Battery talk
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Regulated Charge Control

Many vehicle manufacturers are now producing vehicles with RCC (Regulated Charge Control) systems that, in conjunction with a suitable battery, can deliver a 2% saving in fuel consumption and reduce vehicle emissions by up to 2%.

The Australian Government is working with vehicle manufacturers to reduce CO_2 emissions as part of the governments' commitment to the Kyoto Protocol. In February 2005, the Kyoto Protocol was established as part of a strategy to counteract global warming. The protocol aims to reduce emissions of green-house gases in advanced countries by at least 5% of 1990 levels by 2012.

In this issue

What is Regulated Charge Control?

Test results indicate that fuel efficiency in vehicles, fitted with a RCC system and a battery designed to suit the system, improved by 2% compared with test vehicles using conventional batteries. It was concluded that this was a result of the battery's ability to charge faster, allowing sufficient capacity for discharge during periods of high electrical load in the vehicle. Using the battery for power reduces the mechanical load on the alternator, thereby reducing fuel consumption.

It was these results that led to the development of a battery with improved charge acceptance over conventional batteries. Charge acceptance is the key feature of a battery that leads to improved fuel consumption.

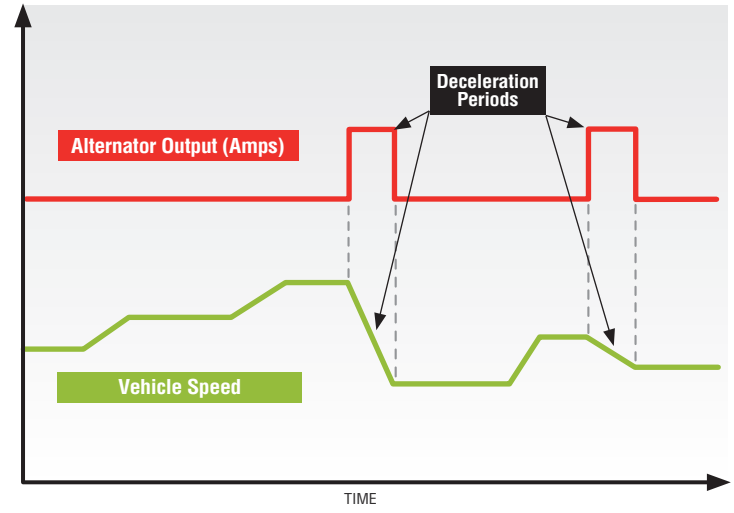
Cars designed with RCC systems should be fitted with batteries that have a higher than normal charge acceptance. The theory behind this is depicted in ***Figure 1*** which compares the conventional system with the regulated charge controlled system.

In vehicles featuring conventional charge control systems, the battery is in a constant state of charge while the engine is running. When the engine revs are low, such as when idling, there is insufficient energy from the alternator to power the vehicles electrical systems. In this situation additional power is supplied by the battery.

In vehicles fitted with RCC systems, power from the alternator is controlled according to the vehicles running conditions and the battery's state of charge (SOC). Under normal driving conditions the vehicles RCC system will supply energy from the battery as long as the state of charge is high. This reduces the load on the engine and leads to a reduction in fuel consumption.

When the vehicle is decelerating, there is less load placed on the engine, providing an opportunity for the vehicle to use the alternator to charge the battery with a high current flow in a short period.

Figure 1: Schematic diagram of electricity management for charge control system. Note, there may be slight differences in the system depending on the make of car.



Electricity Management for an RCC System

The alternator output is lower during acceleration and constant speed compared to deceleration when the alternator output is high this is the fuel and greenhouse gas reduction mode.

If the battery control unit and the vehicle ECU senses high electrical loads such as when the air conditioner and lights are switched on, and the battery voltage is low, the alternator may operate to charge the battery during periods other than deceleration.

A high charge acceptance battery can charge faster than a conventional battery to maximise fuel and greenhouse gas savings.

Which vehicles feature RCC systems?

All hybrid vehicles have this technology, however some normal vehicles such as the Holden Commodore, from 2006, are also equipped with RCC. It is estimated that more than half of vehicles made in Japan and Europe include RCC systems.
In summary Japan and Europe accounted for 60% of all automotive imports into Australia in 2008.

The role of the battery?

In vehicles fitted with RCC systems the battery must recharge as fast as possible in order to minimise the alternator load on the engine and reduce fuel consumption. This means the battery is required to operate less than fully charged, often at 80% state of charge. Without the ability to recharge faster than a normal battery, the vehicle will not be able to provide fuel savings.
High charge acceptance characteristics are critical.

What is charge acceptance?

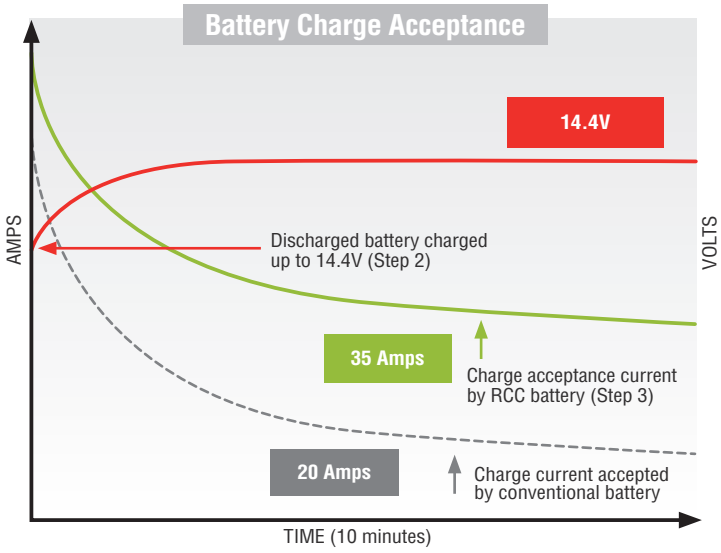
Charge acceptance refers to a battery's ability to recharge from a discharged state and is measured in a controlled laboratory environment.

The following is used to determine a battery's charge acceptance:

1 Discharge a fully charged battery at 25A to a terminal voltage of 10.5V.

2 After 16 hours at 0°C, charge the battery at a constant voltage of 14.4V.

3 Measure the charge current at 10 minutes, flowing into the battery.



The higher the charge rate accepted by the battery, the better the battery will work in conjunction with a vehicles alternator and battery management system to reduce fuel consumption and vehicle emissions. Batteries optimised for vehicles fitted with RCC systems can achieve up to 8% higher charge acceptance than conventional batteries.

Fuel saving initiatives

Within the scope of current mainstream petrol passenger vehicles, all the following features contribute to improved fuel efficiency and reduced emissions:

- **Direct Fuel Injection:** More accurate fuel delivery.
- **Regenerative Braking:** Recovers energy from braking to return to the battery.
- **Continuously Variable Transmission:** Engine runs close to maximum efficiency.
- **Variable Valve Timing**: Low rpm efficiency & high rpm power
- **Electric Power Steering**: Not driven by engine power.
- **Regulated Charge Control System:** Alternator drive management.
- **HEV (three levels)**: Hybrid Electric variants.

The Regulated Charge Control system represents the largest single fuel consumption benefit out of all of these developments outside of hybrid electric vehicles. More importantly, vehicles featuring this system are currently in mainstream high volume production.

Demands of a battery in conventional and regulated charge control systems

	Conventional Charging System	Regulated Charging Control System
Ignition	Yes	Yes
Idling	No	Yes
Starting	Yes	Yes
Acceleration	No	Yes
Cruising	No	Yes
Deceleration	Yes/No	No
Air conditioner	Yes	Yes
Defroster	Yes	Yes
Lights	Yes	Yes

Summary

When used in conjunction with vehicles fitted with Regulated Charge Control (RCC) systems, optimized batteries can lead to a 2% reduction in fuel consumption and vehicle emissions.

The fitment of conventional batteries in vehicles fitted with RCC systems may not lead to fuel or emissions savings. Vehicle performance would not be significantly affected but battery life may be shorter than in a conventional vehicle. Similarly the fitment of a battery, optimised for RCC systems, in vehicles not incorporating such technology will not have a negative effect on vehicle performance. The number of vehicles manufactured with regulated charge control systems is increasing year on year with locally manufactured vehicles such as the Holden Commodore featuring RCC systems since 2006.

All hybrid vehicles have this technology and it is estimated that more than half of vehicles made in Japan and Europe include RCC systems. In 2008, 60% of all vehicles imported into Australia were from Japan and Europe.

For more information contact your Century Yuasa representative.
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