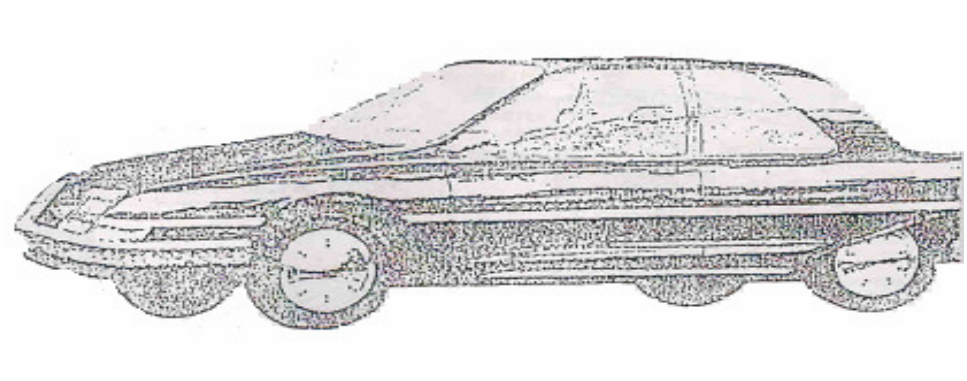


The Automotive Battery Construction and Service

After studying this chapter, you should be able to:

1. Discuss the construction and operation of a lead-acid storage battery.
2. Describe the chemical actions in the battery during charge and during discharge.
3. Define and discuss battery ratings.
4. Explain why battery terminal voltage varies with temperature, charging rate, discharge rate, and state of charge of the battery.

24-1 THE BATTERY

Battery (Fig. 24-1) supplies current to operate the starting motor and the ignition system when the engine is being started. It also acts as a voltage stabilizer by supplying current for the lights, radio, and other electrical accessories 'when the alternator is not handling the load. The battery is an *electrochemical* device. This means it uses chemicals to produce electricity. The amount of electricity it can produce is limited. As the chemicals in the battery are "used up" the battery runs down, or is *discharged*. It can be *recharged* by supplying with electric current from a battery charger, or a vehicle alternator can recharge it. The "used up" chemicals are then returned to their original condition, so the battery becomes recharged.

24-2 CHEMICALS IN BATTERY

The chemicals in the battery are sponge lead is solid, lead oxide (a paste), and sulfuric acid (a liquid). These three substances are made to react chemically to produce a flow of current. The lead oxide and sponge lead are held in plate prides to form positive and negative and negative plates (Fig. 24-5).

The plate grid is a framework of lead alloy with horizontal and vertical bars. The plate grids are made into plates by applying lead oxide paste. The horizontal and vertical bars hold the paste in the plate.

After the plates are assembled into the battery is given a "forming" charge. This changes the lead oxide paste in the negative, or minus, plate to sponge lead. It changes the lead oxide paste in the positive, or plus plate to lead peroxide.

24-3 BATTERY CONSTRUCTION

In the battery, several similar plates are properly spaced and welded, or *lead-burned*, to a strap. This forms a plate group. Plates of two types are used, one for the positive plate group, the other for the negative plate group. A positive plate group is nested with a negative plate group. Separators are placed between the plates to form an element (Fig. 24-3). The separators hold the plates apart so that they do not touch. At the same time the separators are porous enough to permit liquid in circulate between the plates. Wooden sheets, spun glass matted into sheets and porous sponge rubber sheets have been used as separators. Late-model batteries have separators made of acid-resistant polyvinyl chloride on polyethylene saturated cellulose.

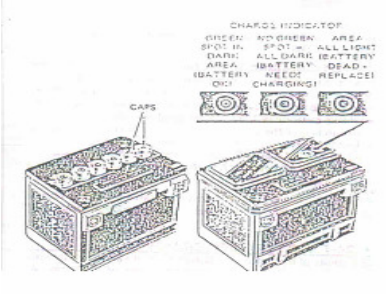


Fig. 24-1 Two types of automotive batteries. The left battery it caps which can be removed to check the battery state charge and add to water. If needed the right battery with side terminals is a sealed maintenance free type and requires no water. The charge indicator in the top shows the state of charge of the battery.

The elements are placed in cells in the battery case. Then heavy lead connectors are attached to the cell terminals to connect the series. After the internal connections are in place the cover is put (Fig. 24-1 to 24-3). In many batteries, the cover has openings through which liquid can be added water; the filler plug or vent caps are removed. After the liquid is added and the battery is given an initial charge. It is ready for operation Maintenance-free batteries have no vent caps

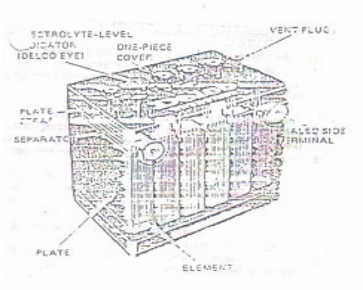


Fig.24-2 phantom view of a 12-volt battery with the terminals in the state of the battery (Division of General Motors Corporation).

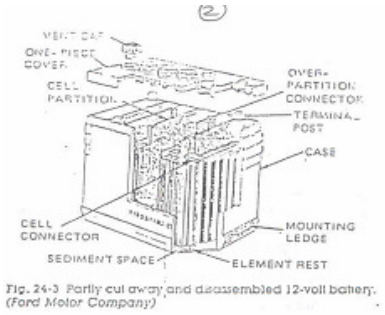


Fig. 24-3 Partly cut away and disassembled 12-volt battery. (Ford Motor Company)

Fig.24-3 Partly cut away and disassembled 12-volt battery(Ford Motor Company)

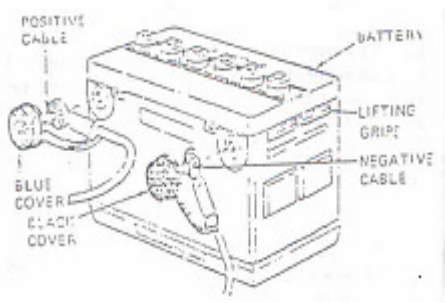
Some batteries have the two main terminals on the battery cover as in 24.3. Other batteries have the terminals in the side of the battery (Ford Motor Company) cover as in Fig 24.3 Other batteries have the terminals in the side of the battery case as in Fig 24.2 Figure 24.4 shows how the cables are connected to a side terminal battery. It also shows the battery-mounting

arrangement. On a top-terminal battery the positive terminal (or "post") is larger than the negative post.

Many batteries are the maintenance-free type. They require no special attention expect for an occasional check of the connections and the built-in charge indicator (Fig 24-1 right) other batteries have vent caps (Figs 24-3 and 24-4), which can be removed. Then you can look down into the battery cells to see whether they need water. Also a hydrometer can be used to check the battery charge.

24-4 CHEMICAL ACTIONS IN BATTERY

The liquid in a battery is called the electrolyte. It is made up of about 40 percent sulfuric acid and about 60 percent water (in a fully charged battery) when sulfuric acid is placed between the pieces chemical actions takes place. These actions removed electron from one group of plates and collect them at other. This creates a pressure of 2.1 volts between the two terminals of the battery cell. If any circuit no connects the two terminals, no further chemical activity takes place. However when the two terminals do become connected by an electric circuit, electrons (current will flow.



battery (Cadillac Motor Car Division of General Motors Corporation) from the terminal where chemical activity has collected them. They now through the circuit to the other from terminal where the chemical activity has removed them. Chemical activities now begin again so the tire 2-volt pressure is maintained. The current now continuous. The chemical action use up the sponge lead, lead peroxide and sulphuric acid. After a certain amount of current has been withdrawn the battery is discharged ("run down or dead"). It is not capable of delivering any additional current. When the battery has reached this state, it may be recharged. This is done by supplying it with a flow of current from some external source. The external source forces current back through the battery.This reverses the chemical activity in the battery.The plates are restored to their original composition and battery becomes recharged.It is then ready to deliver additional current.

The Chemical action that take place are rather complicated.The sponge lead(negative plate) and lead peroxide(positive plate) change to lead sulphate during the discharge process.The sulphate comes from sulphuric acid. The electrolyte loses acid and gains water as the sulfate goes into the plates. Therefore discharging the battery changes the two different chemicals in the battery pieces to a third chemical lead sulfate. Recharging the battery changes the lead sulfate back to sponge lead in the negative plates, and to lead peroxide in the positive plates. Meantime the sulphuric acid

reappears in the electrolyte of the battery.

24-5 CONNECTING CELLS

Automotive batteries are usually 12 volts: units. There are six cells in the 12-volt battery. The six cells are connected in series. In series connections, the voltages add. Some special applications use 24-volt batteries: these special-purpose batteries have 12 cells.
Although a battery cell at 80^0F will test on open circuit about 2.1 volts when fully charged common practice is to cell 2 volts. Therefore a six-cell battery is said to be a 12 volts battery rather than a 12.6 volt battery.

24-6 BATTERY RATINGS

The amount of current that a battery can deliver depends on the total area and volume of active plate material. It also depends on the amount and strength of electrolyte. This is the percentage of sulfuric acid in the electrolyte. Factors that influence battery *capacity* – its ability to deliver current – include the number of plates, the cell size, and the quantity of electrolyte. The ratings most commonly used in referring to battery capacity are discussed below.

1.Reserve Capacity- Reserve capacity is the length of time in a minute that a fully charged battery at 80^0F can deliver 25 amperes. A typical rating would be 125 minutes. This figure tells how long a battery can carry the electrical operating load if the alternator quits.
2.Ampere Hour Capacity- An older in the 20-hour rate also called the compare hour compare. This is the amount of current time a battery can deliver for 2v hours witness the cell voltage dropping below 1.75 volts with a electrolyte temperature 80^0F 26.7^0C. For example battery that can deliver current of 5 amperes lo: 20 hours is rated as having a 100. amperes hour capacity 120x5= 100

3.Cold Cranking Rate- One of the two cold-cranking rate if the number of appears that a battery can deliver for 30 spreads when at OFF 178'C without the cell volt ages ladling below 1.2 volts. A typical rating for a battery with a reserve capacity of 125 minutes would be 430 amperes. This figure indicates the ability of the battery to crank: the engine at low temperature. The second cold-cranking rate is measured at – 20^0F – 28.9^0C. In this the final voltage is allowed to drop to 1 volt per cell. A typical rating for a battery with a reserve capacity of 125 minutes would be 320 amperes.

4.Watts Delco- uses an additional rating – watts. This is roughly equivalent to the battery cold-cranking rating.

24.7 BATTERY EFFICIENCY

The ability of the battery to deliver current varies within wide limits. It depends on temperature and rate of discharge. At low temperature chemical activities are greatly reduced. The sulfuric acid cannot work as actively on the plates. Therefore the battery is less efficient and cannot supply as much current for as long a time. High rates of discharge will not produce as many ampere-hours as low rates of

discharge. At high discharge rates the chemical activities take place only on the surfaces of the plates. They do not have time to penetrate the plates and to use the materials below the plate surfaces. The chart below relates battery efficiency to battery temperatures. However these are only approximations.

Efficiency Percent	Battery Temperature Deglees F(C)
100	80|[26.7]
65	32[0]
50	0[-17.8]
10	-45[-42.8]

24-8 VARIATIONS IN TERMINAL VOLTAGE

Because the battery produces voltage by chemical means voltage varies according to a number of conditions. These conditions and their effect on battery voltage may be summed up as follows

1. Terminal voltage pattern being charged increases with

a. Increasing charging rate. To increase charging rate (ampere input) the terminal voltage must go up.

b. Increasing state of charge. As state of charge goes up voltage must go up to maintain charging rate For example a voltage of approximately 2.6 volts per cell is required to force a current through a fully charged battery. This is the reason that voltage regulators are set to operate at 15 volts – slightly below the voltage required to charge a fully charged battery. This setting protects the battery from overcharge.

c. Decreasing temperature. Lower battery temperatures resource a higher voltage to maintain charging rate

2. The terminal voltage of a battery that being discharge decreases with:

a. Increasing discharge rate. As the rate of discharge proof or chemical activities increase and cannot penetrate plates so effectively. Therefore voltage reduced.

b. Decreasing state or charge. With less of the active mate takes place and voltage drops.

c. Decreasing temperature. With lower temperature the chemical activities cannot go on as effectively and the voltage drops.

BATTERY MAINTENANCE AND SERVICE

24-9 BATTERY MAINTENANCE

Complete battery maintenance includes the following:

1. Visually check the battery.
2. Check electrolyte level in cells on batteries with caps.
3. Add water if the level is low (vent-cap batteries).
4. Clean off corrosion around battery terminals and from top of batteries with top terminals (Fig 24-3)
5. Check battery condition by testing its state of charge (explained later).
6. Recharge battery if it is low.

24.10 CAUTIONS FOR BATERY SERVICE

These are the important cautions to observe when working with batteries

1. The sulfuric acid in the electrolyte is very corrosive. It can destroy most things it touches it will eat holes in cloth. It can cause serious burns if it gets on your skin. If it gets in your eye protection when working around batteries. If you get battery acid on your skin. Flush it out at once with water over and over Fig 2-12 Then get to a doctor at once.
2. Gases form in the battery when it is being charged. These gases are highly explosive. Never light a match or a cigarette when working around batteries. You might cause an explosion that could seriously harm you.
3. The battery can supply a very high current. Never wear rings bracelets, watches or hanging necklaces when working around batteries. If a metal ring or other ornament should accidentally short a battery a very high current will flow. This could turn the ring white-hot in an instant and you could get a serious burn.
4. When jump-starting a car follow the instructions and caution in 25-9. A wrong step can damage the electrical system and cause you to get hurt.
5. When disconnecting a battery always disconnect the cable from the grounded the insulted terminal or any terminal or wire that is hot (connected to the insulted terminal you will not be making a direct short across the battery.

24.11 VISUAL INSPECTION OF BATTERY

Look for signs of leakage a crackled case or top corrosion buildup on battery terminals and tops missing vent caps and loose or missing hold-down clamps. Leakage causes white corrosion on the battery carrier and surrounding metal parts. Leakage is due to a crackled battery case or top. The remedy is to install a new battery.

The top of the battery can be crackled if the wrong wrench is used to disconnect or install cable clamps top terminals. The case can be cracked if the hold-down clamps are over tightened.

24.12 CHECKING ELECTOLYTE LEVEL AND ADDING WATER

On vent cap batteries the electrolyte level can be checked by removing the caps, Some batteries have a spilt ring which indicates the electrolyte level (Fig 24.5). If the level is low add water. Some batteries have an electrolyte-level indicator (a “Delco Eye”). It gives a visual indication of the electrolyte level (Fig 24.6). Black means the level is okay. White means the level is low.

Careful : Do not add too much water. This can cause electrolyte to leak out and corrode the battery carrier and other metal nearby.

24.13 CLEANING CORROSION OFF BATERY

On batteries with the terminals on top the terminals and cable clamps sometimes corrode. This corrosion can be cleaned off disconnecting the clamps and cleaning the terminal and clamps with special wire brushes (Fig 24-7). Battery-top corrosion can be cleaned off by brushing the top with baking soda solution. After the foaming stops,

flush off the battery top with water. Terminals can be coated with an anti corrosion compound to retard corrosion.

24.14 CHECKING BATTERY CONDITION

On vent-cap batteries, the battery can be checked with a hydrometer to determine its condition. Other methods use testing instruments, as explained later. These other methods are for the maintenance-iree batteries but can also be used on the vent-cap type.

24.15 HYDROMETER TEST

The hydrometer tests the specific gravity of the battery electrolyte. There are two types of hydrometer (Fig 24-8). One uses a series of plastic balls, the other a glass float with a stem on top. To use a ball-type hydrometer, stick the rubber tube in the electrolyte. Then squeeze and release the rubber bulb. This draws electrolyte up into the glass tube. The number of balls that float tells you the battery state of charge. If all ball float the cell fully charged. If none float the cell is discharged.

Careful : Do not drip electrolyte on the car or on yourself Electrolyte will damage the paint on the car and eat hole in your clothes. See caution 1 in 24-10

The float type hydrometer (right in Fig 24-8) has a float with a stem that sticks up above the electrolyte level in tubs. They float stem is marked to indicate the spare.

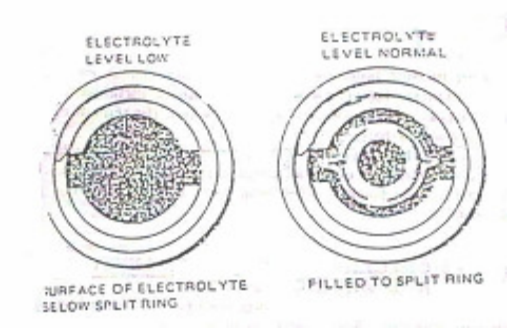
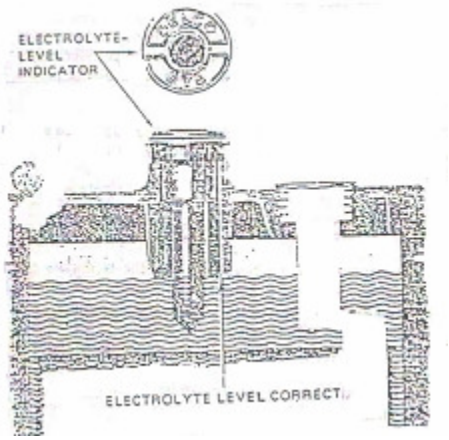


Fig 24.5 Appearance of the electrolyte and split ring when the electrolyte is too low and when it is correct (Delco-Remy Division of General Motors Corporation) of the electrolyte (Fig 24.9). The height of the stem above the electrolyte tells you the battery state of charge. Here is what the readings mean.
1.265 – 1.299 Fully charged battery
1.235 – 1.265 Three-fourths charged
1.205 – 1.235 One half charged
1.170 – 1.205 One fourth charged
1.140 – 1.170 Barely operated 1.110
1.110 - 1.140 Completely charged.



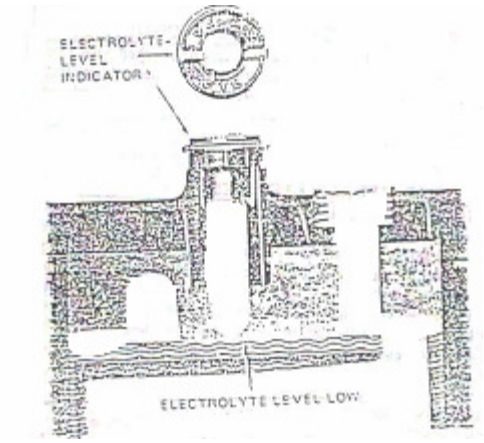


Fig 24.6 A battery cell with electrolyte level indicator(top).The electrolyte at one correct level and(bottom)low electrolyte level.(Delco-Remy Division of General Motor Corporation).

If some cells test considerably lower than others, it means there is something wrong with those cells. It could be that a cracked case has allowed electrolyte leakage or perhaps there is internal damage to the plates or separators. If the variation is only a few specific-gravity points, then there is probably no cause for alarm. But if the low cells measure 50 points lower then those cells are defective and the battery should be replaced.

Some 12-volt batteries for passenger cars have a slightly lower specific gravity when charged For example one type is fully charged with a specific gravity of 1.270. Other batteries such as those used in hot climates have a specific gravity of 1.225 when fully charged.

The decimal point is not normally referred to in a discussion of specific gravity. For example “twelve twenty twenty-five means 1.225 and eleven fifty means 1.150.

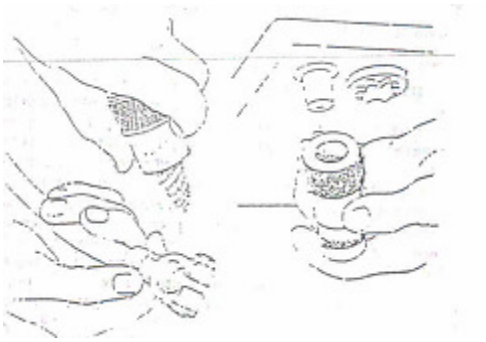


Fig 24.7 Using battery terminal brush to clean the battery terminal posis and cable clamps Black Motor Division of General Motor Corporation

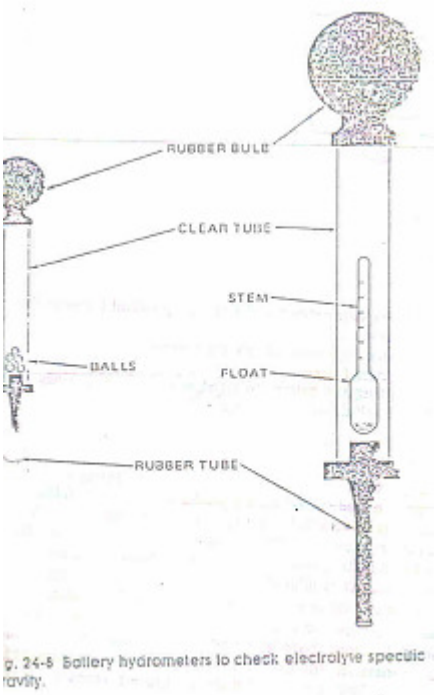


Fig.24-8 Battery hydrometers to check electrolyte specific gravity.

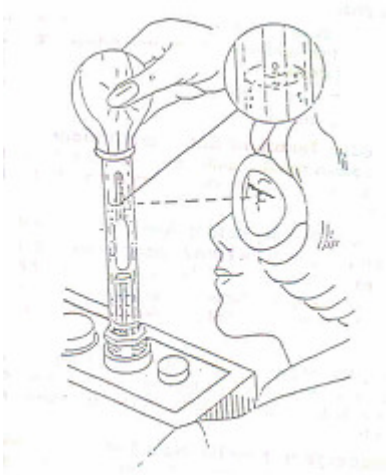


Fig.24-9 Using a float hydrometer to check a battery cell. Reading must be taken at eye level. The higher the float stem stick out of the electrolyte, the higher the state of charge of the battery.

24-16 VARIATIONS OF SPECIFIC GRAVITY WITH TEMPERATURE

The electrolyte thickens (gains specific gravity) as it coos. It loses specific gravity, as it gets hot. On the ball hydrometer this is not important. But on the float hydrometer correction of the specific gravity reading should be made if the electrolyte temperature is well above or below the 80^0F [27^0C] standard. Specific gravity changes about four points for every 10^0F change in temperature. A reading of 1.250 at 120^0F (48.9^0C) would correct to 1.266 (add 0.016 or 4x 0.004) A reading of 1.230 at 20^0F (-6.7^0C) would correct to 1.206 (subtract 6x 0.004 or 0.024).

24-17 LOSS OF SPECIFIC GRAVITY FROM AGE

As a battery ages the electrolyte gradually loses specific gravity. This loss is due to aging and nothing can be done about it. Eventually the battery wears out and must be replaced.

24-18 LOSS OF SPECIFIC GRAVITY FROM SELF-DESCHARGE

If a battery stands idle for a long time, it will gradually run down. This is due to the chemical actions between the electrolyte and the battery plates. The higher the temperature the more rapid this self-discharge.

24-19 FREEZING TEMPERATURE OF ELECTROLYTE

The higher the specific gravity of the electrolyte the lower the temperature must be before the electrolyte freezes. The battery must be kept sufficiently charged in cold-weather to prevent freezing. Freezing may run the battery (Fig 24-10).

24-20 CHARGE INDICATOR ON MAINTENANCE FREE BATTERIES

Many maintenance free batteries have a charge indicator on their top (Fig 24-11) The appearance of the charge indicator shows the state of charge of the battery.

CAUTION If the charge indicator shows yellow do not attempt to recharge or test the battery. It is close to failure and should be replaced. Never attempt to jump-start the car if the charge indicator shows yellow (25-9)

24-21 BATTERY-CAPACITY (HIGH DISCHARGE) TEST

For this test a special tester is used. It places a load on the battery voltage can be measured while a

Specific gravity	Freezing Temperature Degrees F(C)
1.100	18 [-8.2]
1.100	1[-17.2]
1.200	-17[-27.3]
1.320	-31[-35]
1.260	-75[-59.4]
1.300	-95[-70.5]

Fig 24-10 Specific gravities and freezing temperatures for battery electrolyte.

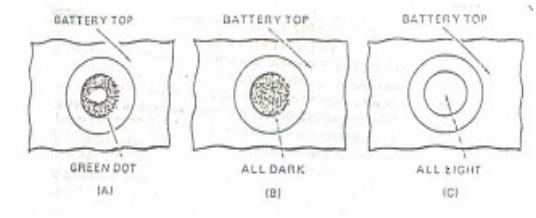


Fig 24-11
Appearance of the charge indicator in the top of some maintenance-free batteries (A) If the green dot shows the battery is charged (B) If the indicator shows black the battery low and should be charged before testing (C) If the indicator shows light yellow the battery is dead and should be discarded.

High current flowing out of the battery. Specifications for this test vary. Follow the procedure in the tester operating instructions. Specifications for voltage and battery capacity are in the manufacturer's service manual. In general a load of three times the battery ampere-hour capacity is placed on the battery. You can also use one-half of the cold-cranking rate at 0^0F (- 17.8^{0}C). At the end of 15 seconds a good battery should show a voltage of 9.6 volts or together. If the voltage is less than 9.6 volts and the battery has removable vent plugs check the specific gravity of each cell if there is more than a 50-point difference between cells replace the battery.

24-22 BATTERY SERVICE

Battery service can be divided into four parts visual inspection testing charging and care of batteries in stock.

24-23 BATTERY TESTING AND ANALYSIS

Battery testing includes a check of the condition of the battery. It should also include analysis of any abnormality found so that corrections can be made. This will prevent a repetition of trouble. Following are various battery troubles and their possible causes. These apply mainly to vent-plug batteries

1.**Overcharging** -If the battery frequently requires after, it is probably being over being overcharged. Too much current is being supplied to the battery. This is a damaging condition that overworks the active materials in the battery and shortens battery life. In addition overcharging causes more rapid loss of water from the battery electrolyte. Unless this water is replaced frequently the electrolyte level is likely to fall below the tops of the plates. This exposes the plates and the separators to the air and may run them. Also battery overcharge causes the battery plates to buckle and crumble. Therefore a battery subjected to severe overcharging will soon be ruined Where overcharging is experienced or suspected the charging system should be checked. It should be serviced if necessary to prevent overcharging (Chap 26).

2.**Undercharging-** If the battery is discharged, it should be recharged as outlined later in this chapter. In addition an attempt should be made

to determining the cause of the trouble. It could be caused by:

a. Charging-system malfunctioning.
b. Defective connections in the charging circuit between the alternator and the battery.
c. Excessive load demands on the battery.
d. A defective battery.
e. Permitting the battery to stand idle for long periods so that it self discharges excessively.

In addition an old battery may have a low specific-gravity reading because it is approaching failure.

3. **Sulfation** -The active materials in the plates are converted into active material during recharge. However if the battery stands for long periods in a discharged condition the lead sulfate is converted into hard crystalline substance. This substance is difficult to reconvert into active materials by normal charging processes. Such a battery should be charged at half the normal rate for 60 to 100 hours. Even though this long charging period may convert the sulfate to active material, the battery may still remain in a damaged condition. The crystalline sulfate, as it forms tends to break the plate grids.

4.**Cracked Case-** A cracked case may result from excessively loose tight hold-down champs, from battery freezing or from flying stones.

5.**Bulged Cases** - Bulged cases result from tight hold-down clamps from high temperatures.

6.**Corroded Terminals and Cable Clamps** -The condition occurs naturally on batteries. Excessive corrosion should be removed from cable clamps and terminals(24-13)

7.**Corroded Battery Holdo-** Some spraying of battery electrolyte is natural as the battery is being charged. The battery holder may become corroded from the effects of the electrolyte. Such corrosion may be cleaned off, with the battery removed. Use a wire brush and a solution of baking soda and water.

8.Dirty Battery Top- The top of the battery may become covered with dirt and grime mixed with electrolyte sprayed from the battery. This should be cleaned off periodically (24.13).

9.**Discharge to Metallic Hold-Down-**

If the hold down clamps are the uncovered metallic type, a show discharge may occur from the insulted terminal to the hold down clamp. This is more apt to occur with a dirty battery top across which current can leak. The remedy to keep the battery top clean and dry.

24-24 REMOVING AND REPLACING BATTERY

To remove a battery from a car first take off the grounded battery-terminal cable clamp. This prevents accidental grounding of the insulted terminal when it is disconnected To remove a nut-and-bolt type of cable loosen the clamp out about 3/6 inch (9.5 mm) Use a box wrench or special cable pliers. Do not use ordinary pliers or an open-end wrench. Either of these might break cell cover when swung ground. If the clamp sticks, use a clamp puller. Do not use a screwdriver or bar to pry on the clamp. This could damage the battery cell all or cover. To detach the spring-ring type of clamp squeeze the ends of the rings apart with Vise-Grip or Cannel lock pliers.

After the grounded cable is disconnected disconnect the insulted-terminal cable. Clean both battery terminals and cable clamps (24.7) Loosen the battery hold-downs and take out the battery. When installing a battery do not reverse terminal connections. Reconnect the insulted-terminal cable Apply corrosion inhibitor to clamps and terminals. Install and tighten the hold-downs. Avoid overtightening.
Careful -Make sure the cable clamps are light and make good connections with the terminal posts (top terminal battery) If the jaws of fine clamp touch together the clamp is not tight on the post. Shave the clamp jaws with a file until there is a gap when the clamp is installed.

24-25 BATTERY ADDITIVES

Certain chemical compounds when added to the battery cells are supposed to restore a battery to a charged condition. Such chemicals should never added the battery. Their use may void the battery guarantee and cause battery failure.

24-26 BATERY SLOW CHARGING

Two methods of slow charging batteries are in use, the constant-current and the constant-voltage methods. In the constant-current method, the current input to the battery is adjusted to the manufacturer's specifications. The charging is continued until the battery is gassing freely and there is no rise in specific gravity for 2 hours. In the constant-voltage method, the charging voltage is held at a constant value. The battery, as it approaches a charged condition increases in resistance to the charging current. At the same time, the current input gradually tapers off. When the battery is fully charged the current input has been reduced to a few amperes. The battery electrolyte temperature must remain within limits. If the battery electrolyte temperature increases greatly the resistance of the battery will remain low. Then the battery will be damaged by overcharging unless it is quickly removed from the charger. Before charging battery check the electrolyte level If the level is low, the battery can be damaged. If the level is too high the electrolyte can overflow because of gassing and heat. Here are cautions to observe.

1. The gases released by batteries under charger are very explosive. Be sure the area is well ventilated. Do not smoke on have open flames around charging batteries This could cause an explosion
2. Be sure to disconnect the battery ground step if the battery being charged in a car Otherwise you can damage the electrical equipment in the car
3. Most manufacturers recommended leaving the cell caps in place. But make sure the vent holes are open. Cover the caps with a cloth during the charging procedure Some manufacturers recommended removing the caps and coving the openings with a cloth
4. Do not charge a battery that is frozen. It could explode
5. Always wear some type of eye protection
6. If the charger indicator of a maintenance-free battery shows yellow on clear, do not charge it.

The electrolyte level is low, and charging it could cause an explosion. The battery should be discharged

7. Do not turn the charger on until the charger cables are connected to the battery. Turn the charger off before disconnecting the cables
8. Check the specific gravity and temperature of the electrolyte periodically during charge. If the temperature goes above 125^0F (51.7^0C) stop the charge.
9. The battery is fully charged when the specific gravity shows no increase for 3 hours. Also the cells should be gassing freely
10. After charging, wash and dry the battery top. This removes any electrolyte that might have spewed out during charge.

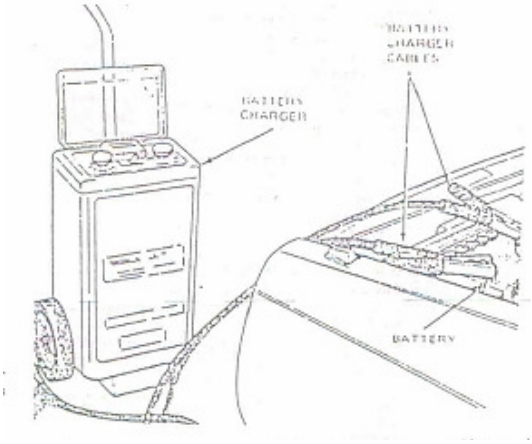
24-27 QUICK CHARGERS

The quick charger can be wheeled up to the car and connected to the battery in the car (Fig 24.12) Here are some special points to watch when using a quick charger. These chargers can supply a fast charge of up to 100 amperes (for some types) Normally you would set the charging rate for about 40 to 50 amperes and charge the battery for about 30 to 45 minutes. This boosts the battery with up to 38 ampere does not go above 125^0F (51.7^0C)

Quick charging usually cannot bring the battery to full charge in a short time. To bring it up to full charge, the battery should be given a slow charge after the quick charge.

Careful -A battery with discolored electrolyte (from cycling) or with gravity readings more than 25 points apart should not be quick charged. Likewise a badly sullated battery should not be quick charged. Such batteries may be near failure but they may give additional service if slow charged However quick charging might damage them further. During quick charging check the color of the electrolyte Stop charging if it becomes discolored as a result of the stirring up of washed-out active plate material Likewise cell voltages should be checked every few minutes Charging should be stopped it cell voltages vary more than 0.2 volt.

Careful -When quick charging a battery in a car disconnect the battery ground strap to protect the electrical system from damage due to high voltage. If the charge indicator in a maintenance free battery shows yellow do not try to quick charge it(24-20)



24.12 Quick charger connected to a battery in the car. The grounded battery cable should be disconnected before charger cables are connected(Chryster Corporation).

A very low battery may not accept a fast charge. The electrolyte in a very low battery does not have very much sulfuric acid in it. Therefore, the

conductivity of the electrolyte is too low to allow a high current to flow through the battery. You might think a battery that refuses to make a high charge is torn out. However, it may be possible to restore the battery to a charged condition. First slow charge it for a few minutes to see whether it starts coming up to charge. If does, then it can be put on fast charge.

24-28 CARE OF BATTERIES IN STOCK

Wet batteries (new batteries shipped with electrolyte in them) their perishable. They are subject to self-discharge. If allowed to prevent this batteries in stock should be recharged every 30 days. They should not be stacked on top each other without additional support. The weight of one battery is enough to collapse the plate assemblies.

24-29 DRY-CHARGED BATTERIES

Dry-charged batteries contain fully charged positive and negative plates but no electrolyte. The batteries are sealed with rubber or plastic seals placed in the vent plugs. Since the batteries contain no moisture practically no chemical action can take place in them. This means that they will remain in good condition for as long as 36 months.

Dry-charged battery manufacturers supply ready-mixed electrolyte in special cartons. The carton contains an acid proof plastic bag, which holds the electrolyte. The following steps are performed to activate a dry-charged battery

1. Remove the vent plugs, and take out the plastic seals
2. Remove the lid from the electrolyte container. Unfold the top of the plastic bag, and cut a small opening in one corner of the bag
3. Use a glass acid-proof funnel and fill each battery cell. Wear goggles and observe all cautions already noted regaraging sulfuric acid. Wait a few minutes and then add more electrolyte if necessary. Some electrolyte will probably be left. Do not attempt to use it all. Do not overfill the battery.
4. Before discharging the container, empty it Rinse the bag thoroughly with water. Otherwise someone who handles the carton might be severely burned.

*****REVIEW QUESTIONS*******

Select the one correct. best or most probable answer to each question. You can find the answers in the section indicated at the end of each question.

1.When working around batteries remember that (24-10)

a. battery electrolyte contains a very corrosive acid.

b. explosive gas forms in the battery which it is being charged.

c. the battery can furnish a very high current if it is shorted.

d. all of the above.

2. When disconnecting a battery always (24-10)

a. remove the vent plugs first

b. disconnect the insulated – terminal cable first

c. disconnect the grounded-terminal cable first

d. put the transmission in PARK or REVERSE.

3. The battery is an electrochemical device. This means that the battery(24-1)

a. makes chemicals by mechanical means

b. uses chemical action to provide electricity.

c. has curved instead of flat plates

d. does not use an electrolyte.

4.The purpose of the battery is to(24-1)

a. supply current for cranking the engine

b. supply current when the charging system can't handle the complete electrical load

c. both of the above

d. neither of the above

5. The length of time in minutes that a fully charged battery at 80^0F (26.7^0C) can deliver 25 amperes is called the (24-6)

a. charging rate

b. reserve capacity

c. Cold-cranking rate

d. ampere-hour rate

6. The number of amperes that the battery can deliver for 30 seconds when it is at 0^0F (1-17.8^0C) before the battery voltage falls to 7.2 volts is called the (24-6)

a. charging rate

b. reserve capacity

c. cold-cranking rate

d. ampere-hour rate

7. If you must add water to the battery every few days, the battery probably (24-23

a. overloaded

b. overcharged

c. sulfated

d. old

8. A loose battery-cable clamp could cause (24-23)

a. battery overcharged

b. high battery voltage

c. overheating

d. run down battery

9. On a top-terminal battery, the negative terminal post is (24-3)

a. Smaller than the positive terminal post

b. Larger than the positive terminal post

c. The same size as the positive terminal post
d. None of the above

10. You can quick charge the battery at as much as 50 amperes provided (24-27)
    a. the electrolyte does not get too hot
    b. you do not charge for more than 5 minutes
    c. you make sure the battery is fully charged
    d. It remains connected to the electrical system.