

Common Battery Pack Issues and Problems (and how *PakTrakr* helps you solve them!)

PakTrakr helps you monitor and manage a battery pack during driving and charging cycles. It quickly identifies battery pack and individual battery problems, then alerts you or your service technician by displaying “alert symbols.” If recognized and addressed early, most battery problems can be easily corrected. In some cases, the remedy might be to replace a single battery. In other cases, you may simply need to add water to the batteries, recharge the pack, adjust the charging cycle, or charge individual batteries to balance the pack. Proper and timely correction of these problems extends the life and enhances the reliability of your battery pack.

In lead-acid batteries, and particularly in strings or packs of batteries, there are common problems and issues that can surface. These are described in the following paragraphs.

Low State of Charge (SOC)

Lead-acid batteries are designed to perform for hundreds of charge-discharge cycles. However, batteries that are left in a discharged (or even partially discharged) state begin to lose some of their long-term storage capacity due to sulfation—an insulating build-up on the battery plates that reduces battery performance. That means it’s important to recharge a battery pack immediately after every use. Also, the deeper a battery is discharged (the lower the SOC), the shorter the useful life of the battery will be. So, for excellent battery life, it is recommended to keep a battery’s charge level at 50% or higher. If you consistently discharge a battery (or battery pack) to 0% SOC, you could reduce its useful life by one-half, compared to one that you consistently discharge to no lower than 50% SOC.

Think of battery power as “fuel” and remember that you should “top off” the fuel tank after every driving cycle, and don’t let the “tank” get below “half full.”

Just like a fuel gauge, *PakTrakr*’s SOC display helps you estimate your remaining range based on the current state of charge. In addition, the *PakTrakr* SOC display will flash as an alert that the pack has less than 30% charge remaining.

To optimize the life of your battery pack, use the *PakTrakr* display to help you keep your battery pack’s SOC as high as possible, and to remind you to plug-in the charger after each driving cycle.

Failing Batteries

Due to manufacturing variations, excessive sulfation, prolonged battery pack imbalance, or loss of electrolytic fluid, the storage capacity of one or more batteries within a pack can diminish significantly, reducing their ability to provide their share of the pack's energy. This condition is seen as excessive voltage "sag" (drop) under load by one or more of the batteries, compared to the voltage levels of the other batteries in the pack.

A failing battery puts an additional load on the other batteries in the pack. It also significantly reduces the range of your vehicle, so it's important to replace failing batteries with healthy, new batteries as soon as possible. (If you're using an old battery pack, it's probably best to replace the entire pack and start with a new, well-balanced pack.)

PakTrakr identifies failing batteries while the vehicle is being driven, and notifies you with a *failing battery* alert. It also indicates which battery (or batteries) is failing.

Pack Imbalance

Pack Imbalance means the voltages of the batteries within the pack vary widely at the end of a charge cycle. This variance itself is not critical, but it can lead to other, more damaging problems. When charging an unbalanced pack, an automatic charger can be fooled into believing the pack is fully charged when, in reality, one or more batteries are being consistently over-charged, and one or more batteries are under-charged. If not corrected, this condition usually worsens over time and eventually will result in pack failure.

Some chargers attempt to maintain pack balance by over-charging for a brief period after every charge cycle. The reason for this is to give low-voltage batteries time to reach a full charge, but it does so at the expense of over-charging the other batteries. Even with automatic over-charging, pack imbalance is fairly common, but, if detected early, it can be easily corrected.

PakTrakr monitors the charging cycle and alerts you to excessive pack imbalance—and which batteries are under-charged—with its *pack imbalance* alert. To correct an imbalance problem, you can connect an individual battery charger (e.g., 6/8/12V) to each of the under-charged batteries to "top them off." You shouldn't need to perform pack balancing more than once every few months.

Low Electrolyte Level (“Low Water”)

“Flooded” batteries are those that require and allow you to add water to the existing electrolytic fluid, which is sulfuric acid diluted with water. When flooded batteries are over-charged, they split their electrolytic fluid into hydrogen and oxygen gas molecules. This “gassing” is normal behavior, and it causes battery problems only if the gassing is excessive and the fluid lost to gassing is not replaced in a timely manner.

WARNING: These gases are explosive, and charging should always take place in a well ventilated location (see the vehicle and charger manuals for cautionary details).

(Note: In “sealed” batteries, the gases are recombined and recovered, eliminating the need to add water.)

Electrolytic fluid is the medium through which the battery’s electrical energy flows, therefore, the loss of this fluid results in reduced capacity. It also causes damage to the battery’s plate surfaces due to exposure to the air as the fluid level drops. Low electrolyte level, in fact, is probably the number-one cause of premature battery failure in flooded batteries and often results in the failure of the entire pack.

To prevent these failures, *PakTrakr* continuously monitors all batteries in the pack for gassing during all charging cycles. When it determines that excessive gassing has occurred in one or more batteries, *PakTrakr* displays a *low water likely* alert, and indicates which battery(ies) needs fluid. You should then check each battery cell for the proper electrolyte level. Adding distilled or low-mineral-content water is recommended to obtain the adequate electrolyte level (see the battery manufacturer for specific level and fluids recommendations).

Damaged or Shorted Battery

Occasionally, a battery will have a catastrophic failure. *PakTrakr* detects any battery with less than minimum voltage and will display a *damaged battery* alert. Typically, even a full recharge will not revive such a battery. In this case, you should replace it immediately.

Incomplete Charging

As mentioned earlier, under-charging batteries is harmful because it leaves them in a partially discharged state, which can cause sulfation. And, of course, an under-charged battery cannot provide a vehicle with its full, expected range. Occasionally, a charger will not complete its charge cycle due to a faulty charger, a tripped circuit breaker, or various other reasons.

PakTrakr monitors the charging cycle and will display an *interrupted charge* alert if the charge cycle is not completed. In this situation, you should remedy the charger problem and make sure the battery pack always gets a full charge after every use.

Improper Maintenance

Dirt and debris that accumulates on the top of a battery can provide an electrical path through which battery energy (charge) can be lost. Loose terminal connections can result in excess resistance or even arcing, which causes energy loss or even a complete break in the connection. So, to maintain optimal battery pack performance, regular maintenance should include rinsing the tops of the batteries with tap water, tightening the terminals, and adding water to bring the electrolytic fluid to the proper level.

PakTrakr has a programmable *maintenance reminder* alert that is displayed to remind you to perform this maintenance. The default maintenance period is every four weeks, however, you can change it to any period from one to six weeks, as desired. Following this regularly scheduled maintenance plan can as much as double the life of your battery pack!