 25 seconds of a simulated requirement for engineered safety features.

b. Promptly following the above annual test, each hydro unit will be loaded to at least the combined load of the auxiliaries actuated by ESG signal in one unit and the auxiliaries of the other two units in hot shutdown by synchronizing the hydro unit to the offsite power system and assuming the load at the maximum practical rate.

(83) SR ~~3.7.1.4~~ 3.7.1.5

4.6.3 Monthly, the Keowee Underground Feeder Breaker Interlock shall be verified to be operable.

(84) SR ~~3.7.1.8~~ 3.7.1.9

4.6.4 During each refueling outage, a simulated emergency transfer of the 4160 volt main feeder buses to the startup transformer (i.e., CT1, CT2 or CT3) and to the 4160 volt standby buses shall be made to verify proper operation.

(85) SR 3.7.7.1 RELOCATED TO SLC

4.6.5 Quarterly, the External Grid Trouble Protection System logic shall be tested to demonstrate its ability to provide an isolated power path between Keowee and Oconee.

(86) SR ~~3.7.1.5~~ 3.7.1.6

4.6.6 Annually and prior to planned extended Keowee outages, it shall be demonstrated that a Lee Station combustion turbine can be started and

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~~SR 3.7.1.5~~ SR 3.7.1.6

connected to the 100 kV line. It shall be demonstrated that the 100 kV line can be separated from the rest of the system and supply power to the 4160 volt main feeder buses.

88 .6.7 ~~SR 3.7.1.6~~ 3.7.1.7

At least once every 18 months, it shall be demonstrated that a Lee station combustion turbine can be started and connected to the isolated 100 kV line and carry the equivalent of the maximum safeguards load of one Oconee unit (4.8 MVA) within one hour.

89 .6.8 SR ~~3.7.1.6~~ 3.7.1.7

Annually, it shall be demonstrated that a Lee station combustion turbine can be started and carry the equivalent of the maximum safeguards load of one Oconee unit plus the safe shutdown loads of two Oconee units on the system grid.

90 4.6.9 TS 3.7.12

Batteries in the Instrumentation and Control, Keowee, and Switching Station shall have the following periodic inspections performed to assure maximum battery life. Any battery or cell not in compliance with these periodic inspection requirements shall be corrected to meet the requirements within 90 days or the battery shall be declared inoperable.

a. Weekly verify that:

91 SR 3.7.12.3 (1) The electrolyte level of each pilot cell is in between the minimum and maximum level indication marks.

92 SR 3.7.12.2 (2) The pilot cell specific gravity, corrected to 77°F and full electrolyte level, is ≥ 1.200.

93 SR 3.7.12.1 (3) The pilot cell float voltage is ≥ ~~2.12~~ 2.13 VDC.

94 SR 3.7.9.1 (4) The overall battery float voltage is ≥ 125 VDC.

b. Quarterly verify that:

95 (A) SR 3.7.12.5 (1) The specific gravity of each cell corrected to 77°F and full electrolyte level, is ≥ 1.200 and is not less than
(B) SR 3.7.12.8 0.010 below the average of all cells measured.

96 SR 3.7.12.4 (2) The voltage of each cell under float charge is ≥ ~~2.12~~ 2.13 VDC.

97 SR 3.7.12.6 (3) The electrolyte level of each connected cell is between the minimum and maximum level indication marks.

c. Annually verify that:

98 SR ~~3.7.9.5~~ 3.7.9.4 (1) The cells, end-cell plates and battery racks show no visual indication of structural damage or degradation.

99 SR ~~3.7.9.6~~ 3.7.9.5 (2) The cell to cell and terminal connections are clean, tight and coated with anti-corrosion grease.

(100) 4.6.10 Annually, a one hour discharge service test at the required maximum load shall be made on the instrument and control batteries, the Keowee batteries, and the switching station batteries.

SR ~~3.7.9.4~~ 3.7.9.3

(101) 4.6.11 Monthly, the operability of the individual diode monitors in the Instrument and Control Power System shall be verified by imposing a simulated diode f[illegible] signal on the monitor.

~~SR 3.7.9.2~~ Deleted

(102) 4.6.12 Semiannually, the peak inverse voltage capability of each auctioneering diode in the 125 VDC Instrument and Control Power System shall be measured and recorded.

~~SR 3.7.9.3~~ SR 3.7.9.2

Bases

The Keowee Hydro units, in addition to serving as the emergency power sources for the Oconee Nuclear Station, are power generating sources for the Duke system requirements. As power generating units, they are operated frequently, normally on a daily basis at loads equal to or greater than required by Table 8.1-1 of the FSAR for ESF bus loads. Normal as well as emergency startup and operation of these units will be from the Oconee Unit 1 and 2 Control Room. The frequent starting and loading of these units to meet Duke system power requirements assures the continuous availability for emergency power for the Oconee auxiliaries and engineered safety features equipment. It will be verified that these units will carry the equipment of the maximum safeguards load within 25 seconds, including instrumentation lag, after a simulated requirement for engineered safety features. To further assure the reliability of these units as emergency power sources, they will be, as specified, tested for automatic start on a monthly basis from the Oconee control room. These tests will include verification that each unit can be synchronized to the 230 kV bus and that each unit can energize the 13.8 kV underground feeder.

The interval specified for testing of transfer to emergency power sources is based on maintaining maximum availability of redundant power sources.

Starting a Lee Station gas turbine, separation of the 100 kV line from the remainder of the system, and charging of the 4160 volt main feeder buses are specified to assure the continuity and operability of this equipment. The one hour time limit is considered the absolute maximum time limit that would be required to accomplish this.

REFERENCE

FSAR, Section 8

Unit" to be inoperable at a time, unless the inoperability is due to loss of power from a 125VDC I&C panelboard. TS 3.7.5 allows one trip coil on one or more breakers to be inoperable regardless of the cause. This is acceptable since the trip coils would be capable of performing the required safety function with with one inoperable on each breaker. Further details are provided in Justification 29-32.

B. Currently no surveillance requirements are specified for the N and SL breakers. SR 3.7.5.1 has been added to require a monthly breaker exercise. This is an additional restriction not presently included in the technical specifications.

80) [4.6.1] The monthly tests of the emergency power paths have been retained as SR 3.7.1.2 and SR 3.7.1.3. The test verifies operability of the Keowee Hydro Unit to its preselected emergency power path. Verification that an individual Keowee Hydro Unit can meet the surveillance requirement for both emergency power paths is not specified, as this function is not required for emergency power path operability.

81) [4.6.1.d] The monthly exercise of the E breakers and S breakers has been retained as SR 3.7.1.4. There is no technical change from current requirements.

82) [4.6.2] The annual test of the overhead emergency power path has been retained as SR 3.7.1.8. There is no technical change from current requirements.

83) [4.6.3] The test of the Keowee underground feeder breaker interlock has been retained as SR 3.7.1.5. The test interval has been extended to 6 months based on evaluation of previous test data and interlock design. The interlock is accomplished by use of breaker auxiliary contacts which are not expected to change or fail without hardware modifications. These contacts are excercised routinely during breaker operation.

84) [4.6.4] The simulated emergency transfer of the main feeder buses to the startup transformer and to the standby buses has been retained as SR 3.7.1.9. In addition, SR 3.7.1.9 also requires a retransfer to startup. This is an additional restriction not presently included in the technical specifications.

85) [4.6.5] The quarterly test of the external grid trouble protection system logic has been replaced by a refueling frequency test of the new EPSL Degraded Grid Voltage Protection System per SR 3.7.7.1. Analysis has shown grid voltage values become critical for ES actuation at voltages less than normal values and greater than the External Grid Trouble Protection System (EGTPS) setpoints. The new system provides protection for safety systems. Therefore, primary DBA protection is provided by the new system. The frequency portion of the EGTPS will be maintained as safety related. A Selected Licensee Commitment (SLC) will be provided to

contain the logic test requirement of 4.6.5.

86/87) [4.6.6] The annual test from a Lee Gas Turbine to the main feeder buses has been replaced with a test which does not imply connection to the main feeder buses. More frequent cycling of the standby breakers is performed per SR 3.7.1.4. The new surveillance is SR 3.7.1.6. 4.6.6 infers that there is a separate surveillance performed prior to "planned extended Keowee outages." TS 3.7.1 Required Action G.1 effectively includes this requirement for all extended Keowee outages by requiring the standby buses be energized by a Lee gas turbine prior to exceeding 72 hours. There are no technical changes from current requirements.

88) [4.6.7] The 18 month loading (to max ES load of one Oconee Unit) of a Lee gas turbine through the isolated 100kV line has been combined with 4.6.8 to require annual loading (to one Unit's ES load plus two Unit's hot shutdown load) on the system grid within one hour. The new surveillance is SR 3.7.1.7. SR 3.7.1.7 does not require loading 4.8MVA onto the isolated 100kV line. The 4.8MVA value was based on previous load demand calculations for a single unit with a LOCA. Current calculations show that the load demand would be significantly more. It is not possible to provide this load from a shutdown unit for testing, therefore the load testing requirements for the isolated 100kV line have been made consistent with the test requirements for the Keowee Units.

89) [4.6.8] The requirements of 4.6.8 have been retained as SR 3.7.1.7. By combining 4.6.8 with 4.6.7, SR 3.7.1.7 includes the time restriction of 1 hour. This is an additional restriction not presently included in the technical specifications.

90) [4.6.9] The 90 day AOT for battery cell parameters has been retained as TS 3.7.12 Required Actions D.1, E.1, F.1, and G.1. There is no technical change from current requirements.

91) [4.6.9a(1)] The weekly verification of pilot cell electrolyte level has been retained as SR 3.7.12.3. There is no technical change from current requirements.

92) [4.6.9a(2)] The weekly verification of pilot cell specific gravity has been retained as SR 3.7.12.2. There is no technical change from current requirements.

93) [4.6.9a(3)] The weekly verification of pilot cell float voltage has been retained as SR 3.7.12.1. The acceptance criterion has been increased from 2.12VDC to 2.13VDC consistent with IEEE 450-1980 guidance.

94) [4.6.9a(4)] The weekly verification of overall battery float voltage has been retained as SR 3.7.9.1. There is no technical change from current requirements.

95) [4.6.9b(1)]
A. The quarterly verification of specific gravity has been retained as SR 3.7.12.5. There is no technical change from current requirements.

B. The quarterly comparison of average cell specific gravity has been retained as SR 3.7.12.8. There is no technical change from current requirements.

96) [4.6.9b(2)] The quarterly verification of cell float voltage has been retained as SR 3.7.12.4. The acceptance criterion has been increased from 2.12VDC to 2.13VDC consistent with IEEE 450-1980 guidance.

97) [4.6.9b(3)] The quarterly verification of electrolyte level has been retained as SR 3.7.12.6. There is no technical change from current requirements.

98) [4.6.9c(1)] The annual verification of battery integrity has been retained as SR 3.7.9.4. There is no technical change from current requirements.

99) [4.6.9c(2)] The annual verification of battery connections has been retained as SR 3.7.9.5. There is no technical change from current requirements.

100) [4.6.10] The annual battery service test has been retained as SR 3.7.9.3. There is no technical change from current requirements.

101) [4.6.11] The monthly test of the diode monitors has been deleted. Diode monitors provide indication only and have no effect on the function of the diodes. SR 3.7.9.2 (measure peak inverse voltage capability of each diode) is an actual test of the diodes and ensures operability. Operability of the diode monitors will be ensured by the normal preventative maintenance program.

102) [4.6.12] The semiannual test of the auctioneering diodes has been retained as SR 3.7.9.2. There is no technical change from current requirements.

ADDITIONAL REQUIREMENTS NOT CURRENTLY INCLUDED IN TECHNICAL SPECIFICATIONS

1) There are currently no Tech Spec requirements for operability of the SL breaker trip coils. If power is lost to transformer CT-5 while it is energizing the standby buses, the SL breakers must open to allow CT-4 to energize the standby buses. Thus, the SL breaker function is similar to that of the N breakers. TS 3.7.5 has been developed to address requirements for the N and SL breakers.

2) There are currently no Tech Spec requirements to exercise the N and SL

breakers. 4.6.1.d requires exercise of the E breakers and S breakers to ensure availability of these infrequently used breakers. Since the N and SL breakers are used infrequently, SR 3.7.5.1 has been developed to require a monthly exercise. Currently, the N breakers are cycled with the E breakers.

3) There are currently no Tech Spec requirements to verify proper AC distribution system alignment. SR 3.7.2.1 has been developed to require a weekly verification of correct breaker alignment and indicated power availability for the AC distribution system.

4) As described in LER 269/90-05 degraded grid protection is currently addressed in Tech Specs by the undervoltage setpoints of the E breakers. TS 3.7.7 has been developed based on the new EPSL Degraded Grid Voltage Protection system.

5) There are currently no specific Tech Spec requirements in the event that battery electrolyte level is below the top of the cell plates, cell float voltage is < 2.07 volts, or electrolyte temperature is < 60°F. TS 3.7.12 Conditions A, B, and C have been developed to require that the associated DC source be declared inoperable in these situations.

6) There are currently no specific Tech Spec requirements in the event that more than two cells have been jumpered in one battery. TS 3.7.12 Condition H has been developed to require that the associated DC source be declared inoperable in this situation.

7) There are currently no Tech Spec requirements to verify operability of interlocks preventing the Keowee Unit which is aligned to the underground path from automatically closing to the overhead path. SR 3.7.1.2 includes this requirement.

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

125 VDC 230 KV SWITCHYARD BATTERY SERVICE TEST AND ANNUAL SURVEILLANCE

1.0 PURPOSE

Demonstrate SY-1 and SY-2 Batteries ability of delivering power required during a loss of normal power.

2.0 REFERENCES (Use Current Copy)

2.1 Duke Drawings

0-802 230 KV Switchyard Oneline Diagram 125VDC.

2.2 OM Manuals and Drawings

OM 320-25 Lead Calcium Battery Instructions

2.3 Miscellaneous Documents

2.3.1 BCT-2000 Battery Capacity Test System Operation Manual Revision 1.1.

2.3.2 IEEE Standard 450-1975, IEEE Standard 450-1980, IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations

2.4 Final Safety Analysis Report (FSAR)

Section 8, Electric Power

2.5 Technical Specifications / Selected Licensee Commitments

Refer to Maintenance Directive 4.4.3.

2.6 Procedures

2.6.1 IP/0/A/3000/011D, 125 VDC KV Switchyard Battery Quarterly Surveillance

2.6.2 IP/0/A/3000/001C, Removal, Installation, and Jumpering of Battery Cells

2.6.3 IP/0/A/3000/013, Cleaning and Inspection of Battery Cell Terminals and Inter-Cell Connectors

2.6.4 OP/1&2/A/1107/010, Operation of the Batteries and Battery Chargers

Information Only

3.0 EQUIPMENT REQUIRED

3.1 Test Equipment

3.1.1 Alber Engineering, Inc. BCT-2000 Battery Capacity Test System

3.1.2 DVM, Fluke 8600A or equivalent

3.1.3 Melter-Parr DMA 35 Digital Density Meter or Calibrated Hydrometer

3.1.4 Biddle Cat. No. 247000 Digital Low Resistance Ohm Meter or equivalent

3.1.5 Torque Wrench - capable of torquing to 150 in-lbs

3.1.6 Battery vent mounted alcohol thermometer 0-150°F - (Four required)

3.2 Other Equipment

N/A

4.0 PREREQUISITES

4.1 Verify all changes to the control copy are incorporated on the working copy.
IF the activity is NOT completed within 14 calendar days, additional comparisons shall be made for each 14 calendar day period until the procedure is completed. No verification required during the break of activity.

Initial Comparison Date:_____ By:_____

Date:_____/_____ Date:_____/_____ Date:_____/_____
Initial Initial Initial

_____ 4.2 Prior to or during the job, have Supervisor review, mark N/A and initial any step or section that is NOT applicable. Sections or steps that can be omitted as specified in the procedure do NOT need the Supervisor's review.
Supv

____, _____ 4.3 Prior to performance of procedure, review Technical Specifications and/or Selected Licensee commitments associated with this procedure per Maintenance Directive 4.4.3 to ensure all requirements are satisfied.
Supv

_____ 4.4 Verify test equipment calibration is current.

_____ 4.5 An equalizing charge has NOT been conducted on the battery within the past 10 days.

_____ 4.6 Verify the alternate battery and charger are operational.

_____ 4.7 Ensure battery area ventilation equipment is operable.

5.0 LIMITS AND PRECAUTIONS

5.1 Appropriate precautions shall be used to avoid injury from HIGH VOLTAGE and SPILLED ELECTROLYTE.

5.2 If a component malfunction is found the Component Malfunction Sheet should be completed.

5.3 Additional safety equipment such as gloves, face shield, and apron should be used while in the Battery Room as needed.

5.4 Battery room exit shall be clear of obstructions.

5.5 Handles of tools shall be insulated, or short handle tools NOT long enough to reach between the cell terminal posts used.

5.6 If any cell voltage drops to 1.25 volts the test shall be secured.

5.7 If electrolyte temperature exceeds 100°F charging voltage/current shall be reduced.

5.8 Charging voltage/current shall be adjusted as needed to prevent electrolyte spillage.

6.0 UNIT STATUS

Procedure may be performed in any unit status.

7.0 GENERAL DESCRIPTION

The Service Test and Annual Surveillance is performed to ensure the battery is capable of meeting its design requirements and to maximize battery life. IEEE Standard 450, "IEEE Recommended Practice for Maintenance, Testing, and Replacement for Large Lead Storage Batteries for Generating Stations and Substations," provides the basis for the development of this test and surveillance.

The Annual Surveillance is performed to ensure maximum battery life and performance. This is accomplished by: 1. inspecting the cell-to-cell and terminal connectors for a clean and tight fit. 2. inspecting for physical damage and/or degradation of racks, cells, and cell-to-cell terminal connectors.

The Service Test discharges the battery in its "AS FOUND" condition at a rate to approximate the expected load during a loss of off-site power event. The DC bus is designed to operate with a minimum voltage. If during the test, voltage drops below the minimum voltage, the test shall be stopped, corrective action taken and the test repeated.

8.0 MAJOR COMPONENTS

230 KV SWYD Batteries, 60 cell, Lead - Calcium Battery

0 EQUIPMENT SPECIFICATIONS

C&D KCR-11 Cells, 410 Amp. Hr. at 8 Hr. Rate

10.0 PROCEDURE

NOTE: Test is performed with the battery in the AS FOUND condition. No corrective maintenance is to be performed prior to test unless necessary to prevent equipment damage.

10.1 Preliminary Checks

10.1.1 Verify correct battery and document on Enclosure 11.3.1.

NOTE: If no single cell chargers are connected to battery N/A step 10.1.2.

_____10.1.2 Turn off and disconnect any single cell chargers connected to the battery to be tested (using IP/0/A/3000/017) two hours before the test.

NOTES:
1. Electrolyte Specific Gravity shall be read from a sample taken approximately 1/3 of the way down from the top of the cell plates (~9" from top of cell jar).
2. If digital hydrometer is not available, measure and record on the enclosure, the temperature of every sixth cell using alcohol thermometer. Otherwise, the temperature is to be read and recorded for each cell.
3. The previous monthly battery readings can be used if they were taken within the last week.
4. Specific gravity corrections are on Enclosure 11.2.3. If the temperature was recorded only on every sixth cell, the average temperature reading will be used when correcting specific gravity readings for temperature.

_____10.1.3 Complete Enclosure 11.3.1 using correction factors on Enclosure 11.2.3.

_____10.1.4 Measure and record on Enclosures 11.3.2, 11.3.3 and 11.3.4 the resistance of intercell connections using the following steps:

NOTE: The readings are rounded off to the nearest whole number.

CAUTION

Do not connect the test leads across different intercell connectors. High voltage (6 VDC) can cause damage to the test set.

10.1.4.a Connect the low resistance test set probes to the cell posts as indicated on appropriate enclosure.

10.1.4.b If jumpers are installed across a defective cell, take the reading of the jumper and enter data diagonally in both of the affected blocks on the data sheet. Also, note the jumpered cell in the remarks section of Enclosure 11.1.

10.1.4.c Set the test set on the lowest possible scale for a mid scale reading (do not over-range meter).

10.1.4.d Take a forward and reverse reading, by reversing position of leads and average the readings.

10.1.4.e Repeat Steps 10.1.4.a through 10.1.4.d for all connectors as indicated on Enclosures 11.3.2, 11.3.3 and 11.3.4.

_____10.1.5 If any intercell connection resistance average reading is greater than the Maximum Acceptable Resistance (MAR), place a check in the appropriate column on Enclosures 11.3.2, 11.3.3 and 11.3.4.

____, Engr. _____10.1.6 If any intercell connection resistance average reading is greater than 500 Micro-Ohms, contact Component Engineering to determine if corrective action is warranted prior to performing test to prevent possible equipment damage. Document on Enclosure 11.5.

10.2 Battery Capacity Test Unit Connection

____, OPS _____10.2.1 Direct Operations to remove from service and isolate battery being tested using their procedure (OP/1&2/A/1107/010).

NOTE: Reference Enclosure 11.2.1 for electrical hook-up of BCT-2000.

_____10.2.2 Position the MASTER LOAD UNIT, near the BATTERY being tested and the BCT-2000 Test Equipment near the Battery bank to be tested.

_____10.2.3 Disconnect normal load carrying cables from battery being tested.

NOTE: Steps 10.2.4 through 10.2.9 may be performed in any order.

____, DV _____10.2.4 Connect temporary cables, capable of carrying 244 Amps for one minute and 42 Amps for 58 minutes, from the battery to the Master Load Unit (J10 and J11).

_____10.2.5 Connect the Control Cable from the BCT-128 to the MASTER LOAD UNIT.

_____10.2.6 Connect the 120 VAC Power Cord to the MASTER LOAD UNIT.

NOTE: Sense leads are to be placed to include the full length of the interconnecting straps. All connections will be made on the terminal whose cell number is one greater than the number labeled on the sense lead. Make connection on the terminal post farthest from the cell whose cell number matches that labeled on the sense lead. Reference Enclosure 11.2.2.

10.2.7 Connect each of the numbered clip leads to measure its respectively numbered cell. Reference Enclosure 11.2.2.

_____10.2.8 Connect the Bus Volts Monitor cable from the Data Logging Acquisition Device (BCT-128) to the Battery Bank being discharged. Reference Enclosure 11.2.2.

_____10.2.9 Connect following cables from Laptop Computer to Data Logging Acquisition Device (BCT-128) and "DICONIX" printer:

a. Connect ten foot gray cable with the two thirty-seven pin molded computer connectors (female style) as follows:

- On BCT-128 to socket labeled "Computer Port".
- On Laptop Computer open door labeled "EXP" and make connection.

b. Connect six foot printer cable as follows:

- On "DICONIX" printer to printer port.
- On Laptop Computer to socket labeled "PRT/FDD".

c. Connect twenty-five foot gray Senselead-Extender Cables as follows:

- Connect Amphenol connector to Amphenol connector on sense leads.
- Connect DB37 pin connector to correct cells port on BCT-128 (example "Cells 1-32").
- Connect DB37 pin connector of Senselead-Extender cable connected to Sense lead cables labeled 0V+,0V-,IT-1,IT-2,etc., to port labeled "System" on BCT-128.

d. Connect 120 VAC power cords to:

- Laptop Computer.
- Data Logging Acquisition Device (BCT-128).
- "DICONIX" printer.

CAUTION

DO NOT turn on power to MASTER LOAD UNIT, until after BCT-2000 System has initialized.

_____10.2.10 Turn power ON to BCT-128, Printer and Laptop Computer.

_____10.2.11 Once the Alber BCT-2000 system has initialized to the BCT-2000 PROGRAM MENU, turn the MASTER LOAD UNIT "ON".

10.3 Battery Bank Discharge

NOTE: The Service Test may be performed with up to two cells jumpered out of the battery.

_____10.3.1 Program the following steps using the Laptop Computer:

- Test Location: Unit # <ENTER>
- Battery ID: (example: SY1 or SY2) <ENTER>
- Battery Mfg. & Model: C&D, KCR-11 <ENTER>
- Installation Date: October 1992 <ENTER>
- Test File: [Put Test File name as follows: BA Battery #(example: SY1) Year (example:93)] <ENTER>
- Temperature: 77°F <ENTER>
- Warning: Cells 1.250 <ENTER> OV 0.0 <ENTER>
- Shutdown: Cells 0.000 <ENTER> OV 105.0 <ENTER>
- Test Program:

Step	Time	Load	Type
001 <ENTER>	00:01:00 <ENTER>	244 <ENTER>	AMPS <ENTER>
002 <ENTER>	00:58:00 <ENTER>	42 <ENTER>	AMPS <ENTER>
003 <ENTER>	00:01:00 <ENTER>	219 <ENTER>	AMPS <ENTER>

- Number Of Cells To Scan: 60 <ENTER>
- Voltage Polarity: NORMAL <ENTER>
- Printer Time Interval: 29:00 <ENTER>

_____10.3.2 Return to MAIN MANU. Push F5 to Save Configuration, then push (Y).

10.3.3 Push F2 to select Run Load Test.

_____10.3.4 Verify all cell sense lead connections are correct on the computer screen.

_____10.3.5 IF all cell sense lead connections are correct, push F7 (Print Now) to print out copy of cell sense leads readings.

IF NOT, correct problems with cell sense leads, then repeat steps 10.3.3 and 10.3.4.

NOTES: 1. If the battery voltage drops below 105.0 volts the test will be automatically terminated.

2. If steps 10.3.6 and 10.3.7 need to be N/A, they should not be N/A until after completion of step 10.3.10.

10.3.6 IF at anytime during the discharge test any of the following is observed, perform Steps 10.3.6.a through 10.3.6.d:

a. During the first minute of the discharge the battery voltage is less than 105.0 VDC.

b. During the next 58 minutes of the discharge the battery voltage is less than 113.0 VDC.

c. During the last minute of the discharge the battery voltage is less than 105.0 VDC.

_____10.3.6.a Notify Supervisor that the test acceptance requirement was not met and document on Enclosure 11.5.

_____10.3.6.b Notify Operations Shift Supervisor that the test acceptance requirement was not met AND the battery SHALL be declared inoperable until the test can be repeated with satisfactory results. Document on Enclosure 11.5.

_____10.3.6.c The Supervisor shall write a work order as
Supv. necessary to upgrade the battery. Document action (work order number) on Enclosure 11.5.

10.3.6.d When the battery has been upgraded, repeat test using a new procedure.

NOTE: If any individual cell voltage drops to 1.25 volts an alarm will sound on the CONTROL UNIT.

10.3.7 IF at anytime during the discharge test any individual cell voltage drops to 1.25 VDC, perform Steps 10.3.7.a through 10.3.7.f.

_____10.3.7.a Press F2 to PAUSE the test.

_____10.3.7.b Record on Enclosure 11.1, elapsed time and note the test was secured before completion.

_____10.3.7.c Notify Supervisor a cell(s) approached reversal and document on Enclosure 11.5.

_____10.3.7.d Notify Operation Shift Supervisor that the battery performance was unsatisfactory and SHALL be declared inoperable until the test can be repeated with satisfactory results.

_____10.3.7.e Supv. The Component Engineering representative and the I&E Supervisor shall determine course of action necessary to correct problem and document it on Enclosure 11.5 along with their initials and the date.

10.3.7.f When the battery has been upgraded, repeat test using a new procedure OR if the Component Engineering Representative makes the determination to continue test. Press F2 button on BCT-2000 computer to resume test or F1 to secure the test.

NOTE: Press F4 button on BCT-2000 computer to reset the audible alarm.

_____10.3.8 Start the Test by pressing the F1 button on the BCT-2000 computer.

10.3.9 Record the minimum bus voltage during the first minute, 1 to 59 minutes and last minute of discharge by the following method at the completion of the discharge test:

- From the Load Test Program Menu, press F3 key (Test Reports).
- IF TEST FILE name is not correct, select the correct Test File name, then <ENTER>.
- In the REPORT OUTPUT window select "SCREEN", using the (+) and (-) keys, then <ENTER>.
- In the REPORT TYPE window select "STANDARD", then <ENTER>.
- IF TIME does not read 00:00, type in 00:00, then <ENTER>.
- IF OVERALL VOLTAGE does not read 0.2, type in 0.2, then <ENTER>.
- Press F1 key twice to output report.
- As technician scrolls through the program he should take note of the lowest BUS voltage in the first minute, the next fifty eight minutes and the last minute of discharge test, then record them in steps 10.3.9.a, 10.3.9.b and 10.3.9.c.
- Press SPACE BAR to scroll through program.
- Press "ESC" key twice to go back to Load Test Program Menu.

_____10.3.9.a Record the minimum bus voltage during the first minute of discharge (_____VDC).

_____10.3.9.b Record the minimum bus voltage during 1 to 59 minutes of discharge (_____VDC).

_____10.3.9.c Record the minimum bus voltage during the last minute of discharge (_____VDC).

NOTE: Allow the MASTER LOAD UNIT to cool down, before turning it off.

_____10.3.10 Turn off power to MASTER LOAD UNIT.

CAUTION

Do not continue with procedure, until step 10.3.10 has been completed.

10.4 Battery Capacity Test Unit Disconnection

_____10.4.1 Turn power "OFF" on BCT-2000 computer, printer and BCT-128.

10.4.2 Disconnect cables from MASTER LOAD Unit to battery.

____, _____10.4.3 Reconnect LOAD carrying cables to battery.
DV

_____10.4.4 Disconnect all other hook ups from the Printer, Laptop computer and BCT-128, then return equipment to storage location.

10.4.5 Disconnect remaining test equipment.

10.5 Recharge

10.5.1 Inspect cell-to-cell and terminal connections of bank and verify they are clean and coated with anti-corrosion grease.

NOTE: N/A steps 10.5.1.a through 10.5.1.c if no degrading conditions are found on cell and terminal connections.

_____10.5.1.a Notify Supervisor if cell and terminal connection need to be cleaned or regreased. Document on Enclosure 11.5.

_____10.5.1.b Upon notification in step 10.5.1.a, the
Supv. Supervisor shall write a work order to clean and grease degraded connections. Document work order on Enclosure 11.5.

_____10.5.1.c The Supervisor shall calculate the date 90 days
Supv. from the date the degraded connection(s) was (were) noted and document on work order and Enclosure 11.5 "Tech Spec Violation on (Date)".

10.5.2 Inspect all cells, end-cell plates and battery racks for any visual indication of structural damage or degradation.

NOTES: 1. Visual indication of structural damage or degradation is defined as any condition of the equipment that is abnormal and/or, in the opinion of the observer, may prevent the equipment from performing properly during a seismic event (earthquake).

2. N/A steps 10.5.2.a through 10.5.2.e if no indication of structural damage or degradation is found.

_____10.5.2.a Notify Supervisor if any visual indication of structural damage or degradation is noted. Document on Enclosure 11.6.

_____10.5.2.b The I&E Supervisor shall notify Component Engineering
Supv. and have them evaluate the problem.

_____10.5.2.c The Component Engineering representative shall document
Eng. his evaluation of the problem, i.e., whether or not structural damage or degradation has actually occurred, in Section 'B' of Enclosure 11.6. He shall initial and date this documentation.

_____10.5.2.d If damage or degradation has occurred, the Component
Supv. Engineering representative and the I&E Supervisor shall determine course of action necessary to correct problem and document it in Section 'C' of Enclosure 11.6 along with their initials and the date.

NOTE: Tech Specs require any "out of spec" condition be corrected within 90 days or the battery declared inoperable.

_____10.5.2.e If 10.5.2.d is applicable, the I&E Supervisor
Supv. shall calculate the date 90 days from the date the visual indication of structural damage or degradation was noted on the equipment and document it on the work order (if applicable) indicating "Tech Spec Violation on (Date)" AND in Section 'C' of Enclosure 11.6.

_____,_____10.5.3 Verify torque on all battery connector bolts to be
DV 100 in-lbs.

_____,_____10.5.4 Verify torque on Battery load cable connector bolts to be
DV 100 in-lbs.

NOTE: IF connector resistance is in tolerance on step 10.5.5, N/A steps 10.5.6 and 10.5.7.

_____10.5.5 IF any intercell or inter-rack connector resistance on Enclosure 11.3.2, 11.3.3 and 11.3.4 was greater than the Maximum Acceptable Resistance, recheck them using instructions in step 10.1.4., then document on Enclosure 11.1.

_____10.5.6 Notify Supervisor if any intercell or inter-rack connector resistance on Enclosures 11.3.2, 11.3.3 and 11.3.4 is greater than the Maximum Acceptable Resistance (MAR). Document on Enclosure 11.5.

_____10.5.7 Upon notification in Step 10.5.5 the Supervisor shall
Supv. write a Work Order to upgrade the affected connectors. If connectors were rechecked after torquing in Step 10.5.3 - 10.5.4 and resistance is less than MAR then a work request need not be written. The Complete By Date in Section I of the Work Request should be 90 days from when the connector resistance was determined to be greater than the maximum acceptable. Record Work Order number on Enclosure 11.5.

CAUTION

Battery and charger are NOT to be connected to the bus during recharge.

____, ____ OPS 10.5.8 Have Operations place the Stand-by charger on the battery to be recharged.

____ 10.5.9 Place charger on equalize mode.

10.5.10 IF necessary, when charger comes out of current limit, adjust charger to obtain proper equalize voltage as indicated below:

- 143.40 to 144.60 volts for 60 cells (no cells jumpered).
- 141.01 to 142.19 volts for 59 cells (1 cell jumpered).
- 138.62 to 139.78 volts for 58 cells (2 cells jumpered).

10.5.11 Record every hour on Enclosure 11.4.1 the Charger Output Amps, Battery Terminal Voltage and electrolyte temperature of four (4) pilot cells, one in each tier of battery bank.

CAUTION

Do not allow the electrolyte to boil out of the cells or electrolyte temperature to exceed 110 °F.

____ 10.5.12 When charging current has stabilized for 2 hours (3 consecutive current readings), set equalize timer for 40 hours. Document on Enclosure 11.4.1.

HOLD: DO NOT continue until battery has completed 40 hour charge following charging current stabilization.

10.6 Restoration

____, ____ OPS 10.6.1 Have Operations return the battery and associated charger to service as required.

____, ____ DV 10.6.2 IF necessary, adjust battery charger to obtain proper float voltage as indicated below:

- 132.60 to 134.60 volts for 60 cells (no cells jumpered).
- 130.39 to 132.39 volts for 59 cells (1 cell jumpered).
- 128.18 to 130.18 volts for 58 cells (2 cells jumpered).

10.6.3 Verify correct Battery and document on Enclosure 11.4.2.

NOTES: 1. Electrolyte Specific Gravity shall be read from a sample taken approximately 1/3 of the way down from the top of the cell plates (~9" from top of cell jar).

2. If digital hydrometer is not available, measure and record on enclosure the temperature of every sixth cell using alcohol thermometer. Otherwise, the temperature is to be read and recorded for each cell.

3. Specific gravity corrections are on enclosure 11.2.3. If the temperature was recorded only on every sixth cell, the average temperature readings will be used when correcting specific gravity readings for temperature.

10.6.4 Complete Enclosure 11.4.2, 3 to 7 days after equalize timer has timed out using correction factors on Enclosure 11.2.3.

NOTE: N/A steps 10.6.5, 10.6.6, 10.6.7 and 10.6.8, if all Tech Spec requirements are satisfied.

_____10.6.5 If any of the Tech Spec requirements listed below are not met, place a check in the appropriate column.

NOTE: Tech Spec requirement is 2.12 Design Basis is 2.13

- Voltage of each connected cell ≥ 2.13 vdc.
- Corrected specific gravity is ≥ minimum acceptable specific gravity. (Minimum acceptable specific gravity = average corrected specific gravity of the battery bank - 0.010, but is never < 1.200).
- Electrolyte level of each connected cell is between "Hi" and "Lo" level marks.

_____10.6.6 Notify Supervisor if any requirement of Step 10.6.5 is not met. Document on Enclosure 11.5.

_____10.6.7 Upon notification in Step 10.6.6, the Supervisor shall
Supv. write a Work Order to upgrade the affected cell(s). He shall record this action on Enclosure 11.5 along with his initials and the date.

NOTE: Tech Specs require that out of spec cells be upgraded to the minimum requirements within 90 days or the battery shall be declared inoperable.

_____10.6.8 The Supervisor shall calculate the date 90 days from when the cell was determined to be out of spec. He shall record this date on Enclosure 11.5 and on the Work Order Complete By Date.

_____10.6.9 Forward a copy of page(s) with step 10.3.9 to Component Engineering.

11.0 LIST OF ENCLOSURES/Verification Checklist

___11.1 Procedure Performance Sheet

11.2 Reference Data Sheets

_____11.2.1 Electrical Hookup of BCT-2000

_____11.2.2 Sense Lead Connection

_____11.2.3 Specific Gravity Correction Factors

11.3 AS FOUND

_____11.3.1 Individual Cell Report - Before Discharge

_____11.3.2 Intercell Connector Resistance Data Sheet 1

_____11.3.3 Intercell Connector Resistance Data Sheet 2

_____11.3.4 Intercell Connector Resistance Data Sheet 3

11.4 AS LEFT

_____11.4.1 Battery Recharge Record

_____11.4.2 Individual Cell Report - After Recharge

_____11.5 Component Malfunction Sheet

_____11.6 Structural Damage/Degradation Sheet

ENCLOSURE 11.1
PROCEDURE PERFORMANCE SHEET

Date Begun _____

Date Complete _____

W.O. # _____

Battery # _____

Torque Wrench # _____

Cal. Due Date: _____

Additional Test Equipment Used

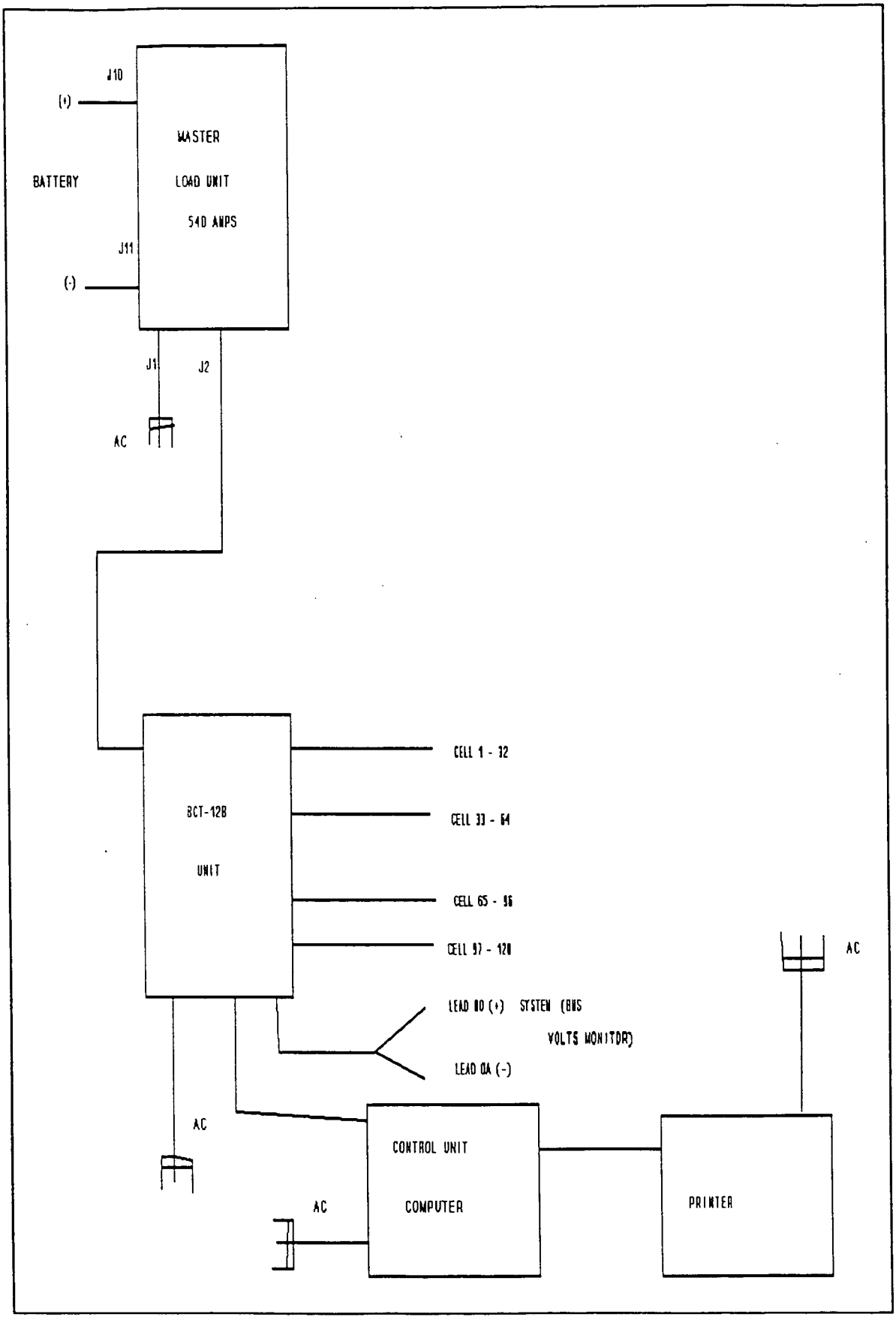
Item	SN	Cal. Due Date

Performed By _____ _____

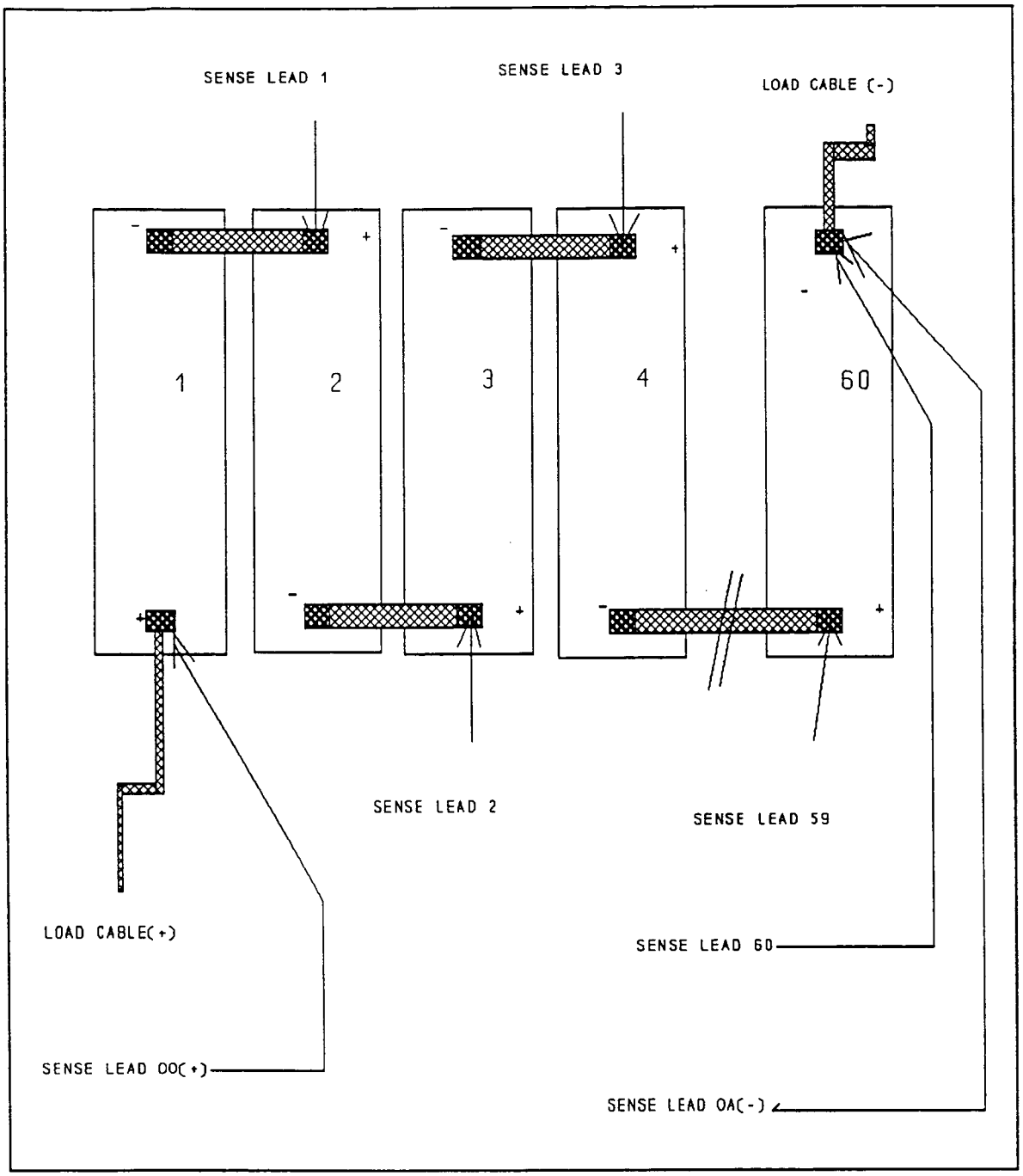
_____ _____

Remarks: _____

ENCLOSURE 11.2.1
ELECTRICAL HOOKUP OF BCT-2000



ENCLOSURE 11.2.2
SENSE LEAD CONNECTIONS



Sense Leads are to be placed to include the full length of the interconnecting straps.

ENCLOSURE 11.2.3
SPECIFIC GRAVITY CORRECTION FACTORS

Correction factors for Electrolyte Temperature

a) For every 3° of temperature above 77°F, add 0.001 to the hydrometer reading.

b) For every 3° of temperature below 77°F, subtract 0.001 from the hydrometer reading.

Correction factors for Electrolyte Level

The desired electrolyte level is zero.

Correction Factors		Electrolyte Level
+0.015		+ ½ (High Mark)
+0.008		+ ¼
0.000		0
-0.008		- ¼
-0.015		- ½ (Low Mark)

ENCLOSURE 11.3.1 Sheet 1 of 3

INDIVIDUAL CELL REPORT - BEFORE DISCHARGE

Date _____
Batt _____
Battery Bus Volt _____
Ambient Temp _____

Correct Component _____,DV_____
DVM No _____
Hydrometer No _____
Average Corrected Spec Grav _____
Min Acceptable SG _____

Cell	Cell Volt	Tech Spec Req	√ If Out of Spec	As Found SG	Electrolyte Correction				Corrected SG	Tech Spec Req	√ if < 1.200 √ if < 0.010 Below Avg
					Elyte Temp	Corr Fact	Elyte Level	Corr Fact			
1		2.13								1.200	
2		2.13								1.200	
3		2.13								1.200	
4		2.13								1.200	
5		2.13								1.200	
6		2.13								1.200	
7		2.13								1.200	
8		2.13								1.200	
9		2.13								1.200	
10		2.13								1.200	
11		2.13								1.200	
12		2.13								1.200	
13		2.13								1.200	
14		2.13								1.200	
15		2.13								1.200	
16		2.13								1.200	
17		2.13								1.200	
18		2.13								1.200	

ENCLOSURE 11.3.1 Sheet 2 of 3

INDIVIDUAL CELL REPORT - BEFORE DISCHARGE

Cell	Cell Volt	Tech Spec Req	√ If Out of Spec	As Found SG	Electrolyte Correction				Corrected SG	Tech Spec Req	√ if < 1.200 √ if < 0.010 Below Avg
					Elyte Temp	Corr Fact	Elyte Level	Corr Fact			
19		2.13								1.200	
20		2.13								1.200	
21		2.13								1.200	
22		2.13								1.200	
23		2.13								1.200	
24		2.13								1.200	
25		2.13								1.200	
26		2.13								1.200	
[redacted]		2.13								1.200	
28		2.13								1.200	
29		2.13								1.200	
30		2.13								1.200	
31		2.13								1.200	
32		2.13								1.200	
33		2.13								1.200	
34		2.13								1.200	
35		2.13								1.200	
36		2.13								1.200	
[redacted]		2.13								1.200	
38		2.13								1.200	
39		2.13								1.200	

ENCLOSURE 11.3.1 Sheet 3 of 3

INDIVIDUAL CELL REPORT - BEFORE DISCHARGE

Cell	Cell Volt	Tech Spec Req	√ If Out of Spec	As Found SG	Electrolyte Correction				Corrected SG	Tech Spec Req	√ if < 1.200 √ if < 0.010 Below Avg
					Elyte Temp	Corr Fact	Elyte Level	Corr Fact			
40		2.13								1.200	
41		2.13								1.200	
42		2.13								1.200	
43		2.13								1.200	
44		2.13								1.200	
45		2.13								1.200	
46		2.13								1.200	
47		2.13								1.200	
[redacted]		2.13								1.200	
49		2.13								1.200	
50		2.13								1.200	
51		2.13								1.200	
52		2.13								1.200	
53		2.13								1.200	
54		2.13								1.200	
55		2.13								1.200	
56		2.13								1.200	
57		2.13								1.200	
[redacted]		2.13								1.200	
[redacted]		2.13								1.200	
60		2.13								1.200	

ENCLOSURE 11.3.2

Intercell Connector Resistance Data Sheet 1

Date_____

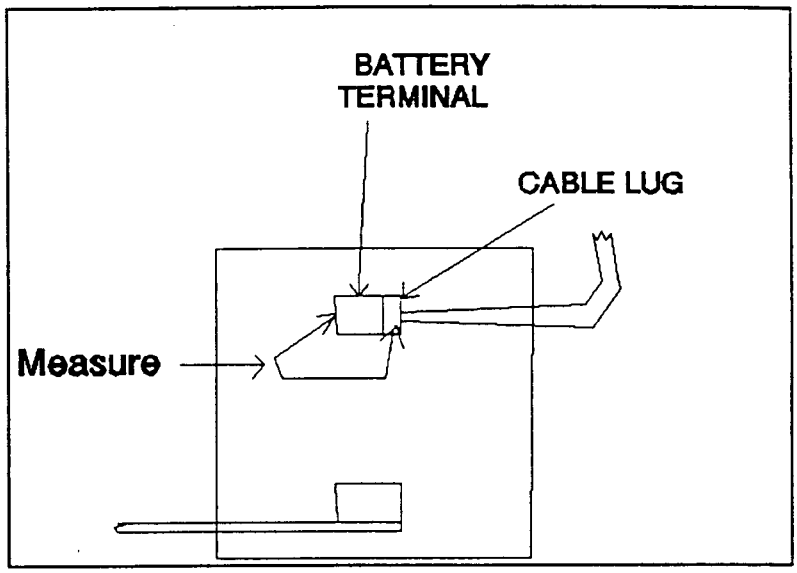
Battery_____

Max. Acceptable

Resistance (MAR)_____

Test Equipment: Megger-OCIAC_____

Batt.	MAR
SY-1	15
SY-2	14



Terminal Connection	Resistance in Micro-Ohms			√ if > MAR
	Forward Reading	Reverse Reading	Average Reading	
Cell 1				
Cell 60				

ENCLOSURE 11.3.3

Intercell Connector Resistance Data Sheet 2

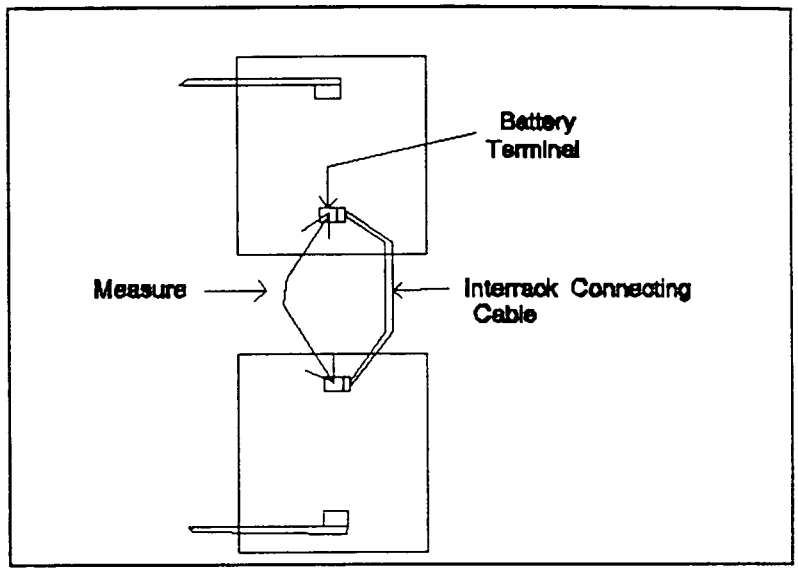
Date_____

Battery_____

Max. Acceptable

Resistance (MAR)_____

Batt.	MAR
SY-1	178
SY-2	182



Connection cell - cell	Resistance in Micro-Ohms			√ if > MAR
	Forward Reading	Reverse Reading	Average Reading	
15 - 16				
30 - 31				
45 - 46				

ENCLOSURE 11.3.4

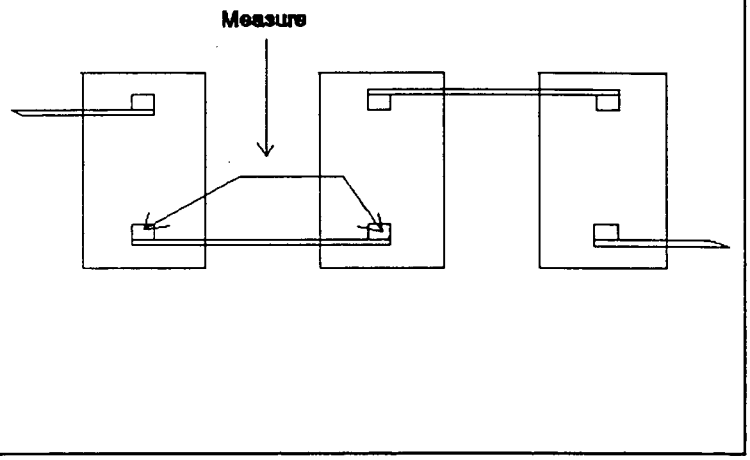
Intercell Connector Resistance Data Sheet 3

Date _____

Battery _____

Max. Acceptable Resistance (MAR) _____

Batt.	MAR
SY-1	50
SY-2	49



Connection Cell - Cell	Resistance in Micro-Ohms			√ if > MAR
	Forward Reading	Reverse Reading	Average Reading	
1 - 2				
2 - 3				
3 - 4				
4 - 5				
5 - 6				
6 - 7				
7 - 8				
8 - 9				
9 - 10				
10 - 11				
11 - 12				
12 - 13				
13 - 14				
14 - 15				

ENCLOSURE 11.3.4

Intercell Connector Resistance Data Sheet 3

Connection Cell - Cell	Resistance in Micro-Ohms			√ if > MAR
	Forward Reading	Reverse Reading	Average Reading	
16 - 17				
17 - 18				
18 - 19				
19 - 20				
20 - 21				
21 - 22				
22 - 23				
23 - 24				
24 - 25				
25 - 26				
26 - 27				
27 - 28				
28 - 29				
29 - 30				
31 - 32				
32 - 33				
33 - 34				
34 - 35				
35 - 36				
36 - 37				
37 - 38				
38 - 39				
39 - 40				

ENCLOSURE 11.3.4

Intercell Connector Resistance Data Sheet 3

Connection Cell - Cell	Resistance in Micro-Ohms			√ if > MAR
	Forward Reading	Reverse Reading	Average Reading	
40 - 41				
41 - 42				
42 - 43				
43 - 44				
44 - 45				
46 - 47				
47 - 48				
48 - 49				
49 - 50				
50 - 51				
51 - 52				
52 - 53				
53 - 54				
54 - 55				
55 - 56				
56 - 57				
57 - 58				
58 - 59				
59 - 60				

ENCLOSURE 11.4.1
BATTERY RECHARGE RECORD

W.O. No. _____

Battery _____

Instrument Number _____

Date	Time	Charger Output amps	Batt Terminal Voltage	Bank Temp Cell No____	Bank Temp Cell No____	Bank Temp Cell No____	Bank Temp Cell No____

ENCLOSURE 11.4.2 Sheet 1 of 3

INDIVIDUAL CELL REPORT - AFTER RE-CHARGE

Date _____
Batt _____
Battery Bus Volt _____
Ambient Temp _____

Correct Component _____,DV_____
DVM No _____
Hydrometer No _____
Average Corrected Spec Grav _____
Min Acceptable SG _____

Cell	Cell Volt	Tech Spec Req	√ If Out of Spec	As Found SG	Electrolyte Correction				Corrected SG	Tech Spec Req	√ if < 1.200 √ if < 0.010 Below Avg
					Elyte Temp	Corr Fact	Elyte Level	Corr Fact			
1		2.13								1.200	
2		2.13								1.200	
3		2.13								1.200	
4		2.13								1.200	
5		2.13								1.200	
6		2.13								1.200	
7		2.13								1.200	
8		2.13								1.200	
9		2.13								1.200	
10		2.13								1.200	
11		2.13								1.200	
12		2.13								1.200	
13		2.13								1.200	
14		2.13								1.200	
15		2.13								1.200	
16		2.13								1.200	
17		2.13								1.200	
18		2.13								1.200	

ENCLOSURE 11.4.2 Sheet 2 of 3

INDIVIDUAL CELL REPORT - AFTER RE-CHARGE

Cell	Cell Volt	Tech Spec Req	√ If Out of Spec	As Found SG	Electrolyte Correction				Corrected SG	Tech Spec Req	√ if < 1.200 √ if < 0.010 Below Avg
					Elyte Temp	Corr Fact	Elyte Level	Corr Fact			
19		2.13								1.200	
20		2.13								1.200	
21		2.13								1.200	
22		2.13								1.200	
23		2.13								1.200	
24		2.13								1.200	
25		2.13								1.200	
26		2.13								1.200	
[redacted]		2.13								1.200	
28		2.13								1.200	
29		2.13								1.200	
30		2.13								1.200	
31		2.13								1.200	
32		2.13								1.200	
33		2.13								1.200	
34		2.13								1.200	
35		2.13								1.200	
36		2.13								1.200	
[redacted]		2.13								1.200	
38		2.13								1.200	
39		2.13								1.200	

ENCLOSURE 11.4.2 Sheet 3 of 3

INDIVIDUAL CELL REPORT - AFTER RE-CHARGE

Cell	Cell Volt	Tech Spec Req	√ If Out of Spec	As Found SG	Electrolyte Correction				Corrected SG	Tech Spec Req	√ if < 1.200 √ if < 0.010 Below Avg
					Elyte Temp	Corr Fact	Elyte Level	Corr Fact			
40		2.13								1.200	
41		2.13								1.200	
42		2.13								1.200	
43		2.13								1.200	
44		2.13								1.200	
45		2.13								1.200	
46		2.13								1.200	
47		2.13								1.200	
[redacted]		2.13								1.200	
49		2.13								1.200	
50		2.13								1.200	
51		2.13								1.200	
52		2.13								1.200	
53		2.13								1.200	
54		2.13								1.200	
55		2.13								1.200	
56		2.13								1.200	
57		2.13								1.200	
[redacted]		2.13								1.200	
[redacted]		2.13								1.200	
60		2.13								1.200	

ENCLOSURE 11.5
COMPONENT MALFUNCTION SHEET

Initial & Date

_____
Technician

(A) Notified I&E Supervisor a component malfunction was found.

_____
Supervisor

Initial & Date

_____
Engineer

(B) An Engineering evaluation was made on the above problem(s) and the following corrective action was taken:

ENCLOSURE 11.6
STRUCTURAL DAMAGE/DEGRADATION SHEET

Initial/Date

_____ Tech

(A) Notified I&E Supervisor structural damage/degradation was found on the following components:

Initial/Date

_____ I&E Eng

(B) An evaluation was made by I&E Engineering Support on the above problem(s) and concluded:

Initial/Date

_____ I&E Sup

(C) The following corrective action was taken:

_____ I&E Eng

WR _____ written to upgrade equipment to be completed by _____ (Date). Record this date on the Work Request as follows: "Tech Spec Violation on _____".
(Date)