

2D12-1989



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PLANT MANUAL SECTION:
ELECTRICAL
MAINTENANCE

PROCEDURE/WORK PLAN TITLE:

2D12 PERFORMANCE TEST

ARKANSAS NUCLEAR ONE

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- 8.1.20 Record the "As Found" reading on Data Sheet 1.
- 8.1.21 If any single reading is questionable,
Then move the "Forward/Reverse" lever to "Reverse"
and average the two readings,
If not,
Then mark this step N/A. *N/A*
- 8.1.22 Repeat Steps 8.1.16 through 8.1.21 for each cell
connection in the battery. *W/C*

NOTE

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

- 8.1.23 Micro-ohm the inter-tier connections from battery
terminal to battery terminal. *W/C*
- 8.1.24 If the "As Found" reading in Step 8.1.7 or 8.1.23
exceeds 150 micro-ohms,
Then initiate a Condition Report and notify the
Cognizant Supervisor for further instructions,
If not,
Then mark this step N/A. *N/A*
- 8.1.25 Connect any remaining battery load test set control
wiring needed for load monitoring or control. *W/C*

8.2 Commence the battery performance test discharge as directed below

INDEPENDENT VERIFICATION

An independent verifier shall perform the average cell temperature calculation, the discharge current correction factor calculations, and the discharge current calculation to verify that the performer has made the correct calculations

- 8.2.1 Obtain and record below and on Attachment 1 the
average cell temperature, and the time the
calculations were completed, for the ten cells
listed on Attachment 1.

WM
78.80 ° Temp, 1432 Time
Avg

W/C



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- 8.2.2 Independent verifier shall repeat and record below the average cell temperature calculation, for the ten cells listed on Attachment 1:

78 °F Temperature Average

Mike Martin
Independent Verifier

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

(K Factor) Discharge Current Correction
Factor: .994

WM

- 8.2.4 Independent verifier shall determine and record below the discharge current correction factor (K Factor) based upon the average cell temperature in Step 8.2.2 and the Table on Attachment 1.

(K Factor) Discharge Current Correction
Factor: .994

Mike Martin
Independent Verifier

- 8.2.5 Calculate the actual discharge current by dividing 258 by the K Factor from Step 8.2.3.

258 amps ÷ .994 = 250 260
Rated discharge K Factor Actual discharge
current current

258 Amps = 260 Amps
(K)

WM

- 8.2.6 Independent verifier is to calculate the actual discharge current by dividing 258 by the K Factor from Step 8.2.4 calculation and record below.
(ref. 8.2.5)

258 amps ÷ .994 = 260
Rated discharge K Factor Actual discharge
current current

258 Amps = 260 Amps
(K)

Mike Martin
Independent Verifier

- 8.2.7 Set up the load tester to 260 amps calculated in Steps 8.2.5 and 9 hours of discharge.

WM

10046302554



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N

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- 8.2.8 Independent verifier shall verify that the load tester is set up correctly for a 9 hour discharge at the current value calculated in Step 8.2.6

[Signature]
Independent Verifier

- 8.2.9 Verification of calculations performed by Cognizant Supervisor and permission to start test.

[Signature]
Cognizant Supervisor

- 8.2.10 Close 2D52 disconnect switch. *W/M*

- 8.2.11 Start the discharge test. *W/M*

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

- 8.2.13 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.) *R/H*

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.

- 8.2.14 Monitor and record the discharge rate and the battery voltage at intervals established in Data Sheet 2

- 8.2.15 IF the discharge is stopped for any reason other than a low voltage cell,
THEN record the stop and restart times below.
IF NOT,
THEN mark this step N/A. *N/A*

Stop time _____ Restart time _____

Reason for discharge stop _____

00046702555



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- 8.2.16 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 .75 vdc,

If not,

Then mark this step N/A:

Cell number: _____ Volts: _____

Cell number: _____ Volts: _____

Cell number: _____ Volts: _____

N/A

- 8.2.17 If at any time during the test a cell(s) voltage drops below .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.

- 8.2.18 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: 105.7 R.H.

- 8.2.19 Decrease the test load to "0" when the overall battery voltage is 105 VDC.

N/R

- 8.2.20 Turn off test load.

R.H.

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

- 8.2.22 Open 2D52 disconnect switch.

R.H.

* ALBERS Unit Automatically Decreased Test Load To "0" when 9 hours HAD completed. Voltage WAS 105.7



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WARNING

Opposite side of fuse connections are energized. Contact should be avoided when installing fuses and disconnecting cables.

8.2.23 De-energize load tester. *R.H.*

8.2.24 Unbolt and remove the load test cables from the fuse cabinet. *R.H.*

8.2.25 Disconnect any remaining battery load test set control or monitoring cables connected to the battery. *R.H.*

8.3 Restore the battery to service with the help of operations.

8.3.1 Install the 800 AMP fuses and pin indicating fuses in 2D42 *R.H.*

8.3.2 Close the Battery 2D52 Disconnect Switch. *R.H.*

8.3.3 Verify that the electrical lineup is restored and the charger is working properly. *R.H.*

8.3.4 Record below the charger being used:

Charger used: 2D-32 *R.H.*

8.3.5 Place the battery on an equalize charge; after the battery bank voltage is equal to the charger set point of 135.2 to 138 volts then start the 72 hour equalize charge. *R.H.*

NOTE

Step 8.4 may be accomplished at any time after Step 8.3.5 has been accomplished.

8.3.6 Record below the Equalizing start and stop times and the equalizing voltage. *137.6*

05/5/9-29-91/135.2
Start time Date Voltage

05/5/10-28-91/129.7
Stop time Date Voltage



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- 8.3.7 Record below the equalize voltage at the battery after 15 hours from the start of equalization

137.37 VDC Battery Terminal Voltage

Measuring and Test Equipment number: DMM-128

Calibration due date: 2-25-90

- 8.3.8 Place the charger on float after completing 72 hours of equalizing charge.

- 8.3.9 Record the voltage measured at the battery below:

Voltage 129.76

8.4 Battery Capacity Calculation

- 8.4.1 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)

- 8.4.2 IF the discharge was stopped in step 8.2.15,
THEN the time that the discharge was stopped
(from data in 8.2.15) must be subtracted from
the T_A to obtain the actual length of the test
(T_A) for step 8.4.2

IF NOT,
THEN mark this step N/A

- 8.4.3 Determine the capacity of the battery by completing the following equation:

$$\% \text{ capacity at } 77^\circ\text{F} = (T_A / T_S) \times 100$$

T_A = Actual time of the test to specified
terminal voltage (105 volts if no cells were
jumpered) in minutes, See Data Sheet 2)

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

$$T_A \text{ (minutes)} \frac{540}{480 \text{ minutes}} \times 100 = \frac{112.5}{48.75} \% \text{ capacity}$$

POOR ORIGINAL

WM



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INDEPENDENT VERIFIER

An independent verifier shall repeat the calculations for determining the capacity of the battery.

- 8.4.4 Repeat the calculations for determining the capacity of the battery (Independent Verifier).

$$T_A \text{ (minutes)} \frac{540}{480 \text{ minutes}} \times 100 = 112.5 \% \text{ capacity}$$

[Signature]
Independent Verifier

- 8.4.5 If the capacity calculated is less than 90%,
Then notify maintenance engineer for evaluation,
If the capacity is greater than or equal to 90%
Then mark this step N/A.

N/A

8.5 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 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 8.5.1 through 8.5.7 may be accomplished at any time after Step 8.3.5 has been accomplished. Steps 8.5.8 through 8.5.10 may be accomplished after equalize charge current diminishes to a low enough level such that charge current does not affect resistance readings.

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

[Signature]

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

Torque wrench number: *TW-083 & TW-084*

Calibration due date: *11-16-89* *11-16-89*

Torque value: *125 in/lb*

[Signature]

- 8.5.3 Check the rack nuts, but not the tie rod nuts, with torque wrench at 27 ft/lbs.

Torque wrench number: *TW-42* *TW-378*

Calibration due date: *10-10-89* *11-9-89*

[Signature]

00016302559



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ATTACHMENT 1

DISCHARGE CURRENT CORRECTION FACTOR K FOR TEMPERATURE

Temperature	
(F)	Factor K

Cell No.

Temp.

1	78	62	1.098
6	78	63	1.092
12	78	64	1.086
18	78	65	1.080
24	78	66	1.072
30	78	67	1.064
36	78	68	1.056
43	77	69	1.048
49	78	70	1.040
54	78	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

TOTAL Temps $\frac{779}{10} = \text{Avg.}$

Average Temp.

77.9 °F 9-28-89/1432
78 Date Time

Test Equip: DT-031

Cal. Due: 10/3/89



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DATA SHEET 2

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Performance Discharge Test Battery Bank and Cell Voltages

Battery Bank 2D12

Start Time 1447

Cell	1 Hour		2 Hours		3 Hours		4 Hours	
No.	30 Min.	1 Hour	30 Min.	2 Hours	30 Min.	3 Hours	30 Min.	4 Hours
1	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.93
2	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.93
3	1.97	1.98	1.97	1.96	1.95	1.94	1.94	1.93
4	1.97	1.97	1.96	1.96	1.95	1.95	1.94	1.93
5	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93
6	1.97	1.97	1.96	1.96	1.95	1.95	1.94	1.93
7	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93
8	1.98	1.97	1.97	1.96	1.95	1.95	1.94	1.93
9	1.94	1.94	1.97	1.97	1.96	1.95	1.95	1.93
10	1.97	1.96	1.96	1.95	1.95	1.94	1.93	1.92
11	1.97	1.97	1.96	1.96	1.95	1.95	1.94	1.93
12	1.97	1.97	1.97	1.96	1.95	1.95	1.95	1.93
13	1.98	1.97	1.97	1.96	1.96	1.95	1.95	1.93
14	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93
15	1.97	1.97	1.96	1.96	1.95	1.95	1.94	1.93
16	1.97	1.97	1.96	1.96	1.95	1.95	1.94	1.93
17	1.98	1.97	1.97	1.96	1.95	1.95	1.94	1.93
18	1.97	1.97	1.97	1.96	1.95	1.95	1.94	1.93
19	1.97	1.97	1.96	1.96	1.95	1.95	1.94	1.93
20	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.93
21	1.96	1.96	1.96	1.95	1.95	1.94	1.93	1.92
22	1.97	1.97	1.96	1.96	1.95	1.95	1.94	1.93
23	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.92
24	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93
25	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93
26	1.97	1.96	1.96	1.95	1.95	1.94	1.93	1.92
27	1.97	1.96	1.96	1.95	1.95	1.94	1.94	1.92
28	1.97	1.96	1.96	1.95	1.95	1.94	1.94	1.92
29	1.97	1.97	1.96	1.95	1.95	1.94	1.94	1.92
30	1.97	1.97	1.97	1.96	1.96	1.95	1.94	1.93
31	1.92	1.92	1.92	1.91	1.90	1.90	1.89	1.87
32	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93
Bank								
Volts	115.2	115.0	114.7	114.4	114.0	113.6	113.2	112.8

Performed by

Signature

Date

Rich Hall 19-28-89



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DATA SHEET 2

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Performance Discharge Test Battery Bank and Cell Voltages

Battery Bank 2D12

Cell No.	30 Min.	1 Hour	30 Min.	1 Hour	30 Min.	1 Hour	30 Min.	1 Hour	30 Min.	1 Hour
33	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.93	1.92	1.92
34	1.97	1.96	1.96	1.95	1.95	1.94	1.93	1.93	1.92	1.92
35	1.97	1.96	1.96	1.95	1.95	1.94	1.93	1.93	1.92	1.92
36	1.97	1.97	1.96	1.96	1.95	1.95	1.94	1.93	1.92	1.92
37	1.97	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.93	1.93
38	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.93	1.93
39	1.98	1.97	1.97	1.96	1.95	1.95	1.94	1.94	1.93	1.93
40	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.93	1.92	1.92
41	1.97	1.97	1.96	1.95	1.95	1.94	1.94	1.93	1.92	1.92
42	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.93	1.92	1.92
43	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93	1.93	1.93
44	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93	1.93	1.93
45	1.97	1.97	1.96	1.95	1.95	1.94	1.94	1.93	1.92	1.92
46	1.97	1.97	1.97	1.96	1.96	1.95	1.94	1.93	1.93	1.93
47	1.97	1.97	1.96	1.96	1.95	1.95	1.94	1.93	1.92	1.92
48	1.98	1.98	1.97	1.97	1.96	1.96	1.95	1.93	1.93	1.93
49	1.97	1.97	1.96	1.96	1.95	1.95	1.94	1.93	1.92	1.92
50	1.98	1.97	1.97	1.96	1.96	1.95	1.94	1.93	1.93	1.93
51	1.97	1.96	1.96	1.95	1.95	1.94	1.93	1.93	1.92	1.92
52	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.93	1.92	1.92
53	1.97	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.93	1.93
54	1.97	1.97	1.96	1.96	1.95	1.95	1.94	1.93	1.93	1.93
55	1.96	1.96	1.96	1.95	1.94	1.94	1.93	1.93	1.92	1.92
56	1.97	1.96	1.96	1.95	1.95	1.94	1.93	1.93	1.92	1.92
57	1.97	1.97	1.96	1.96	1.95	1.95	1.94	1.93	1.93	1.93
58	1.97	1.97	1.96	1.96	1.95	1.94	1.94	1.93	1.92	1.92
Disch Rate (Amps)	261	260	260	260	263	262	261	260	260	260

Performed by

Puck Acell
Signature

19-28-89
Date

Test Equip: BCT-001

Cal. Due: 1-27-90



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Performance Discharge Test Battery Bank and Cell Voltages

Battery Bank 2D12

Cell No.	5 Hours		6 Hours		7 Hours		8 Hours		9 Hours
	5 Hours	30 Min.	6 Hours	30 Min.	7 Hours	30 Min.	8 Hours	30 Min.	
1	1.91	1.91	1.90	1.88	1.87	1.86	1.85	1.83	1.80
2	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.82	1.80
3	1.91	1.91	1.90	1.89	1.88	1.86	1.85	1.83	1.81
4	1.92	1.91	1.90	1.89	1.88	1.86	1.85	1.83	1.80
5	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.84	1.81
6	1.92	1.91	1.90	1.89	1.88	1.86	1.85	1.83	1.81
7	1.92	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.82
8	1.92	1.91	1.90	1.90	1.88	1.87	1.86	1.84	1.82
9	1.93	1.92	1.91	1.90	1.89	1.88	1.86	1.85	1.83
10	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.82	1.79
11	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.83	1.81
12	1.92	1.91	1.90	1.89	1.88	1.86	1.85	1.83	1.80
13	1.92	1.91	1.91	1.90	1.89	1.87	1.86	1.85	1.83
14	1.92	1.92	1.91	1.90	1.89	1.88	1.86	1.85	1.83
15	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.83	1.81
16	1.92	1.91	1.90	1.89	1.88	1.86	1.85	1.83	1.81
17	1.92	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.82
18	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.83	1.81
19	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.84	1.82
20	1.91	1.91	1.90	1.89	1.88	1.86	1.85	1.83	1.81
21	1.91	1.90	1.89	1.88	1.87	1.86	1.85	1.83	1.81
22	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.83	1.81
23	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.82	1.79
24	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.84	1.81
25	1.92	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.82
26	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.82	1.79
27	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.82	1.80
28	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.82	1.79
29	1.92	1.91	1.90	1.89	1.88	1.86	1.85	1.83	1.81
30	1.92	1.92	1.91	1.90	1.88	1.87	1.86	1.85	1.83
Bank Volts	111.9	111.4	110.9	110.3	109.7	109	108.1	107.1	105.7

Performed by

Rick Hall 19.05.89
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.



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NO:
2403.002

ARKANSAS NUCLEAR ONE

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REVISION 2 DATE 08/23/89
CHANGE DATE

DATA SHEET 2

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Performance Discharge Test Battery Bank and Cell Voltages

START BANK VOLTAGE 129.40
FINAL Bank Voltage: 105.7
Start Time: 1447
Stop Time: 2347

Battery Bank 2D12

Cell No.	5 Hours	30 Min.	6 Hours	30 Min.	7 Hours	30 Min.	8 Hours	30 Min.	9 Hours
31	1.87	1.86	1.85	1.84	1.83	1.82	1.80	1.79	1.77
32	1.92	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.82
33	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.84	1.81
34	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.82	1.80
35	1.91	1.90	1.89	1.88	1.87	1.85	1.84	1.82	1.79
36	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.83	1.81
37	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.83	1.81
38	1.92	1.91	1.91	1.89	1.89	1.87	1.86	1.84	1.82
39	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.83	1.81
40	1.91	1.91	1.90	1.88	1.87	1.86	1.84	1.82	1.80
41	1.91	1.90	1.90	1.88	1.87	1.86	1.85	1.83	1.81
42	1.91	1.91	1.90	1.89	1.88	1.86	1.85	1.83	1.81
43	1.92	1.91	1.91	1.90	1.88	1.87	1.86	1.84	1.82
44	1.92	1.92	1.91	1.90	1.89	1.87	1.86	1.84	1.82
45	1.91	1.91	1.89	1.88	1.87	1.86	1.84	1.82	1.79
46	1.92	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.82
47	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.83	1.81
48	1.93	1.92	1.91	1.90	1.89	1.88	1.86	1.85	1.83
49	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.83	1.81
50	1.92	1.91	1.91	1.90	1.89	1.88	1.86	1.84	1.83
51	1.91	1.90	1.90	1.89	1.87	1.86	1.85	1.83	1.81
52	1.91	1.91	1.90	1.89	1.87	1.86	1.85	1.83	1.81
53	1.92	1.91	1.90	1.90	1.89	1.87	1.86	1.84	1.82
54	1.92	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.82
55	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.83	1.80
56	1.91	1.90	1.89	1.88	1.87	1.86	1.84	1.83	1.80
57	1.92	1.91	1.90	1.89	1.88	1.87	1.85	1.84	1.81
58	1.92	1.91	1.90	1.89	1.88	1.86	1.85	1.84	1.81
Disch Rate (Amps)	260	260	260	260	261	260	260	260	260

Performed by

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.