POWER PLANT DATA
EMERGENCY ENGINES
OFFICE LOADS AND BATTERY RESERVES
FORMS P 527 AND P 527A

1. GENERAL

1.01 This section provides for semi-annual reviews and reports of power plant equipment, office loads and battery reserves at both attended and unattended offices and PBXs.

1.02 It is reissued to revise Form P 527, Power Plant Data — Standby Engines — Office Loads and Battery Reserves, and to change instructions for preparing the form.

1.03 This is a general revision, so marginal arrows normally used to indicate changes have been omitted.

1.04 Information from the reviews and reports will:

(a) Serve as an aid in detecting and correcting the following unsatisfactory power plant conditions:

- Insufficient battery reserve
- Inadequate charging equipment
- An inadequate emergency engine
- An inadequate ringing plant
- Safety hazards

(b) Enable the engineer to economically plan for additions to existing facilities.

(c) Provide administrative and central office supervisory personnel with a convenient reference when needed in an emergency.

2. PROCEDURES

2.01 Record battery discharge load readings semi-annually on Form P 527 (Exhibits 1 and 1A) and Form P 527-A (Exhibit 2).

2.02 Whenever possible, take all the readings on the high traffic peg count day:

(a) In early June.

(b) Just before Christmas for a reflection of Christmas traffic conditions. Exclude Sundays and holidays (see 2.04).

2.03 At locations (summer resorts, etc.) where seasonal peak loads do not occur on the above specified dates [see 2.02 (a) and (b)], schedule readings for the time of year when the peaks occur.

2.04 In addition to the semi-annual readings, record battery discharge load readings connected with unusual circumstances in the office area (a severe storm, disaster, special public event, etc.).

2.05 Take readings on the following voltages: 12, 24, 48, 130, 152, 250, and "ac"-operated — "no break" equipment. Include dc-to-dc converters and any other special voltage plants.

(a) Make a separate entry for each voltage and power plant.

(b) If the load is a "constant load" type of service, make only one reading with a notation stating this.

2.06 Readings for unattended offices and PBXs should coincide with the regular maintenance visits. Make a special effort to take them during the busy-hour load.

2.07 Readings from the recording ammeters that are installed in some central offices may be used for this report. (Transcribe these readings to the form.)

3. PREPARATION AND DISTRIBUTION OF FORMS P 527 AND P 527-A

3.01 Fill out Forms P 527 and P 527-A in triplicate. For stations owned by Long Lines but maintained by our Company, complete four copies.

(a) Keep one copy for the office file.

(b) Send two copies directly to the Maintenance Supervisor or his equivalent. If the office is owned by Long Lines, send three copies. The Maintenance Supervisor or his equivalent will:

(1) Retain one copy.

(2) Forward one copy to the power engineer responsible for the plant.

(3) Forward one copy, if the office is owned by Long Lines, to:

General Plant Operations Manager
Switching and Toll
Attn: Power Coordinator
140 New Montgomery Street
San Francisco, California 94105

3.02 Fill out Form P 527 as described below. Where entries are self-explanatory, no details are given. (See Exhibits 1 and 1A.)

Commercial Supply Data

(a) Voltage: Enter the voltage of the commercial power source.

(b) KW: Enter normal ac power and lighting peak loads for an average business day. This applies to locations equipped with KW or KVA meters mounted on the main distribution board.

(c) Phase: Enter the number of phases of each power source.

(d) Cond.: Enter the number of conductors of each power source.

(e) Supplies: Enter the number of commercial power supplies available.

(f) Outages: Enter the number of power outages since the last P 527 was filled out.

(g) Comm. Company: Enter the name of the commercial power company.

(h) Tel. No.: Enter the telephone number of the commercial power company.

Standby Engine Equipment and No Break Equipment

(i) Code or Name: Enter the KS and list number and the manufacturer's name of the complete unit.

(j) Type Start: Enter (M) manual, (A) automatic, or (A/M) automatic start, manual shut-down.

(k) Fuel-Type/Days: Enter the type of fuel; gasoline, diesel or kerosene, and the number of days fuel reserve.

NOTE: Assume the tank is ¾ full. (See Exhibit 3 for engine fuel consumption.)

(l) Cap-KW-KVA: Enter the capacity of the standby engine alternator.

(m) Load Readings — Rout. Com'l: Enter the highest reading in the last six months.

(1) Circle "Rout." or "Com'l." to indicate that the readings were taken during a routine run or commercial power failure.

(2) Use the formula below for engines not equipped with KW meters (for 3-phase sets):

$$KW = \frac{1.73 \times E \times I \times \text{Power Factor}}{1000}$$

E — Average line voltage (generally 208 or 240)

I — Average line current

Power factor — Normally about .8 for central office load.

(n) Telephone Power, Lighting Power and Building Power: Entries are required in these blocks when facilities are provided to connect these loads to the standby engine alternator individually. Measure these loads annually and transcribe these readings onto the next P 527.

Ringing Power Plant

(o) Peak Loads in Amps: Where required, record the peak ringing load current for offices equipped with DM1 and DM2 jacks. The measurement is usually taken with a ringing demand meter. Special portable ammeters may be substituted.

NOTE: The DM1 jack is in series with the central office ringing supply; the DM2 is in series with the PBX ringing supply lead.

Power Panels

(p) Meters: Enter the last date the meters were calibrated.

(q) Volt. Reg., Fuses, Contactors, Switches, and Stenciling: Enter the condition of these items as good, fair or poor. If fair or poor, explain the condition and the action taken.

Vacant Plug In Positions

Enter the number of vacant plug in equipment slots for the items listed. Add items equipped that are not shown and are powered by the plants under report. If additional space is required, add an attachment to the report.

Central Office Loads and Battery Reserves

(r) Cap. of CUs (capacity of charging units): Enter the total output of all charge units associated with plant. Obtain the capacity from the nameplate data of each charge unit.

(s) Peak Loads in Amps: Enter the highest peak load in amperes and the time taken; morning, afternoon, and evening. An office with a split load should show each load separately.

(t) Min. Load: Enter the lowest load reading and the time it was taken. An office with a split load should show each load separately.

(u) Busy-Hour Reserve: Determine the busy-hour reserve for each battery plant. In calculating any battery reserve:

(1) Consider the equipment failure voltages for the various types of equipment connected to the battery. (See Tables A, B, C, D, E and F for typical circuit voltages. See CDs and SDs for circuit voltages not shown.)

(2) Calculate the battery reserve based on the highest peak load reading plus any emergency equipment loads. (See Exhibits 4, 5 and 6.)

(3) Report the battery reserve at 100% capacity of the battery. (Battery reserve calculations are for Plant information only.)

Battery Data

(v) Code of Plant and Voltage: List the code number of the power plant and the voltage. (Examples are: 105E, 302A, 702C, etc.)

(w) Battery String: Enter all battery strings associated with the plant.

(x) % Cap'y of String: Enter the capacity of each string as reported on the last Discharge Capacity Test.

(y) Safety Items: Check for rubber gloves, fire hazards, etc.

Miscellaneous

(z) Power Failure Instructions, Lighting and Ventilation and Housekeeping: Enter good, fair or poor.

3.03 Enter explanations or comments in connection with the equipment or readings in the "Remarks" or "Action Taken" spaces. If additional space is required, include an attachment to the report.

3.04 Fill out Form P 527-A as described below. Where entries are self-explanatory, no details are given (see Exhibit 2).

PBX Loads and Battery Reserves

(a) List the code or J number, voltage and capacity in amps of the Power Plant.

(b) List the peak load in amps for both AM and PM and hour of the day these loads occur.

(c) Determine the busy hour reserve for the battery plant. In calculating any battery reserve:

(1) Consider the equipment failure voltages of equipment connected to the battery (see Table D for typical circuit voltages. See CDs and SDs for circuit voltages not shown.)

(2) Calculate the battery reserve based on the highest peak load reading plus any emergency equipment loads (see Exhibits 4, 5 and 6).

(3) Report the battery reserve at 100% capacity of the battery (battery reserve calculations are for Plant information only).

Safety Items

(d) Check for fire hazards, storage of tools, etc.

Battery Data

(e) See 3.02; 3.02 (v), (w) and (x).

3.05 Enter explanations or comments in connection with the equipment or readings in the "Remarks" or "Action Taken" spaces. If additional space is required, include an attachment to the report.

TABLE A
CIRCUIT VOLTAGE LIMITS FOR LOCAL CENTRAL OFFICES

	Nominal Voltage	Normal Voltage Range	Emergency Voltage Limits
Panel)			
No. 1 Crossbar)	-24	24 to 26	22 to 26
Crossbar Tandem)	-48	48 to 50	45 to 50
No. 1 Crossbar - With AMA	+130	125 to 135	120 to 140
Crossbar Tandem	+135	130 to 135	127 to 140
	+170	165 to 170	160 to 180
No. 1 Crossbar	+24	-	20 to 28
No. 5 Crossbar	-24	24 to 26	22 to 26
	-48	48 to 50	45 to 50
	+130	125 to 135	125 to 135
	-130	125 to 135	125 to 135
	(115V (60 Cycles)	-	103.5 to 131.5 (58 to 60 Cycles)
No. 1 Crossbar) No. 5 Crossbar) With AMA Crossbar Tandem)	(115V (60 Cycles)	-	103.5 to 131.5 (58 to 60 Cycles)
AMA - Accounting Center	-53	-	50 to 53.25
No. 1 SxS	-24	24 to 26	22 to 26
350A) 355A) 360A)	-24	22 to 26	(22 to 26 (20 to 28
No. 1 SxS) 350A) 360A)	-48	48 to 50 or 50 to 52	45 to 52
No. 1 SxS) Message 350A) Register Supply	+60 to -75		60 to 75
355A	-48	48 to 50 or 50 to 52	44 to 52 44 to 52
356A	-48	50 to 52	44 to 52
370A)) 370B)		(48 to 50) or (50 to 52)	44 to 52
No. 11, Manual, Machine Ringing	-24	22 to 26	22 to 28
	-48	48 to 50	45 to 50
No. 12 Manual	-48	48 to 50 or 50 to 52	40 to 56

TABLE B
CIRCUIT VOLTAGE LIMITS FOR TOLL

	Nominal Voltage	Normal Voltage Range	Emergency Voltage Limits
Toll Testboards			
No. 5, 17B, 17C	-48	48 to 50	45 to 50
	-24	22 to 26	22 to 26
No. 18B	-24	22 to 26	21 to 26
	-48	48 to 50 or 50 to 52	45 to 52
Switchboards			
No. 3, 3B, 3C, 3CL, 3CF) No. 4, 4A Toll Switching Systems)	-24	(23 to 25) (24 to 26)	22 to 26
Intertoll Dialing	+130	125 to 135	120 to 140
No. 4, 4A Toll Switching Systems	-48	48 to 50	45 to 50
No. 3, 3B, 3C, 3CL, 3CF) Intertoll Dialing)	-48	48 to 50 or 50 to 52	45 to 52
Transmission Measuring	-48	48 to 50	45 to 50
	-24	22 to 26	22 to 26

TABLE C
CIRCUIT VOLTAGE LIMITS FOR DESKS AND MISCELLANEOUS

	Nominal Voltage	Normal Voltage Range	Emergency Voltage Limits
No. 14 Local Test Desk	-24	22 to 26	(20 to 28 Manual (22 to 26 Dial
	-48	48 to 50 or 50 to 52	(40 to 50 Manual (45 to 52 Dial
No. 2, 3, 3A, 4, 4A, 6A, 6B, 6C, 6D, 23 Information Desks	-48	48 to 50 or 50 to 52	45 to 52
No. 2 Repair Service Desk) Test and Supervisor Desk)	-48	48 to 50	40 to 56
	-24	22 to 26	20 to 28
No. 4A, 2D Announcement System - Time of Day	-48	48 to 50 or 50 to 52	45 to 50 or 45 to 52
No. 4, 6, 7, 9, 10, 11 Service Observing Desks	-48	48 to 50 or 50 to 52	40 to 56
	-24	22 to 26	20 to 28
No. 12 Service Observing Desk	-48	48 to 50	45 to 50
	+130	125 to 135	125 to 135
No. 3 Cable Test Desk	-48	48 to 50	40 to 56
No. 19 Operating Room Desk)	-24	22 to 26	20 to 28
No. 3 Local Test Cabinet	-24	22 to 26	20 to 28
	-48	48 to 50 or 50 to 52	40 to 56

TABLE D
CIRCUIT VOLTAGE LIMITS FOR PBXs AND STATION SYSTEMS

	Nominal Voltage	Normal Voltage Range	Emergency Voltage Limits
Dial PBXs			
701A) 701B) 711A) 711B)	-48	48 to 50 or 50 to 52	44 to 52
740A) 740B) 740C) 740D) 740AX) 740E)	-48	-	44 to 52
702A	-48	48 to 50	45 to 50
755A	-24	-	18 to 25
756A	-48	51.6 to 52.6	45 to 52.6
Manual PBXs			
506A, 506B			12 to 28
507A, 507B			16 to 52
550SC, 551A, 551B			14 to 28
551D			15 to 20 or 14 to 28
552A, 552D	-48	48 to 52	44 to 52
554B, 554C	-38	-	32 to 46
555	-	-	16 to 52
556	-48	46 to 52	45 to 52
605A	-38 or -48	- 48 to 52	32 to 46 44 to 52
606A	-48	48 to 50 or 50 to 52	44 to 52
606B, 607A, 607B	-48	48 to 50 or 50 to 52	44 to 52
	+6	-	44 to 52 5.5 to 7

TABLE E
CIRCUIT VOLTAGE LIMITS FOR CARRIERS

	Normal Voltage			
	Nominal Voltage	Between	Allowable* Variation (Per Cent)	Emergency Voltage Limits
N1 Carrier				
Terminals	-48	46 to 52	±2	±6 Volts*
	+130	125 to 136	±2	±8 Volts*
Repeaters	+130	125 to 136	±2	115 to 140 Volts
	-130	125 to 136	±2	110 to 140 Volts
0-1 Carrier				
Terminals	-48	46 to 52	±2	±6 Volts*
	+130	125 to 136	±2	±8 Volts*
Repeaters	-48	46 to 52	±2	±6 Volts*
	+130	125 to 136	±2	115 to 140 Volts
	or			
	+130	125 to 136	±	115 to 140 Volts

*From normal voltage, which may have any nominal value between the limits shown.

TABLE F
MICROWAVE RADIO TELEPHONE SYSTEMS

	Nominal Voltage	Normal Voltage Range	Emergency Voltage Limits
TD-2 Radio Relay	-12	11 ± 0.1	10 to 11.7
	-24	22 to 26	20 to 26
	+130	135 to 137	116 to 140
	+250	255 to 259	224 to 270
TE-1, TE-2 Microwave	115V 60 Cycles	-	105 to 125 60 Cycles
RCA Microwave System	117V 60 Cycles	(105 to 115 or) (115 to 125)	105 to 125 60 Cycles
TJ Microwave System	1 phase 117V 60 Cycles	-	117 ± 10% 60 Cycles ± 5
TH Microwave System	1 phase 230V 60 Cycles (Firm ac)	230 ± 1% 60 Cycles ± 1%	230 ± 5% 60 Cycles ± 3%

P 527 (7-71)

POWER PLANT DATA
STAND BY ENGINES - OFFICE LOADS AND BATTERY RESERVES

COMMERCIAL SUPPLY DATA

	VOLTAGE	KW	PHASE	COND.	SUPPLIES	OUTAGES
POWER	208	160	3	4	1	2
LIGHTING	120	10	1	3	1	2

COMM. COMPANY PG&E CO.
TEL. NO. 223-2222
REMARKS: BOTH OUTAGES OF SHORT DURATION

STAND BY ENGINE EQUIPMENT AND NO BREAK EQUIPMENT

CODE OR NAME	TYPE START	FUEL TYPE	FUEL DAYS	CAP. KW-KVA	LOAD READINGS-ROUT. COM'L KW	V1-2	V1-3	V2-3	A-1	A-2	A-3
KS 5574-01-L230A #1 GM	A	D	21	100	65	212	215	215	200	165	180
KS 5574-01-L230A #2 GM	M	D	21	60	40	212	212	212	140	140	150

TELEPHONE POWER KW	V1-2	V1-3	V2-3	A1	A2	A3
65	212	212	212	180	180	185

LIGHTING POWER KW	V1-2	V1-3	V2-3	A1	A2	A3
10	212	212	212	35	35	35

BUILDING POWER KW	V1-2	V1-3	V2-3	A1	A2	A3
30	212	215	215	100	65	70

REMARKS: SET #2 STARTING BATTERY CELL SHORTED

ACTION TAKEN NEW BATTERY ON ORDER REQ #67249 DATED 7-29-71

RINGING POWER PLANT

CODE OF PLANT	VOLTAGE CO	VOLTAGE PBX	PEAK LOADS IN AMPS. AM CO	AM PBX	PM CO	PM PBX	EVE. PM CO	EVE. PM PBX
803C	84	103						

REMARKS: NO METERS OR JACKS AVAILABLE

ACTION TAKEN:

DATE TAKEN: 7-1-71

POWER PANELS

METERS: 1-5-71
VOLT. REG. GOOD
FUSES: GOOD

CONTACTORS: GEN. #2 HOT
SWITCHES: GOOD
STENCILING: GOOD

REMARKS:

ACTION TAKEN: CLEANED AND ADJUSTED CONTACTOR

VACANT PLUG IN POSITIONS

	QTY
N1 TERMINAL	20
N2 TERMINAL	
N3 TERMINAL	
ON2 TERMINAL	
N1 REPEATER	30
N REPEATER	
N2 REPEATER	

	QTY
TCXR CHANNEL BANK	
TCXR REPEATERS	
SPAN TERM. ASSEMBLY	
" " " 48V	
" " " 48V & +130	
" " " +130	

	QTY
E2 & E3 REPEATERS	380
E6 & E7 REPEATERS	240
E SIGNALING	60
1-A ECHO SUPPRESSOR	10

OFFICE	PARCEL NO.
CITY	
DISTRICT	

DIVISION	
NAME	SUPV. TITLE
DATE	

(OVER)

EXHIBIT 1

CENTRAL OFFICE LOADS AND BATTERY RESERVES

CODE OF PLANT & VOLTAGE	CAP. OF CU'S	PEAK LOADS IN AMPS						MIN. LOAD	TIME	BUSY HOUR RESERVE
		AM-TIME		PM-TIME		EVE. PM-TIME				
302A-48	3150	1475	11 00	1250	3 45	1050	8 00	450	12M	* 3
302A-24	600	112	10 45	110	3 20	100	6 15	80	12M	18
702C+130	350	60	—	60	—	60	—	60	—	35
410A-130	54	1	—	1	—	1	—	1	—	100+

REMARKS: 4 RECTIFIERS TO BE REMOVED FROM 410A PLANT ON JOB 744T

ACTION TAKEN: * SEE BATTERY DATA FOR DETAILS

DATE TAKEN: 6-6-71

BATTERY DATA

CODE OF PLANT & VOLTAGE	BATTERY STRING	NO. OF CELLS	KS & LIST NO.	DATE OF MFR.	MFD. BY	% CAP'Y OF STRING	DATE OF LAST CAP'Y TEST
302A-48	* A	27	15544-508	10-59	CD		
	B	27	15544-508	10-59	CD		
	D	27	15544-508	4-59	EXIDE	87%	11-15-68
	E	27	15544-508	4-59	EXIDE	82%	11-29-68
302A-24	A	14	15544-508	5-56	EXIDE	86%	10-26-68
702C+130	B	69	15544-508	5-58	GOULD		
410A-130	B	66	5361-151	4-58	GOULD		

REMARKS: * 48A STRING REUSED - INSTALLED 12-17-73 STRING A OF BOTH 410 AND 702 PLANTS BEING REMOVED ON 744T JOB. STRINGS ARE NOW DISCONNECTED

ACTION TAKEN: LETTER WRITTEN TO MAINTENANCE SUPERVISOR DATED 12-6-68 CALLING HIS ATTENTION TO 3 HOUR RESERVE AND THE CONDITION OF THE 48V D & E STRINGS

SAFETY ITEMS

REMARKS: POOR EMERGENCY LIGHTING IN STAIRWAYS

ACTION TAKEN: LETTER TO MTCE. SUPVR. 12-28-68

MISCELLANEOUS

POWER FAILURE INSTRUCTIONS: GOOD

LIGHTING AND VENTILATION: GOOD

POWER LOGS UP TO DATE: YES

HOUSEKEEPING: GOOD

MISCELLANEOUS POWER DATA

KS NO. OF AIR DRYER: McINTYRE MOD. CAD 7500

504 TYPE PLANT-AC-KVA RATING: 1.875 VOLTS: 120 PH: 1

EXHIBIT 1A

FORM P527A

PBX POWER PLANT DATA

PBX LOADS AND BATTERY RESERVES

CODE OF PLANT OR J-NUMBER	VOLTS	CAPACITY OF RECTIFIERS	PEAK LOADS IN AMPS AM-TIME		PM-TIME		BUSY HOUR RESERVE
111A	48	60	55	10⁰⁰	58	2³⁰	6.5

REMARKS: During sales plant load is 70 to 80 amps. Load exceeded 80 amps during Christmas time

RINGING POWER PLANTS

CODE OF PLANT	KS & LIST NO. OF MACHINE
8066	15804-L1

REMARKS: None

ACTION TAKEN:

ACTION TAKEN: Letter written to Maintenance Supervisor Dated 1-2-67 calling attention to the need of an additional charging unit.

POWER PANELS

CONDITION: METERS Call 11-15-66 VOLTAGE REGULATORS Good FUSES Good
CONTACTORS Warm SWITCHES Good STENCILING Good

REMARKS: Contactor for C.E.M.F. Cells warm.

ACTION TAKEN: Cleaned and adjusted.

SAFETY ITEMS

REMARKS: None

ACTION TAKEN:

MISCELLANEOUS

ARE LIGHTING AND VENTILATION ADEQUATE? YES ARE POWER LOG AND POWER MTCE. NOTES UP-TO-DATE? YES ARE LOCAL POWER FAILURE INSTRUCTIONS AVAILABLE? YES
IS PLANT IN CLEAN CONDITION, FLOOR COVERING, ETC? YES
ACTION TAKEN:

BATTERY DATA

CODE OF PLANT AND VOLTAGE	BATTERY STRING	NO. OF CELLS	KS-& LIST NO.	DATE OF MFR.	MFD BY	% CAP'Y OF BAT	DATE OF LAST CAP'Y TEST
111 A	A	24	5553-405	4-54	EXIDE		

REMARKS: Cell 24 replaced due to cell leaking 3-9-66

ACTION TAKEN:

PARCEL NO. ADDRESS	DIVISION
CITY	NAME/TITLE
DISTRICT	DATE

EXHIBIT 2

EMERGENCY ENGINE EQUIPMENT

(Water-Radiator Cooled)

CAPACITY & FUEL CONSUMPTION – CORRECTION FOR ALTITUDE

KS- OR MODEL NO.	J-SPEC.	MANUFACTURER OF ASSEMBLY	SOURCE OF INFORMATION	CAPACITY				FUEL CONSUMP.	
				INSTR (PAR. OR TABLE)	RATED AT OUTPUT (KW)	RATED AT MAX ALT (FT)	REDUCED CAPACITY FOR ALTITUDE	INSTR (PAR. OR TABLE)	FUEL CONS (GPH)
		GASOLINE ENGINE-ALTERNATORS, FIXED INSTALLATIONS							
KS-5525 & KS5525-01	J86610	Hercules	159-115-701	Table B	10	3000	See 159-115-701	(Est.)	2.5
					25	3000		(Est.)	5.5
					50	500		(Est.)	10.0
					70	500		(Est.)	12.5
KS-5636	J86616	Duplex (Hercules Engine)	155-134-701	2.03(b)	20	1000	See 155-134-701 or 155-134-702	2.03(c)	5.1
			155-134-702	&	30	1000		&	6.8
			and		40	1000			8.5
			AA367.911	1.04	50	1000		1.08	10.1
					60	1000			11.5
KS-5664	J86615	Duplex (Herc. Eng.)	155-136-701	2.03(b)	15	1000	See 155-136-701	2.03(c)	3.5
KS-5667		Kohler	155-141-701	2.03(b)	8	3000	See 155-141-701	2.03(c)	1.5
					5	3000			1.25
KS-5667-01	J86618	Kohler	155-141-703	2.03(b)	8	3000	See 155-141-703	2.03(c)	1.5
			802-956-150		4	3000			1.0
Mod. 5RH61		Kohler		2.03(b)	5	3000			1.25
Type R4		Buffalo	159-110-701	2.03(b)	34	1000	See 159-110-701		7.2
			155-516-101	2.03(b)	(50KVA)				
Sterling-Viking II			Mfr. Instr.		250			(Est.)	35.0
		GASOLINE ENGINE-GENERATORS (DC), FIXED INSTALLATIONS							
KS-5525		Hercules	159-180-701	2.03(b)	6 (37.5A)	7000		2.03(c)	1.4
		GASOLINE ENGINE-ALTERNATORS, PORTABLE							
Mod. 25A & 32A		Homelite	155-199-901PT	2.01	5	0	Generally—4KW	EST.	1.33
KS-5565		U.S.Mot.	155-124-701	2.03(b)	10	1000	See 155-124-701	2.03(c)	1.88

NOTE: For engines not listed, compute fuel consumption from actual usage.

EXHIBIT 3

EMERGENCY ENGINE EQUIPMENT (Cont)

(Water-Radiator Cooled)

CAPACITY & FUEL CONSUMPTION – CORRECTION FOR ALTITUDE

KS- OR MODEL NO.	J-SPEC.	MANUFACTURER OF ASSEMBLY	SOURCE OF INFORMATION	CAPACITY				FUEL CONSUMP.	
				INSTR (PAR. OR TABLE)	RATED AT OUTPUT (KW)	RATED AT MAX ALT (FT)	REDUCED CAPACITY FOR ALTITUDE	INSTR (PAR. OR TABLE)	FUEL CONS (GPH)
*Fuel consumption increases about 3% for each 1000 feet above 1000-foot altitude									
KS-15622	J86623	Hercules	155-165-701 & AA367.917	2.04(b) 1.03	120 170	1500 1500	See 155-165-701	1.07	*12.8 *17.15
*Fuel consumption increases about 3% for each 1000 feet above 1500-foot altitude									
KS-15717	J86625	Kohler	155-172-700 155-172-702 802-963-150	2.05(b) 2.05(b)	10	3000	Reduce 2.5% for each 500 feet above 3000 feet.	(Est.)	1.3
KS-15884 Manual	J86628	Gen. Mot.	155-176-701 155-176-702 802-964-150	2.04(b) 2.04(b)	30 45	3500 3500	For 30KW Sets see 155-178-701 For 45, 60 and	1.02	*3.44 *5.0
KS-15890 Automatic	J86629	Gen. Mot.	155-178-701 155-178-702 802-964-151	2.04(b) 2.04(b) 1.05	60 100	3500 3500	100KW Sets see 155-178-702	1.07	*6.29 *10.4
*Increase fuel consumption for altitudes above 1500 feet as follows: 2000 ft = 1.0%, 3000 ft = 1.0%, 4000 ft = 1.8%, 5000 ft = 2.1%, 6000 ft = 2.4%, 7000 ft = 2.7%									
KS-15777	J86627	White Motor Co. (Superior)	155-174-701 155-174-702 802-961-151	2.06(b)	500	4500	Reduce 5% for each 1500 feet above 4500 feet.	EST.	38
KS-15899	J86630	Catapillar	155-180-702	2.06(b)	350	5000	6000 ft = 325 7000 ft = 312 8000 ft = 304 9000 ft = 294 10,000 ft = 286	EST.	27.2
16-567C		Gen. Mot.	West. Area Inst.		1000			EST.	77.2

NOTE: For engines not listed, compute fuel consumption from actual usage.

EXHIBIT 3 (continued)

EMERGENCY ENGINE EQUIPMENT (Cont)

(Water-Radiator Cooled)

CAPACITY & FUEL CONSUMPTION – CORRECTION FOR ALTITUDE

KS- OR MODEL NO.	J-SPEC.	MANUFACTURER OF ASSEMBLY	SOURCE OF INFORMATION	CAPACITY				FUEL CONSUMP.	
				INSTR (PAR. OR TABLE)	RATED AT OUTPUT (KW)	RATED AT MAX ALT (FT)	REDUCED CAPACITY FOR ALTITUDE	INSTR (PAR. OR TABLE)	FUEL CONS (GPH)
Schramm Type		(Herc. Eng.)			10			2.01(b)	2.0
PE95G & H		O'Keefe & Merritt	D.W. Onan (War Dept. TM11-904)		10			Sect. IV Par. 54	1.9
KS-5565		Onan	155-126-701	2.03	10	1000	See 155-126-701	(Est.)	*2.25
KS-15650			155-167-701	2.03	5	3000	See 155-167-701	2.03	*1.12
*Increase fuel consumption 5% for each 1000 feet above 1000-foot altitude									
		DIESEL ENGINE-ALTERNATORS, FIXED INSTALLATIONS							
KS-5574	J86612	Gen. Mot.	155-128-703	2.03(b)	10	1000	See Plant Series	(Est.)	*1.3
			155-128-702		30	2500		(Est.)	*3.2
			155-128-701		40	2500		(Est.)	*4.2
					60	2500		(Est.)	*6.2
*Increase fuel consumption above 1500 feet (same as for KS-5574-01 shown below)									
KS-5574-01	J86614	Gen. Mot.	155-128-703 & 802-963-152	2.03(b) &	20	2000	See 155-128-703	1.07	*2.36
					30	2000			*3.17
					40	2000			*4.17
					60	2000			*6.11
*Increase fuel consumption above 1500 feet per AA367.909, 1.03: 2000 ft = 2.4%, 2500 ft = 4.3%, 3000 ft = 6.0%, 3500 ft = 7.7%, 4000 ft = 8.8%, 4500 ft = 9.8%									
KS-5665	J86619	Gen. Mot.	155-138-701	2.08(b)	300	1500	See 155-138-701		28.5
KS-5750	J86620	Gen. Mot.	155-145-701 & 802-963-151	2.03(b)	20	7000	For 20KW sets see 155-145-701		*2.22
			155-145-702	2.04(b)	30	7000	For 30, 40 and 60		*3.26
					40	7000	KW sets see		*4.3
					60	7000	155-145-702		*6.18
KS-15521	J86620	Hercules	155-161-701	2.05(b)					
			155-161-702 & 802-963-151	2.03(b)	20	7400	See 155-161-701		*2.22

NOTE: For engines not listed, compute fuel consumption from actual usage.

EXHIBIT 3 (continued)

A. To find the reserve hours for a plant where the strings have different list numbers:

Step 1: Add together the ampere hours (8 Hr. discharge rate x 8) for each string.

String "A" - KS-5553, List 508 = 1680 Amp. Hrs.
String "B" - KS-5553, List 508 = 1680 Amp. Hrs.
String "C" - KS-15544, List 503 = 1080 Amp. Hrs.
String "D" - KS-15544, List 503 = 1080 Amp. Hrs.
Total 5520 Amp. Hrs.

Step 2: Divide the ampere hours for any string by the total ampere hours (sum of Step 1).

String "A" - 1680 ÷ 5520 = .304 (or 30.4% of the load)

(String "B" - 1680 ÷ 5520 = .304 (or 30.4% of the load)
(String "C" - 1080 ÷ 5520 = .196 (or 19.6% of the load)
(String "D" - 1080 ÷ 5520 = .196 (or 19.6% of the load)

Step 3: Multiply the answer (quotient) in Step 2 by the load amperes plus the additional emergency load amperes. The office ampere load is 600 amperes plus an additional 35 amperes emergency load.

(String "A" - .304 x 635 = 193 Amps.)

(String "B" - .304 x 635 = 193 Amps.)
(String "C" - .196 x 635 = 124 Amps.)
(String "D" - .196 x 635 = 124 Amps.)

Step 4: Use the answer (Product) of Step 3 to find the reserve hours. This will equal the reserve hours for the entire plant.

String "A" = 9 Hrs. Reserve
(String "B" = 9 Hrs. Reserve)
(String "C" = 9 Hrs. Reserve)
(String "D" = 9 Hrs. Reserve)
} Total Reserve - 9 Hours*

*Battery Discharge Curve - Exhibit 7

EXHIBIT 4
CALCULATING RESERVE FOR A BATTERY PLANT
EQUIPPED WITH MIXED STRINGS OF CELLS

A. To find the reserve hours for an office at peak load, obtain the drain for the following:

Current drain at power board	1600 amps
*DC Ringing Machine	8 amps
*504B (J86617BL2)	62.5 amps
*M.F. RCVR. Emer. Fil. Supply Unit J95 102E (5 amps per unit)	15 amps/
*Emergency Lights (1/2 amp per bulb)	15 amps
	1700.5 amps

*Obtain from name plate.
/Three units.

Composition of Load	Low Emergency Voltage Limits
No. 5 Crossbar Switching Machine	45 volts*
No. 14 Local Test Desk	45 volts*
N1 Carrier	40 volts

*The minimum fuse panel voltage is 45.

Minimum voltage at battery*	47 volts
Drop-in leads (maximum)	- 2 volt
*(Power board meter)	45 volts at fuse panel

NOTE: Assume the battery is made up of 5 strings of KS-15544 L-508 type cells (27 cells in each string).

47 volts ÷ 27 = 1.74 volts per cell

NOTE: Cells have a tendency to reverse polarity below 1.75 volts. For all practical purposes, the minimum voltage limit is 1.75 volts per cell.

Since the load divides equally between the 5 strings, there are 340 amps per string. Referring to Exhibit 7, we get about 4 hours of reserve at a load of 340 amps.

EXHIBIT 5
CALCULATING RESERVE FOR AN OFFICE LOAD (302A-48-VOLT PLANT) UNDER EMERGENCY CONDITIONS

A. To find the reserve hours for an office at peak load, obtain the drain for the following:

Current drain at power board		88 amps
DC Ringing Machine		8 amps
Emergency Lights		4 amps
	Total	100 amps

Composition of Load	Low Emergency Voltage Limit
355A SxS machine	44 Volts

Minimum voltage at battery*	45 Volts
Drop in leads (maximum)	- 1 Volt
*(Power board meter)	44 volts at fuse panel

Assume the battery is made up of 24 KS 15544 L505 type cells.

45 ÷ 24 = 1.875 volts per cell.
(Use 1.88 volts per cell.)

Referring to Exhibit 10 we get about 13 hours of reserve at a load of 100 amps.

EXHIBIT 6
CALCULATING RESERVE FOR AN OFFICE LOAD (110A POWER PLANT) UNDER EMERGENCY CONDITIONS

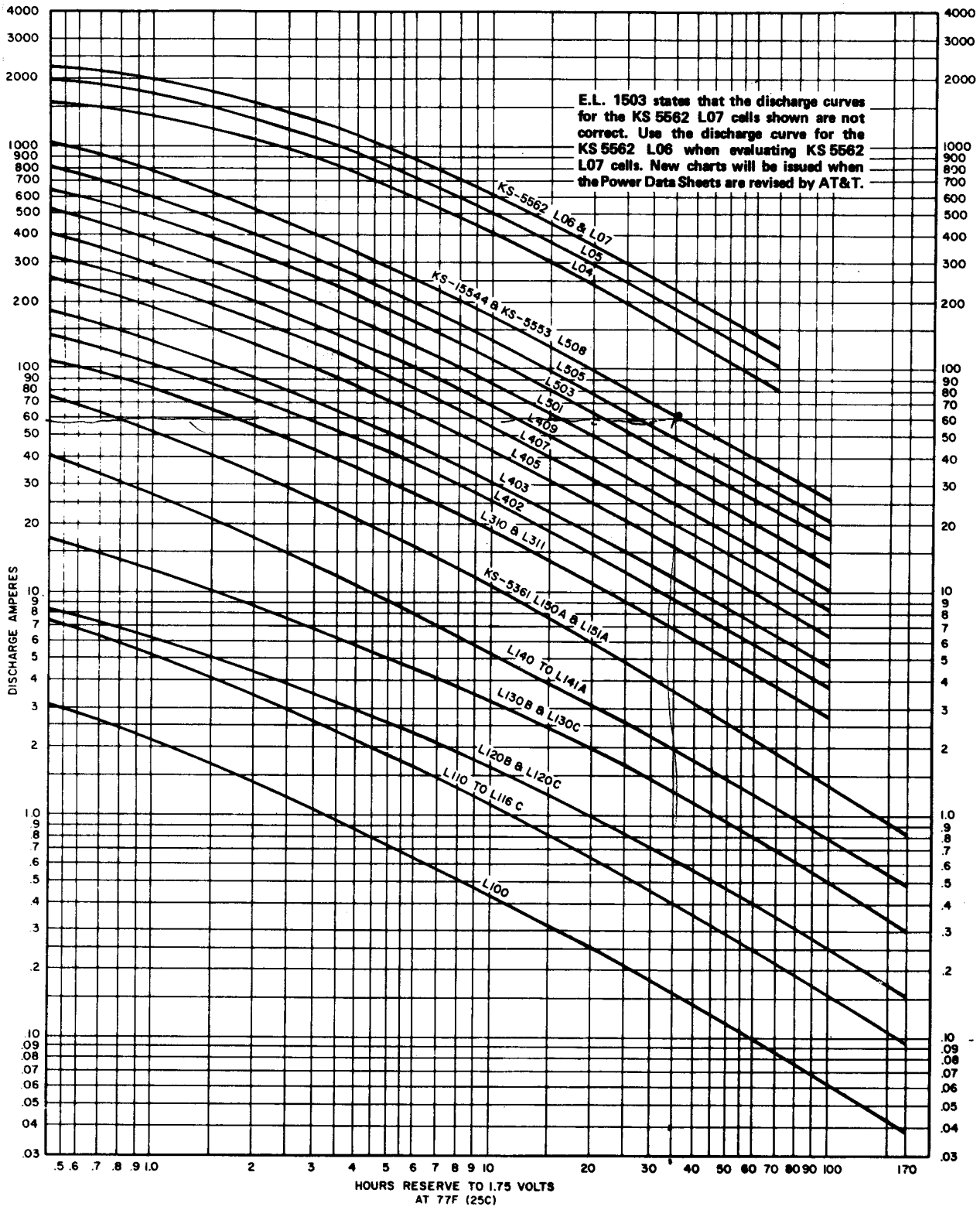


EXHIBIT 7
BATTERY DISCHARGE CURVES TO 1.75 VOLTS PER CELL

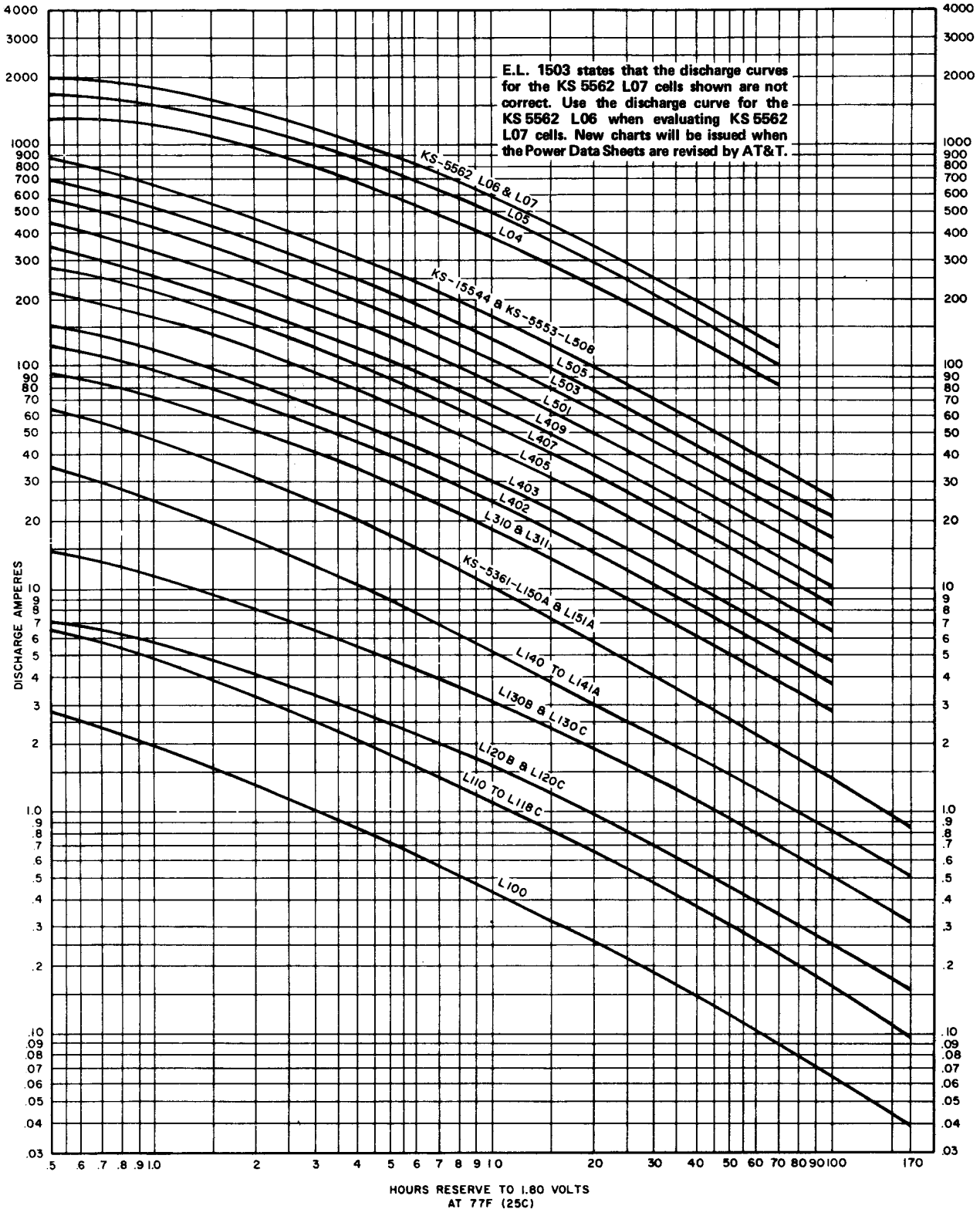


EXHIBIT 8
BATTERY DISCHARGE CURVES TO 1.80 VOLTS PER CELL

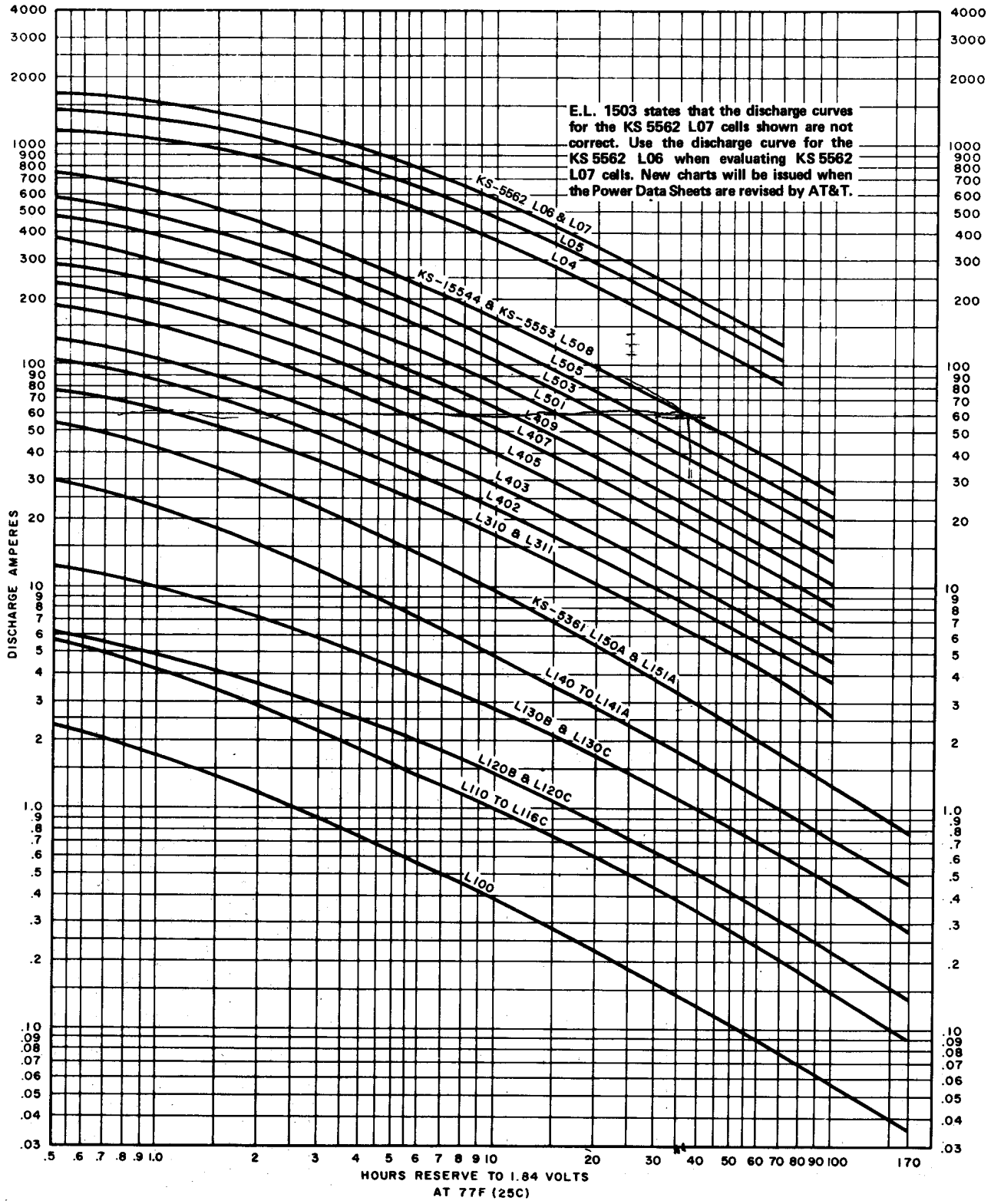


EXHIBIT 9
BATTERY DISCHARGE CURVES TO 1.84 VOLTS PER CELL

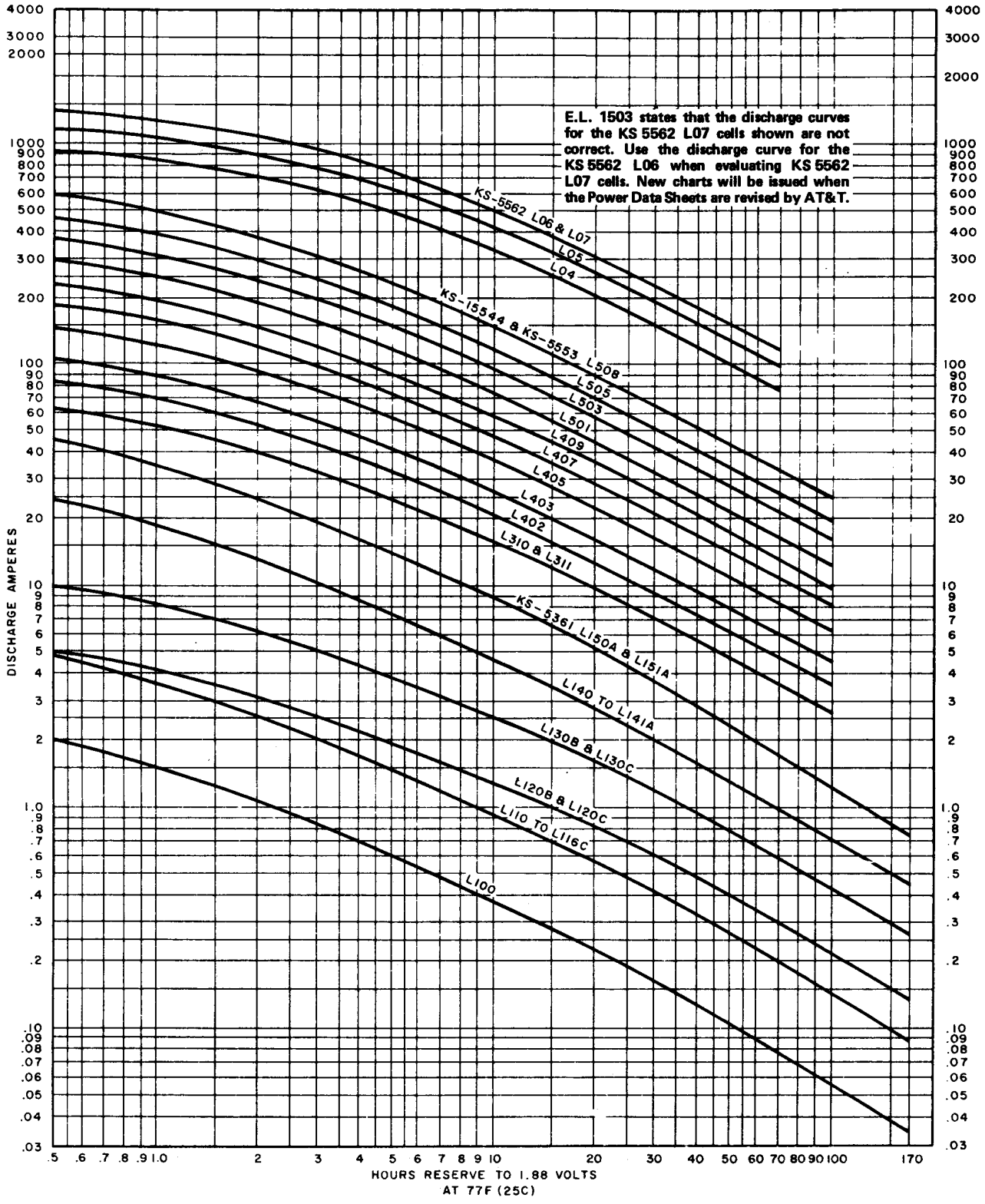


EXHIBIT 10
BATTERY DISCHARGE CURVES TO 1.88 VOLTS PER CELL

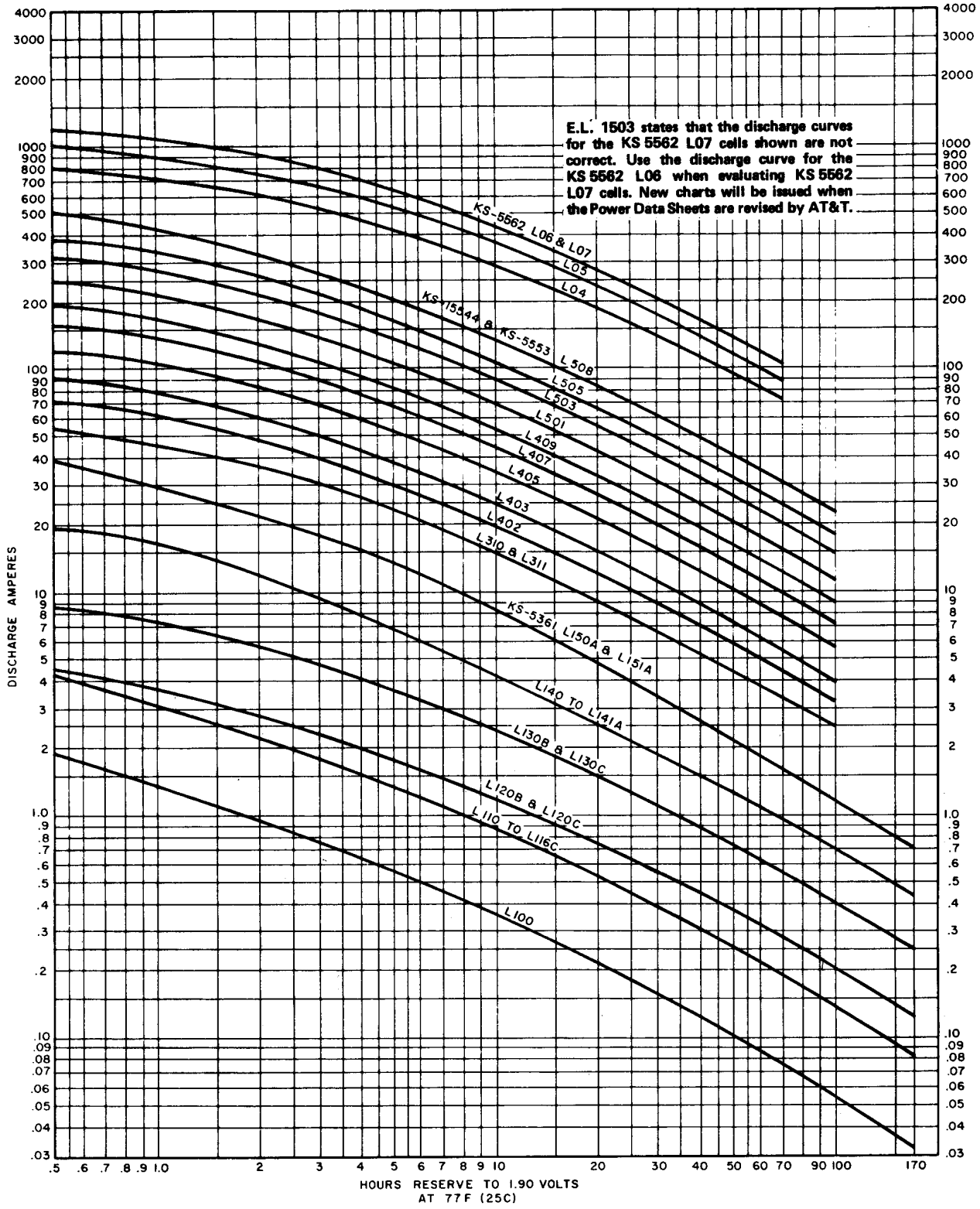


EXHIBIT 11
BATTERY DISCHARGE CURVES TO 1.90 VOLTS PER CELL

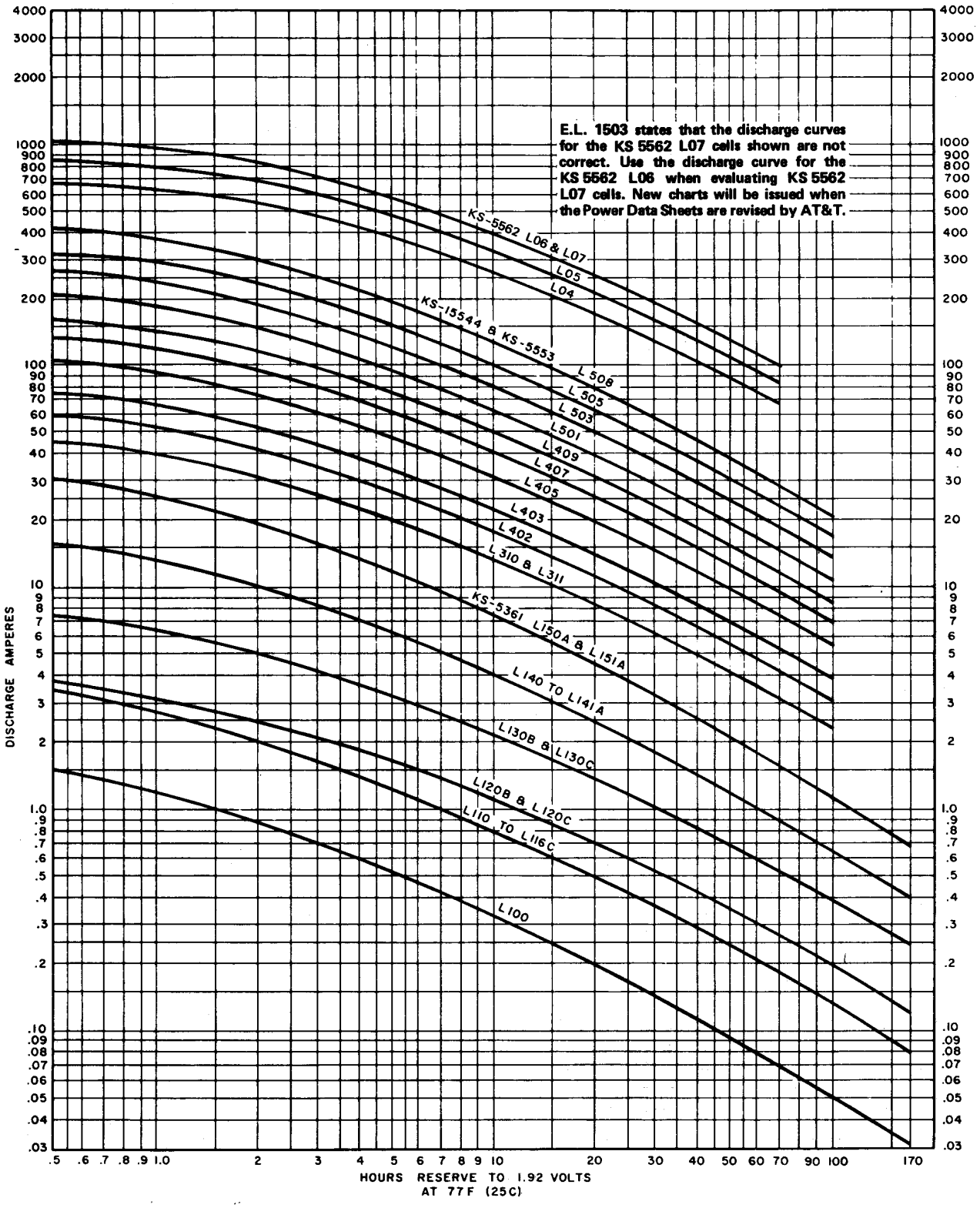


EXHIBIT 12
BATTERY DISCHARGE CURVES TO 1.92 VOLTS PER CELL

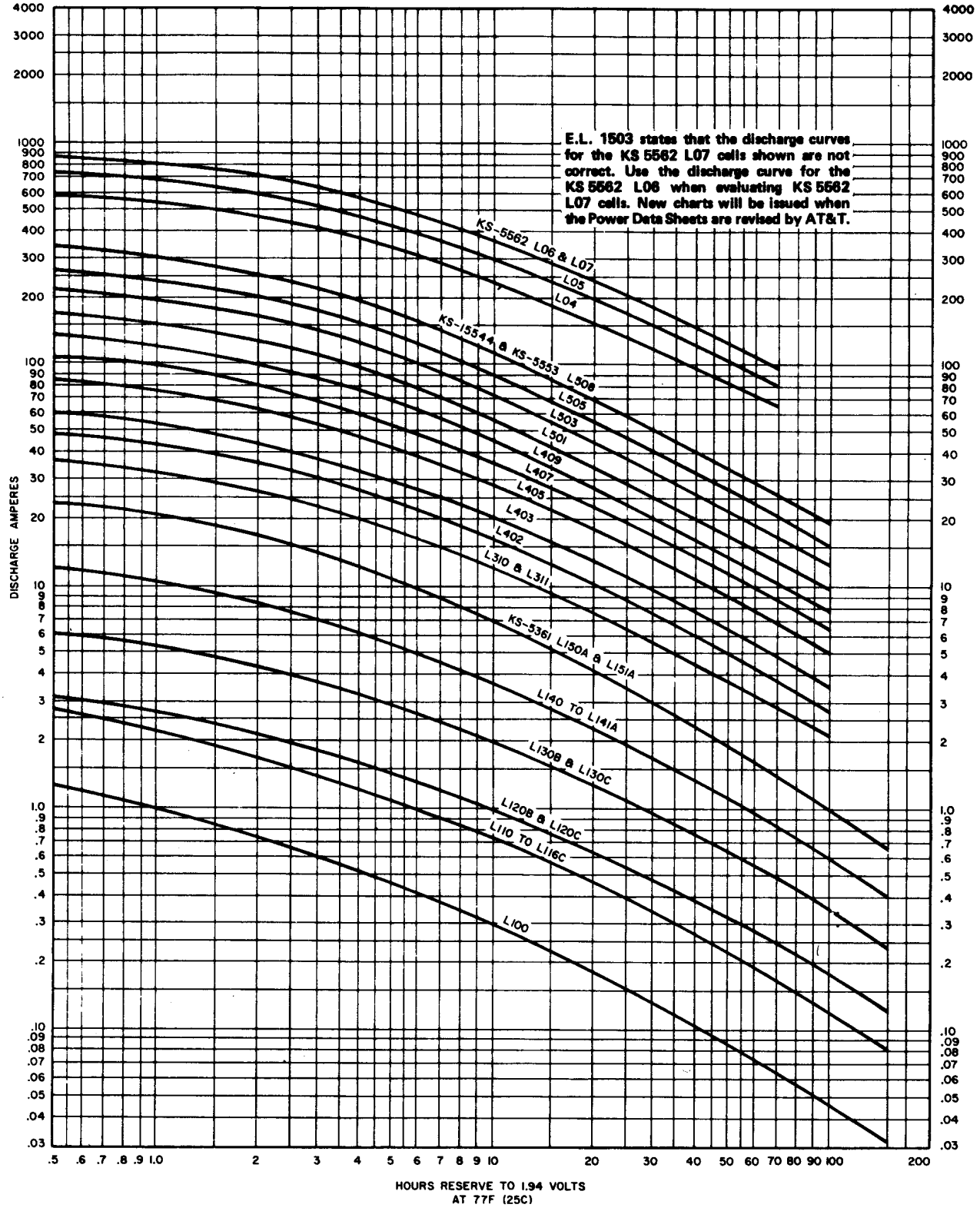


EXHIBIT 13
BATTERY DISCHARGE CURVES TO 1.94 VOLTS PER CELL

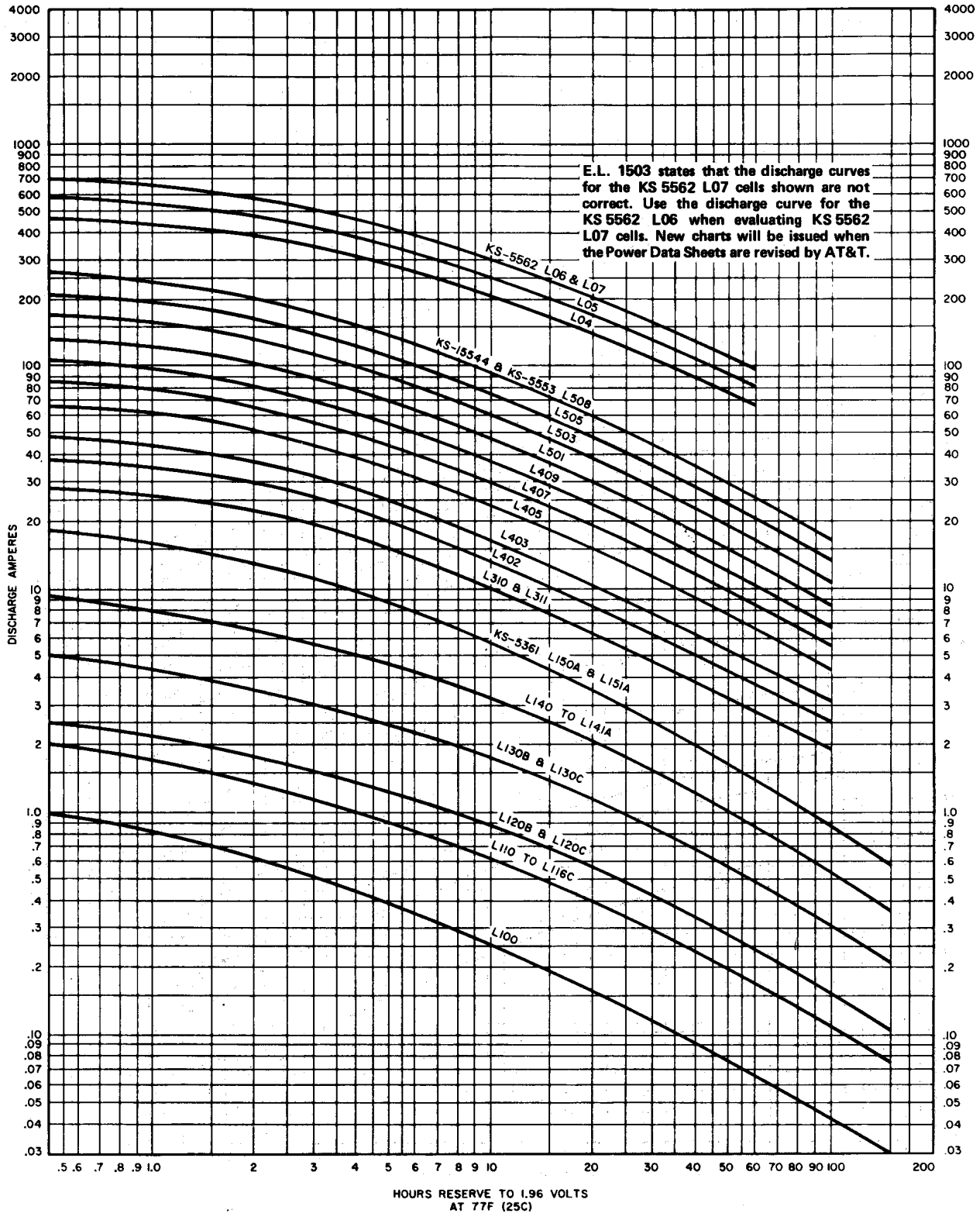


EXHIBIT 14
BATTERY DISCHARGE CURVES TO 1.96 VOLTS PER CELL

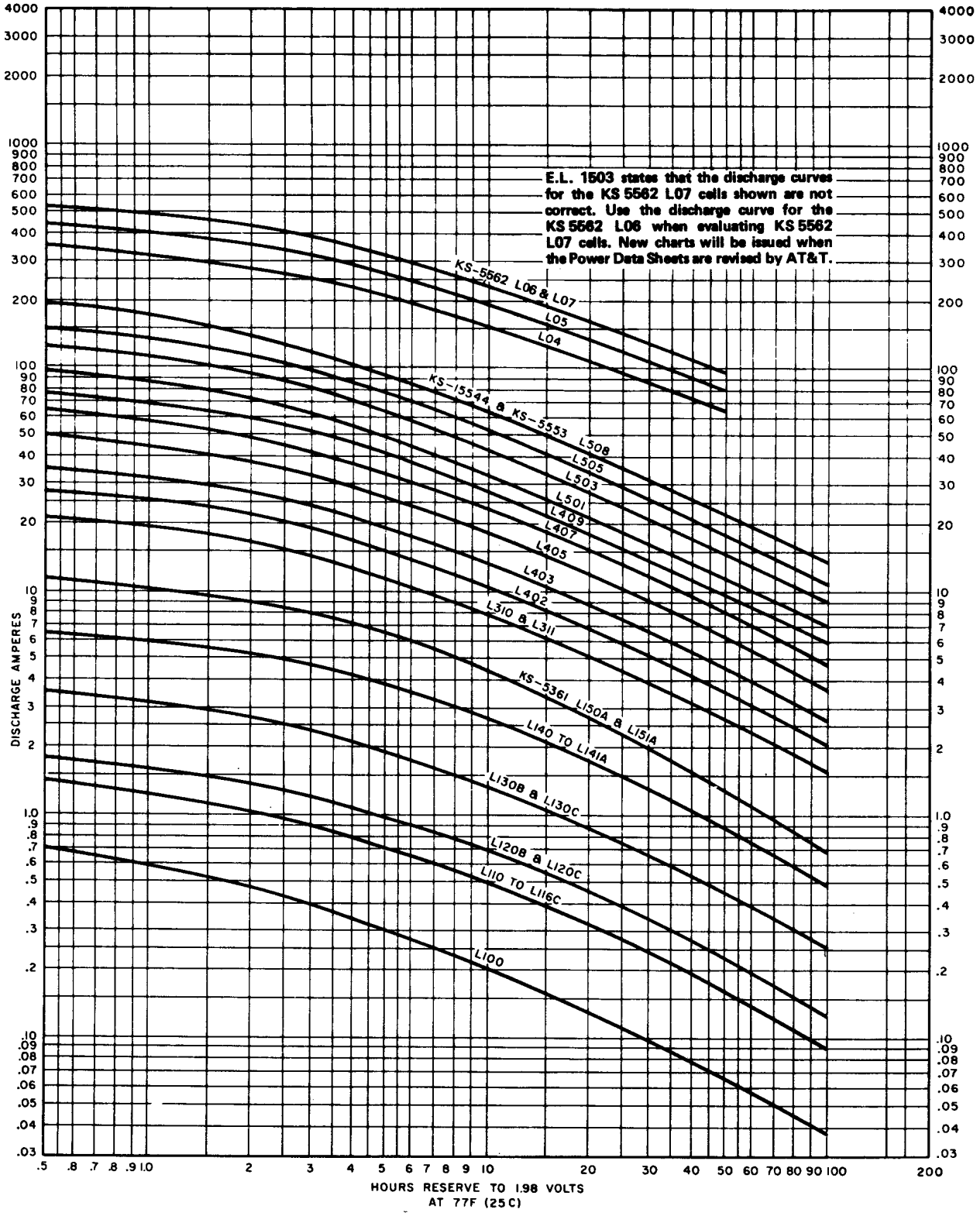
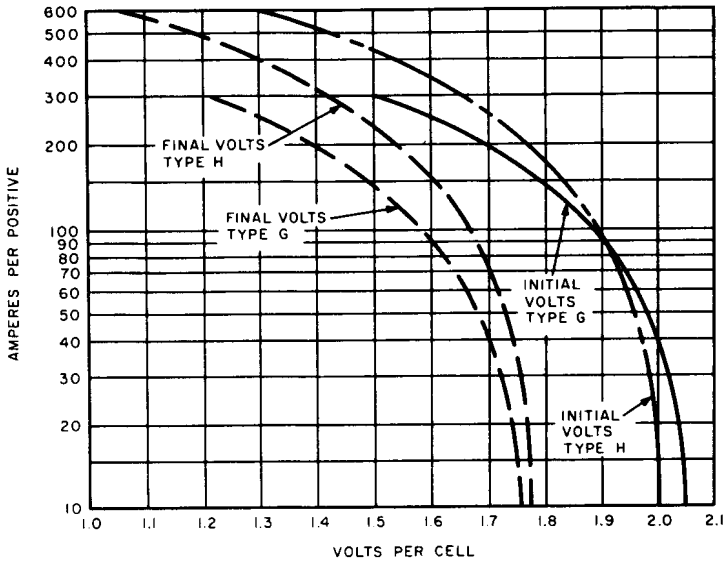


EXHIBIT 15
BATTERY DISCHARGE CURVES TO 1.98 VOLTS PER CELL



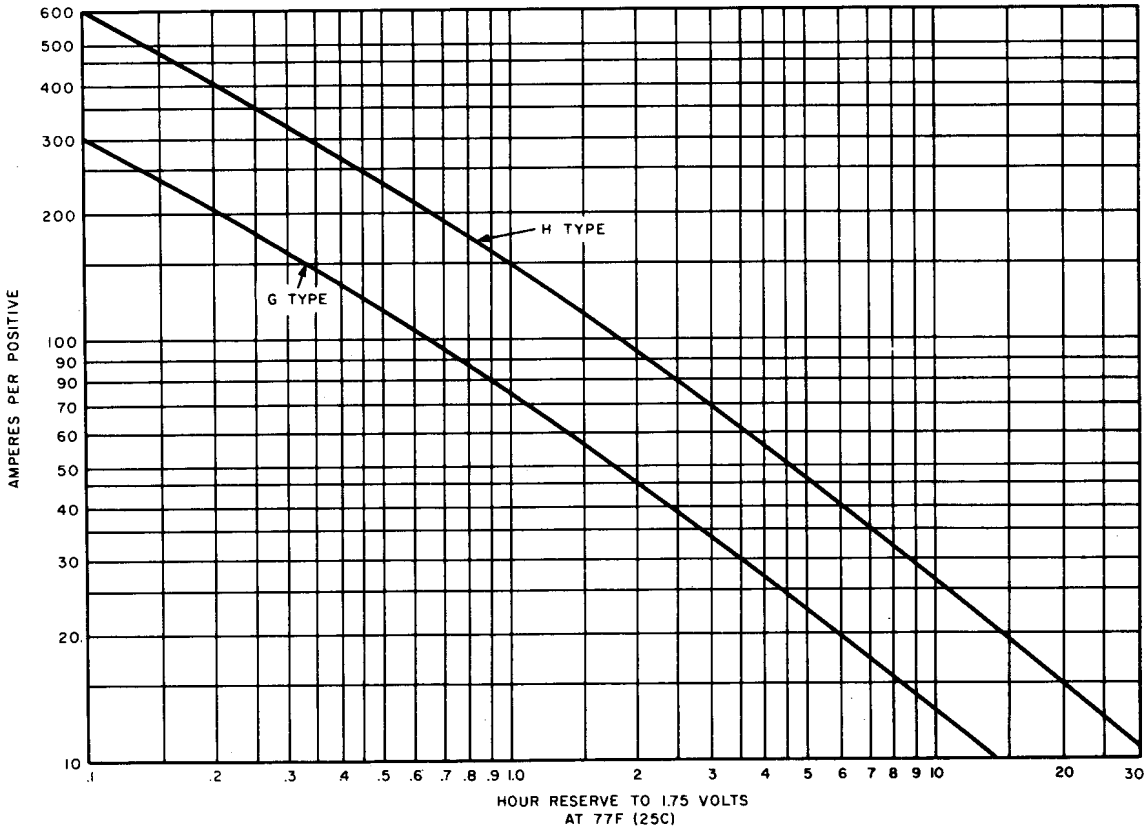


EXHIBIT 16
PASTED TYPES G AND H BATTERIES DISCHARGE CURVES