The Critical Role of AGM Separators in VRLA Car Battery Performance

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Abstract:

As consumer demand for electronic components in automobiles continues to grow, the challenge of meeting power consumption is becoming more complex. The increased electrical requirements placed on the traditional flooded automotive battery have resulted in growing adoption of a more suitable lead acid battery technology. Advanced battery performance demands include enhanced cycling, improved safety features, and eco-friendly design. Valve regulated lead acid (VRLA) batteries, featuring absorbed glass mat (AGM) separators, have proved to be an effective solution to these needs.

Introduction

With the advance in electronics technology, the demand on a car battery is changing. Automobiles require a 24-hour power source for electronic features. Today's battery must supply more power than ever, for both the increasing number of electrical devices and for critical components such as electronic steering and braking. In addition, the supply of power has become critical for vehicle safety and environmental concerns. Increasing 24-hour electrical demands and the need for versatility from a power source led car manufacturers to use a more suitable lead acid battery technology enhanced with absorbed glass mat (AGM) separators.

The customer's problem

Customers want better power delivery experience, but at the same time, demand extended battery life. Premium automotive electrical devices are in high demand. This is especially true with electronic accessories that provide for increased convenience, safety, and energy savings, such as power seats and windows, DVD players, remote or voice-activated start, anti-theft devices, Global Positioning Systems (GPS), brakes, valve controls, and more. These new systems require more electrical power, driving the need for stronger alternators and more powerful batteries.

These ever-increasing power requirements have put a greater demand on the older generation of maintenance-free car batteries and alternators. A Wall Street Journal article by Jonathan Welsh, "Why Car Batteries Are Dying Young", verifies the fact that car batteries are being consumed by the power electronics in today's vehicles. The article mentions that today's batteries may last only 2 years, rather than the traditional lifespan of 3-5 years, due to steady growth of electrical accessories in the average car. Given the continual need to supply a better power source, car manufacturers are seeking a solution that can sustain these demands.

What technologies are available?

Traditional flooded lead acid batteries were designed to start a car on hot summer or sub-zero winter days. These conventional batteries, grouped as Starting-Lighting-Ignition (SLI) batteries, performed well when starting the car and powering the radio and lights. However, the automotive battery of the future must be able to effectively handle cycling – charging and discharging – an attribute that was not built into today's flooded batteries. To solve this problem, a more technologically advanced battery is becoming the future standard - the valve regulated lead acid (VRLA) battery. With improved designs and state of the art separators, VRLA provides the driver with a power source that offers excellent starting despite cold or hot weather conditions, effective cycle capability, and increased safety.

A better solution

The VRLA battery with AGM separator, also known as recombinant or sealed lead acid battery, was developed in the 1970's, and the technology has replaced the traditional flooded lead acid batter-

ies in most Uninterruptible Power Supply (UPS) and stand-by applications because it offers a better power delivery experience. In addition to improved power capability, VRLA batteries with AGM separators offer increased safety and better environmental performance.

VRLA batteries deliver safety benefits through the AGM separator, by absorbing the electrolyte and eliminating spillage. This allows battery placement in any location within the car without the need for spill containment. The gases generated upon recharging, under normal charging conditions inside a VRLA, will recombine. Additionally, under typical recharge, the vent valve is sealed and will open only if internal pressure exceeds the predetermined level of the valve. Therefore, VRLA batteries can be used in multiple locations, while minimizing the dangerous gas a lead acid battery may deliver on overcharge. In the Pontiac Grand Prix™, for example, the VRLA battery is positioned in the engine compartment, while Mercedes® and BMW® place it outside the engine compartment. In the case of an accident, the battery should still provide power to critical electrical components, since the AGM separator holds the acid. Even if the battery is damaged, it can continue delivering power to emergency services such as OnStar®.

Environmental benefits include minimal electrolyte leakage in the event of a crash and longer service life, compared to the older, maintenance-free lead acid technology. The VRLA can have 2-3 times the lifespan of a maintenance-free battery. This is especially true for deep-cycle applications, which are becoming more common in modern cars with electronics that require power 24 hours per day. A longer lifespan reduces the need to purchase and recycle batteries over the life of the automobile. Environmental demands will continue to grow as automobile sustainability moves forward with increased mileage standards and regenerative breaking applications. Car manufacturers may utilize the VRLA battery's power supply capabilities to improve gas mileage through enhanced electrical options, thereby reducing the carbon footprint.

Some automobile manufacturers use an innovative dual battery approach for applications in cars that require the characteristics of a VRLA battery. In the Mercedes-Benz® R-230 dual battery onboard electrical system , the starter battery, a standard automotive maintenance-required lead acid, supplies electrical power for the starter motor armature only and provides back up power to the system circuit. The second battery, a VRLA with AGM separator supplies electric power for the rest of the vehicle's requirements. Because the entire electrolyte is absorbed in the glass separator, VRLA battery safety features enable a trunk location.

Advantages over traditional technology

The VRLA battery's AGM separator has a critical role in battery performance compared to a traditional separator in a flooded lead acid system. Separators are used between the battery's plates to prevent short circuits, and must meet a number of requirements, such as permeability, porosity, mechanical strength, electrical resistance, and ionic conductivity. The AGM separator must provide force to the active material, which minimizes premature capacity loss. It should also have suitable strength characteristics for high-speed assembly, hold all the required sulfuric acid, and regulate the oxygen transfer from the positive to the negative plate.

The separator will affect:

- compression
- acid availability
- wicking
- stratification
- cost of battery assembly
- life of the battery - both cycling and performance characteristic (i.e. cold crank)

More robust hybrid separators can actually reduce battery assembly costs as compared to 100% microglass AGM types. The force that the separator applies to the positive and negative plates gives a VRLA battery much greater vibration resistance for off-road or heavy-duty equipment. One company reported their VRLA product has twelve times the vibration resistance over conventional flooded batteries.

How is the product optimized for a particular problem?

Hollingsworth & Vose (H&V) has been the leading global producer of AGM separators (also called RBSM) for over a decade. H&V realizes that each battery manufacturer has unique applications and may require a custom separator design. To meet this need, H&V has developed a family of hybrid separator platforms, as well as the traditional 100% microglass AGM separator.

EnergyGuard®, a high-strength VRLA separator, is a combination material that blends the best properties of microglass and the added strength of synthetic fiber. The separator has significantly higher puncture resistance that leads to a lower incidence of shorting in batteries produced with all grid types, allowing excellent assembly performance through higher manufacturing yields. A manufacturer could use "less than perfect" grids and still have a battery that passes short testing requirements, and allow for higher plate wrapping speeds.

EnergyGuard products have a reinforced skeleton structure that provides for both improved dry and wet strength. Higher wet strength improves the vibration and decreases premature battery mortality. The result is improved battery life under severe use conditions and reduced battery warranty cost. Better wet compression resistance and higher wet force within a cell enables lower compression design. This may positively influence battery cycle performance and assist in battery assembly. Based on the fill and spill technique, the product's hydrophobic areas eliminate the need for precision filling equipment. H&V works closely with customers to custom engineer products, assuring that the correct material is used for each application.

Conclusion

Faced with rising consumer and automobile producer expectations, battery manufacturers are seeking advanced materials and custom engineering to meet power delivery challenges. VRLA batteries with AGM separators offer increased safety, improved environmental performance, and greater cycling capability over traditional flooded lead acid batteries. Enhancing VRLA technology with AGM separators can help meet the convenience, safety, and energy needs for today's automobile.

[1] Jonathan Welsh, "Why Car Batteries Are Dying Young", Wall Street Journal, 14 March 2007, online ed.

[2] Mercedes-Benz document number 507 HO Dual Battery (ACB) 11-28-02.

[3] Exide Technology, "Exide Technology Launches Two New Batteries", Tuesday April 17 5:35 pm ET

About H&V

Established in 1843, Hollingsworth & Vose Company is a global leader in creating, manufacturing, and supplying technically advanced engine, high efficiency, and liquid filtration media; battery materials; and industrial nonwovens. H&V adds value to customers' products by inventing next-generation materials with superior performance. H&V's expertise and process capabilities include wet-laid, dry-laid, meltblown, and composite technologies. The company operates manufacturing sites and research centers in the Americas, Europe, and Asia.

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