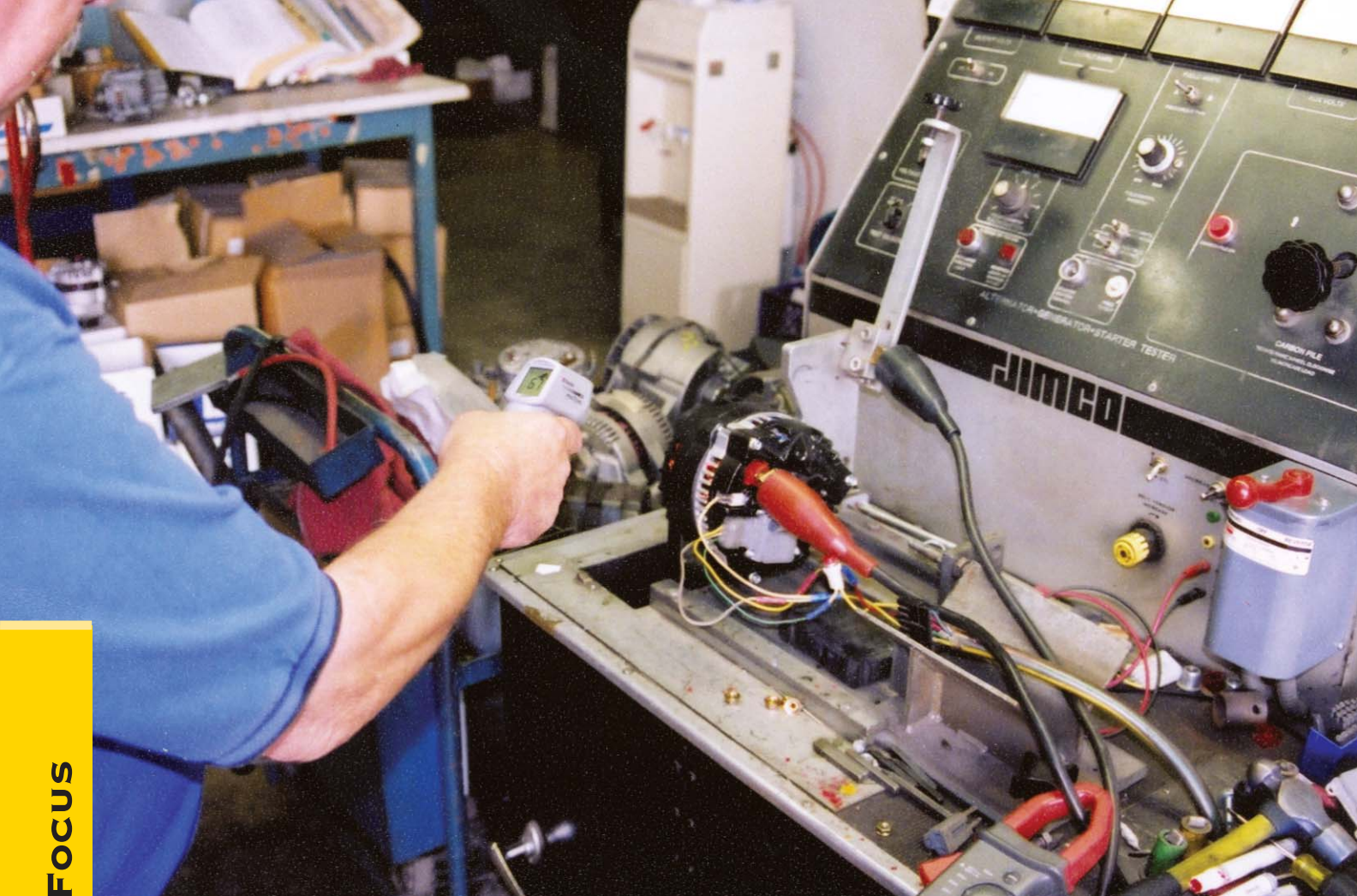


Circle 26 on Reader Service Card or Online at
- <http://info.ims.ca/3355-26>

Super glue (the white haze) holds the suction cup in place... and can be easily scraped off.

This article is available online at www.pfmmag.com.



FOCUS

Quality Power heat-tests its units at operating temperatures using a laser thermometer.

Alternator & Battery **LIFE**

By John Bellah

Many departments are experiencing electrical system difficulties, with repeated alternator and battery failures. This is almost exclusively related to installing more electrical equipment than the alternator can handle. The amp demand, especially at idle, simply cannot exceed the amp supply.

When the current version of the Ford Crown Victoria Police Interceptor was introduced in 1992, it came equipped with a 130-amp alternator. This was adequate for the times, when police vehicles were less complex.

These early vintage CVPIs were equipped with an engine-driven cooling fan to draw cool air through the radiator at low speeds and idle to keep the engine cool. Later models of the CVPI were equipped with electric cooling fans, which draw about 33 amps. This added to the electrical load, yet alternator capacity remained the same.

Later, computer equipment became increasingly popular in police vehicles, causing even more and complex problems. Computer equipment is extremely sensitive to voltage spikes or operating at low voltages.

Many agencies in the South experience electrical problems during the hot summer as officers idle their cruisers to keep the air conditioning operating. This is not for officer comfort, but to keep the computers cool and to prevent them from “crashing.” Extended idling kept the

engine cooling fans operating constantly, which adds to the electrical drain.

Police departments in the North experience electrical problems during the cold winter as officers use block heaters, but more importantly, rear window defrosters. These pull up to 35 amps.

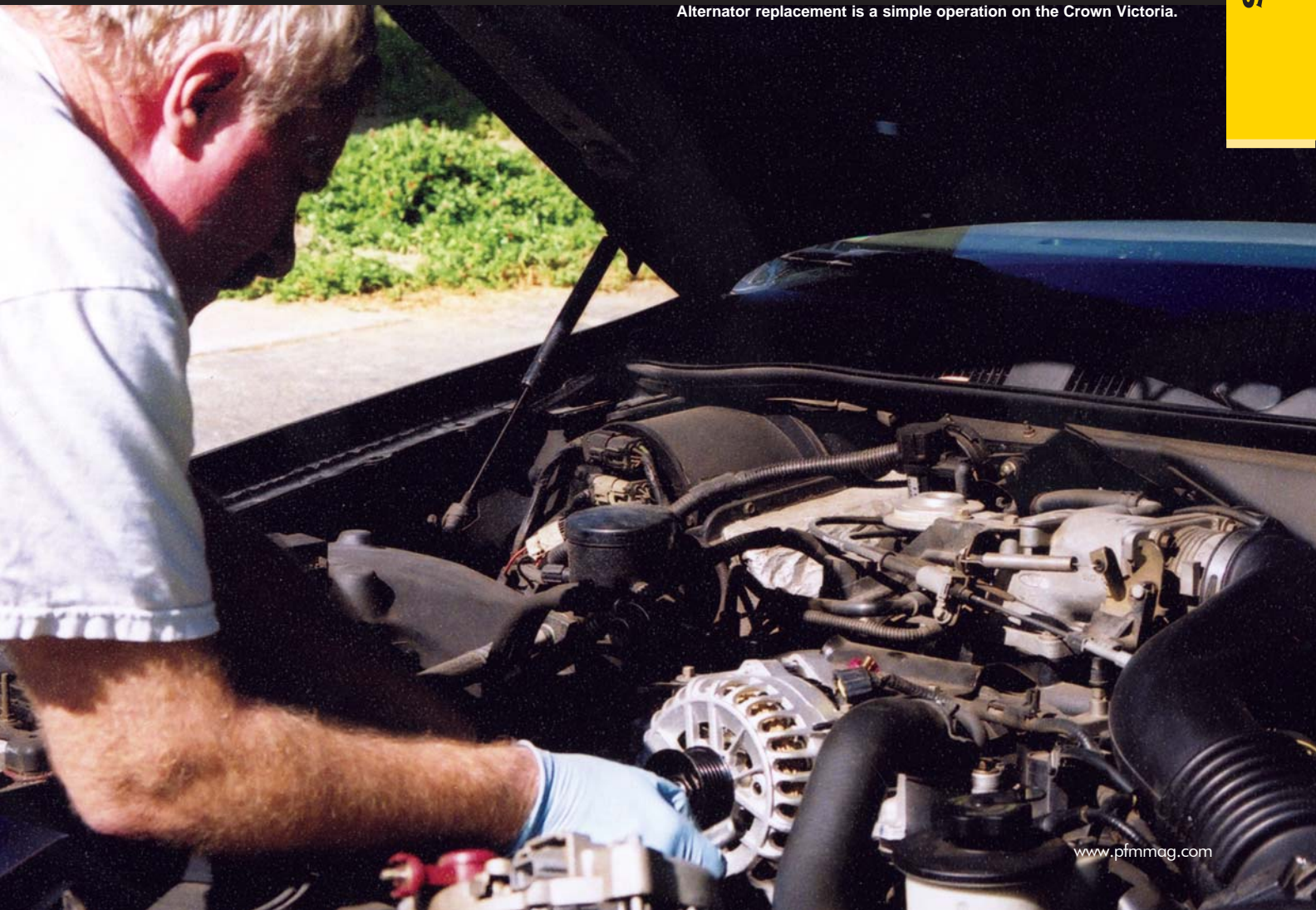
The alternator on a 2003 or earlier Ford Crown Victoria produces 82 amps at idle, provided that everything is operating properly. The basic electrical needs on a Crown Victoria require almost 65 amps. Turn on the police equipment, like a 75-amp draw halogen lightbar and the electrical system goes into “deficit spending.”

Eventually, the vehicle will quit running, and will not restart. More of the alternator cycling the battery, and it will be ruined. For long term operation, i.e., a few hours, the electrical demand must be met by an equal electrical supply.

Battery Issues

Batteries are as involved in this total process as the alternator. Alternators supply perishable energy. Batteries supply storage energy. While the actual power drain of most computers in the operating mode is less than 10 amps, nevertheless, computers do draw power even when shut off. Thus, a 4-amp draw will completely discharge a fully charged battery rated at 78-amp/hours within a period of 20 hours.

Alternator replacement is a simple operation on the Crown Victoria.



Battery technology is continually changing. To completely discharge, or “flatten,” a battery will cause permanent damage. This is the reason modern vehicles have chimes to tell if headlamps have been left on and why dome lights will automatically shut off after a few minutes.

While charging or jump-starting a battery that has been completely discharged will seemingly revive it, permanent damage has been done. A battery subjected to this abuse may load-test satisfactorily; however, much of its original capacity is lost forever. Repeated episodes of this nature will result in a battery which will start the engine, once jump-started, but will fail to hold a charge after even a few minutes of nominal drain. Additionally, overcharging, excessive heat and vibration are also battery killers.

Numerous makes and types of batteries exist; some good and some not-so-good. The varieties are endless: starting, SLI, maintenance-free, marine, RV, deep cycle, lead-acid, gel and AGM, just to name a few. Each battery has a specific intended usage, and to deviate from that usage may

be defeating the intended purpose. Additionally, it is not a good idea to incorporate different types of batteries within the same charging system as charging requirements differ.

Lead acid batteries are considered to be the “traditional” battery, and have been for many years. The lead acid battery is supplied as Original Equipment (OE) by our automakers. This type of battery is referred to as a “starting” or SLI (Starting Lighting & Ignition) battery. This battery is designed to produce large amounts of current necessary to operate the starter. These batteries work well unless they become completely discharged.

Deep cycle batteries are designed to be discharged to within 80% of their capacity; however, a deep cycle battery produces less cranking amperage, and it is not designed to provide large amounts of current for starting. If a deep cycle battery is used to start a vehicle, it is suggested that a battery with 20% additional capacity over the recommended OE battery be utilized. Another solution would be to use a marine battery as those batteries are somewhat of a hybrid between a starting battery and a deep cycle battery.

Gelled electrolyte batteries, otherwise referred to as “gel-cells,” contain an electrolyte that has been gelled into a solid mass similar to the consistency of Jell-O. These batteries can be mounted in any position and they won’t spill acid even if broken.

Disadvantages to gel-cells are they are very sensitive to overcharging. Both excessive voltage and current will permanently damage this type of battery. In automotive applications, voltages in excess of 14.0 Volts are sufficient to cause damage to this type of battery. Successful utilization of “gel-cells” requires special voltage regulation so that this voltage is not exceeded for both the vehicle’s charging system, as well as the shop charger.

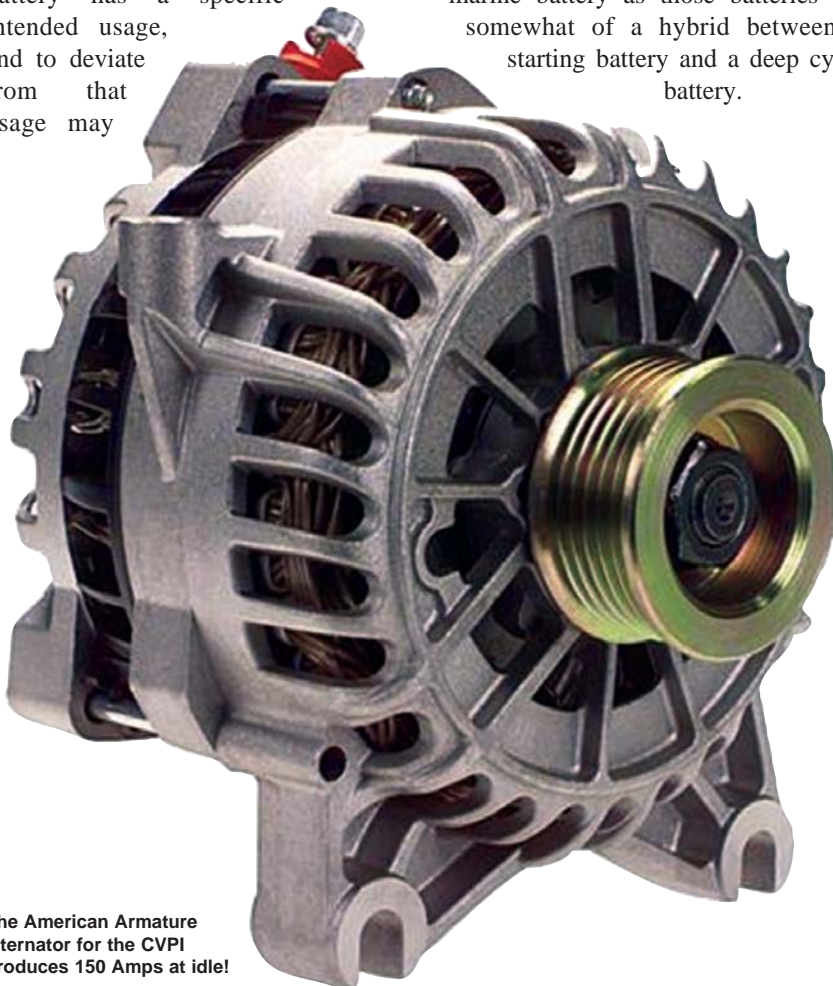
The AGM type of battery is a relative newcomer to the industry and offers a lot of advantages. Absorbed Glass Mat batteries are marketed under the trade names of Exide Select Orbital®, Concorde®, Odyssey® and Optima®. The AGM battery construction utilizes a very fine fiber Boron-Silicate glass mat, saturated with electrolyte, between the plates. Like the gel battery, this battery can also be mounted in any position. Similar to the above batteries, the AGM battery is unforgiving if it has been “flattened,” even once.

Alternator Issues

Excessive heat will significantly lower an alternator’s output and eventually will cause damage to it. Later versions of the standard Ford alternator are designed for more cooling airflow by designing larger fins into the housing.

One of the problems encountered with the 1999 to 2002 CVPIs is an insufficient serpentine-belt contact area around the alternator pulley. During full throttle acceleration, just prior to upshift to the next gear, the serpentine belt may slip on the pulley. This slippage is extremely hard on both the serpentine belt and the alternator, as the excessive heat is transferred to the bearings. Repeated episodes will eventually cook the lubricant within the alternator bearings, ruining the unit.

Jump-starting a unit with a dead battery, and letting the alternator charge the battery is also extremely hard on



The American Armature alternator for the CVPI produces 150 Amps at idle!



Often the connectors are different on replacement alternators. Some alternators have a "D" shaped connector, instead of the rectangle shape as shown, which will not fit the Police Interceptors.

alternators. Vehicles with dead batteries should be charged with a battery charger before being placed back into service.

For the 2004 model year, Ford has fitted an upgraded alternator in their CVPI. Manufactured by Mitsubishi, this unit produces a hefty 130 amps at idle with 200 amps maximum. This unit has both more serpentine-belt contact surface area and an over-running clutch on the pulley.

This new clutch is part of the new alternator technology as serpentine belts allow very little slippage at low speeds. It has been determined that when the engine is shut off, the sudden stoppage of the alternator will damage the rotor. The over-running clutch prevents this.

The 200-amp alternator on the 2004 CVPI will retrofit earlier CVPIs, but only the 2003 model, and only if the harness has also been changed with heavier gauge wiring. The 2003 and 2004 alternators are PCM-regulated. The earlier model CVPI alternators are self-regulated. Unfortunately, the engine computer on earlier models cannot adapt to the new alternator.

Solutions

In theory, the solution is simple. Increase electrical capacity or reduce the load. Many agencies are reducing their electrical load by utilizing LED

emergency lighting, which draws about one-third the amount of energy. However, as LEDs become brighter, their amp draw is also rising.

Numerous battery shut-off devices are on the market such as the Start® shut-off device which shuts off the battery when battery voltage falls below 11.9 Volts, with 10.0 Volts being

www.prioritystart.com minimum voltage needed to start a car. This device will prevent the battery from being completely discharged if someone forgets to shut off a radio, a computer or a dome light for extended periods while the vehicle is unattended.

Copeland Engineering offers an auxiliary power controller which can be programmed to automatically shut down components at a predetermined time while the vehicle is unattended.

www.copelandengineering.com They also market their Dock Master Vehicle Laptop Computer Management System, which constantly monitors operating voltages and will automatically shut off the computer to protect it from excessively low or high voltages.

This device will warn the operator of a pending shutdown and shut down the computer in the proper stages to prevent damage. They also offer accessory shutdown devices for motorcycles.

AC/DC Industries also markets

several different types of delay timers and shut-off devices.

www.acdcind.com

Lind Industries markets a device that not only shuts down different devices at preset intervals, but also has a low voltage sensor that shuts down equipment when voltage drops below 10.5 Volts.

www.lindelectronics.com

Idle Booster Devices

Back in the old days a hand-throttle was available as a fleet option to increase idle speed on our cruisers to increase electrical and air conditioning output. Those days are long gone, and today's vehicles' idling speeds are preset by the engine computer, which is virtually tamper-proof.

A low-cost alternative to inadequate electrical output at idle for the CVPI is the easily installed Trooper Charger. This device is similar to the systems in the police version of the Chevrolet Impala, and the upcoming police Tahoe. It senses when the car is at idle and automatically adjusts the engine rpm to the necessary level to keep the battery charged. This device is current in use, or under test, by the Kentucky State Police and the Washington State Patrol.

Increased Storage Capacity

The stock CVPI battery is rated at 78-amp/hours and 750-Cold Cranking Amps (CCA). One supplier has been able to mount a larger PC1700 Odyssey® battery where the stock battery is mounted. This battery offers 850 CCA by removing the battery stop protrusions in the battery tray near the right fender. This battery will fit inside a Crown Victoria, sideways. To mount upright requires longer battery cables. Many agencies have been happy by simply utilizing the larger battery.

Some agencies have gone to a dual battery installation with the auxiliary battery mounted in the trunk in a marine-type battery box. Used with an isolator, the auxiliary battery can be charged by the charging system with the engine running. Some agencies connect all of the law enforcement equipment to the rear battery—radios, radar, computer, spotlight(s) and lightbar.

Thus, an officer does not need to idle



The Quality Power upgrade, pictured on the right, uses a heavier 4-gauge welding cable for the output harness.

the engine excessively during traffic stops, which saves fuel and unnecessary wear on the vehicle's drivetrain. If the auxiliary battery becomes drained, the officer will still be able to start the vehicle. At least one computer company strongly recommends a dual battery installation.

Increased Charging Capacity

Several suppliers market higher output alternators. Caution is recommended before making this change. Installing a higher capacity alternator, without replacing the output lead will result in a melted harness, along with other related problems. Some "supposed" high-amperage alternators may actually produce less current at idle than an OE alternator.

Another trick is to place a smaller pulley on an alternator to boost idle amperage by getting it to spin faster. This might be fine with a fire engine, but in police service, high engine speeds may cause internal damage to the unit in a high-speed pursuit.

The Public Safety Division of American Armature inavenport, IA, offers a high output (HO™) alternator for the Ford Crown Victoria that will deliver a whopping 230 Amps maximum; with 150 Amps at idle. Peter Quinn, Director of OEM Sales, stated that its HO™ Alternators will fit the 1998 to 2002 generation and the 2003 to 2004 generation Ford CVPI without modifications, and will interface with the Powertrain Control Module (PCM). While this is a "bolt-in" installation, an upgraded output cable is included.

American Armature also offers upgraded alternators for both the civilian and police versions of the Chevrolet Impala and for the Dodge Intrepid. The company offers a one-year warranty and its technical support will work with the customer to find charging system solutions.

For battery needs, American Armature offers its PowrBank

Series battery intended for police service. This battery offers the lowest amount of internal resistance which allows for faster charging. This will allow the alternator to run cooler and last longer. The estimated life cycle of this battery is three years. Similar to other AGM batteries, this battery can be mounted in any position. For further information, contact Peter Quinn at American Armature Inc. at (563) 323-7994 or www.AmericanArmature.com.

Quality Power of Duarte, CA, has been supplying high-capacity charging systems to law enforcement and other public service agencies since 1992. They market a kit consisting of a 200-amp alternator, wiring harness, and a choice of one or two Odyssey® batteries. This is a "bolt-in" operation, using the existing factory regulator. Installation of the kit with a single battery should take 1.5 hours, including the modification to the battery tray.

Quality Power markets its own alternators using premium bearings, lubricated with high temperature lubricants, premium diodes and rewind internal components using heavier gauge wiring. The alternators are heat-tested and measured for output at 200°F, which is about what some underhood temperatures run. Some test practices measure alternator output at room temperatures. Under hot conditions, its alternator produces 207 amps.

Quality Power, Inc. can be contacted at (626) 359-1546 or by e-mail at qualitypower@earthlink.net.

Located in Texas, MPI-Vital has been a supplier for high output alternators for the public safety field in both the United States and Canada for almost 11 years. Their 200-amp alternator for the Crown Victoria uses an external regulator and features a dual-delta six-lead stator over the standard Ford three-lead stator. Their alternator also has 18 diodes to prevent component-damaging voltage spikes.

Its kits include an extra idler pulley to prevent the belt slippage during full throttle acceleration. MPI-Vital indicates its alternator offers excellent output at idle speeds, where output is vitally important. Its kits also include an upgraded wiring harness equivalent to 4-gauge, or in some applications, 2-gauge welding cable.

Both Quality Power and MPI-Vital are conducting research and development on 160-amp units for other emergency vehicles. In addition to the lower cost, the 160-amp unit, in many cases would provide more current at idle, where it is really needed, than the larger unit.

If a rebuilt alternator is needed, and no upgrades are performed, stay away from retail parts-house units. Many of these units are of questionable quality for heavy duty service. While the unit will bolt-in, the connectors may not match up to the harness on the vehicle.

While Ford no longer supplies new alternators for years prior to 2003, the dealers do have rebuilt alternators available. The Part Number on this unit is #F8AZ-10346-ABRM and should cover CVPI models from 1992 to 2003. The dealer price for this Ford unit is within a few dollars of what the local parts houses quote for rebuilt units at their "discounted" prices. Experience had shown that the Motorcraft units from the dealer deliver the proper output and the connectors fit.

Keeping the alternator cool will help prolong the life of the alternator. Removing the plastic “beauty bonnet” that covers the intake manifold and part of the alternator may help in keeping things cool. This is because cooling air enters from the rear and exits the front of an alternator or generator, and removal of the bonnet ensured cooler air entering the unit.

Chevrolet and Dodge

While the Chevrolet Impala police car does not produce as much high end output as the Crown Victoria, it does produce 96 amps at idle. Additionally, the police version Impala comes with an idle boost system which senses when voltage drops and automatically bumps the idle up to 1200 rpm, so the alternator produces 124 amps.

Chevrolet states that it has had no major charging system problems to date. Its 125-amp Bosch unit is a police specific item, and replacing the OE alternator with one of a different type will negate the idle boost feature and may cause other problems.

DaimlerChrysler engineers have fitted a 160-amp unit that has been used



Heavier gauge wiring on Quality Power's alternators (left) allow it to produce more amperage than the stock Ford alternator (right).

for many years on their minivans, to the police version Dodge Intrepid. To this date, DaimlerChrysler Engineering has not received any charging system complaints.

Different agencies have different needs and requirements. Electrical problems should be thoroughly investigated to determine exactly where the

problem lies before attempting to correct the problem.

John L. Bellah spent eight years as an automotive mechanic/technician, specializing in electrical, air conditioning and tune-up issues. He is currently a corporal with the California State University, Long Beach Police Department, and may be reached at jbella@csulb.edu.