SECTION 10-B

BATTERY AND CABLES

CONTENTS OF SECTION 10-B

10-7 GENERAL BATTERY INFORMATION

Delco-Remy 12-volt storage battery model 570 is used in all models. This battery has 6 cells with 11 plates per cell, a capacity of 70 ampere-hours at a 20 hour rate, and a rating of 840 watt-hours.

The battery is mounted on the left front fender skirt under the hood. The battery negative (-) post is grounded to the engine cylinder head by a copper cable. The positive (+) post is connected by an insulated copper cable to a junction block on the fender skirt.

a. Registration of Battery

Delco-Remy Battery dealers and distributors are prepared to carry out terms of the manufacturer's warranty on Delco-Remy batteries. In order that Buick owners shall have the protection and benefit of this warranty, it is necessary for the dealer or car owner to register his battery with the local Delco-Remy Battery dealer or distributor on all new car deliveries, and on all deliveries of new replacement Delco-Remy batteries. The Battery Owner's Certificate is located in the Owner's Protection Plan Booklet.

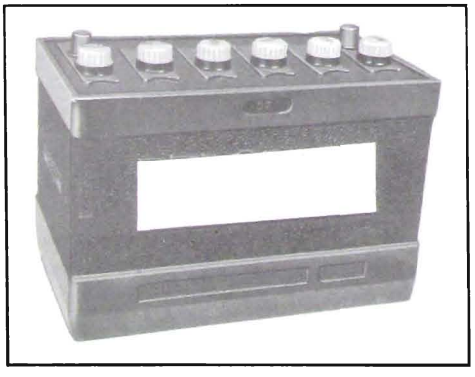

Figure 10-1—Battery

b. Care of Wet Batteries in Storage

Batteries in stored new cars, as well as batteries in stock, must be given regular attention to prevent sulphation of plates that may result from inactivity and self-discharge. All automotive wet batteries will slowly discharge on standing idle, whether in stored vehicles or in stock, and will self-discharge much faster when warm than when cold. Batteries in stock should be rotated and the older ones used first.

To minimize the extent of self-discharge always store batteries fully charged and in cool place where the temperature does not go below freezing. Every 30 days check the level of electrolyte, add water as required and charge the batteries at a 5 ampere rate until fully charged.

Batteries used for display purposes or standing in cars in storage must be treated in the same manner as batteries in stock.

When a new car, or a new replacement battery is delivered, make certain that it is fully charged and the electrolyte is at proper level. This is extremely important because the delivery of a partially discharged battery may not only lead to its return for charging but may also result in shortened life of battery.

c. Importance of Maintaining Electrolyte at Proper Level

Water is the only component of the battery which is lost as the result of charging and discharging, and it must be replaced before the electrolyte level falls to the tops of the separators. If the water is not replaced and the plates become exposed, they may become permanently sulphated, which would impair the performance of the plates. Also, the plates cannot take full part in the battery action unless they are completely covered by the electrolyte.

d. Importance of Keeping Battery Properly Charged

The battery has three major functions: (1) It provides a source of energy for cranking the engine. (2) It acts as a stabilizer to the voltage in the electrical system. (3) It can for a limited time furnish energy when the demands of the electrical units in operation exceed the output of the generator.

In order for the battery to continue to function, it is necessary that current withdrawal from the battery be balanced by current input from the generator so that the battery is maintained in a properly charged condition. If the outgo exceeds the input the battery will become discharged so that it cannot supply sufficient energy.

The state of charge of the battery as well as the temperature of the electrolyte has an important bearing on its capacity for supplying energy. Battery efficiency is greatly reduced by decreased electrolyte temperature as it has a decided numbing effect on its electrochemical action. Under high discharge such as cranking, battery voltage drops to lower values in cold temperatures than in warm temperatures.

In extremely cold climates it is important to keep batteries in a nearly full charged condition to avoid the possibility of freezing, which will damage any battery. The following table shows the temperatures at which freezing will occur in electrolytes of different densities, with specific gravity corrected to 80°F.

Specific Gravity	Freezing Point
1.220	-35°F.
1.200	-20°F.
1.160	0°F.

e. Care of Dry Batteries in Storage

A "dry charge" battery contains fully charged positive and negative plates but no electrolyte.

Dry charged batteries should be stored in a dry place away from excessive heat. A dry charged battery should be kept in its original carton until ready to be put into service. This type of battery will retain its "charged" condition indefinitely if protected from moisture. Dry batteries may be stacked in vertical columns provided they are not stacked more than four high.

f. Preparing Dry Charged Batteries for Service

To prepare "dry charge" batteries for service use approved battery-grade acid electrolyte (1.265 sp. gr. at 80°F). Care should be exercised in its use to prevent bodily injury or damage to clothing or other material resulting from actual contact with the electrolyte.

Electrolyte should be added to dry charged batteries in an area where water is readily available for flushing in case the electrolyte comes into contact with the body. Refer to instructions on side of electrolyte container for antidotes to use if electrolyte comes into contact with the body.

It is strongly recommended that a person filling batteries with electrolyte wear glasses (preferably safety glasses) to prevent possible damage to the eyes should any spattering of the electrolyte occur.

1. Remove dry charged battery from its original carton.

2. Remove the vent plugs.

3. Using a glass or acid-proof plastic funnel, fill each battery cell with electrolyte. Do not use a metal funnel for filling the battery. The cell is properly filled when the electrolyte level rises to the split ring at the bottom of the vent well. Do not overfill or underfill. Overfilling will cause acid corrosion in the battery area; underfilling will cause early battery failure.

4. After filling cells, wait five to ten minutes and add additional electrolyte, if necessary, to bring the electrolyte to the proper level.

5. Never finish filling a dry charge battery with water. If electrolyte is spilled, more electrolyte must be obtained.

g. Test After Batteries are Prepared for Service

The Delco Dry Charge Battery may be put into service immediately after activation. However, to insure good battery performance, the following activation tests are recommended.

1. After adding electrolyte, check the open circuit voltage. Less than 10 volts indicate a reverse cell or an open circuit and the battery should be replaced.

2. Check the specific gravity of all cells. If the specific gravity corrected to 80°F. shows more than a thirty point (.030) drop from the initial filling with electrolyte, or if one or more cells gas violently after addition of electrolyte, the battery should be fully charged before use.

3. For best performance in cold weather (32°F. or less), or if the battery and the electrolyte are not at 60°F. or above at time of activation, warm the battery by boost charging.

10-8 PERIODIC BATTERY INSPECTION AND SERVICE

The battery requires very little attention, but periodic inspection is essential to secure the maximum efficiency and life. The following services are essential to maintain the battery at maximum efficiency.

CAUTION: The gas which is produced in the battery cells during charging is dangerously explosive. Extreme care must be taken to avoid bringing open flames, lighted matches, etc., near a battery which is or has been recently on charge, and which is or has been gassing. Likewise care must be taken to avoid causing

any sparks near a battery with jumper cables or fast charger cables, since this can also set off an explosion of the gases.

a. Maintain Electrolyte Level

Add distilled water as required to maintain the electrolyte level at the split ring at bottom of filler well. See Figure 10-2. CAUTION: Do not overfill, as electrolyte may be sprayed out by gassing or may overflow due to heat expansion during charging.

If distilled water is not available, it is better to add clean, mineral-free tap water than to allow the electrolyte level to remain below the top of the plates.

In freezing weather the water should be added just before using the car or otherwise charging the battery so that the water will be mixed with the acid before it is allowed to stand in freezing temperatures.

If it is found necessary to add water to the battery more frequently than about every 1,000 miles and the quantity of water added per cell is great, check setting of voltage regulator and adjust, if necessary (par. 10-21). Abnormal water loss is an indication that the battery is being overcharged.

b. Inspect Battery, Mounting and Cables

Check outside of battery for damage or signs of serious abuse such as broken case or broken covers. Check inside of battery by removing the vent caps and inspecting for signs of abuse such as electrolyte level too low, or bad or unusual odors. If battery shows signs of serious damage or abuse, it should be replaced.

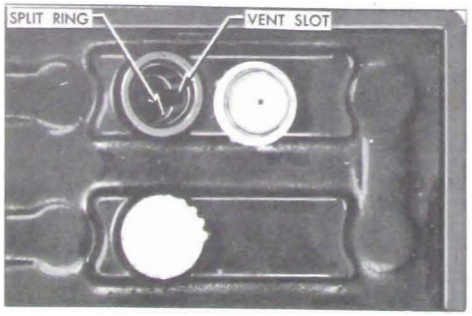

Figure 10-2—Battery Filler Well

Check the battery hold down bolts to make certain that battery is securely held in place. Excessive tightening may distort or crack the battery case.

If the top of battery is dirty or the hold down strap is corroded, clean thoroughly with a brush dipped in ammonia or soda solution. Care must be used to prevent any solution from getting into battery cells. After the foaming of solution stops, flush off with clean water and dry thoroughly. If hold down strap is corroded it should be painted with acid-resisting paint after cleaning.

Check battery cables to make certain they are tight at battery posts, engine mounting bracket and junction block. If a connection is found loose it should be cleaned before being tightened as arcing and corrosion may have taken place in the loose connection. Check condition of cables and replace if badly corroded or frayed. See paragraph 10-11 for instructions on cleaning and tightening cable terminals and replacement of cables.

10-9 LIGHT LOAD TEST OF BATTERY

The light load battery test is an in-the-car test designed to quickly determine the serviceability of any lead-acid battery. Nonuniform readings, as described in c below, are sufficient evidence for immediate replacement of the battery. This test is simpler and more conclusive than the hydrometer test; however, a cell voltage tester having .01 volt division is required. Before testing, visually inspect the battery as described in paragraph 10-8.

If battery passes visual inspection, check condition of battery cells as follows:

1. Add water to fill all cells to proper level.

2. Place load on battery by closing starter switch for 3 seconds. It makes no difference whether starter turns engine or not. However, if engine starts, turn off ignition immediately.

3. Turn headlights on low beam. After 1 minute, with lights still on, read individual cell voltages of battery with voltmeter having .01 volt divisions.

Compare readings with the following:

(a) Uniform Readings. If any cell reads 1.95 volts or more, and the difference between the highest and lowest cell is less than .05 volt (5 divisions), battery is good.

(b) Low Readings. If all cells read less than 1.95 volts, battery is too low to test properly. Failures of the meter to register on all cells does not indicate a defective battery. Quick-charge battery and repeat light loat test. See paragraph 10-12, subparagraph b. If none of the cells come up to 1.95 volts after the first quick-charge, the battery should be given a second charge. Batteries which do not come up after second quick-charge should be replaced.

(c) Nonuniform Readings. If any cell reads 1.95 volts or more and there is a difference of .05 volts (5 divisions) or more between the highest and lowest cell, battery should be replaced.

3. After test, close openings in sealing compound above cell connector straps. During light load test, if any cell reads below 2

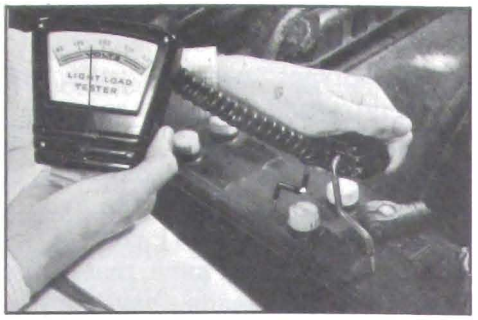

Figure 10-3—Light Load Test

volts, battery should be charged before returning car to owner.

NOTE: If any battery found to be "good" by Light Load Test does not perform satisfactorily in subsequent service, it should again be tested by the Light Load Test and if it still tests "good", it should be removed from car and tested as outlined under Full Charge Hydrometer Test. See paragraph 10-10.

10-10 FULL CHARGE HYDROMETER TEST OF BATTERY AND USE OF HYDROMETER

a. Full Charge Hydrometer Test

The full charge hydrometer test should be used on any battery originally found to be "good" by the Light Load Test, but has since failed to perform satisfactorily in service and which still tests "good" by the Light Load Test.

IMPORTANT: The full charge hydrometer test is not valid unless battery has been tested and found to be "good" by the Light Load Test.

1. Fully charge battery as described under slow-charging (par. 10-12, subpar. a).

NOTE: Hydrometer reading taken on partially charged batteries are unreliable for this test.

2. Measure specific gravity of electrolyte in each cell and compare readings with the following:

(a) If cell readings range between 1.230 and 1.310, the battery is ready for use. All it needed was a full charge. Any variation in the specific gravity between cells within this range does not indicate a defective battery.

(b) If any cell reads less than 1.230 and:

(1) Battery has been in service 3 months or less, battery is good but it has been improperly filled with electrolyte or water and will give poor performance. To correct this condition, empty the electrolyte from any cell reading less than 1.230 and refill with 1.265 specific gravity battery grade electrolyte. The battery is now ready for use.

(2) Battery has been in service more than 3 months, it should be replaced.

(c) If any cells read above 1.310 battery may be returned to service. However, specific gravities above 1.310 are harmful to battery and will cause early failure. Such high readings are caused by improper addition of electrolyte. Adjusting the specific gravity will not correct the damage that has been done by high specific gravity.

b. Use of Hydometer

The hydrometer measures the percentage of sulphuric acid in the battery electrolyte in terms of specific gravity. As a battery drops from a charged to a discharged condition, the acid leaves the solution and enters the plates, causing a decrease in specific gravity of electrolyte. With a hydrometer, an indication of the concentration of the electrolyte is obtained.

The specific gravity of the electrolyte varies not only with the percentage of acid in the liquid, it also varies with temperature. As temperature increases, the electrolyte expands so that the specific gravity is reduced. As temperature drops, the electrolyte contacts so that the specific gravity increases. Unless these variations in specific gravity are taken into account, the specific gravity obtained by the hydrometer may not give a true indication of the concentration of acid in the electrolyte.

Correction can be made for temperature by adding .004, usually referred to as 4 "points of gravity", to the hydrometer reading for every 10°F. that the electrolyte is above 80°F. or subtracting .004 for every 10°F. that electrolyte is below 80°F. Figure 10-4 shows the exact correction figure to use for any temperature above or below 80°F., the three steps used in obtaining the corrected or true specific gravity, and two examples showing how it is figured.

When using a hydrometer, observe the following points:

1. Hydrometer must be clean, inside and out, to insure an accurate reading.

2. Hydrometer readings must never be taken immediately after

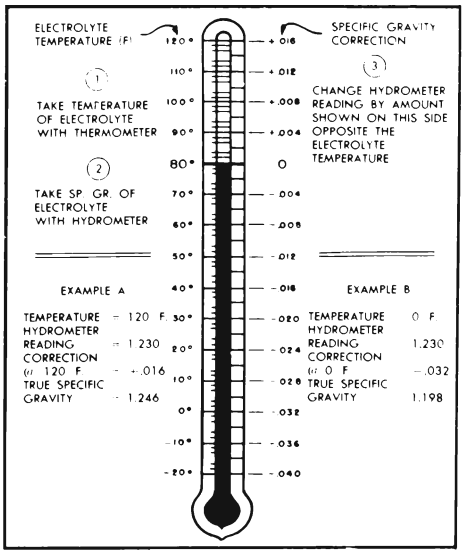

Figure 10-4—Specific Gravity Temperature Correction Scale

water has been added. The water must be thoroughly mixed with the electrolyte by charging for at least 30 minutes before hydrometer values are reliable.

3. If hydrometer has built-in thermometer, draw liquid into it several times to insure correct temperature before taking a reading.

4. Hold hydrometer vertically and draw in just enough liquid from battery cell so that float is free floating, and with bulb fully released. Hold hydrometer at eye level so that float is vertical and free of outer tube, then take reading at surface of liquid. Disregard the curvation where the liquid rises against float stem due to surface tension.

5. Avoid dropping liquid on car or clothing as it is extremely corrosive. Any liquid that drops should be washed off immediately with soda solution.

10-11 TESTING AND CLEANING BATTERY AND CRANKING MOTOR CABLES

Whenever the battery is tested (par. 10-9) the battery and cranking motor cables should also be inspected for condition and tested for resistance. Resistance in the cables and connections causes voltage drop, and excessive voltage drop is liable to cause starting difficulties.

Carefully inspect the battery to junction block, battery to engine (ground) and cranking motor to junction block cables. If cable strands are broken, corroded, or loose in terminals the cable should be replaced with the correct cable to insure ample capacity.

Check terminals at both ends of each cable for tight connections. Since loose connections are usually dirty or corroded, any loose connections should be thoroughly cleaned before being tightened. If terminals are tight and cables are apparently in good condition, it is advisable to test them with a low-reading voltmeter to detect any abnormal internal resistance.

a. Testing Resistance of Cables and Terminal Connections

Battery cables and terminal connections may be tested with equipment comprising a voltmeter (5 volts maximum), ammeter of 300 or more amperes capacity, and carbonpile rheostat having a minimum capacity of 300 amperes connected in series with the ammeter.

1. Adjust rheostat to provide maximum resistance ("OFF" position).

2. Connect ammeter positive (+) lead to battery terminal stud on junction block. Connect ammeter negative (-) lead to one side of rheostat and connect other side of rheostat to ground on engine, preferably at point where battery ground strap is attached. In the instrument shown in Figure 10-5 the ammeter and rheostat are connected in series inside the case.

3. Connect voltmeter negative (-) lead to battery terminal stud on junction block. Use prod with voltmeter lead, if necessary, to insure direct contact with the terminal stud. Do not connect to the ammeter lead clip. Attach a prod to voltmeter positive (+) lead and apply the prod to center of battery positive (+) post (Figure 10-5). Make sure that clips of voltmeter leads have clean metal contact with prods.

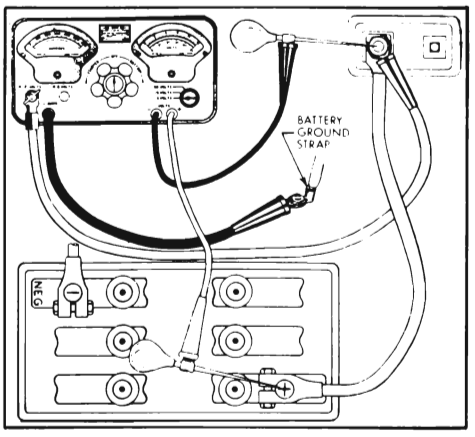

Figure 10-5—Battery Cable Test Connections

4. Adjust rheostat until ammeter reads 200 amperes, immediately read voltmeter, then turn rheostat to starting ("OFF") position to avoid excessive drain on battery. Voltage drop across battery positive cable and terminal connections should not exceed 2/10 volt.

5. Connect voltmeter positive (+) lead to ground on engine. Attach prod to voltmeter negative (-) lead and apply prod to center of battery negative (-) post. Voltage drop across the battery ground cable and terminal connections should not exceed 2/10 volt at 200 amps.

6. A reading in excess of 2/10 volt when testing either battery cable indicates excessive resistance in cable or connections. Clean and tighten cable or connections. Clean and tighten cable terminals (subpar. b, below) and recheck for voltage drop. If voltage drop still exceeds 2/10 volt replace cable with a genuine Buick cable to insure ample capacity.

7. If cranking is below normal speed, connect the ammeter positive (+) lead to the battery terminal stud on cranking motor solenoid switch, leaving the other lead attached to ground in engine.

8. Connect voltmeter negative (-) lead directly to battery terminal stud on solenoid switch. With prod of voltmeter positive (+) lead applied directly to battery terminal stud on junction block, repeat Step 4 above. The voltage drop across cranking motor cable and terminal connections should not exceed 2/10 volt at 200 amperes.

b. Cleaning Cable Terminals

If loose connections are found by inspection, or high resistance is found by voltage test, disconnect the cable for thorough cleaning of terminals. When removing a corroded cable terminal from battery post do not pry against battery case or hammer on terminal to break it loose, since either practice will result in broken cell covers. Use a screw type terminal puller if terminal cannot be loosened by hand after clamp bolt is fully loosened.

Thoroughly clean all corrosion from disconnected battery cable terminals and terminal posts, using suitable wire brushes. If wire brushes are not available, corroded terminals may be cleaned by brushing with a strong soda solution, using care not to get solution into battery cells.

To prevent corrosion of battery terminals and connections, apply a coating of petroleum jelly over the battery post and cable terminals after cables have been installed on terminals.

10–12 BATTERY RECHARGING

There are two separate methods of recharging batteries which differ basically in the rate of charge. In the slow-charge method, the battery is supplied a relatively small amount of current for an extended period of time. In the quick-charge method, the battery is supplied with a high current for a short period of time.

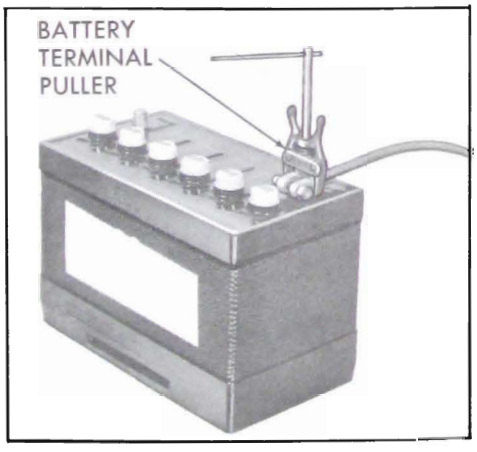

Figure 10-6—Using a Battery Terminal Puller

a. Slow-Charging

Slow charging is the best and only method of completely charging a battery. The slow-charge method, properly applied, may be safely used under all possible conditions of the battery, provided electrolyte is at proper level in all cells. The battery may be fully charged by this method, unless the battery is not capable of taking a full charge. The normal slow charging rate for the 12-volt battery is 5 amperes.

Full charge of battery is indicated when all cell specific gravities do not increase when checked at three intervals of one hour and all cells are gassing freely.

Due to the low rate during slow charging, plenty of time must be allowed. Charge periods of 24 hours or more are often required.

b. Quick-Charging

Since time is often of most importance to the battery owner, quick-charging must sometimes be used to partially charge the battery so that the engine will start and the owner can be on his way.

Charge at 50 amperes for 20 minutes (50 x 20 = 1000 ampere minutes). If charger will not give this rate, charge for an equal number of ampere minutes at the best rate available. For purposes of charging for the light load test, do not boost battery more than the amount indicated.

CAUTION: Too high a current during quick-charging will damage battery plates.

A battery cannot be brought up to a fully charged condition by the quick-charge method. The battery can be substantially recharged or boosted, but in order to bring the battery to a fully charged condition, the charging cycle must be finished by charging at a low or normal rate. Some quick-chargers have a provision for finishing the charging cycle at a low rate so that the battery can be brought up to a fully charged condition.

Used with care, and employing all safeguards provided by the manufacturer, a quick-charger will not damage a battery which is in good condition.

10–13 BATTERY AND CABLES—TROUBLE DIAGNOSIS

a. Quick Check of Battery and Cables

Whenever electrical trouble develops it is desirable to make a quick check of the battery and cables to make certain that this source of current is in good condition, securely connected, and is functioning properly. This check will also give a good check on the cranking system.

1. Turn on the lights. They should burn steadily and with normal brilliance.

2. With lights burning, operate the cranking motor. Either have the headlights shining on a wall so their brilliance can be noted, or have someone watching the headlights.

3. When cranking motor solenoid switch is closed, one of the following conditions will occur: (1) Lights will stay bright or will dim slightly if temperature is cold, and engine will be cranked at normal speed; (2) Lights will go out; (3) Lights will dim considerably; (4) Lights will stay

bright but no cranking action will take place. The first named condition indicates that nothing is wrong with the battery, cables, and cranking system. The other conditions indicate trouble as follows:

4. If lights go out as cranking motor solenoid switch is closed, it indicates a poor connection in the circuit between battery and cranking motor. Check battery cables and clean and tighten loose or corroded terminals (par. 10-11).

5. If lights dim considerably as cranking motor solenoid switch is closed, it indicates that the battery is run down, or there is a condition in cranking motor or engine which causes an excessive current drain on the battery. A low battery will be indicated by a clattering noise in cranking motor solenoid because the battery cannot sustain the voltage required to hold solenoid plunger "in" after switch contacts close and the "pull in" winding is shorted out.

Test battery with a light load test (par. 10-9). If battery is found to be in good condition check cranking motor (par. 10-28).

6. If lights stay bright but no cranking action occurs when cranking motor solenoid switch is closed, it indicates an open circuit in cranking motor, switch, or control circuit. See paragraph 10-28.

b. Undercharge Failure of Battery

The most frequent trouble experienced with storage batteries is failure to maintain a state of charge sufficient to crank the engine and also furnish current to the ignition system, lights and accessories. Failure to mainatin a proper state of charge may be due to one or more of the following conditions:

1. Operating Conditions. When determining cause of premature failure of a battery, consideration must be given to the conditions under which the car is operated.

In very low temperatures the capacity of a storage battery is considerably reduced and the energy required for cranking the engine is considerably increased.

Frequent starting, particularly in cold weather, accompanied by short runs may take more energy from the battery for cranking than the generator can replace in the limited running time. This condition is aggravated by night driving when lights are turned on, or by operation of an air conditioner in heavy traffic.

When the car is operated under these conditions, adjusting the voltage regulator to the high limit may allow enough increase to keep the battery at a safe state of charge. If the high limit setting does not maintain a safe state of charge an occasional booster charge should be given to the battery or an extra output generator obtained through dealer.

2. Low Charging Rate. In case of premature battery failure, the charging rate of generator should always be checked and adjusted if below specifications. See paragraph 10-21.

3. Internal Condition. The internal condition of the battery may be such that it cannot hold a charge satisfactorily. Check electrolyte level and light load test the battery (par. 10-11).

c. Overcharge Failure of Battery

A common cause of battery failure is overcharging, that is, continued input of excessive charging current after the battery has reached a fully charged condition.

One evidence that battery is being overcharged is the need for frequent addition of water to the battery in order to maintain the electrolyte level above the tops of the battery separators, since overcharging causes rapid water loss. When this becomes evident the charging rate of generator should be immediately checked and adjusted (par. 10-21) to avoid internal damage to battery.