ALTERNATE STORAGE BATTERIES — LEAD ACID
ENGINE STARTING AND CONTROL
DESCRIPTION, REQUIREMENTS, AND PROCEDURES

1. GENERAL

1.01 This appendix provides PTEL 2046 information, which rated certain engine alternator starting and control batteries manufactured by AC-Delco, C&D Batteries and Prestolite Batteries as an alternate ***STANDARD*** for use in Pacific Telephone and Nevada Bell.

1.02 (Reserved for future use)

1.03 Lead acid (KS-15577) and Nickel-Cadmium (KS-15578) batteries have been used for starting and controlling KS engine alternator sets throughout the Bell System. Many of the original batteries have been Manufacture Discontinued. Table A provides a cross-reference of engine alternator set KS designations, STANDARD KS battery applications and alternate STANDARD commercial equivalents. The commercial equivalents include the group 7D and 8D heavy duty truck type batteries, 8 volt monobloc marine or railroad type batteries and the new 12 volt Freedom Batteries, referred to in this practice as maintenance free type batteries. All are equipped with flame arrester venting.

1.04 Table B provides a cross-reference of direct replacement batteries for STANDARD KS to alternate STANDARD commercial equivalents.

1.05 ***Battery Records:*** Maintain complete battery records. Engineering Complaints on performance cannot be accurately analyzed and satisfactorily settled unless they are accompanied by records which provide a thorough history of cells in question, including complete nameplate information.

1.06 For more information on lead acid batteries used in telephone and telegraph offices, which also applies generally to lead acid start and control batteries, refer to Section 157-601-701. For Nickel-Cadmium batteries, refer to Section 157-631-101.

1.07 ***Neutralizing Electrolyte:*** Electrolyte spilled on equipment should be neutralized with a soda solution and rinsed with water (see Section 157-601-701).

1.08 ***First Aid for Electrolyte in Eyes or on Skin:*** In case of electrolyte splashes, use of the KS-21527L1 eye wash kit is recommended. However, if the KS-21527 kit is not available, use the following procedure. Remove electrolyte splashed on the skin or in the eyes ***immediately*** by flushing the affected area with large amounts of plain tap water. In case of electrolyte in the eye, pour water into the inner corner of the eye and allow at least one quart of water to run over the eye and under the eyelid. A drinking fountain near at hand may be utilized for this purpose. Eye injuries should be placed under the treatment of a physician, preferably an eye specialist, as soon as possible.

Danger 1: Remove electrolyte splashes on skin or in eyes immediately.

Danger 2: Never create sparks, including those from static electricity, and avoid the use of an open flame near batteries since the gas is explosive when sufficiently concentrated.

2. DESCRIPTION

2.01 Group 1-1 is a small 8 volt 4-cell monobloc marine type battery designed for operation with small stationary engines. They are furnished with one-hole bolt-on lugs, flame arrester vent caps and 1.265 specific gravity electrolyte. Batteries with 1.265 (high) specific gravity should be float charged at 2.25 volts per cell.

2.02 Groups 1-2 to 1-5 are 8 volt 4-cell monobloc construction, designed specifically for starting stationary engines. They are similar to the KS batteries, constructed for long life and reliability. They are furnished with two-hole bolt-on lugs, flame arrester vent caps and 1.210 specific gravity electrolyte. Batteries with 1.210 (low) specific gravity should be float charged at 2.17 volts per cell.

2.03 Group 2-1 is a small 12 volt light utility battery that will furnish standby engine control power. They are furnished with one-hole bolt-on lugs, flame arrester vents and 1.265 (high) specific gravity electrolyte.

2.04 Groups 2-2 and 2-3 are 6 and 12 volt standard commercial 7D and 8D diesel starting batteries. They are furnished with one-hole bolt-on lugs, flame arrester vents and 1.265 (high) specific gravity electrolyte.

2.05 Group 3-1 is a small 12 volt maintenance free sealed battery for standby engine control power, to be used in coordination with Group 3-2 and 3-3 start batteries. They are furnished with SAE top posts, built-in flame arrester and built-in hydrometer.

2.06 Groups 3-2 and 3-3 are 12 volt high power, heavy duty maintenance free sealed truck starting batteries. They are furnished with stainless steel threaded terminal studs, built-in flame arrester and built-in hydrometer. Group 3 batteries should be floated at 2.25 volts per cell.

2.07 Group 4-1 is a small 6 volt glass jar lead acid battery similar to the KS 5538-L19 designed for standby engine control power. They are furnished with one-hole bolt-on lugs, flame arrester caps and 1.210 (low) specific gravity electrolyte. They should be used in coordination with Group 1-2 to 1-5 start batteries.

2.08 Refer to Table C for additional descriptive details of battery size, weight and capacity.

3. REQUIREMENTS AND PROCEDURES

3.01 ***Periodic Check Intervals:*** Table D contains the intervals of the periodic checks which must be made. Engine starting batteries shall be considered to be in the same category as emergency cells.

3.02 Maintenance free batteries have no filler caps, therefore, water ***cannot*** be added to the cells. The batteries are sealed, except for small vent holes in the cover. The vents allow what small amount of gasses that are produced in the batteries to escape. The special chemical composition inside the batteries reduces gassing to a very small amount at normal charging voltages and greatly reduces the possibility of overcharging damage.

3.03 ***Float Voltage:*** Lead acid engine starting and control batteries should be maintained at the proper float voltage as specified in Table E. Use the Data Precision Model 248, Digital Multimeter (or equivalent) for measuring battery voltage. Float voltage readings should be made before the engine is started. See Section 157-601-301 for data on manually controlled float and for more specific information on floating lead acid batteries.

3.04 ***Specific Gravity:*** The specific gravity of low gravity cells at electrolyte temperature of 77°F shall be 1.210 ± 0.015. Use the KS-5499, L1305 syringe-type hydrometer. Specific gravity readings shall be read every 6 months and shall be taken before, rather than after, water additions. The C and D Hydrometer, Part No. PL-505, shall be used for checking batteries which contain high (1.265 ± 0.015) gravity, these are of the automotive type. Maintenance free batteries are tested monthly by observing the built-in hydrometer.

3.05 ***Built-in Hydrometer:*** The maintenance free battery has a special temperature compensated hydrometer, built into the cover of each battery, to show at a glance the battery's state-of-charge.

(a) The hydrometer has a green ball within a cage which is attached to a clear plastic rod (Fig. 1). The green ball will float at a predetermined specific gravity of the elecrolyte that represents a 65% state-of-charge. When the green ball floats, it rises within the cage and positions itself under the rod. Visually a green dot then shows in the center of the hydrometer viewer, located on top surface of the battery.

(b) The built-in hydrometer provides a guide for battery testing and charging. In testing, the green dot means the battery is charged and ready for service. If the green dot is not visible (dark) it means the battery must be charged before being put into service.

Note: Do not test or charge a battery having a clear or light-yellow indication; replace the battery.

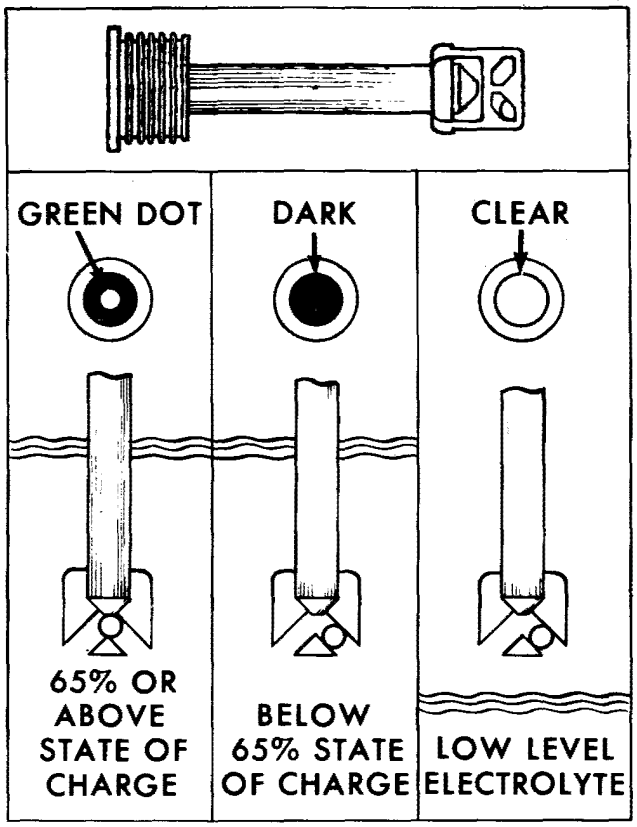

Fig. 1 Hydrometer Operation

3.06 *Electrolyte Level:* The electrolyte level of lead acid batteries shall be maintained between the top of the separators and the bottom of the cover by the addition of distilled water or water approved for storage battery use. Some batteries have high and low level indicator lines and the electrolyte level shall be maintained between these lines. When the actual electrolyte temperature is below 50°F, do not raise the electrolyte level appreciably above minimum level. This helps to prevent an overflow on charge and electrolyte creepage difficulties. The electrolyte level shall be checked every 6 months. The maintenance free battery can be checked monthly by looking at the built-in hydrometer visual indicator. If the electrolyte level is low replace the maintenance free battery.

3.07 *Battery Connections:* The contact surface of all connections should be scraped clean at time of installation and coated lightly with R-3266 NO-OX-ID A compound.

Warning: At no time shall battery intercell connectors be filed, scraped, abraded, or brushed with a wire brush as this will remove their protective coating.

If corrosion appears on connection contact surfaces, it should be scraped off and the surface washed with a solution of bicarbonate of soda (baking soda) in water (2 tablespoons of soda to a pint of water). The contact surfaces should then be wiped with a clean cloth dampened with clean water and coated lightly with R-3266 NO-OX-ID A compound. All connections shall be checked periodically to see that they are tight and free of corrosion.

3.08 *Containers and Covers:* Containers and covers shall be free from cracks, leaks, and seepage of electrolyte. They should be inspected every 3 months and cleaned as necessary. See Sections 157-601-701 and 157-601-703 for more complete information.

3.09 *Seals:* Post seals and seals between covers and containers shall be intact and free from electrolyte.

3.10 *Antiexplosion Features:* The antiexplosion feature of cells shall be dry, clean, and undamaged. Ceramic domes of the screw type shall be screwed down to a snug fit.

Gauge by eye and feel.

(a) This battery, as with any battery, could have an explosion potential due to abusive treatment. It is the purpose of the flame arrester vent cap to prevent external sparks from entering the cell(s) and to vent, at a safe rate, the explosive gases that are generated within the cell(s) under normal charging conditions.

(b) The maintenance free sealed batteries have built-in vent holes and a special chemical composition inside the battery to reduce gassing. Flame arrester vent caps are supplied with the other batteries. Any vent cap which has been broken should be replaced at once. Replacement vent caps should be obtained from the appropriate supplier.

Danger: Do not allow the gas vents to become clogged as explosion of the battery may result. Overfilling and overcharging may contribute to plugging of vents. Refer to Section 157-601-701.

3.11 ***Initial Charge and Boost Charge:***

(a) The battery should have been received fully charged, if not, it should be given an initial charge at installation in accordance with Section 157-601-201. If the battery is not to be installed or connected to a suitable float or charging source for 3 months, it shall be given a special initial charge in accordance with Section 157-601-201.

(b) The battery should be given a boost charge whenever the battery fails to start the engine or there is other evidence of undercharge that cannot be corrected by normal float charges. For boost charge instructions see Section 157-601-701. A cell or battery that will not retain a charge and must have frequent special charges should be replaced. If equipment is not available with boost charge capabilities, the battery can be boost charged by a reputable garage or battery service station, but the attendant should be instructed that the battery is of the low specific gravity type.

Note: Many rectifiers such as the J87249B (Section 169-649-301) are not capable of boost charging batteries.

3.12 ***Discharge Capacity Test:*** Low rate capacity is not an absolute indicator of the ability of an engine starting battery to start its associated engine. Only the starting battery's high rate capacity, which bears little resemblance to the 5- or 8-hour capacity rate, is of importance in engine starting. A valid check for a battery's high rate capacity is its ability to start the engine. The low rate capacity is important in the case of control batteries. If battery conditions indicate that a capacity test is needed, contact the Equipment Power Maintenance Staff.

TABLE A

STANDBY ENGINE BATTERIES

ENGINE APPLICATION			STANDARD BATTERY		ALTERNATE STANDARD COMMERCIAL EQUIVALENT							
					HEAVY DUTY				MAINTENANCE FREE			
KS SPEC	SIZE	SYSTEM VOLTAGE	KS-15578	KS-15577	*** GROUP	TOTAL NO.	** S/P	CABLE LIST+	*** GROUP	TOTAL NO.	** S/P	CABLE LIST++
* KS 5525-01	10-25KW	6	L3W	*L3	2-2	1	—	2A	—	—	—	—
* KS 5525-01	50-70KW	12	L2W	*L2	2-3	1	—	3B	3-3	1	—	1
* KS 5574-01	20-60KW	12	L5W	*L5	2-3	1	—	3B	3-2	2	1/2	2
* KS 5666	10KW	12	L2W	*L2	2-3	1	—	3B	3-3	1	—	1
* KS 5667-01	2 8,4KW	12	L2W	*L2	2-3	1	—	3B	3-3	1	—	1
* KS 15884	30-45KW	12	L5W	*L5	2-3	1	—	3B	3-2	2	1/2	2
* KS 15884	60-100KW	12	L6W	*L5	2-3	1	—	3B	3-2	2	1/2	2
KS 22344	24KW	12	L2W	#8	2-3	1	—	3B	3-2	1	—	1
* KS 5667-01	5KW	24	L17W	*L11	2-3	2	2/1	3C	3-3	2	2/1	3
* KS 15992	750KWT	24	L12W	L14	2-3	4	2/2	3D	3-3	6	2/3	5
KS 19583	30KW	24	L13W	L15	2-3	2	2/1	3E	3-3	4	2/2	4
KS 19584	45KW	24	L13W	L15	2-3	2	2/1	3E	3-3	4	2/2	4
KS 19585	75KW	24	L13W	L15	2-3	2	2/1	3E	3-3	4	2/2	4
KS 19586	115KW	24	L13W	L15	2-3	2	2/1	3E	3-3	4	2/2	4
* KS 19587	115KW	24	L13W	L15	2-3	2	2/1	3E	3-3	4	2/2	4
* KS 19587 >40°	115KW	24	L14W	*L16	2-3	2	2/1	3E	3-3	4	2/3	4
* KS 19896	200KWT	24	L15W	L17	2-3	2	2/1	3E	3-2	4	2/2	4
KS 20460	JFS	24	L17W	—	2-3	2	2/1	3E	3-2	4	2/2	4
KS 20523	30KW	24	L13W	L15	2-3	2	2/1	3E	3-3	4	2/2	4
KS 20524	45KW	24	L13W	L15	2-3	2	2/1	3E	3-3	4	2/2	4
KS 20525	75KW	24	L13W	L15	2-3	2	2/1	3E	3-3	4	2/2	4
KS 20526	115KW	24	L13W	L15	2-3	2	2/1	3E	3-3	4	2/2	4
* KS 20527	115KW	24	L13W	L15	2-3	2	2/1	3E	3-3	4	2/2	4
* KS 20527 >40°	115KW	24	L14W	*L16	2-3	2	2/1	3E	3-3	4	2/3	4
* KS 20542	200KWT	24	L15W	L17	2-3	2	2/1	3E	3-2	4	2/2	4
KS 21264	500KWT	24	L14W	#1	2-3	2	2/1	3E	3-2	4	2/2	4
KS 21501	900KWT	24	L12W	#2	2-3	4	2/2	3E	3-3	6	2/3	5
* KS 21962	250KW	24	L15W	—	2-3	2	2/1	3E	3-2	4	2/2	4

TABLE A (Contd)

STANDBY ENGINE BATTERIES

ENGINE APPLICATION			STANDARD BATTERY		ALTERNATE STANDARD COMMERCIAL EQUIVALENT							
					HEAVY DUTY				MAINTENANCE FREE			
KS SPEC	SIZE	SYSTEM VOLTAGE	KS-15578	KS-15577	*** GROUP	TOTAL NO.	** S/P	CABLE LIST+	*** GROUP	TOTAL NO.	** S/P	CABLE LIST++
KS 19583 to 6	CONTROL	24	KB1	KS5538 L19	2-1	2	2/1	IF	3-1	2	2/1	3A
KS 19587	CONTROL	24	MDP2		2-1	2	2/1	IF	3-1	2	2/1	3A
*KS 19896	CONTROL	24	L16W		2-1	2	2/1	IF	3-1	2	2/1	3A
KS 20460	CONTROL	24	L18W		2-3	2	2/1	3E	3-2	2	2/1	3
KS 20523 to 7	CONTROL	24	L16W		2-1	2	2/1	IF	3-1	2	2/1	3A
*KS 20542	CONTROL	24	L16W	#3	2-1	2	2/1	IF	3-1	2	2/1	3A
KS 21264	CONTROL	24	L16W	#4	2-1	2	2/1	IF	3-1	2	2/1	3A
KS 21501	CONTROL	24	L16W	#5	2-1	2	2/1	IF	3-1	2	2/1	3A
*KS 21879	CONTROL	24	L16W	#6	2-1	2	2/1	IF	3-1	2	2/1	3A
*KS 21962	CONTROL	24	L16W	—	2-1	2	2/1	IF	3-1	2	2/1	3A
*KS 5636	20KW	32	L7W	L6	1-4	4	4/1	4G	—			
*KS 5636	30-60KW	32	L7W	L7	1-4	4	4/1	4G	—			
*KS 5665	150KW	32	L8W	*L8	1-4	4	4/1	4G	—			
*KS 5665	200KW	32	L9W	L9	1-4	4	4/1	4G	—			
*KS 5665	300KW	32	L10W	*L10	1-5	4	4/1	4G	—			
*KS 5667	5-8KW	32	L1W	*L1	1-1	4	4/1	1G	—			
*KS 5750	20-60KW	32	L7W	L7	1-4	4	4/1	4G	—			
*KS 15521	20KW	32	L7W	L6	1-4	4	4/1	4G	—			
*KS 15622	120-170KW	32	L8W	*L8	1-4	4	4/1	4G	—			
*KS 15717	10KW	32	—	L12	1-4	4	4/1	4G	—			
*KS 15890	30-100KW	32	L7W	L7	1-4	4	4/1	4G	—			
KS 15929	225KW	32	L8W	*L8	1-4	4	4/1	4G	—			
*KS 15777	500KW	48	L11W	*L13	2-3	8	4/2	3D1	3-3	12	4/3	7
*KS 15899	350KW	48	L11W	*L13	2-3	8	4/2	3D1	3-3	12	4/3	7
*KS 15954	350KW	48	L11W	*L13	2-3	8	4/2	3D1	3-3	12	4/3	7
KS 21879	1500KWT	48	2-L11W	#7	1-5	6	6/1	5G1	3-3	16	4/4	8

Notes:
- * Manufacture Discontinued
- ** Series/Parallel Configuration
- *** See Table B
- + See Table C
- ++ See Table D

KS5538 L19 = 4-KS5361 L116C
#1 — Exide Plan D-8D-295
#2 — Delco 761 (8D)
#3 — Exide AN3150-2
#4 — Willard UIL-18
#5 — Delco 349 (UI)
#6 — C&D 3AC10
#7 — C&D 4CJCSD-19
#8 — Delco 1200

TABLE B

ENGINE START AND CONTROL BATTERIES

LEAD ACID KS COMMERCIAL EQUIVALENTS

KS 15577 LIST NO.	VOLTS	GROUP	NO.	MFR.-MODEL	SPECIFIC GRAVITY
1 -	32	1-1	4	DELCO 801	1.265
2,5	12	2-3	1	PRESTOLITE 8908X	1.265
3	6	2-2	1	PRESTOLITE 7907X	1.265
6,7,8,9	32	1-4	4	C&D 4CJCSD-13	1.210
10	32	1-5	4	C&D 4CJCSD-19	1.210
11	24	2-3	2	PRESTOLITE 8908X	1.265
12	32	1-4	4	C&D 4CJCSD-13	1.210
13	48	1-4	6	C&D 4CJCSD-13	1.210
14	24	1-5	3	C&D 4CJCSD-19	1.210
15,16,17	24	1-4	3	C&D 4CJCSD-13	1.210
KS 5538 L19	24	4-1	4	C&D 3AC10	1.210

Note: Use control battery C&D 3AC10 with low gravity start batteries only. Use charge float voltage of 2.25 ±:02 volts/cell on 1.265 specific gravity batteries.

TABLE C

ENGINE START AND CONTROL BATTERIES

ALTERNATE STANDARD COMMERCIAL EQUIVALENTS

GROUP	MFR-MODEL#	VOLTS	TERM	AMP HRS	*** CCA	MAX. DIM. L	W	IN. H	WGT. LBS.
1-1	DELCO 801	8	B	110*	475	13.9 X	7.1 X	9.1	37
1-2	C&D 4MHCSD-17	8	C	168**	880	27.6 X	7.5 X	11.3	168
1-3	C&D 4MHCSD-23	8	C	231**	1210	26.9 X	10 X	11.3	232
1-4	C&D 4CJCSD-13	8	C	280**	1500	23.5 X	7.9 X	17.3	216
1-5	C&D 4CJCSD-19	8	C	420**	2250	28.4 X	11.2 X	17.7	485
2-1	PRESTOLITE 9948X	12	B	32*	200	7.7 X	5.1 X	7.2	19
2-2	PRESTOLITE 790X	6	A/B	204*	880	16.3 X	7.1 X	9.2	71
2-3	PRESTOLITE 8908X	12	A/B	220*	880	20.8 X	11 X	9.8	146
3-1	DELCO 55-40	12	A	50*	280	9.4 X	6.8 X	8.3	30
3-2	DELCO 1200	12	F	85*	475	13.0 X	6.8 X	9.4	53
3-3	DELCO 1110	12	F	110*	625	13.0 X	6.8 X	9.4	58
4-1	C&D 3AC10	6	B	10**	—	7.6 X	4.3 X	8.5	14

TERM (Terminals) — Type A — Standard SAE Post
Type B — 1 bolt 11/32"
Type C — 2 bolt 3/8", 1-3/4" apart
Type F — Top threaded Stud

* AMP HRS — 20 HOUR RATE
** AMP HRS — 8 HOUR RATE TO 1.75 VOLTS/CELL
*** COLD CRANKING AMPS — 30 SEC. TO 1.2 VOLTS/CELL

TABLE D

INTERVAL CHART FOR LEAD ACID

ENGINE STARTING & CONTROL BATTERIES

DESCRIPTION OF OPERATION	INTERVAL	REFERENCE PARAGRAPH
Battery float voltage	1 month	3.03
Specific gravity reading	6 months	3.04
Electrolyte level	6 months	3.06
Battery connections	3 months	3.07
Clean and Inspect	3 months	3.08

Note: Maintenance free batteries should have a specific gravity and electrolyte level visual check each month utilizing the built-in hydrometer.

TABLE E

FLOAT VOLTAGE RANGES OF LEAD ACID

ENGINE STARTING & CONTROL BATTERIES

BATTERY VOLTAGE	NUMBER OF CELLS	BATTERY FLOAT VOLTAGE RANGE	
		LOW GRAVITY	HIGH GRAVITY
6	3	6.4 thru 6.6	6.6 thru 6.8
12	6	12.8 thru 13.2	13.3 thru 13.7
24	12	25.8 thru 26.3	26.8 thru 27.3
32	16	34.4 thru 35.1	35.7 thru 36.4
48	24	51.6 thru 52.7	53.5 thru 54.6