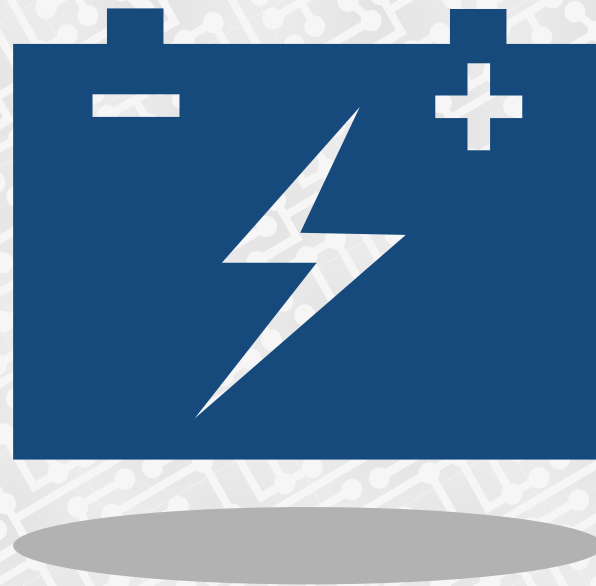




PURKEYS

CREATE A BATTERY PROGRAM THAT SAVES MONEY AND TIME

7 Steps to Improve the Life of Your Truck Batteries



The Heart of the Electrical System

Electrical challenges constantly inundate commercial trucking fleets, causing an increase in expenses and loss of revenue. The most common source of electrical problems is the heart of the electrical system – the battery.

Batteries are expected to perform better than before due to anti-idling laws and driver comfort loads, not to mention hot and cold temperature ranges. Batteries are also impacted by many factors related to the fleet's operations and equipment. Batteries often have shorter lives from being deeply discharged by additional device loads that stay on for long periods of time, such as refrigerators/coolers or GPS tracking systems.

Despite their convenience or operational improvement, additional device loads will slowly discharge the batteries - often unnoticed - until eventually they cannot provide enough power to start the truck. Fleet managers address the problem by making road calls to jumpstart the truck and/or replace batteries. These temporary solutions result in an increase in expenses and loss of revenue due to operational downtime.

Jerel Ellis, Purkeys Director of Customer Service, explains, “We’re not just looking to sell them batteries so we make money; we want to help them save money and use as few batteries as possible.”



The Cycle Life of a Battery is Like a Paper Clip

A paper clip can be bent back and forth, little by little, for a long period of time. However, if a paper clip is bent back and forth at 180 degrees each way, it breaks after a few bends.

Likewise, a battery can be discharged and recharged - known as a complete cycle - many times if the cycles are shallow, such as starting a truck. A discharge greater than 30 percent is generally considered a deep cycle, and when deep discharges occur repeatedly, they cause the battery to have a much shorter life. Powering a cooler/refrigerator for eight hours, is considered a deep discharge.

Many fleets try to mitigate deep cycling by specifying a larger alternator. Although the battery pack is recharged faster, the cycling damage to the battery has already been done and cannot be undone. The key to preventing the battery from ever deeply discharging is to limit the amount and length of time amperage is pulled from the battery pack for additional device loads that remain on while the engine is off.

Extending a battery's lifespan starts with an electrical audit that looks at all aspects of a fleet. From there a custom battery program can be developed to address specific equipment an operational needs.

When the Purkeys team begins an electrical audit of a fleet they look at all aspects of the fleet.

Battery programs should follow these seven steps:

- 1. Understand Battery Specifications**
- 2. Choose the Right Type of Battery**
- 3. Examine the Whole System: Starters, Alternators, Batteries and Circuitry**
- 4. Train Technicians**
- 5. Use Test Equipment Correctly**
- 6. Designate a Recharge Area**
- 7. Track Warranty**

STEP 1

Understand Battery Specifications

The specifications of a battery is the first thing to consider. Since each fleet is dealing with different scenarios it is important to understand:

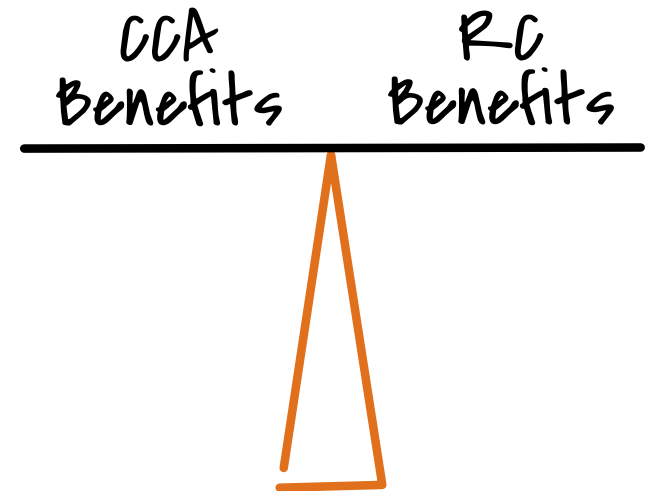
- Cold Cranking Amps (CCA)
- Reserve Capacity (RC)
- SAE J 2185 Test Results

CCA refers to the number of amperes a battery at 0 degrees Fahrenheit (-17.8 degrees Celsius) can deliver for 30 seconds while maintaining at least 1.2 V per cell. The higher the CCA, the more current the battery can deliver.

RC is defined as the number of minutes a new, fully charged battery at 80 degrees Fahrenheit (26.7 degrees Celsius) can be continuously discharged at 25 amps while maintaining at least 1.75 volts per cell. The higher the RC, the longer the battery will last before needing recharged.

A regional fleet in the South probably would not need batteries with high CCA because it may not operate in the severe cold. A regional fleet in the North should consider how many CCA batteries can deliver in cold weather and the fleet should match the correct CCA battery pack with engine CCA requirements.

Fleets that operate nationwide are more complicated since the higher the CCA, the less cycling ability the battery has. Typically, high CCA batteries do not have as much cycling ability as dual-purpose batteries. Using higher CCA batteries for nationwide routes may make the problem worse since sleeper cab operations are subjected to cycling during rest periods.



STEP 1

Understand Battery Specifications

A regional fleet running shorter day routes wouldn't typically need a battery with high CCA as long as the vehicle batteries have enough CCA to satisfy engine requirements in cold weather. Although regional routes may not need as much RC as sleeper cabs, some fleets have multiple stops and starts during the day. Compounded with anti-idling policies, choosing batteries with less RC could become problematic. Fleets that have drivers out overnight should look into batteries with higher RC because they can handle the extra hotel loads.

Adding more batteries will increase both total RC and CCA, which will boost a truck's ability to handle extra loads. Although it is important to compare the cost versus the benefits before making a commitment.

There is a trade-off when it comes to these two battery specifications. Fleets must consider the trade-off and pick the best option. If a battery is high in CCA, it will have a higher RC but it won't cycle as well. To get the most out of a battery, a fleet must first discover its top priorities.

While **SAE J 2185 test results** are not normally published on batteries, battery manufacturers and truck OEMs will have this data from deep cycle tests. Ask the battery supplier for SAE J 2185 test results, as this will be another indicator of how well the battery will cycle.

Purkeys' battery program looks at each fleet's individual needs and chooses the right battery for the application.



STEP 2

Choose the Right Type of Battery

Choosing the right battery for a fleet's specific needs is the second step in extending battery life. It may seem simple, but having the best battery to fit the exact needs of a fleet can make a huge difference. In the heavy-duty, commercial trucking industry, there are two main types of batteries to choose from:

- Flooded Cell
- Absorbed Glass Mat (AGM)

Research shows that AGM batteries are more efficient because they have low internal resistance, deliver high currents and can handle deep cycles. All of these features lead to a longer service life as AGM batteries typically cycle better than a comparably rated flooded cell battery.

While AGM batteries will reduce costs in the long run for some fleets, flooded cell batteries are still the most common. A switch from flooded cell to AGM can be an expensive transition or may not be of value to certain fleets.

Purkeys conducts audits for fleets all over the nation. Each fleet has unique needs that will determine the right type of battery to use.



Flooded Cell



Absorbed Glass Mat
(AGM)

STEP 3

Examine the Whole System

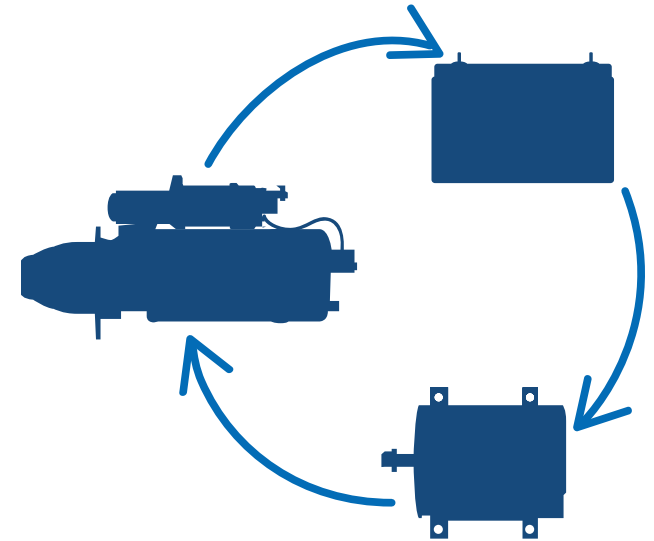
The right battery can only perform at its best when the charging system is working properly. Having the right alternator and charging circuitry will help maximize the life of a battery.

A traditional alternator will maintain 14 volts at the alternator's output terminal but the voltage at the battery pack is less due to voltage drop in the circuit. The charging circuit between the battery and the alternator can lose voltage when wiring ages, corrodes, becomes loose or is not properly connected. Due to the loss of voltage, the battery pack will take longer to reach its full state of charge, if it reaches full charge at all. This reduced state of charge causes less efficiency to the battery pack, which can damage the battery and lead to a significantly shorter life span.

Fleets should consider using remote sense alternators. The remote sense lead is a second wire between the battery and the alternator's remote sense terminal. The alternator's output adjusts based on the voltage at the batteries and helps to ensure batteries quickly return to a full state of charge and remain near full capacity.

Making certain that a battery gets the full 14 volts does the following:

- Improves battery charge time, especially in cold weather
- Improves the life cycle of the battery
- Can decrease warranty claims



STEP 4

Train Technicians

Proper training is critical to ensure the success of a new battery program. Every new routine or piece of equipment requires some amount of training so technicians can learn proper maintenance practices and know how to troubleshoot problems as they arise. Proper training will also reduce maintenance costs and extend investments by eliminating mistakes.

Classroom Training

Begin training in the classroom so technicians can see the electrical system as a whole. Instructors should use diagrams, photos and detailed explanations so technicians can see the electrical circuits that are not visible when working on a truck. Technicians will leave the training with a better understanding of how a vehicle's electrical system works and more prepared to apply the training on the vehicle.

Vehicle Training

By practicing with new meters and testers on vehicles, technicians will see how everything works together. Technicians will also be able to work through any problems that may arise and learn how to correct them before going on the shop floor.

In-Shop Equipment Training

Using in-shop testing equipment will give technicians a realistic approach to properly diagnose electrical problems. Accurately solving issues in the shop will save a fleet time and money by keeping trucks on the road and fully energized.



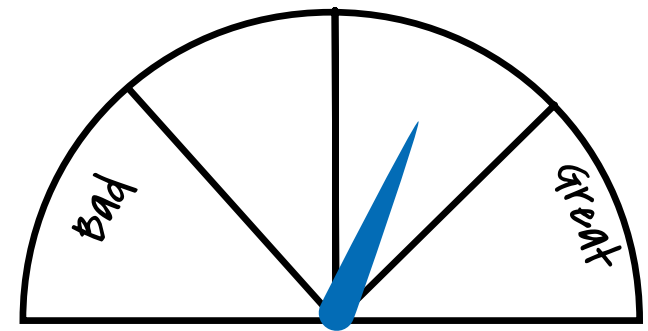
STEP 5

Use Test Equipment Correctly

Having the right testing equipment will help make sure fleets are not throwing away good batteries. Calibrating and maintaining meters and testers according to manufacturer's specifications is also essential. Research the types of meters and testers to find what will work best to support the fleet's goals of more efficient electrical systems on its vehicles.

Once the testing equipment is in place, it is important to use everything correctly. A few ways to get the most out of your testing equipment is to:

- Make sure the **PM sheet and procedures are specific**. For example, the PM sheet should read "test the cranking system for voltage drop with XYZ tester and record the results", versus "test the starter circuit."
- **Make sure the tester is in good working order**. Fix broken testers. Testers that are out of calibration or not functioning properly will give incorrect readings.
- **Calibrate the testers**, since decisions are being made based on their readings. Make sure to set the baseline by zeroing out the meter after it is installed on the circuit.
- **Replace Meter Batteries Annually** as batteries in a low state of charge cause incorrect readings. Date the tester battery with a permanent marker so you know how old it is the next time you check.
- **Review the tester history** and make sure technicians are using the tester and all its features.
- **Upgrade tester software** to the most recent version. Tester manufacturers are constantly upgrading testing software.



Purkeys battery programs take advantage of a fleet's historical data to help identify problems, so they can be quickly fixed.

STEP 6

Designate a Recharge Area

Battery manufacturers will honor warranties on failed batteries. Discharged batteries are not necessarily failed batteries, however, it's critical that batteries be at a good state of charge before testing. Having a well-organized recharge area allows technicians to recharge batteries quickly. It can also reduce confusion by keeping warranty batteries separate from core batteries.

Organize

A fleet's recharge area should incorporate five categories:

- To Be Charged
- Charged and Ready to be Tested
- Tested Good
- Tested Bad, Warranty Claim
- Tested Bad, Core

By implementing a uniform system with clear labels, all technicians can follow the same steps to determine if a battery needs to be recharged or not. It is also helpful to post instructions near the recharge area to avoid confusion.

The Right Charger

The right charger is essential for a successful recharge area. If a fleet is using both AGM and flooded cell batteries, it is important to have a charger that can do both. Not every charger is AGM-compatible, so it may be necessary to have two chargers.

It is also important to have a charger that will shut off automatically. If a battery is overcharged, the heat generated during that process can permanently damage it, causing it to have a much shorter life. By having a charger that shuts off automatically, technicians can also work on other jobs while batteries are charging.

Testing Equipment

The right, correctly calibrated testers can reduce the number of discharged batteries sent to the trash. If a tester is even slightly off it will give incorrect readings, resulting in sending a perfectly good battery into the "tested bad" category.

Use the Following
Labels in the
Recharge Area:



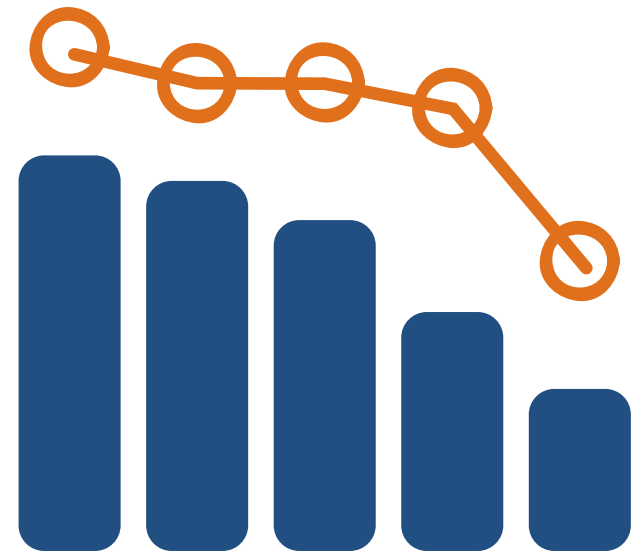
STEP 7

Track Warranty

Fleets should purchase batteries that have warranty coverage by the battery manufacturer or OEM. The likelihood of needing warranty increases each month the battery is in service and yields greater returns in the long run. Similar to an insurance policy, a warranty protects the fleet's investment by providing more service on batteries. Fleets should calculate warranty costs as a cost-per-month expense.

Battery distributors expect fleets to monitor and report battery test results to process a warranty claim, so fleets must be sure to keep up with regular maintenance and documentation. Do not mix cores with warranty units in order to recover expenses of poor performing batteries.

Purkeys provides ongoing support to ensure all battery warranty claims are handled properly. They oversee the number of batteries purchased and submitted for claims. The electrical experts also document how much money is recovered. Good documentation and keeping up with maintenance can reduce a fleet's battery expenses.



Conclusion

By following these battery program improvement steps, fleets will be more likely to see battery turnover and truck downtime decrease and revenue increase. Fleets should implement a battery program for the entire fleet rather than by location, as a standard battery program provides optimal benefits to the fleet. To recap:

1. Select the best battery specifications to meet the needs of the fleet
2. Find the right battery
3. Find a whole system that works together – starter, alternator, batteries and circuitry
4. Train technicians
5. Maintain test equipment for the starter, alternator, batteries and cables
6. Create an organized and efficient recharge area
7. Track warranty



Case Study

How Purkeys Saved Over Two Batteries A Year – Per Truck Reduced Component Usage and Wasted Warranty Returns

Challenge

One of the largest transportation logistics companies in North America hired Purkeys to solve electrical challenges as their fleet grew to 3,000 trucks.

Due to the rapid growth, the Client had inefficient procedures in place. They were not using the right products or testing equipment properly, and some technicians were not adequately trained. Starters and alternators failed and batteries died quickly. “It was a bad situation,” said Bruce Purkey, founder and chief creative engineer at Purkeys. “The Client spent a lot of money replacing parts and around a million dollars a year on jump-starts.”

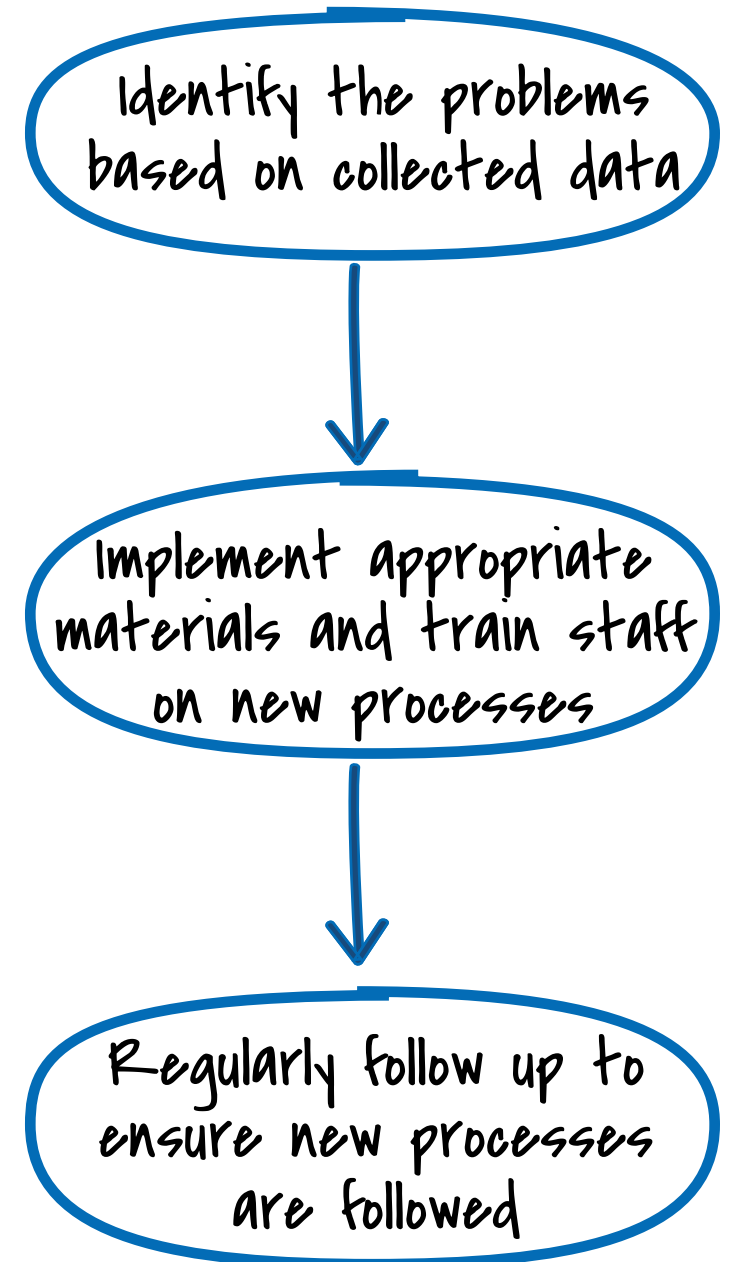
The Client attempted to resolve the issues by throwing away or returning parts for manufacturing warranty. Products submitted for warranty were returned, which cost the Client time and money.

Solution

While the Client’s electrical problems were not resolved overnight, Purkeys established a three-phase process in order to identify the critical issues first.

Purkeys’ first step was to identify the problem. They gathered data and looked at the issues from a statistical standpoint to see what kind of life the Client was getting out of their products.

After identifying the problems, Purkeys determined the correct batteries, alternators, starters and circuitry to use on the Client’s trucks. Purkeys then went to all Client locations and trained staff on how to properly test equipment and follow appropriate processes. After the initial consultation, Purkeys provided ongoing training to staff.



A critical aspect in Purkeys' solution was the Client's willingness and support to resolve the costly challenges. This enforced the new and improved training and procedures. It is critical that upper management support these programs. "It can't be known as a Purkeys Program," Purkey says, "It must come from the fleet and be supported at all levels".

Finally, Purkeys would routinely go back to the Client and check on the staff and test products. Some of the issues they found included people forgetting how to test properly and follow new procedures.

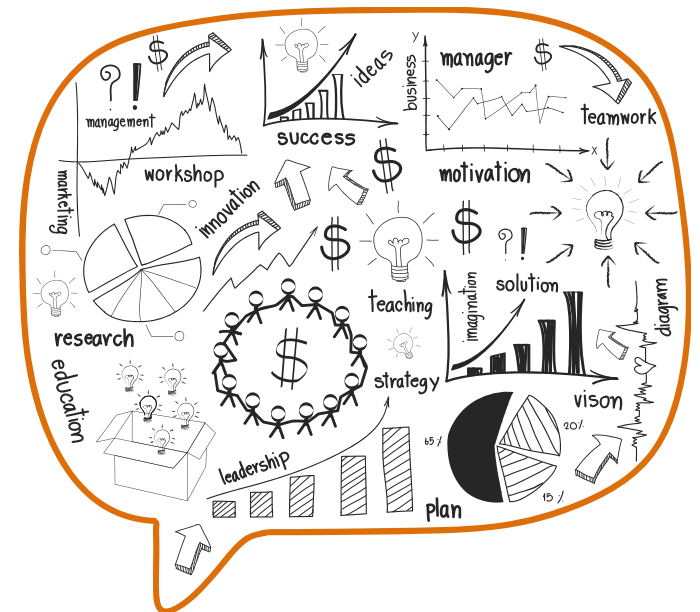
Results

Purkeys immediately saved money for the Client by significantly reducing the number of jump-starts and improper product warranty procedures.

Installing the proper products, developing new testing procedures and training staff reduced the Client's annual purchase of batteries by 78%, alternators by 92% and starters by 89% over the course of a few years and continues today.

Purkeys maintains positive results by monitoring the Client's product warranty programs. "The real value we bring to Clients is monitoring their warranty results, we can see whether the training worked by the amount of warranty claims," Purkey said. "We can see problems before the Clients do. That's our job."

When asked about the Client's success with its electrical system, Purkey said, "I like to think we played a part in their success. They have been very good to us. After all these years, they still value having us around. We continue to build custom solutions that give them a competitive advantage in the industry."



"It can't be known as a Purkeys Program," Purkey says, "It must come from the fleet and be supported at all levels".

About Purkeys

Since 1990, Purkeys has made an impact in the commercial trucking industry through electrical advisement and solutions. Purkeys' success is a result of its industry knowledge, expertise, communication, and innovation by:

- Understanding and overcoming challenges with trucking fleets
- Recognizing electrical problems before equipment and operational breakdown
- Saving money and time through open communication concerning electrical issues
- Innovative solutions to maximize long-term electrical efficiency, prevent waste, and safeguard investments

Purkeys not only identifies electrical problems, they innovate the solutions, educate and train staff. Open and honest communication with clients has been and will continue to be the foundation to Purkeys' support and innovations. Purkeys continues to be involved in the private sector and with trade organizations such as ASE, TMC, and APRA. Fleets and manufacturers depend on Purkeys as a proven credible resource for electrical consultations and solutions.

Bring Purkeys the problem – they will deliver the solution.

