8.0 INSTRUCTIONS

8.1 PERFORMANCE DISCHARGE TEST SET UP.

8.1.1 Removal of 2D12 from service:

A. Verify Charger 2D32 is powered up and supplying power for Bus 2D02. CCM 1-18-99

B. Obtain assistance from Operations to aid with the removal of 2D12 from service. R.H 11-19-99

C. Open the battery disconnect switch, 2D52 R.H 11-19-99

WARNING

The 2D02 side of the fuse connections are energized. Avoid contact when removing the fuses.

8.1.2 Remove the 1800 amp fuses. R.H 11-19-99

WARNING

The Battery side of the fuse connections are energized. Avoid contact when removing the fuses.

8.1.3 Remove the pin indicating fuses from 2D42. R.H 11-19-99

8.1.4 Verify that Handswitch AS1 on 2D42 is in the "NORMAL" position. R.H 11-19-99

WARNING

The 2D02 side of the fuse connections are energized. Avoid contact when bolting cables from test load device.

8.1.5 Bolt the cables from the test load device to the battery side of the 1800 amp fuse connector. R.H 11-19-99

NOTE

This section is to determine the condition of battery connections before the performance discharge test. No repair is to be effected if a high resistance reading is noted. This connection or connections must be watched during the discharge test for excessive heating.

QC HOLD

A QC inspector must be present to witness the reading of the battery connection resistances and sign Data Sheet 1 upon completion.

NOTE

A Second person shall verify micro-ohm readings as they are being recorded on Data Sheet 1 and sign Data Sheet 1 upon completion.

8.1.6 Measure the cell-to-cell and terminal connection resistance to the nearest micro-ohm as directed below:

NOTE

The DLRO's battery test meter will indicate the relative state of charge of the DLRO battery.

A. Check the DLRO display and measuring circuit batteries. CW 11-18-99

B. IF the DLRO's batteries are low, THEN connect the charger to the unit. IF the batteries are OK, THEN mark this step N/A. CW 11-18-99

C. Separate the two sets of test leads and connect the DLRO as follows:

1. Connect the black lead wire of the first set, (marked "C") to the terminal marked "C1". CW 11-18-99

2. Connect the red lead wire of the first set, (marked "P") to the terminal marked "P1". CW 11-18-9

3. Connect the black lead wire of the second set, (marked "C") to the terminal marked "C2". CW 11-18-9

4. Connect the red lead wire of the second set, (Marked "P") to the terminal marked "P2". CW 11-18-9

NOTE

The user should select the lowest range possible on the DLRO that is greater than 150 micro-ohms, this will ensure that they are measuring micro-ohms to the right of the decimal point.

D. Set the DLRO to the lowest possible resistance range, that is greater than 150 micro-ohms. CLL 1-18-99

E. Turn the ON/OFF switch to the "ON" (lock) position CLL 1-18-99

NOTE

Each of the two test probes has the letter "P" on one face. This side of each probe should be in the same orientation to one another (i.e., if the "P" on one probe is facing inside, the "P" on the other probe should also face inside.)

CAUTION

The probes should not be placed across a voltage source! The test probes should not be connected to a positive and negative posts of the same cell.

NOTE

In the step below, the statement "connect the test probes to the left most..." is an attempt to explain the measuring technique to you the user. It is not an instruction or limitation implying that you must begin at the left-most cell or that you cannot begin with cell number 1, beginning with the bus cable connection. Connections may be measured in any sequence so long as each connection on Data Sheet 3 is tested.

NOTE

The micro-ohm test for the intercell strap and cable connections should be measured from: battery post to battery post, battery post to terminal plate, and terminal plate to all cable terminal lugs.

F. Repeat the following steps 1 through 4 for all battery terminal to battery terminal, battery terminal to terminal plate and terminal plate to terminal lugs and record the "As Found" micro-ohm readings on data sheet 1.

ACCEPTANCE CRITERION

IF any recorded "As Found" reading in the following steps exceeds the Technical Specification allowable value of 150 micro-ohms,
THEN initiate a Condition Report and have the Cognizant Supervisor and/or the Maintenance Engineer perform an evaluation to determine if it is safe to proceed with the Service Discharge Test.

1. IF any single "As Found" reading obtained in the following steps is questionable (too high exceeding 150 micro-ohms),
THEN move the "Forward/Reverse" lever to "Reverse" and average the two readings,
IF average of the two readings is acceptable,
THEN proceed with remainder of test.
IF average of two readings is still questionable,
THEN initiate a Condition Report and have the Cognizant Supervisor and/or Maintenance Engineer perform an evaluation to determine if it is safe to proceed with the Service Discharge Test,

2. For battery terminal to battery terminal connections:

   a. Connect the probes to the left-most positive post (P1) of one cell and the left-most negative post (N1) of the adjacent cell. Obtain reading and record on data sheet 1.

   b. Connect the probes to the next left-most positive post (P2) and to the next left-most negative post (N2) of adjacent cell. Obtain reading and record on data sheet 1.

3. For battery terminal to terminal plate connections:

   a. IF testing positive posts to terminal plate,
   THEN connect the probes to the left-most positive post (P1) of cell and the terminal plate.
   THEN connect the probes to the next positive post (P2) of same cell and the terminal plate. Obtain reading and record on data sheet 1.

   b. IF testing negative posts to terminal plate,
   THEN connect the probes to the left-most negative post (N1) of cell and the terminal plate.
   THEN connect the probes to the next negative post (N2) of same cell and the terminal plate. Obtain reading and record on data sheet 1.

4. For terminal plate to wire terminal lug connections, connect the probes to the plate and each wire lug connected to the plate.
Perform this step for each lug listed on data sheet, obtain readings and record on data sheet 1.

8.2 MEASURING CELL TEMPERATURE

8.2.1 Measure the cell temperature of each individual cell as listed on Attachment 1.

CAUTION

Use extreme caution when inserting and removing the thermometer from the sampling tube to avoid breaking the thermometer. If breakage occurs and parts of the thermometer remain in the battery, the Electrical Maintenance Supervisor should be notified as soon as possible.

NOTE

IF the front sample tube is bent or broken,
THEN the thermometer may be placed in the rear sample tube.

NOTE

A Second Person shall observe, sign and verify after completion, that steps A through C have been completed for all cells listed on Attachment 1 and this value recorded.

NOTE

Repeat steps 8.2.1.A through 8.2.1.C until all of the cells listed on Attachment 1 been measured.

A. Place the thermometer in the sample tube of the individual cell being measured. Thermometer should rest on the upper sample tube housing.

B. Leaving the thermometer in the cell being measured for 15 seconds will allow the reading to stabilize.

C. Record the temperature to the nearest °F for each cell on Attachment 1.

SECOND PERSON VERIFIER

An Second Person Verifier shall verify here and on Attachment 1 that temperature values were properly recorded in step 8.2.1.C for all cells.

Jackie Heller 1-19-99

Second Person Verifier Date

D. IF any of the monitored cells have bent or broken sample tubes, or broken thermometer parts in the cell,
THEN record the cell number in the space provided below, and notify the Electrical Maintenance Supervisor;
IF NOT,
THEN mark this step N/A.

Supervisor Remarks:

_____

_____

_____ N/A 1

E. IF any cell temperature deviates more than 3°C (5°F) from the other cells during inspection,
THEN notify the Electrical Maintenance Supervisor;
IF NOT,
THEN mark this step N/A.

Supervisor Remarks:

_____

_____

_____ N/A 1

F. Calculate and record on Attachment 1 the average cell temperature of the monitored cells listed on Attachment 1. R.H 11-19-99

8.3 BATTERY PERFORMANCE DISCHARGE TEST

8.3.1 Connect any remaining battery load test set control wiring needed for load monitoring or control. R.H 11-19-99

8.3.2 Determine and record on Attachment 1 and below the discharge current correction factor (K Factor) based upon the average cell temperature obtained in Step 8.2.1 and the Table on Attachment 1. CW 1

(K Factor) Discharge Current Correction Factor: 1.000

SECOND PERSON VERIFIER

A Second Person Verifier shall determine and record below the discharge current correction factor (K Factor) based upon the average cell temperature obtained in Step 8.2.1 and the Table on Attachment 1.

(K Factor) Discharge Current Correction Factor: 1.000

Second Person Verifier 1-19-99 Date

8.3.3 Calculate the actual discharge current by dividing 258 by the K Factor from Step 8.3.2.

258 amps Rated discharge current ÷ 1.000 K Factor = 258 Actual discharge current

258 Amps / (K) = 258 Amps

1-19-99 CW ~~1-19-99~~ CW 1-22-99

SECOND PERSON VERIFIER

A Second Person Verifier is to calculate the actual discharge current by dividing 258 by the K Factor from Step 8.3.2 and record below.

258 amps Rated discharge current ÷ 1.000 K Factor = 258 Actual discharge current

258 Amps / (K) = 258 Amps

Second Person Verifier 1-19-99 Date

8.3.4 Set up the load tester to 258 amps calculated in Steps 8.3.3 and 9 hours of discharge.

1-19-99 CW ~~1-19-99~~ CW 1-22-99

SECOND PERSON VERIFIER

A Second Person Verifier shall verify that the load tester is set up correctly for a 9 hour discharge at the current value calculated in Step 8.3.3.

Second Person Verifier 1-19-99 Date

8.3.5 Cognizant Supervisor shall verify calculations are correct and has granted permission to start the test.

Keith Brown 1-19-99
Cognizant Supervisor Date

8.3.6 Close 2D52 disconnect switch.

CW 1-19-99

8.3.7 Start the discharge test. CW 11-20-9

8.3.8 Record the Start time on Data Sheet 2 and Attachment 3.

8.3.9 Adjust and maintain current throughout the test to the calculated value + 1% of setpoint, + 1 Amp. (i.e., Displayed Value may vary from setpoint by + 1%, then an additional + 1 Amp.) CW 11-20-9

NOTE

Extra data may be taken and attached for the following test. The discharge rate and the battery voltage should be monitored from start to stop.

NOTE

The print out from the Albers unit may be attached to this procedure to accompany the following step.

8.3.10 Monitor and record the discharge rate and the battery voltage at intervals established in Data Sheet 2.

8.3.11 IF the discharge is stopped for any reason other than a low voltage cell,
THEN record the stop and restart times below;
IF the discharge cannot be restarted,
THEN notify the cognizant supervisor and proceed to step 8.3.18.
IF not,
THEN mark this step N/A RH 11-20-99

Stop time 2210 Restart time N/A

Reason for discharge stop Attempted to ADJUST current UP MANUALLY to KEEP current WITHIN LIMITS of 8.39 AND ALBERS MACHINE WOULD NOT FUNCTION AND test STOPPED AND COULD NOT BE RESTARTED.

8.3.12 IF an individual cell or cells are approaching 1.0 volts,
THEN record the cell(s) number below and notify the Cognizant Supervisor immediately, continue the test closely monitoring the cell voltage to verify that no cell goes below 0.75 VDC;
IF NOT,
THEN mark this step N/A:

Cell number:_____ Volts:_____

Cell number:_____ Volts:_____

Cell number:_____ Volts:_____ N/A

8.3.13 IF at any time during the test a cell(s) voltage drops below 0.75 VDC,
THEN stop the discharge immediately, contact the Cognizant Supervisor and record the stop time below and on Attachment 3, and go to Attachment 2;
IF NOT,
THEN mark this step N/A:

Discharge Stop Time:_____ N/A /

NOTE

The final readings need to be rapidly taken as the decaying overall battery voltage approaches and goes below the 105 VDC voltage level.

8.3.14 Read the individual cell voltages and battery terminal voltage (rapidly) when the battery approaches 105 VDC, and record below and in the last column of Data Sheet 2.
Final Battery readings recorded: 108.5 R.H 1-20-99

8.3.15 Decrease the test load to "0" when the overall battery voltage is 105 VDC. N/A R.H 1-20-99

8.3.16 Turn off test load. R.H / 1-20-99

8.3.17 Record the Stop Time above the last column on Data Sheet 2, and on Attachment 3.

8.3.18 Open 2D52 disconnect switch. R.H / 1-21-99

8.3.19 De-energize load tester. R.H / 1-21-99

WARNING

2D02 side of fuse connections are energized. Contact should be avoided when disconnecting cables.

8.3.20 Unbolt and remove the load test cables from the fuse cabinet. R.H / 1-21-99

8.3.21 Disconnect any remaining battery load test set control or monitoring cables connected to the battery. R.H / 1-21-99

8.4 EQUALIZE CHARGE AND BATTERY RESTORATION

8.4.1 Place the battery on equalize charge by one of the following methods as directed by Cognizant Supervision. Supervision to record below the method to be used.

Method 1 _____ Method 2 _____ Method 3 ✓ 11/21/99
Supervisor

"Method 1"

A. Install the pin indicating fuses in 2D42. _____/

B. Install the 1800 Amp fuses. _____/

C. Close the 2D52 Disconnect Switch. _____/

D. Verify that the electrical lineup is restored and the charger is working properly. _____/

E. Record below the charger being used.

Charger used: _____ _____/

F. Place the battery on an equalize charge. (Charger set point is 135.2 to 138 volts) Record below the equalizing start time and voltage.

_____/_____ _____ _____/
Start time Date Voltage

NOTE

Step 8.5 may be performed at any time after Step 8.4.1.F has been accomplished.

G. Record below the equalize voltage at the battery after 15 hours from the start of equalization.

Battery Terminal Voltage:_____VDC

MT&E used:_____Cal. Due:_____ _____/

H. WHEN the equalize charge current reaches the range of 11-22 amps (end of charge current),
THEN place the battery on float charge.
Record below the equalizing stop time, date, and voltage.

_____/_____/_____ _____/
Stop time Date Voltage

"Method 2"

A. Install the pin indicating fuses in 2D42. ____/

B. Install the 1800 Amp fuses. ____/

C. Close the 2D52 Disconnect Switch. ____/

D. Verify that the electrical lineup is restored and the charger is working properly. ____/

E. Record below the charger being used.

Charger used: _____ ____/

F. Place the battery on an equalize charge and set the equalize voltage to 140 VDC (min 139 max 140) (maximum allowable system voltage). Record below the equalizing start time and voltage.

_____/_____ _____ ____/

Start time Date Voltage

NOTE

Step 8.5 may be performed at any time after Step 8.4.1.F has been accomplished.

G. Monitor electrolyte temperature to ensure it does not exceed 120 deg.F during the high level equalize charge.

H. Record below the equalize voltage at the battery after 15 hours from the start of equalization.

Battery Terminal Voltage:_____VDC

MT&E used:_____Cal. Due:_____ ____/

I. WHEN the equalize charge current reaches the range of 11-22 amps (end of charge current),
Reset the equalize charge back to 135.2 to 138 volts,
THEN place the battery on float charge.
Record below the equalizing stop time, date, and voltage.

_____/_____/_____ ____/

Stop time Date Voltage

"Method 3"

A. Install the pin indicating fuses in 2D42. R.H 11.21.99

NOTE

A Temp. Mod. may be required to power the spare battery charger.

B. Bolt 2-2/C 2/0 AWG cables or greater from the spare 200 Amp battery charger (SCI Model RCS200 or equal) to the battery side of the 1800 Amp fuse connector. R.H 1.21.99

C. Close the 2D52 Disconnect Switch. R.H 11.21.99

NOTE

Charging at the higher equalize voltage of 144 min. - 145 max. will create more gas and heat than at the normal equalize charge of 135.2 to 138 volts

D. Place the battery bank on a high level equalize charge of 144 min. - 145 max. volts and perform the following.

1. Record below the equalizing start time and voltage.

1420	1.21.99	144.95
Start time	Date	Voltage

NOTE

Step 8.5 may be performed at any time after Step 8.4.1.D.1 has been accomplished.

2. Monitor the current supplied by the spare battery charger.

3. Maintain charger voltage at 144 min - 145 max.

4. Monitor electrolyte temperature to ensure it does not exceed 120° F. during the high level equalize charge.

5. When the equalize charge current reaches the range of 20 amps or below, "open" Disconnect switch 2D52 and measure the current by using a Fluke Digital Multimeter 8842A across J1 and J2 of 2D42. (100mv = 20 amps)

6. Stop the equalize charge (by deenergizing the spare battery charger) when the current reaches the range of 11-22 amps as measured in 2D42. Record below the equalizing stop time, date and final measurement reading.

15:45 / 1-21-99 / _____ / 15

Stop time / Date / Mv / Amps

Step D complete JCH 1/21/99

E. Verify 2D52 Disconnect switch is open. JH 1-21-99

F. Verify that the spare battery charger is disconnected and determinate the cables from the charger and 2D42. JH 1-21-99

G. Install the 1800 amp fuses. JH 1-21-99

H. Close the 2D52 Disconnect switch. JH 1-21-99

I. Place the battery on float charge. JH 1-21-99

NOTE

124.7 VDC is the Tech Spec value (lower limit) for a 58 cell bank's float voltage. However, the as left float voltage should be 127.6 to 130.5 when measured at the battery terminal.

8.4.2 Record the float voltage measured at the battery below:

Voltage 129.3 JH 1-21-99

ACCEPTANCE CRITERION

IF the float voltage "is not" within 127.6 to 130.5 volts,
THEN notify the Electrical Supervisor and/or S/S for an evaluation of the problem.
IF the float voltage is below 124.7 VDC,
THEN "immediately" notify the Electrical Supervisor and S/S that a possible Tech Spec violation exists.

8.5 BATTERY CAPACITY CALCULATION

8.5.1 IF Attachment 2 was used,
THEN use the new calculated T_A from step 15 of Attachment 2;
IF NOT,
THEN obtain T_A from Data Sheet 2,
(Start Time - Stop Time) CW 11-21-99

8.5.2 IF the discharge was stopped in step 8.5.11, THEN the time that the discharge was stopped (from data in 8.2.11) must be subtracted from the T_A to obtain the actual length of the test (T_A) for step 8.5.3;
IF NOT,
THEN mark this step N/A.

3 hr 1-26-99 R.H 1-27-99

NOTE

The following calculations is required to comply with Tech Spec step 4.8.2.3 E.

8.5.3 Determine the capacity of the battery by completing the following equation:

% capacity at 77°F = (T_A / T_S) x 100

T_A = Actual time of the test in minutes.

T_S = Rated time to specified terminal voltage in minutes (8 hrs. or 480 minutes)

T_A (minutes) 493 / 480 minutes x 100 = 102.7 % capacity

R.H 1-27-99

SECOND PERSON VERIFIER

A Second Person Verifier shall repeat the calculations for determining the capacity of the battery.

T_A (minutes) 493 / 480 minutes x 100 = 102 % capacity

Second Person Verifier 1-27-99 Date

8.5.4 Notify Systems Engineering to evaluate the calculated capacity to determine compliance with Tech Spec. 4.8.2.3.E and 4.8.2.3.F

CW 2-2-99

8.6 BATTERY MAINTENANCE

NOTE

When tightening the terminal connectors, two insulated wrenches should be used, applying one as counter-torque to prevent damage to the terminal post. If just checking the torque of a 5/16 inch stainless bolt connection that was not disassembled then 125 in/lb is the proper value. If the connection was loosened or disassembled then torque to 165 in/lbs. Step 8.6.1 through 8.6.2 may be accomplished at any time after Step 8.4.6 has been accomplished. Steps 8.6.3 through 8.6.5 may be accomplished after equalize charge current diminishes to a low enough level such that charge current does not affect resistance readings.

8.6.1 Verify that all battery connections are tight by torquing each intercell/intertier connection to 125 in/lbs

R.H 11-24-99

8.6.2 Record below the torque wrench used, calibration due date and the torque values:

Torque wrench number: TW-907

Calibration due date: 2-17-99

Torque value: 125 IN LBS.

R.H 11-24-99

QC HOLD

A QC inspector is to be present to witness reading of the battery connection resistance in Steps 8.6.3 through Steps 8.6.7 for procedure compliance and to sign Data Sheet 3 upon completion.

NOTE

The micro-ohm limit is for the intercell straps and cable connections. The cable connections need to be measured from the battery post to terminal lug.

8.6.3 Perform an "As Left" micro-ohm check using step 8.1.6 as a guideline and record the reading in the "As Left" section of Data Sheet 3.

8.6.4 Verify if any intercell micro-ohm reading is greater than 150 micro-ohms and check the appropriate space below:

☐ Yes ☒ No

IF the answer is "yes",
THEN proceed to step 8.6.5.
IF the answer is "no",
THEN mark steps 8.6.5 through 8.6.7 "N/A" and proceed to step 8.6.8.

8.6.5 IF the answer to 8.6.4 was "Yes",
THEN perform the following;
IF NOT,
THEN mark the following steps N/A.

A. Open disconnect switch 2D52. N/A /

B. Disassemble the affected connection(s). N/A /

C. Clean and neutralize the affected connections using baking soda and water, then coat the connections per C&D Manual (TM C 173.0010) and reassemble. N/A /

D. Torque the affected connections to 165 in/lbs. N/A /

E. Micro-ohm the affected connections. N/A /

F. Record the micro-ohm readings of the affected connections on Data Sheet flagging them as the second "As Left" reading. N/A /
IF the second "As Left" reading IS acceptable,
THEN proceed to step 8.6.7.
IF the second "As Left" reading is NOT acceptable,
THEN proceed to step 8.6.6.

8.6.6 IF the reading is still unacceptable,
THEN perform the following.
IF the reading is acceptable,
THEN mark steps A through F "N/A" and proceed to step 8.6.7.

A. Verify Disconnect Switch 2D52 is open. N/A /

B. Replace the affected parts. N/A /

C. Clean and neutralize replacement parts and coat connections per C&D Manual (TM C 173.0010) and reassemble. N/A /

D. Torque connections to 165 in/lbs. N/A /

E. Obtain "As Left" resistance readings. N/A /

F. Record action taken and readings on the "As Left" comments section of Data Sheet 3. N/A /

8.6.7 Close Disconnect Switch 2D52. N/A /

8.6.8 Place the battery bank on Float charge and record the time, date and float voltage below:

Time and Date 1545 1-21-99
Float Voltage 129.25 VDC

R.R 11-24-99

8.6.9 Perform 3 random specific gravity readings on the 2D12 battery bank, using procedure 2403.023 as a guide, to determine if stratification of these cells exist.

A. IF stratification of the tested cells electrolyte exists,
THEN mix the electrolyte in each cell of the battery bank for 30 minutes on each cell, using a variable speed micro pump, with suction taken from the top of the cells through the flame arrestor hole, and discharge through the sample tube to the bottom of the cells;
IF NOT,
THEN mark this step N/A.

N/A

B. Perform all sections of Quarterly 2403.023, except the micro-ohm readings, and attach it to this procedure.

CW 11-25-99

9.0 RESTORATION AND CHECKOUT

9.1 IF any Condition Reports were issued during the performance of this procedure,
THEN attach a copy of the Condition Report to this procedure;
IF NOT,
THEN mark this step N/A.

CW 11-25-99

9.2 Verify that the requirements of Housekeeping Level II have been met.

CW 11-25-99

9.3 Verify that the measuring and test equipment have no known deficiency.

CW 11-25-99

9.4 Verify with operations that 2D12 has been returned to its normal operation/lineup.

CW 11-25-99

NOTE

124.7 VDC is the Tech Spec value (lower limit) for a 58 cell bank's float voltage. However, the as left float voltage should be 127.6 to 130.5 when measured at the battery terminal.

9.5 Verify that the battery bank float voltage is between 127.6 and 130.5 VDC when on normal float charge.

CW 11-25-99

9.6 Verify that all cell-to-cell and terminal connections are less than or equal to 150 mocro-ohms. CW 11-25-99

9.7 Verify that the battery log book has been updated to include the following:

9.7.1 Date this procedure was performed. CW 11-25-99

9.7.2 Time this procedure was started. CW 11-25-99

9.7.3 Time this procedure was completed. CW 11-25-99

9.7.4 Any problems encountered and corrective action taken. CW 11-25-99

9.7.5 Performer of this procedure. CW 11-25-99

9.8 Notify the Unit 2 Operations S/S that 2D12 Performance Discharge Test is complete. CW 11-25-99

9.9 Perform post-test check of torque wrenches on Torque Tester and record the following:

Equip. No. TT-004 Cal. Due Date 9/3/99

Equip. No. _____ Cal. Due Date __/__/__ CW 11-25-99

9.10 All setpoints and tolerances in this procedure have been checked and are verified to be within the limits herein specified and any exceptions are noted.

Keith Brown 11-25-99
Maintenance Supervisor Date

10.0 ATTACHMENTS AND FORMS

10.1 ATTACHMENTS

10.1.1 Attachment 1 - Discharge Current Correction K Factor For Temperature

10.1.2 Attachment 2 - Jumpering Low Voltage Cells

10.1.3 Attachment 3 - Calculation for Total Down Time

10.1.4 Data Sheet 1 - "As Found" Resistance

10.1.5 Data Sheet 2 - Performance Discharge Test Battery Bank Voltage

10.1.6 Data Sheet 3 - "As Left" Resistance

10.2 FORMS

10.2.1 None

ATTACHMENT 1

DISCHARGE CURRENT CORRECTION
FACTOR K FOR TEMPERATURE

Temperature (F)	Factor K

Cell No.	Temp. (F)
1	77
6	77
12	77
18	77
24	77
30	77
36	77
43	77
48	77
54	77

Temp. Total for 10 cells = 770

Temp. Total for 10 cells / 10 = Avg. Temp.

Average Temp. = 77 °F

Req. Factor K = 1.0

Average Temp. (F)	Factor K
62	1.098
63	1.092
64	1.086
65	1.080
66	1.072
67	1.064
68	1.056
69	1.048
70	1.040
71	1.034
72	1.029
73	1.023
74	1.017
75	1.011
76	1.006
77	1.000
78	0.994
79	0.987
80	0.980
81	0.976
82	0.972
83	0.968
84	0.964
85	0.960
86	0.956
87	0.952
88	0.948
89	0.944
90	0.940
91	0.938
92	0.936

Test Equip. # DT-071 Cal. Due: 11-4-99

Rick Hall — Performed By — 1/19/99 Date

J. R. Bailey — Second Person Verifier — 1/19/99 Date

ATTACHMENT 2

PERFORMANCE TEST CELL JUMPERING PROCEDURE

NOTE

This attachment provides a method to BY-PASS a low voltage cell.

NOTE

Maintenance Engineering shall review Attachment 2 if attachment is required for procedure completion.

NOTE

A Second Person Verifier shall verify the content of steps 10, 11, and 15.

NOTE

Two - 250 mcm cables with 3/8 - 1/2 lug, cables approximate length is 10 feet will be needed for the cell jumpering. These are available in the Maintenance Facility Battery Storage Room.

1. Record the number of the cell(s) at or below 0.75 VDC, the Stop Time, the Cell Voltage and the Bank Voltage below and on Attachment 3.

   Cell Number:_____ Cell Voltage:_____ Stop Time:_____ Bank Voltage:_____

   Cell Number:_____ Cell Voltage:_____ Stop Time:_____ Bank Voltage:_____

   Cell Number:_____ Cell Voltage:_____ Stop Time:_____ Bank Voltage:_____

   Cell Number:_____ Cell Voltage:_____ Stop Time:_____ Bank Voltage:_____

NOTE

At this time the Cognizant Supervisor shall make the judgement to determine if the cell(s) should be jumpered or to continue the test with the cell(s) installed. This judgement should be based on Total Test Time, overall Bank Voltage, and the number of cells at or below 0.75 volts.

2. IF the Cognizant Supervisor's judgement is to continue the test with the cell(s) installed,
   THEN restart the discharge at the calculated current and record the restart time below and on Attachment 3. Continue recording data on Data Sheet 2 and discharge the bank until the bank voltage approaches 105 vdc, N/A Steps 3 through 11 of this attachment and continue with Step 12.

   IF the Cognizant Supervisor's judgement is to jumper the cell(s),
   THEN mark "Restart Time" below N/A and continue with Step 3.

   Restart Time:_____

   _____/_____
   Cognizant Supervisor Date

3. Open 2D52 Disconnect Switch. /

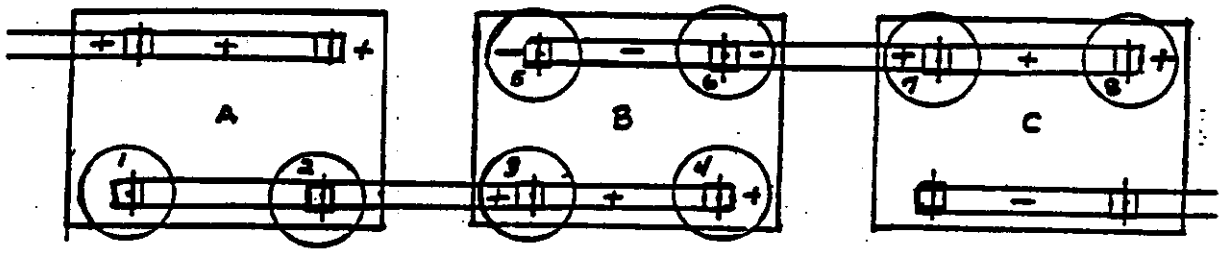

Figure 1

WARNING

Jumpering, shorting or connecting the positive and negative lugs of a single cell may cause equipment damage or personnel injury.

NOTE

Jumpering of end cell may be accomplished by using the inter-tier or inter-bank cables.

4. Using Figure 1 as a guide only and presuming "B" is the affected cell then remove bolts and intercell connection straps from the low voltage cell and its adjacent cell terminals.

NOTE

Based on which is the low cell you may be jumpering the negative of A to the positive of C. As shown below in figure 2.

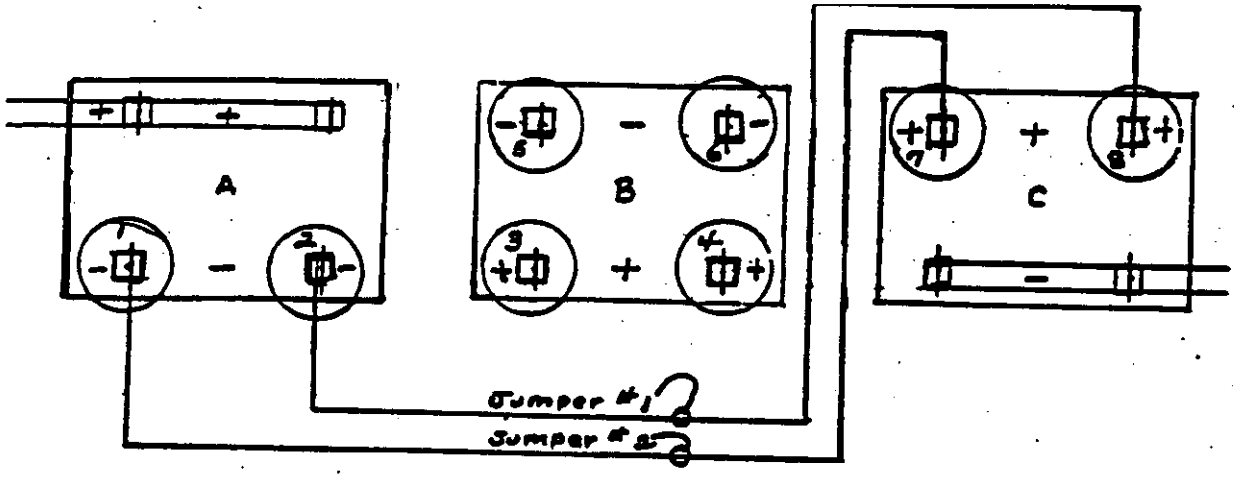

Figure 2

ATTACHMENT 2

5. Bolt a (250 mcm) jumper from the left negative Battery A terminal to the left positive Battery C terminal, using the same stainless bolts as used in the intercell connection straps. ____/____

6. Bolt another (250 mcm) jumper from the right negative Battery A terminal to the right positive Battery C terminal, using the same stainless bolts as used in the intercell connection straps. ____/____

7. Torque terminal bolts to 165 in/lbs and record below the torque value and the recal date:

   Torque wrench number:_____

   Torque value:_____

   Recal Date:_____ ____/____

8. Discharge the battery to a new voltage of

   105 - (1.81 x # of Cells Jumpered) - new voltage

   Example:

   105 - (1.81 x 1 cell) = 103.19 VDC

   105 - (1.81 x 2 cells) = 101.38 VDC

   105 - (1.81 x _____) - _____ New Discharge Voltage

   ____/____

SECOND PERSON VERIFIER

A Second Person Verifier shall verify the "New Discharge Voltage" in step 8 is correct.

_____/____
Second Person Verifier Date

9. Close 2D52 Disconnect Switch. ____/____

CAUTION

While discharging, continue to watch for cells falling below .75 VDC.

10. Restart discharge at the new calculated current. ____/____

ATTACHMENT 2

11. Record the restart time (below and on Attachment 3), and battery terminal voltage after the load is applied:

    Discharge started at _____ Amps

    Time restarted:_____

    Overall battery terminal voltage _____ VDC _____/

SECOND PERSON VERIFIER

A Second Person Verifier shall verify step 11 was correctly completed.

_____/____
Second Person Verifier Date

12. Read and record in the last column of Data Sheet 2, the discharge battery overall bank voltage and cell voltages in the final moments before the minimum calculated voltage is reached.

13. Stop the test and de-energize the test equipment. Record the Stop Time on Attachment 3, on Data Sheet 2 and below:

    Stop Time:_____ _____/

14. Open 2D52 disconnect switch. _____/

15. Find the Down Time and old T_A from Attachment 3 and use below to figure the New T_A:

    Old T_A _____ - Down Time _____ = _____ (New T_A) _____/

SECOND PERSON VERIFIER

A Second Person Verifier shall verify the "New TA" in step 15 is correct.

_____/____
Second Person Verifier Date

ATTACHMENT 2

16. IF cells were jumpered due to low voltage, THEN Engineering and the Cognizant Supervisor must be notified and an evaluation made of cell condition prior to re-assembly of battery connections. ____/____

17. IF cells were jumpered, THEN restore battery connections as follows:

    A. Clean and neutralize the affected connections using baking soda and water.

    B. Coat the connections per C&D Manual (TM C 173.0010) and reassemble. ____/____

18. IF cells were jumpered, THEN torque the connections to 165 in/lbs and record below the torque value used and the recal date of the torque wrench used.

    Torque wrench number:_____

    Torque value:.....:_____

    Calibration due date:_____ ____/____

19. IF cells were jumpered, THEN micro-ohm the affected connections and record the affected connections on Data Sheet, flagging them as the second "As Left" reading. ____/____

20. Mark Steps 8.3.13 through 8.3.19 N/A and proceed with Step 8.3.20 ____/____

NOTE

Maintenance Engineering's signature is not needed to continue the work.

21. Plant Engineering has reviewed data of Attachment 2.

_____/_____
Maintenance Engineering Date

ATTACHMENT 3

CALCULATION FOR TOTAL DOWN TIME

1. Start Time, Stop Time

(A) Start Time: 1352 R.H 1-21-99 (B) Stop Time: 2210 R.H 1-21-99 R.H 1-21-99

(C) Start Time: _____ (D) Stop Time: _____ _____/

(E) Start Time: _____ (F) Stop Time: _____ _____/

(G) Start Time: _____ (H) Stop Time: _____ _____/

SECOND PERSON VERIFIER

A Second Person Verifier shall verify the "Start, Stop" time in step 1 is correct.

J R Powell 11-21-99
Second Person Verifier Date

NOTE

The Total Down Time Calculation is for the Total Time the test is stopped for jumpering cell(s), broken test equipment etc. The Final Stop Time (last stop time from above) shall not be used in the calculation.

2. Total Down Time

Total Down Time (in minutes) = (C - B) + (E - D) + (G - F)

Total Down Time
(in minutes) = (____ -____) + (____-____) + (____-____) = _____

_____/

SECOND PERSON VERIFIER

A Second Person Verifier shall verify the "Start, Stop" time in step 1 is correct.

_____/_____
Second Person Verifier Date

3. Old T_A Calculation

Old T_A = (A) - (Final Stop Time)

Old T_A = _____ _____/

SECOND PERSON VERIFIER

A Second Person Verifier shall verify calculations are correct in step 3.

_____/_____
Second Person Verifier Date

DATA SHEET 1

"AS FOUND"

BATTERY BANK 2D12

BATTERY RACK CELL TO CELL CONNECTIONS	RECORD RESISTANCE IN MICRO-OHMS FOR LISTED CONNECTIONS	
	1N1-2P1	1N2-2P2
1 - 2	23	19
	2N1-3P1	2N2-3P2
2 - 3	24	24
	3N1-4P1	3N2-4P2
3 - 4	32	18
	4N1-5P1	4N2-5P2
4 - 5	22	27
	5N1-6P1	5N2-6P2
5 - 6	22	27
	6N1-7P1	6N2-7P2
6 - 7	26	20
	7N1-8P1	7N2-8P2
7 - 8	23	22
	8N1-9P1	8N2-9P2
8 - 9	23	21
	9N1-10P1	9N2-10P2
9 - 10	21	19
	11N1-12P1	11N2-12P2
11 - 12	28	28
	12N1-13P1	12N2-13P2
12 - 13	24	24
	13N1-14P1	13N2-14P2
13 - 14	24	22
	14N1-15P1	14N2-15P2
14 - 15	21	24
	15N1-16P1	15N2-16P2
15 - 16	27	27

BATTERY RACK CELL TO CELL CONNECTIONS	RECORD RESISTANCE IN MICRO-OHMS FOR LISTED CONNECTIONS	
	16N1-17P1	16N2-17P2
16 - 17	26	27
	17N1-18P1	17N2-18P2
17 - 18	26	24
	18N1-19P1	18N2-19P2
18 - 19	22	28
	19N1-20P1	19N2-20P2
19 - 20	26	25
	21N1-22P1	21N2-22P2
21 - 22	23	27
	22N1-23P1	22N2-23P2
22 - 23	25	25
	23N1-24P1	23N2-24P2
23 - 24	23	25
	24N1-25P1	24N2-25P2
24 - 25	27	25
	25N1-26P1	25N2-26P2
25 - 26	24	23
	26N1-27P1	26N2-27P2
26 - 27	28	25
	27N1-28P1	27N2-28P2
27 - 28	42	21
	28N1-29P1	28N2-29P2
28 - 29	27	26
	29N1-30P1	29N2-30P2
29 - 30	22	23

DATA SHEET 1

"AS FOUND"

BATTERY BANK 2D12

BATTERY RACK CELL TO CELL CONNECTIONS	RECORD RESISTANCE IN MICRO-OHMS FOR LISTED CONNECTIONS	
	31N1-32P1	31N2-32P2
31 - 32	28	28
	32N1-33P1	32N2-33P2
32 - 33	37	29
	33N1-34P1	33N2-34P2
33 - 34	27	30
	34N1-35P1	34N2-35P2
34 - 35	27	26
	35N1-36P1	35N2-36P2
35 - 36	22	23
	36N1-37P1	36N2-37P2
36 - 37	22	23
	37N1-38P1	37N2-38P2
37 - 38	24	22
	38N1-39P1	38N2-39P2
38 - 39	21	19
	39N1-40P1	39N2-40P2
39 - 40	22	23
	41N1-42P1	41N2-42P2
41 - 42	28	28
	42N1-43P1	42N2-43P2
42 - 43	23	22
	43N1-44P1	43N2-44P2
43 - 44	27	31
	44N1-45P1	44N2-45P2
44 - 45	26	28
	45N1-46P1	45N2-46P2
45 - 46	23	22

BATTERY RACK CELL TO CELL CONNECTIONS	RECORD RESISTANCE IN MICRO-OHMS FOR LISTED CONNECTIONS	
	46N1-47P1	46N2-47P2
46 - 47	23	33
	47N1-48P1	47N2-48P2
47 - 48	28	30
	48N1-49P1	48N2-49P2
48 - 49	28	30
	49N1-50P1	49N2-50P2
49 - 50	27	25
	51N1-52P1	51N2-52P2
51 - 52	26	26
	52N1-53P1	52N2-53P2
52 - 53	25	26
	53N1-54P1	53N2-54P2
53 - 54	20	21
	54N1-55P1	54N2-55P2
54 - 55	28	30
	55N1-56P1	55N2-56P2
55 - 56	27	23
	56N1-57P1	56N2-57P2
56 - 57	22	21
	57N1-58P1	57N2-58P2
57 - 58	23	24

DATA SHEET 1

"AS FOUND"

BATTERY BANK __2D12__

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE TO CELL # 1	_1P1-TERM. PLT. 5 _1P2-TERM. PLT. 12
TERMINAL PLATE TO INCOMING 250 MCM CABLE LUGS CELL # 1	_TERM. PLT.-LUG#1 16 _TERM. PLT.-LUG#2 12 _TERM. PLT.-LUG#3 12
TERMINAL PLATE TO CELL # 10	_10N1-TERM. PLT. 12 _10N2-TERM. PLT. 12
TERMINAL PLATE ON CELL # 10 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 14 _TERM. PLT.-LUG#2 9 _TERM. PLT.-LUG#3 10 _TERM. PLT.-LUG#4 12 _TERM. PLT.-LUG#5 11 _TERM. PLT.-LUG#6 11

DATA SHEET 1

"AS FOUND"

BATTERY BANK __2D12__

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE TO CELL # 11	_11P1-TERM. PLT. 12 _11P2-TERM. PLT. 11
TERMINAL PLATE ON CELL # 11 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 15 _TERM. PLT.-LUG#2 15 _TERM. PLT.-LUG#3 12 _TERM. PLT.-LUG#4 14 _TERM. PLT.-LUG#5 13 _TERM. PLT.-LUG#6 13
TERMINAL PLATE TO CELL # 20	_20N1-TERM. PLT. 7 _20N2-TERM. PLT. 9
TERMINAL PLATE ON CELL # 20 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 14 _TERM. PLT.-LUG#2 11 _TERM. PLT.-LUG#3 11

DATA SHEET 1

"AS FOUND"

BATTERY BANK __2D12__

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE ON CELL # 20 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#4 11 _TERM. PLT.-LUG#5 9 _TERM. PLT.-LUG#6 12
TERMINAL PLATE TO CELL # 21	_21P1-TERM. PLT. 11 _21P2-TERM. PLT. 11
TERMINAL PLATE ON CELL # 21 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 16 _TERM. PLT.-LUG#2 14 _TERM. PLT.-LUG#3 13 _TERM. PLT.-LUG#4 15 _TERM. PLT.-LUG#5 13 _TERM. PLT.-LUG#6 10
TERMINAL PLATE TO CELL # 30	_30N1-TERM. PLT. 11 _30N2-TERM. PLT. 14

DATA SHEET 1

"AS FOUND"

BATTERY BANK __2D12__

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE TO OUTGOING 250 MCM CABLE LUGS CELL # 30	_TERM. PLT.-LUG#1 11 _TERM. PLT.-LUG#2 14 _TERM. PLT.-LUG#3 14
TERMINAL PLATE TO CELL # 31	_31P1-TERM. PLT. 19 _31P2-TERM. PLT. 8
TERMINAL PLATE TO INCOMING 250 MCM CABLE LUGS CELL # 31	_TERM. PLT.-LUG#1 18 _TERM. PLT.-LUG#2 19 _TERM. PLT.-LUG#3 16
TERMINAL PLATE TO CELL # 40	_40N1-TERM. PLT. 12 _40N2-TERM. PLT. 7
TERMINAL PLATE ON CELL # 40 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 10 _TERM. PLT.-LUG#2 8 _TERM. PLT.-LUG#3 7 _TERM. PLT.-LUG#4 11

DATA SHEET 1

"AS FOUND"

BATTERY BANK __2D12__

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE ON CELL # 40 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#5 10
	_TERM. PLT.-LUG#6 11
TERMINAL PLATE TO CELL # 41	_41P1-TERM. PLT. 8
	_41P2-TERM. PLT. 15
TERMINAL PLATE ON CELL # 41 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 18
	_TERM. PLT.-LUG#2 17
	_TERM. PLT.-LUG#3 13
	_TERM. PLT.-LUG#4 18
	_TERM. PLT.-LUG#5 17
	_TERM. PLT.-LUG#6 13
TERMINAL PLATE TO CELL # 50	_50N1-TERM. PLT. 18
	_50N2-TERM. PLT. 14
TERMINAL PLATE CELL # 50 INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 17
	_TERM. PLT.-LUG#2 11

DATA SHEET 1

"AS FOUND"

BATTERY BANK __2D12__

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE ON CELL # 50 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#3 11 _TERM. PLT.-LUG#4 14 _TERM. PLT.-LUG#5 9 _TERM. PLT.-LUG#6 15
TERMINAL PLATE TO CELL # 51	_51P1-TERM. PLT. 15 _51P2-TERM. PLT. 15
TERMINAL PLATE ON CELL # 51 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 13 _TERM. PLT.-LUG#2 14 _TERM. PLT.-LUG#3 11 _TERM. PLT.-LUG#4 15 _TERM. PLT.-LUG#5 10 _TERM. PLT.-LUG#6 9
TERMINAL PLATE TO CELL # 58	_58N1-TERM. PLT. 13 _58N2-TERM. PLT. 15

DATA SHEET 1

"AS FOUND"

BATTERY BANK __2D12__

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE TO OUTGOING 250 MCM CABLE LUGS CELL #58	_TERM. PLT.-LUG#1 17
	_TERM. PLT.-LUG#2 16
	_TERM. PLT.-LUG#3 17

COMMENTS: _____

Test Equip. and Cal. Due. Date: DLRO-001 5-9-99 _____/_____

_____/_____, _____/_____, _____/_____

_____/_____, _____/_____, _____/_____

Performed by:..... Carl Webster 1-18-99 Date

Second Person Verifier: Jack Hoff 1-18-99 Date

QC Witnessed by:..... J R Williams 1-18-99 Date

DATA SHEET 2

Performance Discharge Test
Battery Bank and Cell Voltages

Battery Bank 2D12
Start Time 1357

Cell No.	30 Min.	1 Hour	1 Hour 30 Min.	2 Hours	2 Hours 30 Min.	3 Hours	3 Hours 30 Min.	4 Hours	4 Hours 30 Min.
1	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.93
2	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.93
3	1.98	1.98	1.97	1.96	1.96	1.95	1.95	1.94	1.93
4	1.98	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94
5	1.99	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.94
6	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94	1.93
7	1.98	1.98	1.98	1.97	1.96	1.96	1.95	1.95	1.94
8	1.98	1.98	1.98	1.97	1.96	1.96	1.95	1.95	1.94
9	1.99	1.99	1.98	1.97	1.97	1.96	1.96	1.95	1.94
10	1.98	1.98	1.97	1.96	1.96	1.95	1.94	1.94	1.93
11	1.98	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94
12	1.99	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94
13	1.99	1.99	1.98	1.98	1.97	1.96	1.96	1.95	1.95
14	1.99	1.99	1.98	1.98	1.97	1.96	1.96	1.95	1.95
15	1.99	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94
16	1.98	1.98	1.98	1.97	1.96	1.96	1.95	1.94	1.94
17	1.99	1.99	1.98	1.98	1.97	1.96	1.96	1.95	1.94
18	1.98	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94
19	1.98	1.98	1.98	1.97	1.96	1.96	1.95	1.94	1.94
20	1.98	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94
21	1.99	1.99	1.98	1.97	1.97	1.96	1.96	1.95	1.94
22	1.99	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.94
23	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93
24	1.99	1.99	1.98	1.98	1.97	1.96	1.96	1.95	1.94
25	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.95	1.94
26	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94	1.93
27	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93
28	1.98	1.98	1.97	1.96	1.96	1.95	1.95	1.94	1.93
29	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.94
30	1.99	1.99	1.98	1.98	1.97	1.96	1.96	1.95	1.95
31	1.99	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.94
32	1.98	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94
Bank Volts	116.1	114.9	114.7	114.3	114.0	113.6	113.3	112.9	112.5

Performed by Rick Hall 1-20-99
Signature Date

DATA SHEET 2

Performance Discharge Test
Battery Bank and Cell Voltages

Battery Bank 2D12

Cell No.	30 Min.	1 Hour	1 Hour 30 Min.	2 Hours	2 Hours 30 Min.	3 Hours	3 Hours 30 Min.	4 Hours	4 Hours 30 Min.
33	1.99	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94
34	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94	1.93
35	1.98	1.99	1.98	1.98	1.97	1.97	1.96	1.95	1.95
36	1.99	1.97	1.98 1.97	1.96	1.96	1.95	1.95	1.94	1.93
37	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.94
38	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.94
39	1.98	1.98	1.98	1.97	1.96	1.96	1.95	1.94	1.94
40	1.99	1.98	1.97	1.97	1.96	1.95	1.95	1.94	1.93
41	1.99	1.98	1.98	1.97	1.96	1.96	1.95	1.95	1.94
42	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93
43	1.99	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.94
44	1.98	1.98	1.98	1.97	1.96	1.96	1.95	1.94	1.94
45	1.98	1.98	1.97 1.97	1.96	1.96	1.95	1.95	1.94	1.93
46	1.99	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94
47	1.98	1.98	1.98	1.97	1.96	1.96	1.95	1.94	1.94
48	1.99	1.99	1.98	1.98	1.97	1.96	1.96	1.95	1.94
49	1.98	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94
50	1.99	1.99	1.98	1.98	1.97	1.96	1.96	1.95	1.94
51	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93
52	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94	1.93
53	1.99	1.98	1.98	1.97	1.96	1.96	1.95	1.94	1.94
54	1.98	1.98	1.98	1.97	1.96	1.96	1.95	1.94	1.94
55	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94	1.93
56	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93
57	1.99	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94
58	1.98	1.98	1.97	1.97	1.96	1.95	1.95	1.94	1.93
Disch Rate (Amps)	259	259	258	260	259 ~~295~~ R.H 1-20-99	258	258	257	256

Performed by Rob Hall / 1.20.99
Signature Date

Test Equip: BCT-003 Cal. Due: 1-19-00

DATA SHEET 2

Performance Discharge Test
Battery Bank and Cell Voltages

Battery Bank 2D12

Cell No.	5 Hours	5 Hours 30 Min.	6 Hours	6 Hours 30 Min.	7 Hours	7 Hours 30 Min.	8 Hours	8 Hours 30 Min.	9 Hours
1	1.92	1.91	1.90	1.89	1.88	1.87	1.86		
2	1.92	1.91	1.90	1.89	1.88	1.87	1.85		
3	1.92	1.91	1.91	1.90	1.88	1.87	1.86		
4	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
5	1.93	1.92	1.92	1.91	1.90	1.89	1.87		
6	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
7	1.93	1.92	1.91	1.91	1.90	1.88	1.87		
8	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
9	1.94	1.93	1.92	1.91	1.90	1.89	1.88		
10	1.92	1.91	1.90	1.89	1.88	1.87	1.85		
11	1.93	1.92	1.91	1.91	1.90	1.88	1.87		
12	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
13	1.94	1.93	1.92	1.91	1.90	1.89	1.88		
14	1.94	1.93	1.92	1.91	1.90	1.89	1.88		
15	1.93	1.92	1.92	1.91	1.90	1.89	1.87		
16	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
17	1.94	1.93	1.92	1.91	1.90	1.89	1.88		
18	1.93	1.92	1.92	1.91	1.90	1.89	1.87		
19	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
20	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
21	1.94	1.93	1.92	1.91	1.90	1.89	1.88		
22	1.93	1.93	1.92	1.91	1.90	1.89	1.87		
23	1.93	1.92	1.91	1.90	1.89	1.87	1.86		
24	1.94	1.93	1.92	1.91	1.90	1.89	1.88		
25	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
26	1.92	1.92	1.91	1.90	1.89	1.87	1.86		
27	1.93	1.92	1.91	1.90	1.89	1.88	1.86		
28	1.93	1.91	1.91	1.90	1.89	1.87	1.86		
29	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
30	1.94	1.93	1.92	1.91	1.90	1.89	1.88		
Bank Volts	112.0	111.5	111.0	110.4	109.8	109.2	108.5		

Performed by Rick Hall / 1-21-99
Signature Date

NOTE

Terminal voltage of 105 volts may be reached before a hour or ½ hour reading can be taken. Indicate the number of minutes past the hour or half hour above the column where the last reading was taken at test completion.

DATA SHEET 2

Performance Discharge Test
Battery Bank and Cell Voltages

Battery Bank 2D12

Bank Voltage: 108.5
Start Time: 1357
Stop Time: 2210

Cell No.	5 Hours	5 Hours 30 Min.	6 Hours	6 Hours 30 Min.	7 Hours	7 Hours 30 Min.	8 Hours	8 Hours 30 Min.	9 Hours
31	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
32	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
33	1.93	1.92	1.92	1.91	1.90	1.89	1.87		
34	1.93	1.92	1.91	1.90	1.89	1.88	1.86		
35	1.94	1.93	1.92	1.91	1.90	1.89	1.87		
36	1.92	1.92	1.91	1.90	1.89	1.88	1.86		
37	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
38	1.93	1.92	1.91	1.90	1.90	1.88	1.87		
39	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
40	1.93	1.92	1.91	1.90	1.89	1.88	1.86		
41	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
42	1.93	1.92	1.91	1.90	1.89	1.88	1.86		
43	1.93	1.93	1.92	1.91	1.90	1.89	1.88		
44	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
45	1.92	1.91	1.90	1.89	1.88	1.87	1.86		
46	1.93	1.92	1.91	1.91	1.90	1.88	1.87		
47	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
48	1.93	1.93	1.92	1.91	1.90	1.89	1.88		
49	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
50	1.94	1.93	1.92	1.91	1.90	1.89	1.88		
51	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
52	1.92	1.92	1.91	1.90	1.89	1.88	1.96		
53	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
54	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
55	1.92	1.92	1.91	1.90	1.89	1.88	1.86		
56	1.93	1.92	1.91	1.90	1.89	1.88	1.86		
57	1.93	1.92	1.91	1.90	1.89	1.88	1.87		
58	1.93	1.92	1.91	1.90	1.89	1.88	1.86		
Disch Rate (Amps)	258	259	258	257 ~~275~~ Rdg 1-2099	255	254	252		

Performed by Rick Hall 11-21-97
Signature Time

NOTE

Terminal voltage of 105 volts may be reached before a hour or ½ hour reading can be taken. Indicate the number of minutes past the hour or half hour above the column where the last reading was taken at test completion.

DATA SHEET 3

"AS LEFT"

BATTERY BANK __2D12__

BATTERY RACK CELL TO CELL CONNECTIONS	RECORD RESISTANCE IN MICRO-OHMS FOR LISTED CONNECTIONS	
1 - 2	1N1-2P1	1N2-2P2
	24	24
2 - 3	2N1-3P1	2N2-3P2
	24	23
3 - 4	3N1-4P1	3N2-4P2
	24	24
4 - 5	4N1-5P1	4N2-5P2
	28	23
5 - 6	5N1-6P1	5N2-6P2
	23	23
6 - 7	6N1-7P1	6N2-7P2
	21	23
7 - 8	7N1-8P1	7N2-8P2
	40	26
8 - 9	8N1-9P1	8N2-9P2
	22	19
9 - 10	9N1-10P1	9N2-10P2
	22	22
11 - 12	11N1-12P1	11N2-12P2
	22	25
12 - 13	12N1-13P1	12N2-13P2
	21	23
13 - 14	13N1-14P1	13N2-14P2
	21	21
14 - 15	14N1-15P1	14N2-15P2
	20	18
15 - 16	15N1-16P1	15N2-16P2
	23	24

BATTERY RACK CELL TO CELL CONNECTIONS	RECORD RESISTANCE IN MICRO-OHMS FOR LISTED CONNECTIONS	
16 - 17	16N1-17P1	16N2-17P2
	22	24
17 - 18	17N1-18P1	17N2-18P2
	23	19
18 - 19	18N1-19P1	18N2-19P2
	20	22
19 - 20	19N1-20P1	19N2-20P2
	18	20
21 - 22	21N1-22P1	21N2-22P2
	24	23
22 - 23	22N1-23P1	22N2-23P2
	19	24
23 - 24	23N1-24P1	23N2-24P2
	26	27
24 - 25	24N1-25P1	24N2-25P2
	24	22
25 - 26	25N1-26P1	25N2-26P2
	24	21
26 - 27	26N1-27P1	26N2-27P2
	24	25
27 - 28	27N1-28P1	27N2-28P2
	39	21
28 - 29	28N1-29P1	28N2-29P2
	22	26
29 - 30	29N1-30P1	29N2-30P2
	22	23

DATA SHEET 3

"AS LEFT"

BATTERY BANK 2D12

BATTERY RACK CELL TO CELL CONNECTIONS	RECORD RESISTANCE IN MICRO-OHMS FOR LISTED CONNECTIONS	
	31N1-32P1	31N2-32P2
31 - 32	26	26
	32N1-33P1	32N2-33P2
32 - 33	30	29
	33N1-34P1	33N2-34P2
33 - 34	24	32
	34N1-35P1	34N2-35P2
34 - 35	30	27
	35N1-36P1	35N2-36P2
35 - 36	24	23
	36N1-37P1	36N2-37P2
36 - 37	26	25
	37N1-38P1	37N2-38P2
37 - 38	25	26
	38N1-39P1	38N2-39P2
38 - 39	25	23
	39N1-40P1	39N2-40P2
39 - 40	25	29
	41N1-42P1	41N2-42P2
41 - 42	25	22
	42N1-43P1	42N2-43P2
42 - 43	20	19
	43N1-44P1	43N2-44P2
43 - 44	23	23
	44N1-45P1	44N2-45P2
44 - 45	20	22
	45N1-46P1	45N2-46P2
45 - 46	21	22

BATTERY RACK CELL TO CELL CONNECTIONS	RECORD RESISTANCE IN MICRO-OHMS FOR LISTED CONNECTIONS	
	46N1-47P1	46N2-47P2
46 - 47	22	25
	47N1-48P1	47N2-48P2
47 - 48	23	22
	48N1-49P1	48N2-49P2
48 - 49	19	23
	49N1-50P1	49N2-50P2
49 - 50	24	25
	51N1-52P1	51N2-52P2
51 - 52	21	26
	52N1-53P1	52N2-53P2
52 - 53	22	22
	53N1-54P1	53N2-54P2
53 - 54	23	23
	54N1-55P1	54N2-55P2
54 - 55	22	30
	55N1-56P1	55N2-56P2
55 - 56	28	20
	56N1-57P1	56N2-57P2
56 - 57	21	25
	57N1-58P1	57N2-58P2
57 - 58	20	24

DATA SHEET 3

"AS LEFT"

BATTERY BANK __2D12__

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE TO CELL # 1	_1P1-TERM. PLT. 6 _1P2-TERM. PLT. 7
TERMINAL PLATE TO INCOMING 250 MCM CABLE LUGS CELL # 1	_TERM. PLT.-LUG#1 10 _TERM. PLT.-LUG#2 17 _TERM. PLT.-LUG#3 14
TERMINAL PLATE TO CELL # 10	_10N1-TERM. PLT. 9 _10N2-TERM. PLT. 11
TERMINAL PLATE ON CELL # 10 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 20 _TERM. PLT.-LUG#2 9 _TERM. PLT.-LUG#3 10 _TERM. PLT.-LUG#4 24 _TERM. PLT.-LUG#5 16 _TERM. PLT.-LUG#6 18

DATA SHEET 3

"AS LEFT"

BATTERY BANK __2D12__

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE TO CELL # 11	_11P1-TERM. PLT. 35
	_11P2-TERM. PLT. 8
TERMINAL PLATE ON CELL # 11 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 12
	_TERM. PLT.-LUG#2 18
	_TERM. PLT.-LUG#3 18
	_TERM. PLT.-LUG#4 37
	_TERM. PLT.-LUG#5 20
	_TERM. PLT.-LUG#6 15
TERMINAL PLATE TO CELL # 20	_20N1-TERM. PLT. 8
	_20N2-TERM. PLT. 12
TERMINAL PLATE ON CELL # 20 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 9
	_TERM. PLT.-LUG#2 8
	_TERM. PLT.-LUG#3 10

DATA SHEET 3

"AS LEFT"

BATTERY BANK __2D12__

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE ON CELL # 20 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#4 14 _TERM. PLT.-LUG#5 8 _TERM. PLT.-LUG#6 11
TERMINAL PLATE TO CELL # 21	_21P1-TERM. PLT. 4 _21P2-TERM. PLT. 2
TERMINAL PLATE ON CELL # 21 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 8 _TERM. PLT.-LUG#2 7 _TERM. PLT.-LUG#3 7 _TERM. PLT.-LUG#4 6 _TERM. PLT.-LUG#5 4 _TERM. PLT.-LUG#6 7
TERMINAL PLATE TO CELL # 30	_30N1-TERM. PLT. 7 _30N2-TERM. PLT. 13

DATA SHEET 3

"AS LEFT"

BATTERY BANK __2D12__

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE TO OUTGOING 250 MCM CABLE LUGS CELL # 30	_TERM. PLT.-LUG#1 9 _TERM. PLT.-LUG#2 9 _TERM. PLT.-LUG#3 11
TERMINAL PLATE TO CELL # 31	_31P1-TERM. PLT. 8 _31P2-TERM. PLT. 6
TERMINAL PLATE TO INCOMING 250 MCM CABLE LUGS CELL # 31	_TERM. PLT.-LUG#1 9 _TERM. PLT.-LUG#2 10 _TERM. PLT.-LUG#3 6
TERMINAL PLATE TO CELL # 40	_40N1-TERM. PLT. 8 _40N2-TERM. PLT. 7
TERMINAL PLATE ON CELL # 40 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 14 _TERM. PLT.-LUG#2 13 _TERM. PLT.-LUG#3 12 _TERM. PLT.-LUG#4 12

DATA SHEET 3

"AS LEFT"

BATTERY BANK __2D12__

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE ON CELL # 40 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#5 11 _TERM. PLT.-LUG#6 10
TERMINAL PLATE TO CELL # 41	_41P1-TERM. PLT. 5 _41P2-TERM. PLT. 15
TERMINAL PLATE ON CELL # 41 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 11 _TERM. PLT.-LUG#2 9 _TERM. PLT.-LUG#3 8 _TERM. PLT.-LUG#4 11 _TERM. PLT.-LUG#5 8 _TERM. PLT.-LUG#6 12
TERMINAL PLATE TO CELL # 50	_50N1-TERM. PLT. 5 _50N2-TERM. PLT. 8
TERMINAL PLATE CELL # 50 INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 13 _TERM. PLT.-LUG#2 12

DATA SHEET 3

"AS LEFT"

BATTERY BANK __2D12__

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE ON CELL # 50 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#3 11 _TERM. PLT.-LUG#4 8 _TERM. PLT.-LUG#5 9 _TERM. PLT.-LUG#6 8
TERMINAL PLATE TO CELL # 51	_51P1-TERM. PLT. 6 _51P2-TERM. PLT. 5
TERMINAL PLATE ON CELL # 51 TO INTERTIER 4/0 CABLE LUGS	_TERM. PLT.-LUG#1 15 _TERM. PLT.-LUG#2 13 _TERM. PLT.-LUG#3 11 _TERM. PLT.-LUG#4 10 _TERM. PLT.-LUG#5 9 _TERM. PLT.-LUG#6 16
TERMINAL PLATE TO CELL # 58	_58N1-TERM. PLT. 8 _58N2-TERM. PLT. 10

DATA SHEET 3

"AS LEFT"

BATTERY BANK 2D12

BATTERY RACK CELL TO TERMINAL PLATE AND TERMINAL PLATE TO CABLE CONNECTIONS	RECORD RESISTANCE IN MICRO OHMS FOR LISTED CONNECTIONS
TERMINAL PLATE TO OUTGOING 250 MCM CABLE LUGS CELL #58	_TERM. PLT.-LUG#1 6 _TERM. PLT.-LUG#2 4 _TERM. PLT.-LUG#3 5

COMMENTS: _____

Test Equip. and Cal. Due. Date: DLRO-001 / 5-9-99 _____/_____

_____/_____, _____/_____, _____/_____

_____/_____, _____/_____, _____/_____

Performed by:..... Rick Hall 1-24-99 Date

Second Person Verifier:..... 1-24-99 Date

QC Witnessed by:..... 1-24-99 Date