

SHORT DISCHARGE CAPACITY TEST  
 FOR STORAGE BATTERIES  
 30- TO 200-AMPERE-HOUR CAPACITIES

1. GENERAL

1.01 This section describes a one-minute capacity discharge test for a single lead-acid cell. It is intended to indicate whether or not the battery capacity has become reduced to such an extent that reduced reserve, the probability of failure, or the need for increased maintenance would justify replacement.

1.02 This section is reissued to include information on the use of the Exide "Minute-Man" Model 7 Battery Tester and to add testing data on the battery types shown below.

Type	List Numbers
KS-5361	130B, 130C, 140A, 141A, 150A, 151A
KS-5378	430, 431, 432, 433, 450, 451, 452, 460, 461
KS-5520	620, 621, 622, 800, 801, 802, 820, 821, 822
KS-5553	310, 311
KS-15544	310, 311
KS-15577	1, 2, 3, 5, 6

The figures have been rearranged and Fig. 3 has been added. The attachments now include an instruction card for the "Minute-Man" Model 7 Battery Tester. Changes and additions are marked by arrows.

1.03 The test consists of discharging a cell at a high rate for one minute and then noting the voltage. This, combined with a visual inspection, indicates the condition of the cell. The test will reduce the cell terminal voltage materially during the test. However, when the load is removed, the voltage will rise to about 2 volts in a moment. Although a heavy current is drawn, the ampere-hour discharge for the minute of test represents only about 3 per cent of the rated capacity of the cells. This should not affect the regular operation except that it would be well to recharge a floated string if more than half of the cells in the string have received this test. Since lead-calcium cells will not recuperate as rapidly as the lead-antimony cells, they should be given a recharge after each test if practicable.

1.04 The tester is designed for testing one cell at a time and, being unfused, may be damaged if connected to higher voltage.

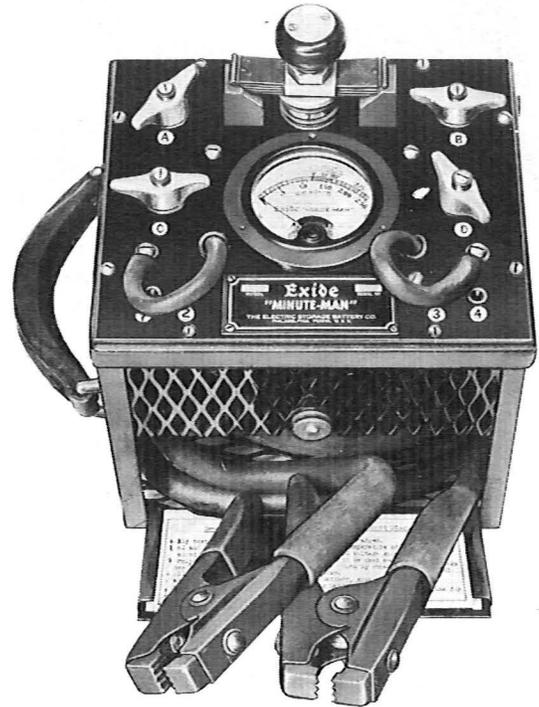


Fig. 1 - "Minute-Man" Mod. 3B Battery Tester

It has eight resistors which can be connected in parallel as shown in Fig. 4. The heavy current (low resistance) resistors A, B, C, and D can be connected in parallel by screwing down on the wing nuts and the light current (high resistance) resistors 1, 2, 3, and 4 by plugging in the jack connections. The rated resistances of the resistors and leads are as follows:

Resistor	KS-5730 Ohms	Min. Man Mod. 3B Ohms	Min. Man <sup>†</sup> Mod. 7 Ohms
1	0.432	0.432	0.288
2	0.216	0.216	0.144
3	0.144	0.144	0.096
4	0.072	0.072	0.048
D	0.048	0.048	0.008
C	0.024	0.024	0.008
B	0.024	0.012	0.016
A	0.024	0.012	0.032
Leads	0.003	0.003	0.003

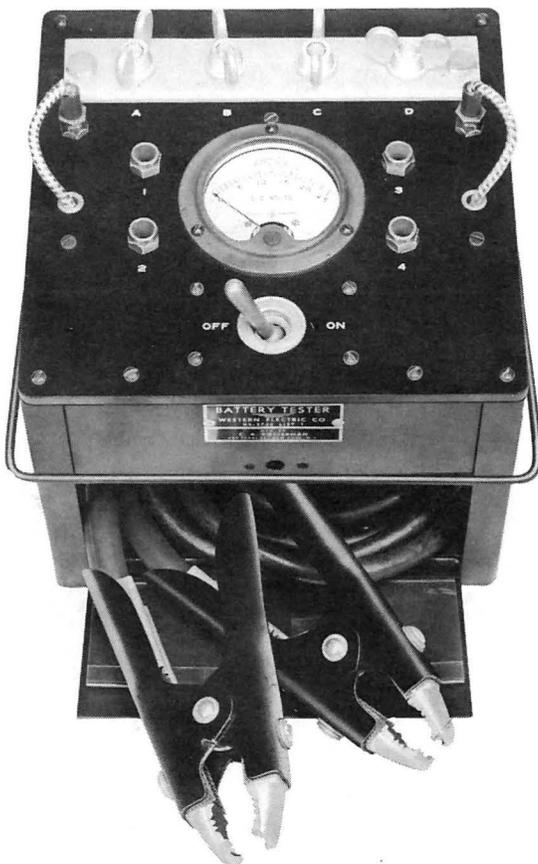


Fig. 2 - KS-5730 Battery Tester

1.05 The switch is provided to permit closing the circuit after connecting the tester clips to a cell and to open the circuit before the clips are disconnected. This avoids sparking at the battery and possible explosion of battery gases.

1.06 The cutoff or discard voltage for a cell, as read on the voltmeter on the tester at the end of one minute, is shown in the table below. Check the voltmeter periodically and adjust with the zero adjustment for accuracy at 1.5 volts. (See Section A401.562.) After adjusting, the off-voltage position of the pointer may not be at "0." The discard voltage is indicated on the scale for temperatures of 0°F to 100°F. However, it is recommended that the test be applied only on cells at 45°F or above. The corresponding temperatures and discard voltages are as follows:

Cell Temp. F	Discard Volts	Cell Temp. F	Discard Volts
100	1.59	70	1.50
95	1.57	65	1.48
90	1.56	60	1.47
85	1.54	55	1.45
80	1.53	50	1.43
75	1.51	45	1.42

Fig. 3 - "Minute-Man" Mod. 7  
Battery Tester

1.07 It is not intended that the current be observed and provision is not made for it. If the clips are placed on the cell terminals and then wiggled to clean the contact surface, the contact resistance will not vary enough to affect the results. The combination of taps specified for a particular cell applies where the tester clips are clipped directly on the cell terminals, or if more convenient, on a burned-on connector. Connection should not be made to the terminal bolt or nut as these might have sufficient contact resistance with the high current to affect the results. On 30-ampere-hour cells, be careful not to damage the relatively light cell terminals.

1.08 The discard voltage values are based on fully charged cells. Ordinarily, no prearrangements to insure full charge will be justified as good cells will pass the test even if not quite fully charged. Cells which fail to pass, but otherwise appear to be in good condition, should be charged and the test repeated. Of course, if a battery is operating on a cycle charge basis, it would be preferable to apply the test when the battery is presumably at full charge, if this can be done conveniently. Where a repeat test is desired, the method of obtaining full charge must be covered by local instructions, since it depends on the regular method of operation and local conditions.

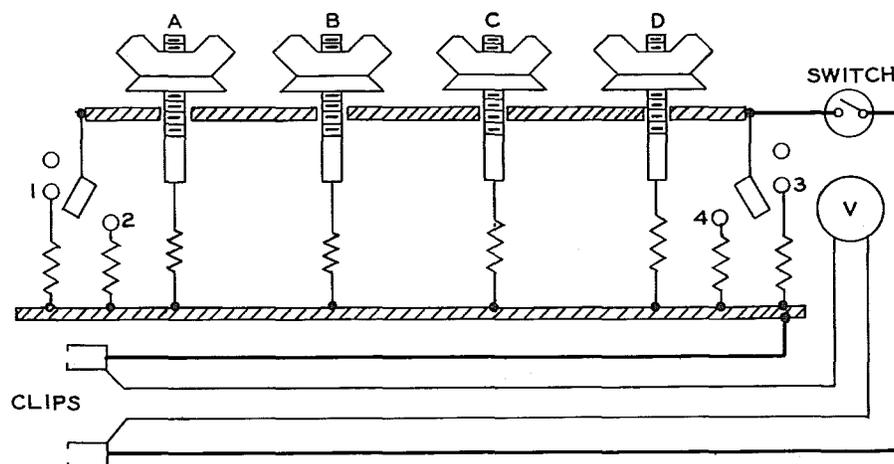


Fig. 4 - Schematic of Testers

1.09 During test, it would be ideal to have no current entering or leaving a cell except that of the test load. However, with single-string batteries, neither the charger output nor the circuit load for this class of battery should ordinarily be large enough to affect the results appreciably. Of course, it would be desirable to be on float or to adjust the charger to carry approximately the circuit load, if this can be done conveniently. With multiple batteries, it is preferable that each string be disconnected while it is being tested. If disconnecting one string increases the charger noise on the telephone circuits objectionably, shutting down the charger during the test is suggested.

## 2. APPARATUS AND MATERIALS

Battery Tester, Exide "Minute-Man" Mod. 3  
 Battery Tester, Exide "Minute-Man" Mod. 7  
 Battery Tester, KS-5730

Flashlight

Soda, Table

Sandpaper

Spirits, Petroleum

Thermometer, of the type furnished with the cells (or equivalent for reading electrolyte temperature)

## 3. TEST

3.01 Record cell number, code, that is, KS and list number, temperature of electrolyte of one cell in string, corresponding discard voltage (see 1.06), and taps used (see Table A). Use blank space on any available form, example E2003.

**Note:** A testman having considerable experience using this tester may disregard references to "discard voltage" and read discard point directly on the temperature scale which is superimposed on the voltmeter scale.

3.02 Firmly turn down wing nuts to be used and put plugs in proper jacks. Turn up other wing nuts and put unused plugs in unnumbered jacks. See Table A.

3.03 If feasible, 30-ampere-hour cells should be removed from the string for testing. This is desirable because of the limited space on these batteries and the relatively small terminal posts.

3.04 On single-string battery, adjust the charger to carry approximately the circuit load during the test, if convenient. ← Otherwise, disregard charger output and circuit load. See 1.09.

3.05 On multiple-string battery, disconnect one string at a time for test. Preferably disconnect on ground end of string. See 1.09.

**Caution:** See that switch on tester panel is open.

3.06 Connect red tester clip to positive (or red) terminal post of cell (not to bolt or nut) and black clip to negative of the same cell. Wiggle clips to obtain good contact.

3.07 Note time and close switch.

**Caution:** Do not remove clips from cell terminals during test as this would cause sparking and possible ignition of explosive gas from battery.

TABLE A

See Note 1

Type	List	Amp.-hr. Cap.	Plates per Cell	Tap Settings			
				Min. Man - Mod. 3B	KS-5730, List 1	Min. Man - Mod. 7	
KS-5361 See Note 2	130	30		1,4	1,4	1,3	
	130A	30		1,4	1,4	1,3	
	130B	30		D,2	D,2	1,4	
	130C	30		D,2	D,2	1,4	
	140	60	9	C,D,1	A,D,3	B,2	
	140	50	7	C,2	A,3	A,2,3	
	140A	50		C,3	A,1,3	A,4	
	141	60	9	C,D,1	A,D,3	B,2	
	141	50	7	C,2	A,3	A,2,3	
	141A	50		C,3	A,1,3	A,4	
	150	105	15	A,C,1	A,B,C,2,4	D,2,3	
	150	100	13	A,D	A,B,D,2,3	A,B,4	
	150	100	11	A,D,1,3	A,B,2,4	A,B,1	
	150A	100		A,D	A,B,D,2,3	A,B,4	
	151	105	15	A,C,1	A,B,C,2,4	D,2,3	
	151	100	13	A,D	A,B,D,2,3	A,B,4	
	151	100	11	A,D,1,3	A,B,2,4	A,B,1	
151A	100		A,D	A,B,D,2,3	A,B,4		
KS-5378	430	80		A,4	A,B,D,1	A,B,3	
	431	120		A,C,1,4	A,B,C,D,1,4	A,D,1	
	432	160		A,B,D,2	none	A,B,D,1,3	
	433	200		A,B,C,D,2,3	none	A,C,D,2,4	
	450	104		A,4	A,B,D,1	A,B,3	
	451	156		A,C,D,2	none	A,D,2,3	
	452	208		A,B,C	none	C,D,2	
	460	104		A,D,2,4	A,B,D,2,4	A,B,2,4	
	461	158		A,B,C,D	none	A,B,C,3	
	461	158		A,4	A,B,4	A,B,1	
KS-5520	620	88		A,4	A,B,4	A,B,1	
	621	132		A,B,2	none	A,C,2,3	
	622	176		none	none	C,D,1,4	
	800	96		A,D,2	A,B,D,2	A,B,2,3	
	801	144		A,B,D,1,3	none	B,C,2	
	802	192		none	none	B,C,D,2	
	820	96		A,D,2	A,B,D,2	A,B,2,3	
	821	144		A,B,D,1,3	none	B,C,2	
	822	192		none	none	B,C,D,2	
	KS-5553	310	180		A,B,1,3	none	B,D,4
	311	180		A,B,1,3	none	B,D,4	
	KS-15544 See Note 3	310	180		none	none	A,C,D,1
311		180		none	none	A,C,D,1	
KS-15577	1	70±		A	A,B,3	B,2,4	
	2	109±		A,C,D,2	none	A,D,2,3	
	3	109±		A,C,D,2	none	A,D,2,3	
	5	137±		A,B,D,1,4	none	C,D	
	6	141±		A,B,D,1,4	none	C,D	

Notes

1. See 3.10 for interpretation of test results.
2. Refer to Section A401.101 for information concerning the number of plates in KS-5361 cells.
3. KS-15544 lead-calcium cells may require recharging after test. See 1.03.
4. Where tap setting is "none" tester cannot be used.

3.08 At end of one minute, promptly read voltage, open switch, record voltage, and remove clips in that order.

3.09 Readjust the charger, reconnect any disconnected string of cells, etc., as required to return plant to normal operation as soon as possible.

3.10 The disposition of cells after the one-minute test as regards discard or retest or the length of time before the next test depends on the test results and local conditions. Unless local instructions specify otherwise, proceed as suggested in Table B. On cells which exceed a capacity of 100 ampere-hours, it is suggested that the one-minute test be supplemented by the standard 8-hour discharge test before discarding these larger cells. This procedure is described in Power Data Section 5.12, Sheet 1. The information is available at the engineering department. Further experience in testing cells of 100- to 200-ampere-hour capacity with the one-minute tester may eventually eliminate the need for the supplementary 8-hour discharge test.

3.11 After a test has been completed and before storing the test cables and clips in the storage compartment, wipe jaws of clips with a dry cloth or a cloth moistened in a weak soda solution to remove any trace of electrolyte and prevent corrosion of the jaws.

3.12 Exposed unpainted metal parts of plugs, wing nuts, and switch of Exide "Minute-Man" Model 3 tester should be kept clean by use of cloth moistened in petroleum spirits. In extreme cases, 8/0 sandpaper may be used.

Attached: Card Plates

TABLE B

<u>Test Results</u>	<u>Condition of Cell</u>	<u>Suggested Procedure</u>
Passes	Appearance and past performance both okay.	Recheck in 12 mo.
Passes by 0.1V min.	Appearance or past performance poor.	Recheck in 6 mo.
Just passes	Appearance or past performance poor.	Discard
Fails to pass	Appearance or past performance poor or cell has had anticipated life (see A401.001).	Discard
Fails to pass	Appearance and past performance both okay and cell has not had anticipated life.	Recharge and re-test. See (1) and (2) below.
(1) <u>30- to 100-ampere-hour Cells:</u>	Discard if it fails to pass retest.	
(2) <u>Larger than 100-ampere-hour Cells:</u>	Consult supervisor for advisability of applying supplementary 8-hour discharge test.	

3.13 The wing nuts and associated metal plate of the KS-5730 tester and the Exide "Minute-Man" Model 7 tester are silver-plated and will darken in time due to oxidation. This discoloration does not increase resistance and no attempt should be made to remove it. Dirt or gum should be removed with a cloth moistened with petroleum spirits. Any greenish colored material that forms on contacting surfaces should be removed with 8/0 sandpaper followed by a cloth moistened in a weak soda solution.

## KS-5730 Tester

The following form may be removed from the section and folded to fit the transparent envelope in the tester.

		KS-5730 Tester				
		Type	List	Amp.-hr. Cap.	Plates per Cell	Tester Settings
<u>GENERAL INSTRUCTIONS</u>						
1.	Record cell number and code, cell temperature, corresponding discard voltage, and taps to be used.	KS-5361	130	30		1,4
2.	Firmly turn down wing nuts to be used and put plugs in proper jacks. Turn up other wing nuts and put unused plugs in unnumbered jacks.		130A	30		1,4
			130B	30		D,2
			130C	30		D,2
3.	See that switch is open. It must be open while connecting or removing clips.		140	60	9	A,D,3
			140	50	7	A,3
			140A	50		A,1,3
4.	Connect red clip to plus terminal (not to bolt or nut) and black clip to negative terminal of the same cell. Wiggle clips to obtain good contact.		141	60	9	A,D,3
			141	50	7	A,3
			141A	50		A,1,3
5.	Note time and close switch.		150	105	15	A,B,C,2,4
			150	100	13	A,B,D,2,3
6.	At the end of one minute, promptly read voltage, open switch, record voltage, and remove clips in that order.		150	100	11	A,B,2,4
			150A	100		A,B,D,2,3
			151	105	15	A,B,C,2,4
7.	Return plant to normal operation.		151	100	13	A,B,D,2,3
8.	KS-15544 lead-calcium cells may require recharging after test. (See BSP A201.033.)		151	100	11	A,B,2,4
			151A	100		A,B,D,2,3
<u>SUGGESTED PROCEDURE</u>		KS-5378	430	80		A,B,D,1
			431	120		A,B,C,D,1,4
			432	160		none
			433	200		none
1.	If cell passes test and both cell appearance and past performance are okay, recheck in 12 months.		450	104		A,B,D,1
			451	156		none
2.	If cell passes by 0.1 volt min., but either cell appearance or past performance is poor, recheck in 6 months.		452	208		none
			460	104		A,B,D,2,4
			461	158		none
3.	If cell just passes, but either cell appearance or past performance is poor, discard.	KS-5520	620	88		A,B,4
			621	132		none
			622	176		none
4.	If cell does not pass and either cell appearance or past performance is poor or cell has had its anticipated life, discard.		800	96		A,B,D,2
			801	144		none
			802	192		none
			820	96		A,B,D,2
			821	144		none
			822	192		none
5.	If cell does not pass, but cell appearance and past performance are okay and cell has not had anticipated life, recharge and retest.	KS-5553	310	180		none
			311	180		none
(a)	<u>30- to 100-ampere-hour cells</u> - Discard if it fails to pass retest.	KS-15544	310	180		none
			311	180		none
(b)	<u>Larger than 100-ampere-hour cells</u> - Consult supervisor for advisability of applying supplementary 8-hour discharge test. (See BSP A201.033.)	KS-15577	1	70±		A,B,3
			2	109±		none
			3	109±		none
			5	137±		none
			6	141±		none
(See other side)		(See other side)				

## "Minute-Man" Mod. 3B Tester

The following form may be removed from the section and folded to fit the transparent envelope in the tester.

	Minute-Man Mod. 3B					
	Type	List	Amp.-hr. Cap.	Plates per Cell	Tester Settings	
<u>GENERAL INSTRUCTIONS</u>						
1. Record cell number and code, cell temperature, corresponding discard voltage, and taps to be used.	KS-5361	130	30		1,4	
2. Firmly turn down wing nuts to be used and put plugs in proper jacks. Turn up other wing nuts and put unused plugs in unnumbered jacks.		130A	30		1,4	
3. See that switch is open. It must be open while connecting or removing clips.		130E	30		D,2	
4. Connect red clip to plus terminal (not to bolt or nut) and black clip to negative terminal of the same cell. Wiggle clips to obtain good contact.		130C	30		D,2	
5. Note time and close switch.		140	60	9	C,D,1	
6. At the end of one minute, promptly read voltage, open switch, record voltage, and remove clips in that order.		140	50	7	C,2	
7. Return plant to normal operation.		140A	50		C,3	
8. KS-15544 lead-calcium cells may require recharging after test. (See BSP A201.033.)		141	60	9	C,D,1	
		141	50	7	C,2	
		141A	50		C,3	
		150	105	15	A,C,1	
		150	100	13	A,D	
		150	100	11	A,D,1,3	
		150A	100		A,D	
		151	105	15	A,C,1	
		151	100	13	A,D	
		151	100	11	A,D,1,3	
		151A	100		A,D	
		KS-5378	430	80		A,4
			431	120		A,C,1,4
			432	160		A,B,D,2
			433	200		A,B,C,D,2,3
			450	104		A,4
			451	156		A,C,D,2
		452	208		A,B,C	
		460	104		A,D,2,4	
		461	158		A,B,C,D	
	KS-5520	620	88		A,4	
		621	132		A,B,2	
		622	176		none	
		800	96		A,D,2	
		801	144		A,B,D,1,3	
		802	192		none	
		820	96		A,D,2	
		821	144		A,B,D,1,3	
		822	192		none	
	KS-5553	310	180		A,B,1,3	
		311	180		A,B,1,3	
	KS-15544	310	180		none	
		311	180		none	
	KS-15577	1	70±		A	
		2	109±		A,C,D,2	
		3	109±		A,C,D,2	
		5	137±		A,B,D,1,4	
		6	141±		A,B,D,1,4	
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## "Minute-Man" Mod. 7 Tester

The following form may be removed from the section and folded to fit the transparent envelope in the tester.

Minute-Man Mod. 7					
Type	List	Amp.-hr. Cap.	Plates per Cell	Tester Settings	
<u>GENERAL INSTRUCTIONS</u>					
<ol style="list-style-type: none"> <li>1. Record cell number and code, cell temperature, corresponding discard voltage, and taps to be used.</li> <li>2. Firmly turn down wing nuts to be used and put plugs in proper jacks. Turn up other wing nuts and put unused plugs in unnumbered jacks.</li> <li>3. See that switch is open. It must be open while connecting or removing clips.</li> <li>4. Connect red clip to plus terminal (not to bolt or nut) and black clip to negative terminal of the same cell. Wiggle clips to obtain good contact.</li> <li>5. Note time and close switch.</li> <li>6. At the end of one minute, promptly read voltage, open switch, record voltage, and remove clips in that order.</li> <li>7. Return plant to normal operation.</li> <li>8. KS-15544 lead-calcium cells may require recharging after test. (See BSP A201.033.)</li> </ol>	KS-5361	130	30	1,3	
		130A	30	1,3	
		130B	30	1,4	
		130C	30	1,4	
		140	60	9	B,2
		140	50	7	A,2,3
		140A	50		A,4
		141	60	9	B,2
		141	50	7	A,2,3
		141A	50		A,4
		150	105	15	D,2,3
		150	100	13	A,B,4
		150	100	11	A,B,1
		150A	100		A,B,4
		151	105	15	D,2,3
		151	100	13	A,B,4
		151	100	11	A,B,1
		151A	100		A,B,4
		KS-5378	430	80	A,B,3
			431	120	A,D,1
			432	160	A,B,D,1,3
			433	200	A,C,D,2,4
			450	104	A,B,3
			451	156	A,D,2,3
			452	208	C,D,2
			460	104	A,B,2,4
			461	158	A,B,C,3
			KS-5520	620	88
621	132	A,C,2,3			
622	176	C,D,1,4			
800	96	A,B,2,3			
801	144	B,C,2			
802	192	B,C,D,2			
820	96	A,B,2,3			
821	144	B,C,2			
822	192	B,C,D,2			
KS-5553	310	180		B,D,4	
	311	180	B,D,4		
KS-15544	310	180	A,C,D,1		
	311	180	A,C,D,1		
KS-15577	1	70±	B,2,4		
	2	109±	A,D,2,3		
	3	109±	A,D,2,3		
	5	137±	C,D		
	6	141±	C,D		
<u>SUGGESTED PROCEDURE</u>					
<ol style="list-style-type: none"> <li>1. If cell passes test and both cell appearance and past performance are okay, recheck in 12 months.</li> <li>2. If cell passes by 0.1 volt min., but either cell appearance or past performance is poor, recheck in 6 months.</li> <li>3. If cell just passes, but either cell appearance or past performance is poor, discard.</li> <li>4. If cell does not pass and either cell appearance or past performance is poor or cell has had its anticipated life, discard.</li> <li>5. If cell does not pass, but cell appearance and past performance are okay and cell has not had anticipated life, recharge and retest.</li> </ol> <p>(a) <u>30- to 100-ampere-hour cells</u> - Discard if it fails to pass retest.</p> <p>(b) <u>Larger than 100-ampere-hour cells</u> - Consult supervisor for advisability of applying supplementary 8-hour discharge test. (See BSP A201.033.)</p>					
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	(See other side)				