

ALTERNATOR 101

With non-usage of a vehicle for extended periods of time, a vehicle's computers, clocks, alarm system, etc. will cause a battery's state of charge to drop (For example; 30 days in a parking lot and the vehicle may not start because of a dead battery, or a vehicle which is driven only a short distance once a week may end up with a discharged battery to the point where the vehicle may not start). But this would be considered abnormal usage of a vehicle and the normally expected result for the vehicle battery, alternator and electrical systems.

At idle, a vehicle's electrical loads may exceed the low-speed current (amperage) output of the alternator and when this happens the shortfall comes from the battery. This will result in a drop in the electrical system voltage as the battery delivers the additional electrical current to meet the demand. This is equivalent to the brown-outs experienced by homes and businesses when the electrical demand is more than the supply. This is where the benefits of high-output alternators come in.

A higher-amp output alternator will not harm your battery or charging system

A good rule of thumb is that more amps are not harmful, but more voltage is. If you look at electrical power like water, amperage is equivalent to the volume of water, and voltage is equivalent to water pressure. More amperage is like having a larger pool of water to draw from when you need it.

Extended periods of engine idling, with high electrical loads, may result in a battery entering a discharging situation. Attempting to recharge a battery by letting the engine run at idle may not be beneficial unless all electrical loads are turned "OFF"

Increased internal alternator temperatures from extended idling can also contribute to lower electrical system output voltage. As the alternator's internal temperature rises, the alternator's output capability is reduced, due to increased electrical resistance with heat. That is why I used the thermal barrier properties of the "cermakrome" coating from ThermalTech. **This coating is an aluminum-ceramic based heat dispersant coating that enables the alternator to run at a cooler temperature, thus prolonging the life of the alternator.**

Depending on the vehicle application, alternator current (amperage) output at engine idle speeds of 600-700 RPM can be as low as 35% of the full rated output. With enough electrical loads engaged, it is easy to exceed the alternator current (amperage) output when the engine is idling at 600-700 RPM. This is a normal condition— the battery supplements for short periods of time.

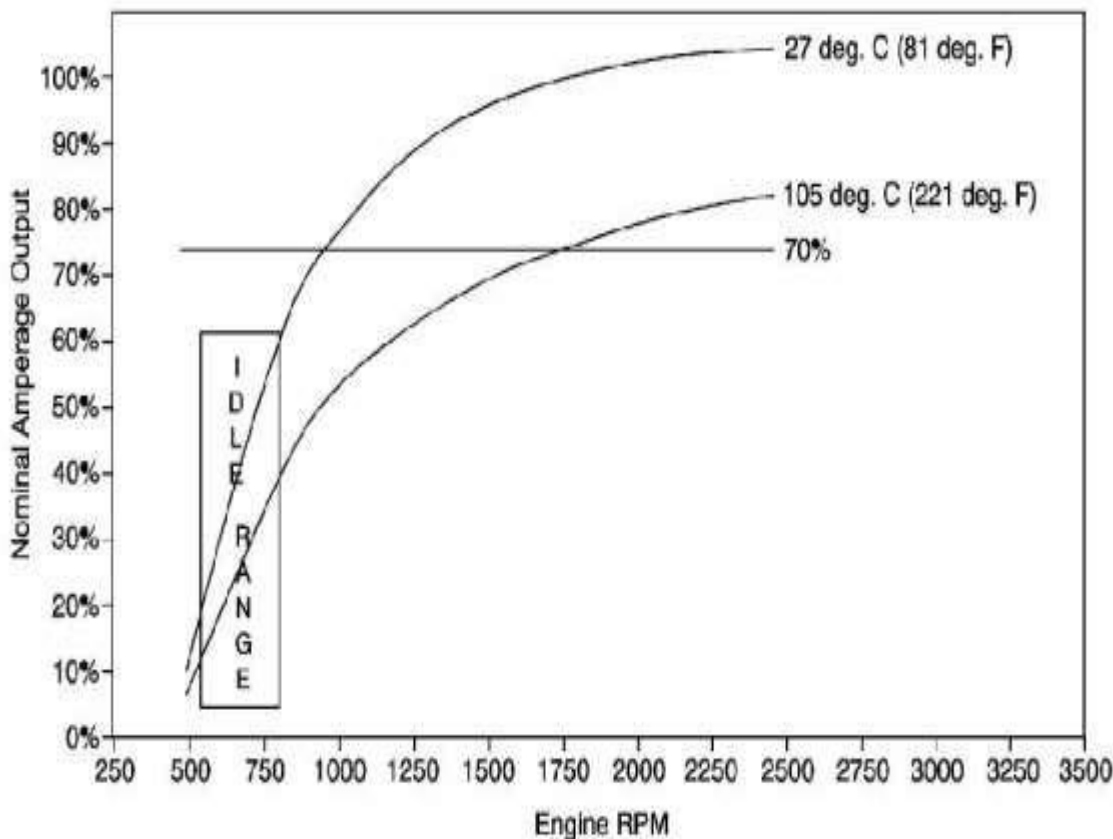
High Output alternators are designed to be around 55% of peak output at idle.

OUTPUT RATING

The SAE rating is the maximum amount of amps the alternator can produce in a "cold" state, about 80 degrees Fahrenheit. An alternator remains "cold" for about 5 minutes, or less under heavy load. As it warms up, output is reduced because the heat causes resistance in the rotor to increase and output amperage is reduced. A stock OEM alternator is more affected by heat than heavy duty units.

The "hot" output rating is taken at 200 degrees Fahrenheit.

Typical Alternator Performance for Cold and Operating Temperatures



Items that affect the vehicle's electrical system current and voltage at idle are the number of electrical loads being used, including any add-on accessories, and extended idle times. When the vehicle speed is above approximately 15 mph (24 km/h), the engine/alternator RPM is high enough and the alternator current (amperage) output is sufficient to supply the current (amperage) requirements of the vehicle as originally equipped and will recharge the battery.

DIMMING LIGHTS AT IDLE?

You may experience dimming lights at idle, but that does not always indicate a problem. It may be considered normal for two reasons:

As the engine/alternator speed changes, so will the current (amperage) output of the alternator. As a vehicle slows, engine/alternator RPM slows, and the current (amperage) output of the alternator may not be sufficient to supply the loads, the vehicle system voltage will drop and the lights will dim.

Dimming of the lights is an indication that current is being pulled from the battery. If the battery is in a low state-of-charge (discharged condition), the driver will notice a more pronounced dimming than a vehicle with a fully charged battery.

When high current loads (A/C, blower fans, rear defroster, headlamps, cooling fans, heated seats, power seats, power windows) are operating or cycled "ON", the alternator's voltage regulator can delay the rise in output. This effect, usually at lower engine speeds, can take up to ten seconds to ramp up the alternator output. This is done to avoid loading the engine severely. To increase the current (amperage) output, additional torque is consumed by the alternator. The engine computer (PCM) will ramp up engine/alternator speed in small steps so engine speed variations are not noticeable to the driver.

SELECTING A POWER CABLE

Cables can only pass a certain amount of current, before they heat up and increase internal resistance to current flow. Therefore, if your car's electrical system and added accessories require high current, then you need to use lower gauge (larger) power cables. That is why the alternator wiring upgrade is so important. When our wires were new and in peak condition, and all grounds were clean and shiny with good contact points, things may have been adequate. But internal resistance due to heat, corrosion and age of materials have taken their toll and decreased the amount of current they were originally designed to carry.

Here are some general values for cable gauge vs. current capacity in amps. These measurements are for wires up to 4 ft. in length.

Wire Gauge	Capacity
2 gauge	215-265 amps
4 gauge	150-200 amps
6 gauge	105-150 amps
8 gauge	85-105 amps
10 gauge	50-65 amps
12 gauge	35-50 amps

Make sure that the voltage drop in the power cable is not too high. Keep the voltage drop below 0.5V. Resistance in the power cable will result in a power (amperage) loss. So, the larger the cable, within reason, the less the resistance.

If you don't think this is true, try jump-starting a car with a set of cheap 14 ga. jumper cables. With the thinner wires, internal resistance to current flow cause them to heat up more quickly-- and that is where your current is lost. A heavier set

of wires won't have the same resistance and heat up much more slowly, allowing maximum current transfer to the other car.

WHAT SIZE FUSE?

Fuses are in the circuit to prevent fires in the case of short circuits.

Remember, that the fuse (at the battery) is there to protect the cable. This means that the fuse rating should not exceed the amount of current that the cable can pass safely. The fuse should be installed inline as close to the power source (battery) as possible.

Rather than fusing the cable by the maximum amount of current it can pass safely (continuously), for example 125 amps for a 4 AWG cable, it is safer to use a fuse that is as small as possible, but that will still be able to pass enough current for the car's loads without regularly blowing.

The power wire that is used to provide additional battery maintaining capabilities from a High-Output Alternator is usually used in addition to the original power cable. In this case you are providing two paths for current, it is not necessary that this power cable be large enough to handle full output of the alternator's charging capabilities, but at least enough to handle its additional abilities when necessary.

At this time of year, the loads placed on our electrical system are greatest. Winter driving, and the need to use current-hungry applications, such as heating/defrosting, rear window and mirror defrosters, lights, etc. are with us almost always in multiple combinations. Cold temperatures also place extra demands on the starter/cranking system.

If you haven't done it, at least do the wiring upgrade. Check and clean all connections and grounds to provide maximum contact and electrical flow.