STORAGE BATTERIES

180- TO 1680-AMPERE-HOUR CAPACITIES

SINGLE-CELL DISCHARGE CAPACITY TEST

(KS-5553 AND KS-15544 LIST 300, 400, AND 500 TYPE CELLS)

1. GENERAL

1.01 This appendix:

(a) Supplements Section 157-601-503.

(b) Lists the procedures for obtaining test equipment.

(c) Includes a discharge capacity test for KS-5553 and KS-15544 List 300, 400, and 500-type cells based on their age and mechanical condition.

(d) Changes the discharge rate from a 1-¾ hour to a 5-hour rate.

(e) Describes the mechanical inspection of cells.

(f) Explains Form P 528 used to record the results of the mechanical inspection and discharge test.

(g) Provides battery replacement criteria based on the electrical and mechanical characteristics of the cells.

(h) Describes how to process Form P 528.

1.02 It is reissued to:

(a) Make each office responsible for scheduling a battery discharge test.

(b) Add instructions for obtaining test sets in Northern Counties.

(c) Add instructions regarding bypassing the boost charge on discharge capacity tests.

(d) Establish requirements for mechanical inspection of all cells in each string that is tested.

(e) Add instructions indicating that the maintenance supervisor will return one copy of Form P 528 to the office with recommendations of action to be taken.

(f) Revise notes to Tables B and C.

1.03 Table B lists the recommended discharge test intervals. Each office shall be responsible for scheduling capacity tests when their batteries reach the ages shown in Table B. Refer to ETL Addendum 157-001-013PT.

1.04 All Areas except Northern Counties shall: Contact the Maintenance Supervisor's office or the equivalent when a discharge test is required. He will arrange to have the test equipment delivered to the location. Assistance will be given to make the discharge capacity test, if required.

1.05 For Northern Counties only:
Test sets are located at major exchange and toll maintenance centers throughout the area. Contact these centers to obtain a test set when required. If assistance is needed to locate a test set, contact the Maintenance Supervisor's office.

1.06 The discharge capacity test consists of a maximum of four cells from each string (see Table C). Cells to be discharged shall be selected randomly.

NOTE: Do not discharge emergency calls.

1.07 In order to protect service, make battery cell discharge in PBXs and central offices only when emergency stand-by AC service is available.

2. TESTS

2.01 Discharge Capacity Test Procedure:

(a) Discharge cells individually using the KS-20142 discharger-recharger. The description and use of this test set can be found in Sections 157-601-504 and 157-601-505.

(b) Select cells according to 1.06.

(c) For KS-15544 cells, set "Volt-Lim" potentiometer designated R-123 on the KS-20142 test set at 2.55 volts.

(d) For KS-5553 cells, set "Volt-Lim" potentiometer at 2.35 volts.

(e) Measure and record the temperature of the cell.

(f) Measure and record the corrected specific gravity (last three digits).

(g) Program the test set to discharge the cell at the five hour rate (see Table A) by passing the BOOST CHARGE as covered in the section covering use of the test set.

NOTE: Before starting the test verify that all connections are clean and tight. Poor electrical connections will distort the accuracy of test.

TABLE A
5-HOUR DISCHARGE RATE

LIST NO.	DISCHARGE CURRENT IN AMPERES
310	31.0
311	31.0
402	43.0
403	52.0
405	74.0
407	93.0
409	120.0
501	145.0
503	180.0
505	230.0
508	290.0

2.02 Mechanical Inspection of Cells: The mechanical condition of all cells in each string that is tested shall be recorded on a locally prepared form and attached to each copy of Form P 528. This form should be forwarded to the Maintenance Supervisor.

(a) Maximum Cover Rise (Hard Rubber Jars) — The only visual indication of plate or strap growth is cover rise at the positive terminal or bulging of the jar.

(1) Measure the distance with a plastic ruler from the top of the cover at both the positive and negative terminal ends of the cover.

(2) Record the difference to the nearest 1/8 of an inch.

(b) Maximum Jar Bulge (Hard Rubber Jars) —

(1) Place a plastic or wood straight edge along the jar wall and measure the maximum amount of protrusion from a plane formed by the corner edges of the jar.

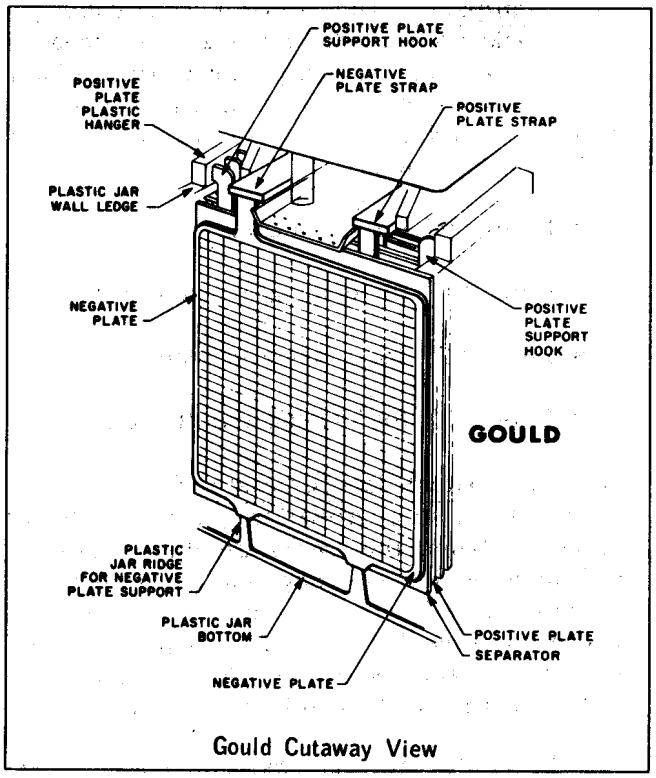
(2) Record the dimension to the nearest 1/8 of an inch.

(c) Transparent Jars (Plate Growth) — Gauge the plate growth by eye. Only the positive plates are expected to grow. When new, the edges of the positive plates do not project beyond the separators. As growth progresses, the plate edges will gradually move out past the separators and eventually touch the inner wall of the jar. Further plate growth will apply pressure to the jar wall which is evidenced by the nosing of the plate edges or flattening of the black plastic wrapper (where equipped) against the jar wall. Plate growth will also occur in the vertical plane and, in some designs, will apply pressure on the cover in an upward direction. Record one of the following conditions:

- Enter "0" for little or no growth (plate within separator edge).
- Enter "1" for slight growth (plates flush with separator edge).
- Enter "2" for plate growth from separator edge to point of touching jar (no nose effect).
- Enter "3" for plate touching jar and nose effect.

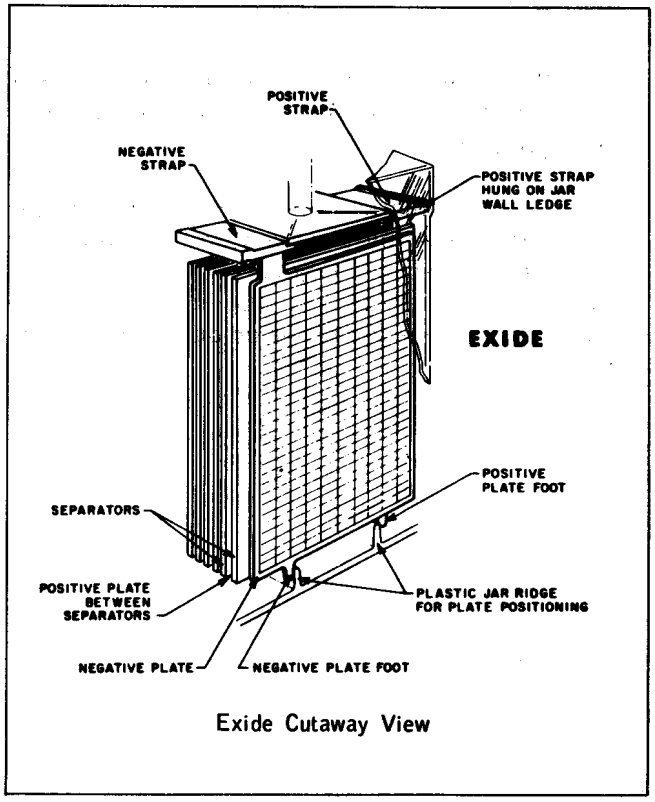
(d) Transparent Jars (Strap Growth) — The upper edges of the positive plates are burned into a lead bar which is called a strap. This strap can also grow enough to apply pressure to the jar wall. On cells made by Exide or C & D, the straps are adjacent to the plastic jar wall (Figures 1 and 3). In cells made by Gould, the positive strap is located in from the wall and has individual plate hangers (Figure 2). The plates fit into a slotted plastic hanger which rests on the inner wall ledge of the jar. When the strap or the plastic hanger is nosing on the jar wall, flattened air bubbles are usually evident. Record one of the following conditions:

- Enter "0" for strap not touching jar.
- Enter "1" for end of strap touching jar.
- Enter "2" for side of strap touching jar.
- Enter "3" for both end and side of strap touching jar.
- Enter "4" for end of strap nosing jar under pressure.



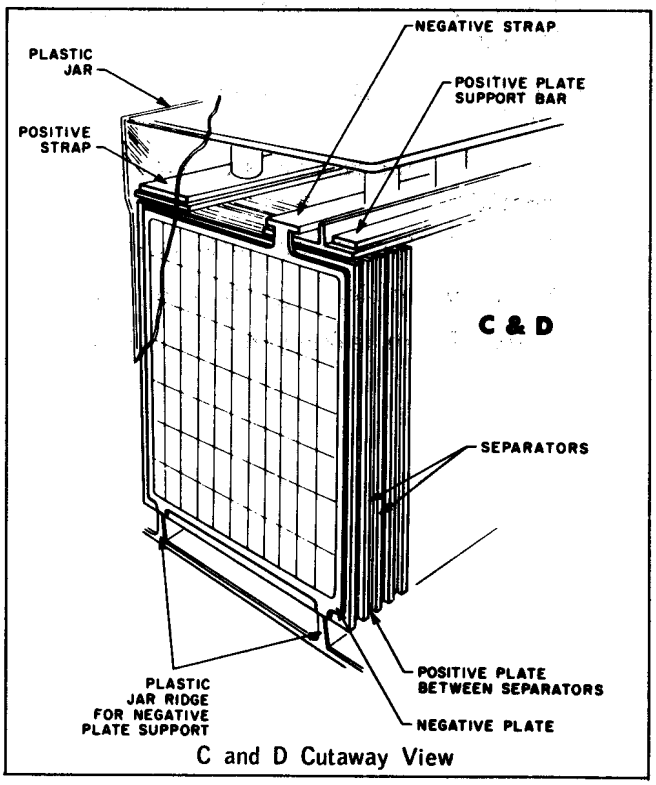
Gould Cutaway View

Figure 2



Exide Cutaway View

Figure 1



C and D Cutaway View

Figure 3

(e) Transparent Jars (Crazes) — Usually, jar cracks are preceded by crazing of the jar at the plate or strap pressure points. Crazing is hard to see but shows up under a light beam as a group of hairline cracks. Record one of the following conditions:

- Enter "0" for no crazing.
- Enter "1" for crazing in strap area.
- Enter "2" for crazing in plate edge area.
- Enter "3" for crazing in both areas.

(f) Transparent Jars (Cracks) — Cracks due to plate or strap growth may occur in the jar or cover. When the cracks are above the electrolyte level, leakage may not occur, but the explosion-proof vent is by-passed. It is only a matter of time before strap and plate growth will cause cracks below the electrolyte level to leak. Record one of the following conditions:

- Enter "0" for no cracks in cover or jar.
- Enter "1" for cracks in cover.
- Enter "2" for jar cracks in strap area not leaking.
- Enter "3" for jar cracks in plate edge area not leaking.
- Enter "4" for jar cracks in both areas not leaking.
- Enter "5" for leaking cracks in strap area.
- Enter "6" for leaking cracks in plate area.
- Enter "7" for leaking cracks in both areas.

(g) Terminal Post Corrosion — Corrosion of the battery terminals is a problem due to leakage of electrolyte through the terminal post cover seal. Evaluate the degree of corrosion found on the terminal posts and intercell connectors. (See Section 157-601-702.) Record one of the following conditions:

- Enter "0" for clean.
- Enter "1" for tolerable.
- Enter "2" for bad.

3. FORM P 528

3.01 Record the requirements listed in Part 2 (type, manufacture, age, etc.) on Form P 528 (Figure 4). List T or R after the manufacturer's name. (T for transparent or R for hard rubber cells.)

3.02 Prepare Form P 528 in triplicate.

(a) Retain one copy for the office file.

(b) Send two copies with the chart paper directly to the Maintenance Supervisor or his equivalent.

(c) After evaluation of Form P 528 and the chart paper by the Maintenance Supervisor and the Maintenance Engineer, one copy of the form will be returned to the reporting office with instructions for retest or other recommendations.

TABLE B

AGE (YEARS)	MANUFACTURER	TYPE	MEASURED CAPACITY	ACTION REQUIRED
7	EXIDE	PLASTIC	LESS THAN 75%	SEE NOTE 1
			75% TO 85%	RETEST IN 1 YR.#
			85% TO 95%	RETEST IN 2 YRS. #
			OVER 95%	RETEST IN 3 YRS.*#
10	ALL MANUFACTURERS	ALL TYPES	LESS THAN 75%	SEE NOTE 1
			75% TO 100%	RETEST IN 2 YRS #
			OVER 100%	RETEST IN 3 YRS.* #
12	ALL MANUFACTURERS	CELLS WITH 75% TO 100% CAPACITY IN 10 YR. TEST	LESS THAN 75%	SEE NOTE 1
			75% TO 85%	RETEST YEARLY #
			OVER 85%	RETEST IN 3 YRS.*#
15 AND OLDER	ALL MANUFACTURERS	ALL TYPES		RETEST ANNUALLY#

*Significant positive plate growth (greater than 1/4-inch) or cover rise in excess of 3/8-inch warrant annual capacity tests to ensure against sudden loss of capacity.

Additional test may be requested by the Maintenance Engineer of the Maintenance Supervisor.

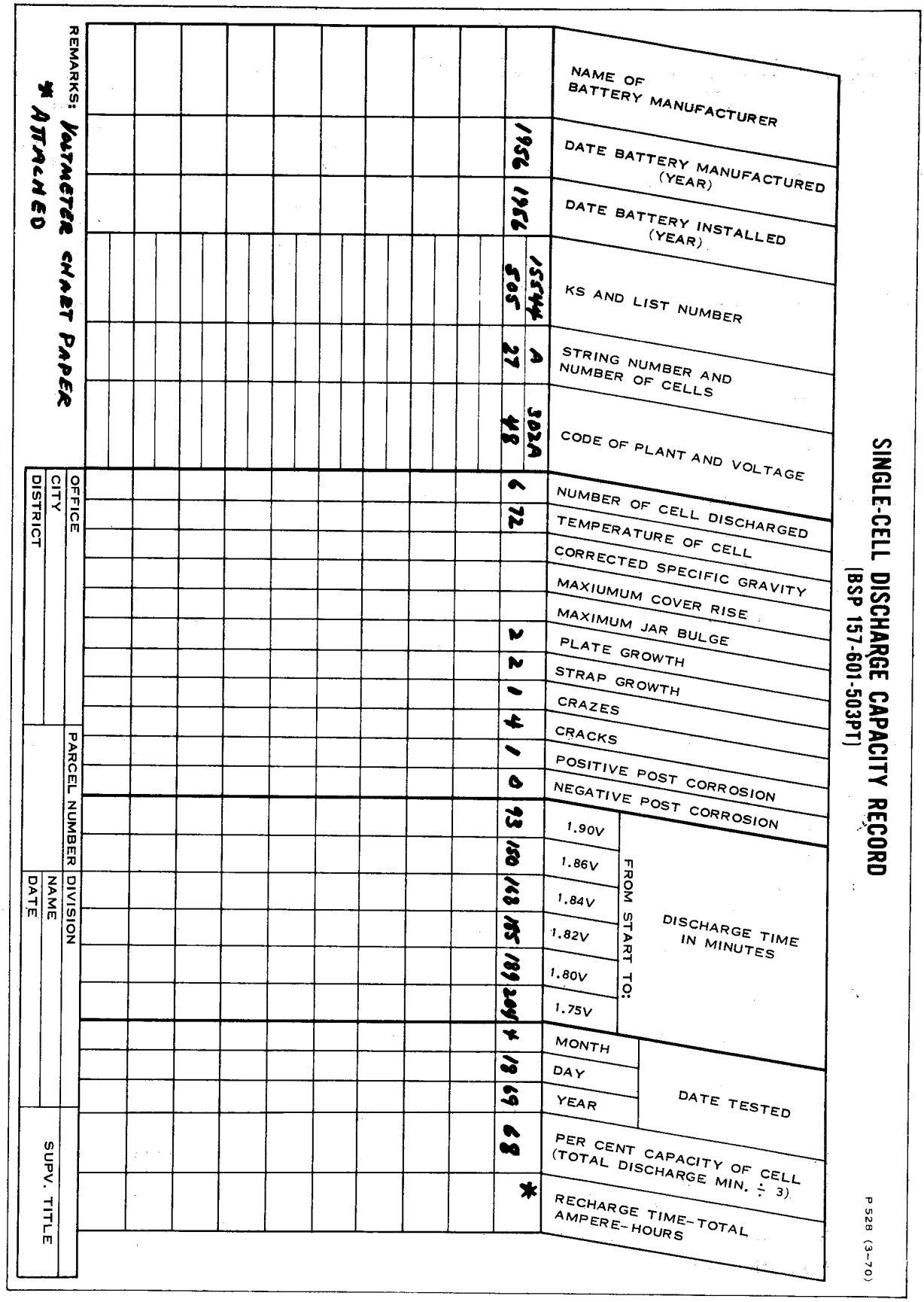
TABLE C

EXIDE TRANSPARENT	EXIDE RUBBER	GOULD AND C & D
SAMPLE 2 CELLS SEE NOTE 2 IF $\bar{X}2 > 92\%$ SEE NOTE 3 IF $\bar{X}2 < 50\%$ IF $\bar{X}2 \geq 50\% \leq 92\%$ TEST 1 MORE	SAMPLE 2 CELLS SEE NOTE 2 IF $\bar{X}2 > 89\%$ SEE NOTE 3 IF $\bar{X}2 < 55\%$ IF $\bar{X}2 \geq 55\% \leq 89\%$ TEST 1 MORE	SAMPLE 2 CELLS SEE NOTE 2 IF $\bar{X}2 > 84\%$ SEE NOTE 3 IF $\bar{X}2 < 64\%$ IF $\bar{X}2 \geq 64\% \leq 84\%$ TEST 1 MORE
SEE NOTE 2 IF $\bar{X}3 > 91\%$ SEE NOTE 3 IF $\bar{X}3 < 70\%$ IF $\bar{X}3 \geq 70\% \leq 91\%$ TEST 1 MORE	SEE NOTE 2 IF $\bar{X}3 > 88\%$ SEE NOTE 3 IF $\bar{X}3 < 71\%$ IF $\bar{X}3 \geq 71\% \leq 88\%$ TEST 1 MORE	SEE NOTE 2 IF $\bar{X}3 > 83\%$ SEE NOTE 3 IF $\bar{X}3 < 72\%$ IF $\bar{X}3 \geq 72\% \leq 83\%$ TEST 1 MORE
IF $\bar{X}4 < 90\%$ SEE NOTE 1	IF $\bar{X}4 < 87\%$ SEE NOTE 1	IF $\bar{X}4 < 82\%$ SEE NOTE 1
$\bar{X}2$, $\bar{X}3$, $\bar{X}4$, ARE THE AVERAGE CAPACITIES OF THE 2, 3 OR 4 CELLS UNDER TEST.		

MATHEMATICAL SYMBOLS	
$>$ IS GREATER THAN	$\geq$ GREATER THAN OR EQUAL TO
$<$ IS LESS THAN	$\leq$ LESS THAN OR EQUAL TO

NOTES TO TABLES B AND C

1. Battery may require replacement, subject to the findings of a study conducted by Plant and Engineering forces. Retest as directed by the Maintenance Engineer or the Maintenance Supervisor.
2. No further testing required. See Table B.
3. No further testing required. See Note 1.



SINGLE-CELL DISCHARGE CAPACITY RECORD
(BSP 157-601-503PT)

NAME OF BATTERY MANUFACTURER	DATE BATTERY MANUFACTURED (YEAR)	DATE BATTERY INSTALLED (YEAR)	KS AND LIST NUMBER	STRING NUMBER AND NUMBER OF CELLS	CODE OF PLANT AND VOLTAGE	NUMBER OF CELL DISCHARGED	TEMPERATURE OF CELL	CORRECTED SPECIFIC GRAVITY	MAXIUMUM COVER RISE	MAXIMUM JAR BULGE	PLATE GROWTH	STRAP GROWTH	CRAZES	CRACKS	POSITIVE POST CORROSION	NEGATIVE POST CORROSION	DISCHARGE TIME IN MINUTES FROM START TO: 1.90V	1.86V	1.84V	1.82V	1.80V	1.75V	DATE TESTED: MONTH	DAY	YEAR	PER CENT CAPACITY OF CELL (TOTAL DISCHARGE MIN. ÷ 3)	RECHARGE TIME-TOTAL AMPERE-HOURS
	1956	1956	15544 505	A 27	302A 48	6	72				2	2	1	4	1	0	93	130	113	135	189	209+	4	19	69	68	*

REMARKS: VOLTMETER CHART PAPER * ATTACHED

OFFICE
CITY
DISTRICT

PARCEL NUMBER DIVISION
NAME
DATE

SUPV. TITLE

P 528 (3-70)

Figure 4