EDISON PUBLICATIONS

104. Edison Storage Battery for Railway Signaling
106. Edison Storage Batteries for Self-Propelled Railway Cars.
118. Train Lighting Batteries, Edison.
300. Edison Electric Safety Mine Lamp.
400. Edison Storage Battery in Marine Service.
500. Edison Storage Battery for Electric Commercial Vehicles.
600. Edison Storage Batteries for Industrial Transportation.
608. Edison Storage Batteries for Use in Storage Battery Locomotives.
610. Edison Storage Batteries for Lumber Transportation.
772. Edison Storage Batteries for Lighting Gasoline Trucks.
804. The Edison Alkaline Storage Battery (Monograph).
819. Edison Portable Lighting Outfits.
820. Edison Storage Batteries for Meter Testing.
828. Edison Alkaline Storage Batteries and Some of Their Applications. (Folder.)
831. Edison Storage Batteries for Electric Time Clocks and Time Recording Systems.
850. Edison Storage Batteries, Types of.

Any of the above sent on application to

EDISON STORAGE BATTERY COMPANY

851 LAKESIDE AVE., ORANGE, N. J.

General Information and Instructions

For the Operation and Care

of the

EDISON ALKALINE STORAGE BATTERY

BULLETIN
850 X

EDISON STORAGE BATTERY CO.
ORANGE, N. J.

General Information and Instructions for the Operation and Care of the Edison Alkaline Storage Battery

Types
A-B-G
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BULLETIN 850X

Printed in U. S. A.

EDISON STORAGE BATTERY CO.
ORANGE, N. J.

S. B. 850X—5M-12-J

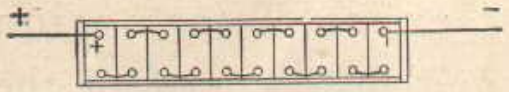


Diagram of a series battery connection, 10 cells are shown so connected. If the voltage between the positive and negative pole of each cell is 1.2 volts, the total battery voltage will be equal to the product of the voltage of a single cell multiplied by the number of cells in the battery, or 12 volts in this case. The current, or amperage, is equal to the value for one cell.

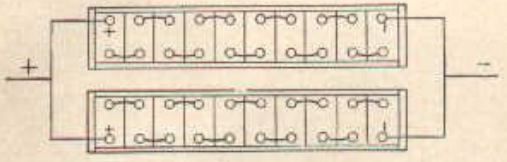


Diagram of a series-parallel battery connection. Two sets of cells are connected in series and the two batteries thus formed are connected in parallel. The total voltage is equal to the voltage of one cell multiplied by the number of cells in one battery. The amperage, or current, is equal to twice the normal value of one cell.

Diagram of a series-parallel battery connection similar to above, but with another battery added. The total voltage is equal to the voltage of one battery, but the amperage, or current, is equal to three times the normal value of one cell.

INSPECTION ON RECEIPT

Edison batteries are shipped either charged or discharged. FOLLOW INSTRUCTIONS on the RED or GREEN LABEL in envelope in the packing case.

CONNECTIONS

The positive pole of an Edison cell is designated by a red bushing around the pole and a plus + mark stamped on the cell cover.

The negative pole is designated by a black bushing around the pole; no designating mark on the cover.

Solid wire *Connectors* are used between cells in a tray. Flexible rubber-covered stranded wire *Jumpers* are used to connect one tray of cells to another.

On the ends of connectors and jumpers are steel lugs tapered to correspond to the taper of the steel poles. A hexagon nut holds the lugs in place.

Carefully *clean* the tapered surfaces of the poles and inside of the lugs before connecting.

For series operation, connect the *positive* pole of one cell to the *negative* pole of the next cell in the series. If the cells are in more than one tray, connect the *positive terminal* of one tray to the *negative terminal* of the next tray in the series. Cells are usually shipped in trays, all cells in each tray being connected in series, so that it is only necessary to connect tray terminals, as above, to complete the battery.

Diagrams on page 2 illustrate connections for parallel or multiple operation.

Maximum electrical contact demands that all electrical connections must be *tight* and the contacting surfaces between the lugs and poles must be *clean*. A loose or dirty contact will cause excessive heating and may be detected by feeling the connectors after the current has been passing for some time.

To disconnect, first take nut off of each pole. A disconnecting jack is shipped with each battery. This jack is designed to straddle the pole and engage the lug and by means of a screw pulls the lug loose, after which it may be taken off by hand.

COMPARTMENTS

Batteries installed in compartments should be held securely. The compartments should be lined with wood and constructed to afford ample ventilation, good drainage and ease in cleaning.

Except in Railway Car Lighting service, where compartments are made according to M. C. B. standards, and in services such as Ignition and Lighting where the batteries are assembled in steel boxes which permit of all advantages as outlined in this section, slots are recommended in the bottom of battery compartments one inch wide and the full length of each tray, directly under each tray when bottomless trays are used, and between trays when trays with bottoms are used. Openings should be provided in the sides of compartments, above the highest point of the battery. The total area of these openings should be slightly greater than the total area of the bottom openings. Locate the openings to keep out as much dirt and water as possible. If battery is used out of doors, these openings should be closed during cold winter weather.

For stationary batteries not installed in a compartment, it is recommended that batteries be placed in a dry room on a rack or shelf, with about one inch space around each tray, and with at least six inches of head room, to permit ample ventilation and sufficient space for proper cleaning and filling the cells.

CHARGING

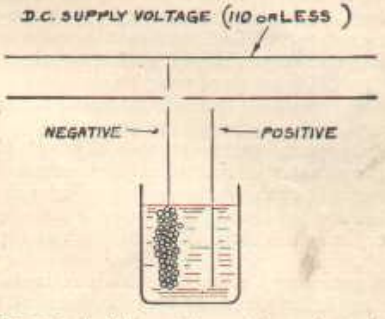
Direct current must be used to charge a storage battery. If alternating current only is available, it must be converted into direct current by a motor-generator set, mercury arc rectifier, or other form of current rectifier.

The charging source should have a voltage equal to 1.85 times the number of cells in series—see page 16.

Before starting to charge, open the covers of the compartment, if the battery is in one. Temperatures greater than 115° Fahrenheit will shorten the life of a battery. If temperature of solution exceeds 115° Fahrenheit, allow the cells to cool. Determine height of solution—see page 11. Solution should be at proper level as given in Electrical Data, pages 15 and 16. If not, bring it to proper height as instructed under Watering, page 9.

In connecting battery in charging circuit, always connect positive terminal of battery to positive side of the line, negative terminal of battery to negative side of the line.

If a suitable instrument is not at hand, the positive and negative sides of the line may be determined, on circuits of 110 volts or less, as suggested in sketch below.



Showing method of determining positive and negative sides of a circuit by placing leads in a pail of water containing a little salt. Bubbles will collect on the negative side. Keep leads one inch apart.

This can also be determined by placing the wires about ½ inch apart on a piece of blue litmus paper that is wet. A red mark is left where the positive wire touched the paper.

CONSTANT CURRENT CHARGE

Specific gravity readings are of no value in determining the state of charge or discharge of an Edison battery, because the specific gravity of the solution does not change during charge or discharge to any appreciable extent. Such small changes, as may be noted, are entirely due to extreme low or high temperatures, or to the loss of water from the electrolyte caused by either evaporation or electrolysis in operating the cell.

If the extent of the previous discharge is unknown, charge at the normal rate until the volt-

meter reading has remained constant for thirty minutes at a point between 1.80 and 1.90 volts per cell, according to temperature and electrolyte conditions.

If battery is totally discharged, recharge at the normal rate for the proper number of hours. Both rate and hours are given under Electrical Data on pages 15 and 16. If battery is one-half discharged, recharge at normal rate for one-half the time, etc.

When an ampere-hour meter is used it should be set to operate 20% slow on charge. Meter will then show the correct amount of charge to put in the battery and will be 25 per cent. in excess of the preceding discharge. Do not confuse per cent. slow on charge with per cent. overcharge.

With the constant current method of charging, the rheostat should be adjusted, as often as necessary, to keep the current at normal rate. At each adjustment, set the current a few amperes high, so that it will not drop much below normal.

If necessary, and if full capacity is not required, a battery may be taken off charge at any time and used.

In an emergency, when time for a normal charge is not available, charging may be done at higher rates than normal, provided there is no frothing and the temperature does not rise above 115° F.

TAPER-CURRENT CHARGING

Before installing this method, send details of operation to the Engineering Department, Edison Storage Battery Company, Orange, N. J., for recommendations or approval.

OVERCHARGING

Before starting an overcharge, bring the solution to the proper level (see Electrical Data, pages 15 and 16) and completely discharge the battery. Tests for solution height (see page 11) should be made before and after overcharge, but not while the battery is being charged. Charge for 12 hours the types that under normal conditions are charged 7 hours, and charge for 8 hours those types that are normally charged 4¼ hours.

It is a well-known fact that the capacity of Edison batteries increase with use. Best results are obtained from a new battery by overcharging it every two weeks for the first two months and every two months thereafter for six months. Whenever the solution is renewed, the battery should be given an overcharge. If the battery is seldom totally discharged in regular service, it is advisable, at times, to give it an overcharge.

Batteries, which have become sluggish through lack of work, may be restored to normal by overcharging.

BOOSTING

The battery may be boosted at high rates during brief periods of idleness, thereby materially adding to the charge, provided the temperature of the solution in the cells near the center, or warmest part, of the battery does not rise above 115° Fahrenheit. The following table gives figures that may be used under average conditions, but values that will not cause excessive heating must be determined in each case by experience:

5 minutes at five times normal rate.
15 minutes at four times normal rate.
30 minutes at three times normal rate.
60 minutes at two times normal rate.

Frothing at the filler opening is an indication that the boosting has been carried too far (if the solution is at the proper height) and the high rate should be discontinued at once.

LOW RATE CHARGING

Except in cases where the battery has been discharged at a very low rate, it should never be charged at less than normal rate. Low rate charging does no permanent injury, but best results are obtained from charging at normal rate.

CLEANING

The cells, trays and battery compartment must be kept dry, and care must be taken that dirt and other foreign substances do not collect at the bottom or between the cells.

The tops of the cells should be given a light coat

of liquid vaseline. It should be applied to the cover of the cell, and to the outside of the filling aperture. The vaseline can be best applied with a small brush. Care should be taken that none of the vaseline gets inside of the lugs or connectors, or on the pole of cells.

Thorough cleaning cannot be done without removing the battery from the compartment. Under average conditions, such cleaning will be necessary about once in two months. A wet steam jet, or even an air blast, will be found most satisfactory for the purpose, but must not be used on cells while in the compartments. We have found that a pressure of 70 pounds with a one (1) inch rubber steam hose about ten (10) feet long into which has been inserted a piece of iron pipe about twelve (12) inches long with an orifice ⅛ inch in diameter will give wet steam with a velocity to satisfactorily clean the battery. (This orifice can be made by plugging one end of an iron pipe and drilling out with a ⅛-inch drill.) When removing incrustations from the tops of cells, do not allow them to fall between or into the cells. Before reassembling, make sure that all poles, connectors and jumper lugs are clean. Also, cells, trays and compartments must be dry before replacing battery.

Dirt and dampness are likely to cause current leakage which may result in serious injury to the cells.

PROTECTIVE COATING

Occasionally, cells and trays, after being cleaned, should be recoated with Esbalite, an alkaline-proof insulating paint, put up solely by us. To make the paint adhere properly, all surfaces to be coated must be cleaned so as to be perfectly free of moisture, grease or dirt, after which the paint may be applied either with a brush or by dipping.

For Marine Service, the cells have a protective coating of a specially prepared rosin-vaseline compound instead of Esbalite.

When cleaning and recoating with any cell coating, be careful not to allow any vaseline to get into the cells.

SOLUTION RENEWAL

If the battery indicates sluggishness, or lack of capacity, after a long period of service and has not been given an overcharge as recommended (see overcharging, page 6), the battery should be given one cycle of overcharge.

If this treatment does not restore the battery to normal condition, a capacity test should be given and specific gravity reading taken of the solution.

If the battery delivers rated capacity and the specific gravity of the solution reads below 1.160, new Edison Electrolyte should be ordered.

If the battery fails to show rated capacity, send the result of the test to our Engineering Department, Orange, N. J., for advice.

No solution other than Edison Electrolyte should be used.

Do not pour out the old solution until you have received the new and never allow Edison cells to stand empty.

State type and number of cells when ordering Edison Electrolyte for renewal. See page 16 for number of pounds per cell.

When ready to refill, first discharge the battery to zero voltage. Pour out about half of the old solution, shake the balance vigorously and empty. Do not rinse cells with water; use only the old solution.

Immediately pour in the new solution, using a glass or enamel-ware funnel, or syphon directly from the drum, using a clean rubber tube.

Never put lead battery acid into an Edison battery, or use utensils that have been used with acid —you may ruin the battery.

Fill to exactly the proper height.

The electric filler, page 13, cannot be used for refilling cells with electrolyte.

When the new electrolyte is in and the battery is again connected up, give it an overcharge at the normal rate as instructed on page 6.

WATERING OR FLUSHING

Do not allow the level of the solution to drop below the tops of the plates. Never fill higher than the proper level. If filled too high, solution will be forced out during charge. The proper height of the solution in the cell is given on pages 15 and 16.

WATERING—CONTINUED

During charge, some of the water in an Edison battery is driven off as a gas and must be replaced with pure distilled water.

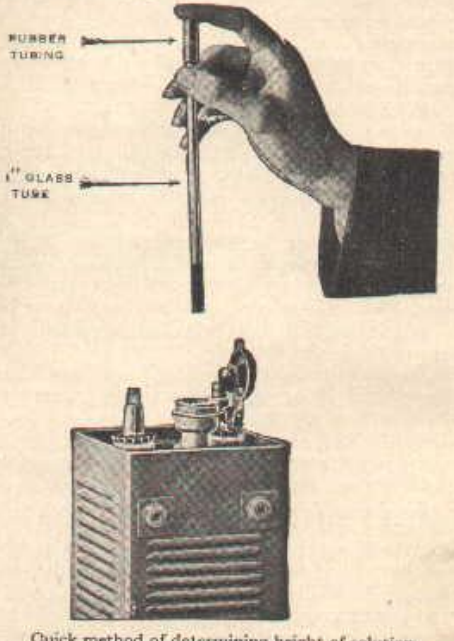
Never use anything but pure distilled water for replenishing, except only when solution has been spilled, in which case use Edison Electrolyte.

Distilled water should be kept in a closed container to exclude impurities.

Stills for making distilled water are sold at reasonable prices by a number of reliable manufacturers.

Battery compartments and trays must be kept clean and dry at all times.

To prevent slopping water over and around the cells and to assure filling to correct height, we recommend the semi-automatic filling apparatus described on page 11.



Quick method of determining height of solution.

TEST THE HEIGHT OF THE SOLUTION

Test for height of solution before placing battery on charge. Do not test for solution height while battery is charging; the gassing during charge creates a false level.

A glass tube, having an inside diameter of not less than 3-16 inch and its ends cut straight, may be used as illustrated.

Insert the tube until the tops of the plates are touched; close the upper end with the finger and withdraw the tube. The height of the liquid in the tube should be as specified in Electrical Data, pages 15 and 16.

ELECTRIC FILLER

An electric filler is made by us to enable the cells (Types "A," "B," and "G") to be quickly filled to the proper level with distilled water. This filler should never be used for renewing solution.

See that the tank is perfectly clean and that all foreign matter is removed. Then fill the tank with pure distilled water and mount in a convenient place at least four or five feet above the cells to be watered. The higher the tank is mounted, the more quickly will the water flow.

The adjustment of the filler for proper use with different types of cells is made by means of Notches on the handle according to the following table:

Notch	Cell Types
1	A-6HW, A-8, A-8H, A-8HW, A-10, A-10H, A-10HW, A-12, A-12H, G-11, G-14, G-18
2	"B" types
3	A-3, A-4, A-4H, A-4HW, A-5, A-5H, A-6, A-6H, G-4, G-5, G-6, G-7, G-9
4	All old types (having two openings in the cell top).

Test the filler by submerging the nozzle, including the metal collar, in a small quantity of electrolyte, diluted with clear water to about half strength. If the bell will not ring, either the electrical connections are wrong or broken, or the bell needs adjusting. The moving element of the relay

should not be more than 1-16 inch away from the end of the magnet core. Later failure to work may be caused by the dry cells being worn out and then they should be replaced.

Now insert the nozzle into the filler opening in the top of the cell. If the solution is already at the proper height, the bell will ring.

If it does not ring, start the flow of water by pressing the handle in toward the cell.

When the bell rings, remove the nozzle from the cell, close valve cap and proceed to the next cell.

Electric Filler in use

CAUTION—ELECTRIC FILLER

Do not use the electric filler for Edison Electrolyte when changing the solution in the battery—it will not work.

Do not use the electric filler or fill cells while cells are on charge.

Use only pure distilled water for watering the battery.

Do not leave the cell filler caps open. They should be closed immediately after watering the battery.

Always remove the remaining distilled water from the tank after watering cells. It should be stored in a clean, closely-stoppered receptacle, preferably glass or earthenware; never in zinc, aluminum, copper or galvanized iron.

Do not use the electric filler without the relay. If the relay cannot be made to work, the entire filler box should be returned to the Edison Storage Battery Company for repairs.

Do not use the filler box to test for grounds; the relay will be burned out if higher voltage should be encountered.

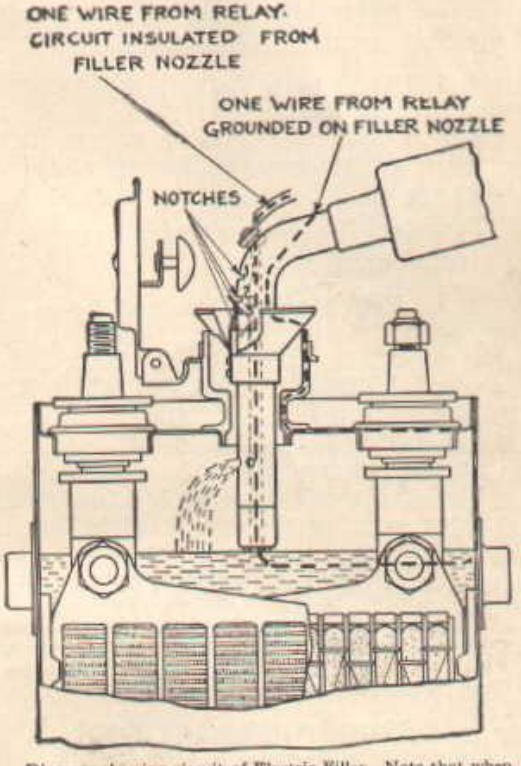


Diagram showing circuit of Electric Filler. Note that when solution reaches the correct level the end of filler nozzle just touches the solution, thereby completing the circuit and causing the bell to ring. The notches on the handle of filler give correct adjustment for different types of cells.

CAUTION

1. Never put lead battery acid into an Edison Battery or use utensils that have been used with acid; you may ruin the battery.

2. Never bring a lighted match or other open flame near a battery.

3. Never lay a tool or any piece of metal on a battery.

4. Always keep the filler caps closed except when necessary to have them open for filling as provided in these instructions.

5. Keep batteries clean and dry externally.

LAYING UP BATTERY

If battery is to be laid for any length of time be sure the plates are covered by the solution or electrolyte to the proper height.

The battery should not be left in a damp place.

Never empty out the solution and let battery stand unfilled.

It does not matter what state of charge or discharge the battery is in when laying up.

When putting battery in commission go over each cell. See that the plates are properly covered with electrolyte and then charge as instructed under Overcharging on page 6.

OTHER APPLICATIONS

Instructions for the operation and the care of batteries for other services, for example: Mine Lamp, House Lighting, Radio, etc., are covered by special instruction books, sent on request.

DATA FOR EDISON CELLS

The type of each cell is plainly stamped on the cell cover; also (except on the "L" type) a cell serial number.

Type of Cell	Amperes Normal Charge and Discharge Rate	Ampere Hour Capacity Normal Rate	Proper Level Above Plates in Inches	Hours Normal Charge	Pounds Renewal Solution for One Cell
A3	22½	112½	½	7	2.3
A4	30	150	½	7	3.2
A4H	30	150	3	7	4.5
A4HW	30	150	3	7	8.1
A5	37½	187½	½	7	3.7
A6	45	225	½	7	4.4
A6H	45	225	3	7	6.7
A6HW	45	225	3	7	10.1
A8	60	300	½	7	6.1
A8H	60	300	3	7	8.8
A8HW	60	300	3	7	13.2
A10	75	375	½	7	7.9
A10H	75	375	3	7	11.3
A10HW	75	375	3	7	15.3
A12	90	450	½	7	9.6
A12H	90	450	3	7	13.8
B1H	3¾	18¾	2¼	7	2.
B2	7½	37½	½	7	1.1
B2H	7½	37½	2¼	7	1.6
B4	15	75	½	7	1.9
B4H	15	75	2¼	7	3.0
B6	22½	112½	½	7	2.7
B6H	22½	112½	2¼	7	4.4
G4	30	100	½	4¾	2.5
G5	37½	125	½	4¾	3.5
G6	45	150	½	4¾	3.6
G7	52½	175	½	4¾	4.2
G9	67½	225	½	4¾	5.1
G11	82½	275	½	4¾	6.1
G14	105	350	½	4¾	7.8
G18	135	450	½	4¾	10.6

(Continued on page 16)

Type of Cell	Amperes Normal Charge and Discharge Rate	Ampere Hour Capacity Normal Rate	Proper Level Above Plates in Inches	Hours Normal Charge	Pounds Renewal Solution for One Cell
L20	3¾	12½	½	4¾	0.35
L30	5⅝	18¾	½	4¾	0.51
L40	7½	25	½	4¾	0.66

The "H" or "High" cells are taller than regular cells, allowing for greater height of electrolyte above the tops of the plates.

The "HW" or "High Wide" cells are taller and wider than regular cells, combining the allowance for greater height of electrolyte above the plate tops with increased space for solution.

VOLTAGE REQUIRED FOR CHARGING AT NORMAL RATE

MINIMUM LINE VOLTAGE IMPRESSED AT BATTERY TERMINALS.

5	cells	require	9.25	volts	D. C.
10	"	"	18.5	"	"
20	"	"	37.	"	"
24	"	"	44.4	"	"
28	"	"	51.8	"	"
32	"	"	59.2	"	"
36	"	"	66.6	"	"
40	"	"	74.	"	"
44	"	"	81.4	"	"
48	"	"	88.8	"	"
52	"	"	96.2	"	"
56	"	"	103.6	"	"
60	"	"	111.	"	"
64	"	"	118.4	"	"
68	"	"	125.8	"	"
72	"	"	133.2	"	"
76	"	"	140.6	"	"
80	"	"	148.	"	"

NOTE.—Where the line voltage is not sufficient to charge the battery with cells in series, the cells may be grouped in multiple. Our Engineering Department will be glad to advise you in the solution of any special problems you may have in charging.