SECTION A

BATTERY AND CABLES

CONTENTS

DIVISION I SPECIFICATIONS AND ADJUSTMENTS

120-1 BATTERY SPECIFICATIONS

	250 Eng. 43-44000 Series	350 Eng. 43-44-45000 Series	455 Eng. 45-46000 Series	455 Eng. 48-49000 Series
Make	Delco	Delco	Delco	Delco
Model	1980032	1980030	1980036	1980038
Location Under Hood	Right Front	Right Front	Right Front	Right Exc. Riviera
Terminal Grounded	Negative	Negative	Negative	Negative
Voltage	12	12	12	12
Capacity (Amp. Hrs. @ 20 Hr. Rate)	44	61	70	70
Catalog Number	Y55	R59	R69	Y71
Cranking Power (Watts @ 0° F.)	2300	2900	3150	3000
Number of Cells & Plates/Cell	6, 9	6, 11	6, 11	6, 11
Specific Gravity, Full Charge @ 80° F.	1.260 to 1.280	1.260 to 1.280	1.260 to 1.280	1.260 to 1.280
Bench Charging Rate, Start	5 Amps.	5 Amps.	5 Amps.	5 Amps.
Bench Charging Rate, Finish	2 Amps.	2 Amps.	2 Amps.	2 Amps.
Case	Hard Rubber	Hard Rubber	Hard Rubber	Hard Rubber
Dimensions (Overall)				
Length	9½"	10¼"	10¼"	12 1/32"
Width	6 13/16"	6 13/16"	6 13/16"	6 13/16"
Height	8¼"	8¾"	9½"	8¾"

DIVISION II

DESCRIPTION AND OPERATION

120-2 GENERAL BATTERY INFORMATION

Every Buick is equipped with an Energizer, which is a type of battery having a one-piece cover. See Figure 120-1. The battery is mounted on the 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 post on the starting motor.

Figure 120-1 - Battery - Special, Skylark and LeSabre

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.

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 a 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.

Figure 120-1A Battery Freezing Points

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.

Figure 120-2 Battery
Wildcat, Electra and Riviera

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. Tests After Batteries are Prepared for Service

The 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.

DIVISION IV

TROUBLE DIAGNOSIS

120-3 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 hydrogen gas which is produced in the battery cells during charging is dangerously ex- plosive. 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

The Energizer features a Delco Eye, which is a specially designed vent plug with a transparent rod extending through the center. (See Figure 120-3) When the electrolyte is at the proper level, the lower tip of the rod is immersed, and the exposed top of the rod will appear very dark; when

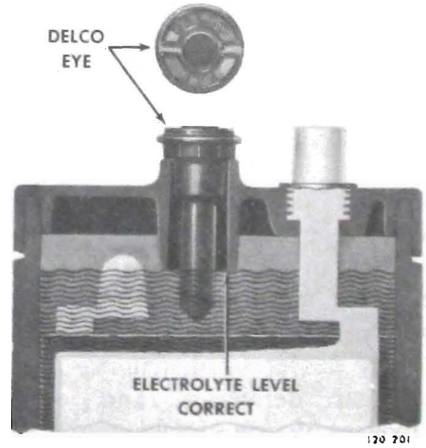

Figure 120-3 Correct
Electrolyte Level

the level falls below the tip of the rod, the top will glow. The Delco Eye reveals at a glance if water is needed, without the necessity of removing the vent plugs. See Figure 120-4.

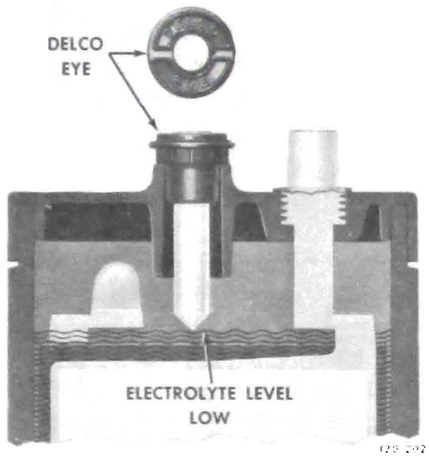

Figure 120-4 Low Electrolyte Level

The Delco Eye is used in only one cell because when the electrolyte level is low in one cell, it is normally low in all cells. Thus when the Delco Eye indicates water is needed, check the level in all six cells.

Add distilled water as required to maintain the electrolyte level at the split ring at bottom of filler well. See Figure 120-3.

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. 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.

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 throughly 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.

120-4 421 BATTERY TEST

New Energizers which have become *completely* discharged over a relatively long period of time during vehicle storage should not be tested by the "421" Test Procedure. Energizers discharged to this degree cannot accurately be tested by *any* procedure as they have no load capability, and must be recharged.

Figure 120-5 421 Battery Tester - Charger

Energizers that become discharged in actual service may be accurately tested by the "421" Test Procedure as periods of inactivity are not involved.

Energizers that are merely discharged are not subject to warranty.

The following test procedure is recommended to determine whether the Energizer or 12-Volt Battery is good and usuable, requires recharging, or should be replaced - any deviation from this complete procedure may produce erroneous results.

a. 421 Test Procedure

1. Visual Inspection - The first step in testing the Energizer or 12-Volt Battery should be a visual inspection, which very often will save time, labor and expense in determining the condition.

(a) Check for broken or cracked case or cover.

(b) Check for loose terminal posts.

(c) Check for defective or mutilated sealing compound.

(d) Check for other visible signs of physical damage.

Obvious damage as a result of conditions described above indicates the need for Energizer or battery replacement.

2. The "421" Test is a programmed test procedure consisting of a series

of timed discharge and charge events, requiring approximately 2 to 3 minutes, that will determine the condition of the Energizer or battery with a high degree of accuracy when used in conjunction with this entire test procedure. "421" Testers are produced by a number of different manufacturers and their directions for tester operation should be carefully followed. General comments on overall "421" Tester operation follow:

(a) Energizers or batteries *should NOT be charged prior to making this test*. Defects within the unit can be hidden by the charging and erroneous test results will be obtained.

(b) Erratic or extremely low initial meter readings may indicate poor connections at the tester terminals. *Obtain clean and tight connections before performing the '421' Test.*

(c) All meter readings should be made *immediately* after the meter indicator light comes "on" even if the meter needle is still moving.

(d) If additional discharges are required after the initial discharge, set meter indicator following the *last* discharge cycle.

(e) Batteries designated as "bad" by the tester should be replaced.

(f) Batteries designated as "good" with no owner's complaint or indication of poor performance, should be left in service. Posts, cable clamps, and top should be cleaned, water should be added and recharging should be performed, if required. For dependable and reliable battery service, the battery should be in at least a 75% state-of-charge.

(g) Batteries designated as "good" that are suspected of being questionable because of owner complaint, or age of the battery, should be further tested by the Hydrometer Test.

120-5 HYDROMETER TEST OF BATTERY

The 421 Battery Test as described in the previous paragraph is the fastest and most accurate means of determining the serviceability of a one-piece cover battery. However, if a 421 Battery Tester is not available, a hydrometer test may be used on a battery that has failed to give proper service.

a. Hydrometer Test

1. Fully charge battery as described under Slow Charging.

2. Measure specific gravity of each cell as described in subparagraph below.

Decide battery serviceability as follows:

(a) If all cells read between 1.230 and 1.310, the battery is okay. All it needed was a full charge.

(b) After fully charging battery, if any cell reads less than 1.230, the battery is defective and should be replaced.

b. Use of Hydrometer

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 contracts 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 120-6 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.

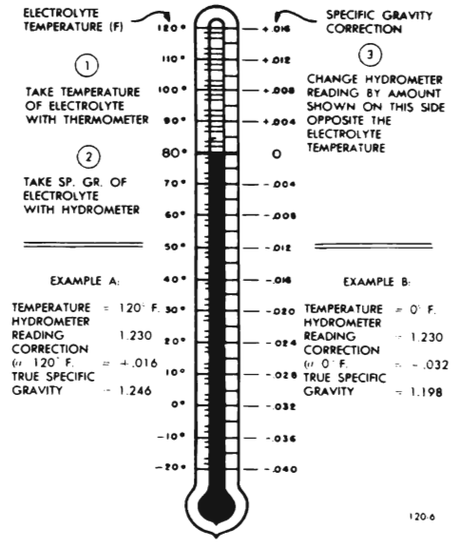

Figure 120-6 Specific Gravity Temperature Correction Scale

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 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 re-

leased. 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.

120-6 FUSIBLE LINKS

All series Buicks have fusible links located between the starting motor post and the lower ends of the main supply wires. These links are the weakest point in the electrical supply system for the complete car, and, as such, will act like a fuse for every wiring harness in the car. Every electrical accessory is still protected by a fuse or circuit breaker, of course, but fusible links have been added to protect the wiring harnesses *before* the fuses. In the past, if a wire became grounded in the portion between the battery and the fuse block, a long section of the wire would burn out, making replacement of a complete wiring harness necessary. These wiring harnesses were generally expensive, complicated and hard to get at; they often required many hours of a skilled electrician's time to replace them. Now, with the fusible links, a short or ground in any unfused wire will only cause a six inch link at the starting motor to burn out. Because of its location, possibility of a fire, such as was sometimes caused by a burned-out wiring harness, is very remote.

All series have two fusible links connected to the starting motor post:

1. In the No. 12 red wire circuit which, for safety purposes, supplies only the headlight circuit.

2. In the No. 10 red wire circuit which supplies all electrical units except the headlights.

A fusible link is simply a short section of wire which is several sizes smaller in gauge than the wire in the circuit which it protects. The No. 10 wire supply circuit is protected by a No. 14 brown link; the No. 12 wire headlight circuit is protected by a No. 16 black link. See Figure 120-7. If a short or ground occurs in either of these circuits the fusible link will melt before the insulation is damaged elsewhere in the circuit.

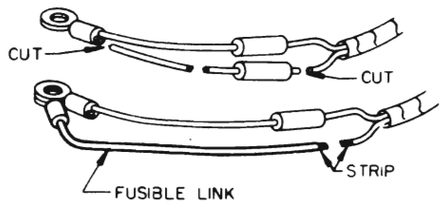

Figure 120-7 Fusible Links

Replace a burned-out fusible link as follows:

NOTE: *Always disconnect battery before attempting any electrical repairs.*

1. Cut off burned-out link close to the starting motor post.

2. Cut off other end of burned-out link along with solder joint.

3. Strip insulation from end of new link and from end of wiring harness so that each will project halfway through soldering sleeve.

4. Crimp new link in soldering sleeve and solder carefully.

5. Cover new connection tightly with electrical tape.

6. Install new link connector eye on starter post.

A burned-out fusible link would be indicated by:

1. *All* electrical accessories dead except headlights, or, headlights dead but all other electrical units working.

2. Starter dead - won't even click. Even with a nearly dead battery, the starter solenoid will generally engage; therefore, no click means no solenoid action possibly due to a burned-out fusible link.

3. For a positive test for a burned-out fusible link, turn blower switch to high speed position. Connect a test light or a voltmeter between positive battery post and No. 10 red wire terminal at generator regulator. If test light lights brightly or if voltmeter reads battery voltage, fusible link is burned out.

A voltmeter reading over .2 volt but less than battery voltage means that there is excessive resistance in the circuit, but fusible link is still in place.

120-7 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.

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.

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.*

120-8 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. 120-8C).

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 421 Battery Test (par. 120-4). If battery is found to be in good condition check cranking motor.

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 68-16.

b. 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 carbon pile 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 post on starting motor. 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 120-8 the ammeter and rheostat are connected in series inside the case.

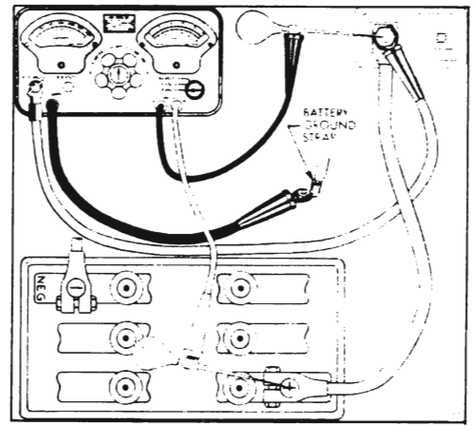

Figure 120-8 - Battery Cable Test Connections

3. Connect voltmeter negative (-) lead to post on starting motor. 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 120-8). Make sure that clips of voltmeter leads have clean metal contact with prods.

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 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.

c. 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.

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.

CAUTION: *When cleaning cable terminals, extreme care must be taken to prevent removing excess material from the moulded contact rings inside the terminal. If excessive material is removed, the terminal may not provide a connection that is capable of carrying the current required during engine cranking.*

If cable strands are broken, corroded, or loose in terminals, the cable should be replaced with the correct cable to insure ample capacity.

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

NOTE: *Do not grease post or terminal BEFORE installing terminal to post. It is very desirable to coat the terminal and exposed post with Silicone AFTER installation to discourage corrosion by water and acid.*

d. Battery Cable R and I

Positive Cable 1. Disconnect cable at battery terminal.

2. Remove wiring harness bracket screws holding bracket to engine block.

3. Disconnect cable at starter solenoid.

4. Remove cable from chassis clips and remove cable.

5. Install cable on starter solenoid.

6. Install wire harness bracket.

I 7. Install cable thru chassis clips.

8. Connect cable to battery terminal.

Negative Cable 1. Disconnect battery cable at battery terminal.

2. Remove cable from chassis clips.

3. Remove delcotron bracket bolt and remove cable.

4. Install cable in reverse to removal.

NOTE: *Adjust cables thru clips to allow at least 1/2 inch clearance between the cables and transmission oil cooler lines. Position top surface of battery cable terminals flush to 1/16 inch below top surface of battery terminal post.*

e. Undercharge Failure of Battery

The most frequent trouble experienced with storage battries 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 maintain 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 considerable 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 68-9.

3. *Internal Condition.* The internal condition of the battery may be such that it connot hold a charge satisfactorily. Check electrolyte level and test the battery using the 421 Battery Test (par. 120-4).

5. Shortage Failure of Battery

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

Over evolves 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 elements, since maintenance causes rapid water loss. When this happens evident the charging rate of generator should be immediately checked and adjusted upon 16-V to avoid internal damage to battery.