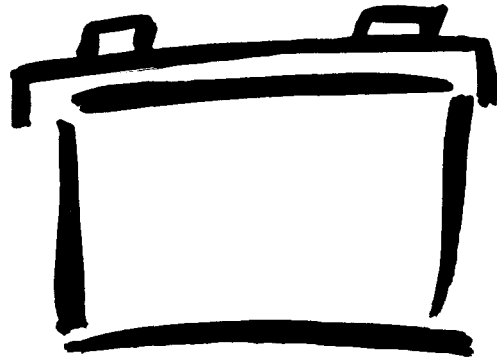




# Battery Basics

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# Battery Construction

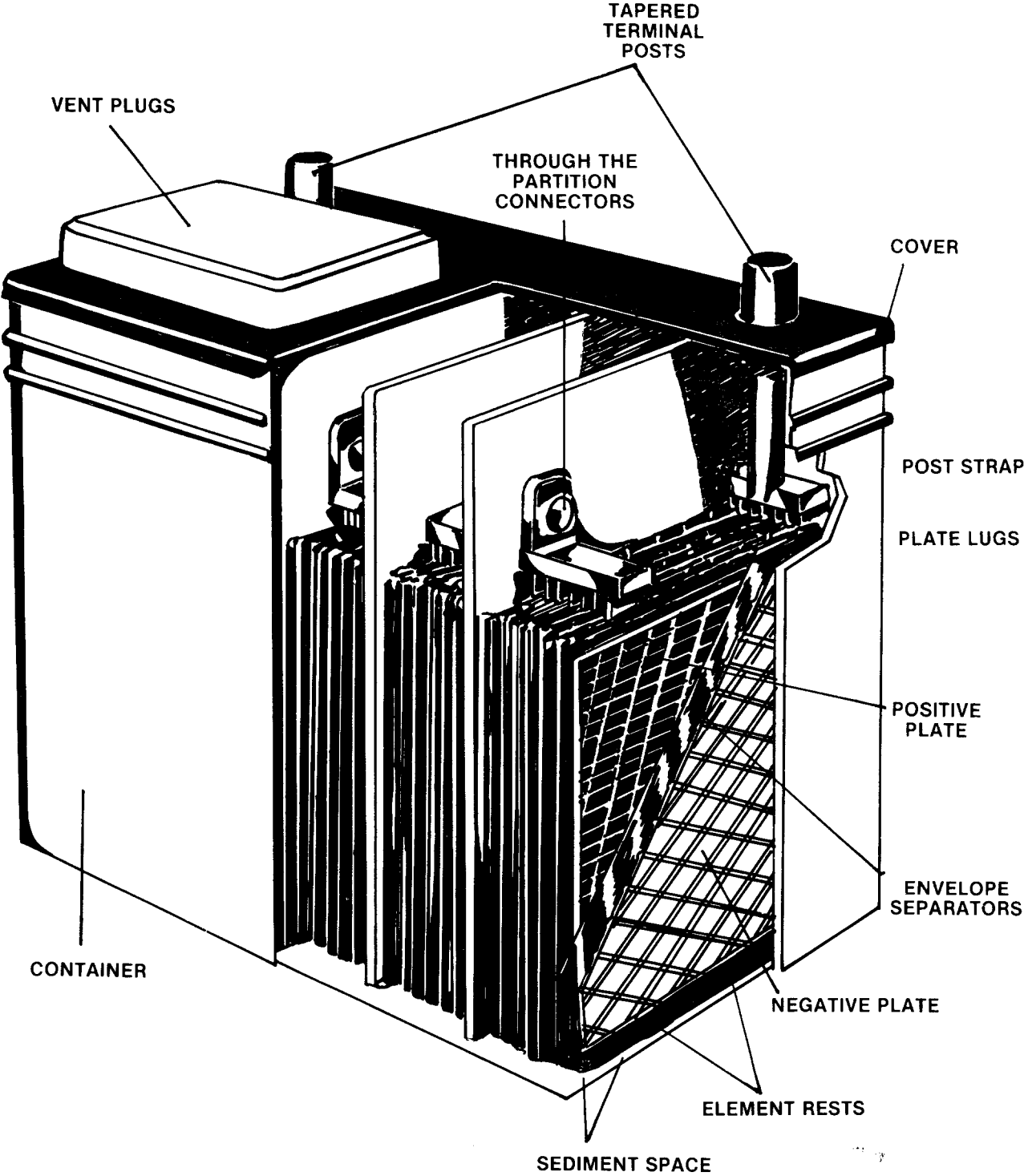


Figure 1. Cutaway of storage battery.

## Battery Safety

Storage batteries must be handled with care. They contain sulfuric acid (the electrolyte) and fragile lead-antimony or lead-calcium plates. The case, made of plastic or hard rubber, can be damaged by rough handling. See Figure 1.

Cable clamps should fit properly without the need to hammer them onto the posts, possibly damaging the battery. Flush mounted cable connections should be tightened with care; tightening too much may result in damage to the battery. Use care in removing cables; too much force can result in battery damage.

The electrolyte in a battery is sulfuric acid. It is strong when the battery is charged and weak when the battery is discharged. The acid can cause severe tissue damage since it is approximately 36 percent sulfuric acid and 64 percent water. It will eat holes in clothing, burn skin, and cause blindness. Even in the discharged state, at 12 percent acid, it can cause burns. Tipping the battery should be avoided since it may cause the acid to spill, with possible injury or damage. Acid must be respected. Lead-acid storage batteries produce hydrogen and oxygen gases when they are charging and discharging. Hydrogen mixed with oxygen is very explosive and can be ignited by a spark or a flame. This may explode the battery case. Always use an electric light to check the electrolyte level, never a match; it could ignite any gases present.

Remove and attach battery cables in the right order. The ground cable should be disconnected first and connected last. If a wrench were to slip while you are working on an ungrounded connection it could complete a circuit with part of the vehicle, produce a spark and ignite any hydrogen gas around the battery. Do not work on a battery while the vehicle's engine is running. Current may be flowing in or out of the battery, increasing the chance of a spark.

Use a battery tester to determine the level of charge. Never short across the posts of a battery to determine its level of charge. Even a heavily discharged battery can produce a spark that could ignite hydrogen gas around the battery and cause an explosion. Connecting the two posts of a battery with a short wire may also cause burns to the hands.

## Battery Maintenance

Always keep the level of the electrolyte at the proper level. Add distilled water to raise the electrolyte level. Using other water may add undesirable minerals to the electrolyte, reducing the life of the battery. Add water to a discharged battery only when it is about to be recharged.

A frequent need to add water may indicate that the battery is being overcharged, so the vehicle's charging system should be checked. Maintenance free batteries are sealed, resulting in electrolyte levels which can't be adjusted, although there are vents for gases to pass through.

Extreme temperatures are not friendly to storage batteries. Extreme cold will reduce the power available, and will make the battery case brittle and easily broken. Extreme heat will result in electrolyte loss due to evaporation. Batteries should be stored at temperatures between 32 and 60 degrees F. and recharged monthly to maintain their charge.

Batteries should be kept clean and dry. Moist accumulations of dirt on a battery may cause it to lose its charge due to current flowing through the moist dirt from one post to the other.

A solution of baking soda and water can be used for cleaning the battery. Use one tablespoon of baking soda per cup of water until completely dissolved. It will neutralize and remove accumulations of acid contaminated soil on the battery and also cleanse the exterior. Do not allow the baking soda water to get in the battery; it is for external cleaning only. The baking soda solution should be rinsed away with plenty of clean water and then all surfaces dried.

Battery connections should be put together clean and dry. The connecting surfaces should be clean, shiny, and snug fitting, but not so tight that they must be forced together by hammering or severe twisting. This may damage the battery.

Treated felt washers are available that can be installed over the battery post before the cable is attached. The washer will reduce corrosion in and around the connection. A light coating of petroleum jelly or grease can be applied to the exterior of the connections to prevent additional corrosion.

The battery should be held in place with clamps or other restraints. Vibration or bouncing is hard on cable connections, the battery case and internal parts, and will shorten the life of the battery.

## Battery Chargers

Battery chargers should always be turned off or unplugged before cables are attached or disconnected from the battery. This reduces the chance of a spark which may ignite hydrogen gas. Even the gas inside the battery may be ignited from an internal spark if there is a poor connection between internal parts, another reason to make battery connections with care. A battery with an intermittent, internal break should be replaced. It is dangerous as well as unreliable.

The battery charger should be set to the correct voltage output and the polarity of the connections correct so that neither the charger or battery is damaged. Remember, positive to positive (usually red to red) and negative to negative (usually black to black). The battery charger and the battery being charged should always be used with good ventilation to prevent any buildup of explosive gases. Do not overcharge the battery, or it will be damaged. Most battery chargers decrease the amount of charge automatically as the battery becomes charged, eventually dropping to a trickle charge.

## Battery Selection

Storage batteries have a limited life and need replacing when that life is over. There are several considerations to selecting the replacement battery.

1. Physical size. The new battery must fit the mounting box and brackets of the vehicle. There may be situations where there is more than enough space. However, a replacement battery should never be too large to fit properly and should be fastened securely in place.
2. Electrical size. There are two ways of measuring the electrical size of a storage battery.

**Cold Power Rating or Cold Cranking Amps.** This rating indicates the power for starting at low temperatures. It is the amperes of electricity that can be delivered at 0 degrees F. for 30 seconds while the battery voltage stays above 7.2 volts. A battery should be selected according to the engine size of the vehicle. A small four-cylinder engine requires fewer cold cranking amps than a large eight-cylinder engine.

**Reserve Capacity.** This new rating indicates the number of minutes that 25 amperes of electricity can be delivered at 80 degrees F. while the battery voltage is above 10.5 volts. Reserve capacity tells you how much time you will have to keep the engine running when the charging system has failed. The load of 25 amperes is similar to the battery drain from ignition, headlights, and normal accessory use. The more minutes of reserve capacity, the greater the margin of safety.

3. Dry-charged vs wet-charged batteries. A dry-charged battery is stored on the dealer's shelf without electrolyte in it. The dealer must put electrolyte in the battery and briefly charge it before installation in the vehicle.

A wet-charged battery is stored on the shelf with electrolyte already in it. It may require charging before dealer installation. Wet-charged batteries that are stored too long without periodic charging may become permanently damaged.

Dry-charged batteries have the advantage of a longer shelf life. Wet-charged batteries are usually ready to go from the dealer's shelf with little or no charging.

4. Maintenance free batteries are constructed differently than conventional batteries. They have lead-calcium plates instead of lead-antimony plates. This reduces the amount of electrolyte loss because there is less gas production. These batteries are wet-charged and have a longer shelf life due to a low discharge rate.

Selecting a replacement battery is not difficult. Carefully match the requirements of the vehicle to the features provided by the batteries considered. Usually it is a process of placing a value on the available features and making a decision.

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