

# Motorcar Tech-Talk



## With Dick and Ron

Dick and Ron, "The all-knowing Motorcar Brothers" who are distantly connected to the Tappet brothers, Tom and Ray from Boston, will answer those tough motorcar technical questions. Please submit your questions to either:

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*(The First Part Of This Series Appeared in the January/February, 1999 Issue of The Setoff)*

### UNDERSTANDING ALTERNATORS - 2

In the first article on alternators we presented an explanation of how an alternator is constructed and how it works. This article is intended to offer some minor repair information, to discuss the charging capability of typical alternators, and to present the current drain of many of the electrical devices found on motorcars. Again we are indebted to Joe Porhammer for much of the information.

Let's start with alternator failures. There are only three things that commonly go wrong with an alternator. These are bearings, diodes and brushes. A bearing failure should be obvious to anyone capable of caring for their motorcar. Bad diodes are rare and require specialized equipment to diagnose. The symptom is low output voltage and can be repaired by installing a new diode assembly containing all the diodes. This assembly may be obtained at most auto-electric shops. Auto parts stores may not carry them and they will want to sell you a whole new alternator.

Possibly the most common alternator trouble is sticky or worn brushes. As you recall from the first article the brushes conduct field current into the rotor. Bad contact leads to insufficient current to obtain any reasonable output current. This is one problem that you can diagnose when the alternator is apart by soaking the brushes and brush holder in degreaser. Also burnish the slip rings with very fine steel wool. New brushes vary in length, but if worn to less than 3/8" should be replaced. The reason for this is there are copper wires embedded in the brushes and if the copper wire gets in contact with the slip rings, it will damage the rings.

As we pointed out in the first article the alternator provides an output due to having battery power supplied to the field coils through the slip rings. In an automobile this comes from the battery through the charging indicator light. As soon as the alternator output comes up to battery voltage there is no voltage across the light bulb and it goes out. Motorcar owners using an automotive alternator need to provide a light bulb or resistor drawing power from the ignition switch and going to the field connection on the

alternator. We do not know the necessary value but since the charge indicator bulb is small a current of 0.2 amps should be enough. The resistance is around 60 ohms. If too low a resistance or too big a bulb is used the regulator may be damaged due to overload.

One popular alternative is the single wire or marine alternator. This unit does not need any connection except the one big wire to the battery. When the engine is not running the alternator field winding does not draw any current from the battery so no connection through the crowded ignition switch is necessary. Residual magnetism in the case and rotor is used to get it started, just as in a generator. The popular 65 amp Delcotron alternators can be converted to single wire by using an inexpensive kit from J C Whitney, among other places.

Voltage regulation is necessary to limit the output voltage to 13.8 volts which is the ideal value. This is simply done by either dropping or opening the field current to the rotor winding, thereby eliminating the magnetic field. Most alternators have integral regulator/rectifier circuits in a small case but some have them mounted on an external circuit board, with the power diodes on a heat sink. It is not something that can be fixed, but requires replacement instead.

The most popular alternators currently used on motorcars are rated at 45 to 65 amps output at higher engine speeds. The graph of figure 1 shows the relationship between alternator speed and maximum output for a typical 55 amp unit. Notice that the maximum rated output is obtained at 4000 RPM at the alternator, and will generate 20 amps at less than 1500 RPM. Since the typical drive ratio is three times engine speed this means that there should be plenty of generating capacity at engine speeds as low as 500 RPM. This is very low, considering that typical autos idle at 800 RPM.

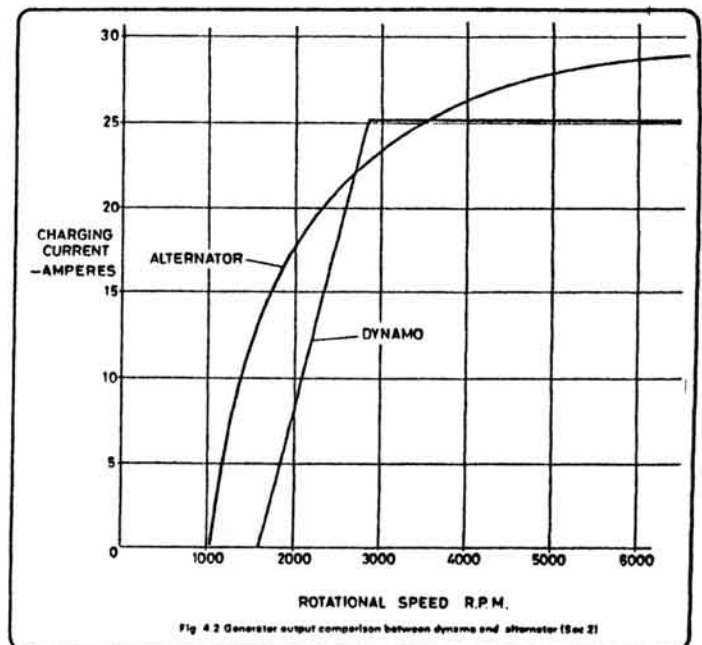


Fig 4.2 Generator output comparison between dynamo and alternator (See 2)

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## ALTERNATORS - 2

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How many amps do you need? The following list of typical current drains has been determined by measurement and calculation. Notice that only long-term steady state loads are listed because things like horns and starter are used only for short periods. Other short term loads include strobes, stoplights, radios and electric air compressors. Only 12 volt loads are shown since this article is on alternators and there are very few 6 volt alternators.

ITEM	CURRENT DRAIN
Onan ignition.....	2 amps
2-cycle ignition .....	less than 1 amp
Headlight bulb .....	4 - 6 amps
Bright rear light bulb .....	2 amps
Tail light rear bulb .....	1 amp
Wiper motor.....	1 amp each
Electric fuel pump.....	1 amp
Refrigerator.....	3 amps

As you can see, even with several lights and other accessories totaling 20 amps the load on the engine is only 260 watts or less than 1/3 HP. Those turning off lights to free up more power on a hill are not accomplishing much. Of course if the battery was run down with the starter additional current is going to recharge it, but those cars with electric starters have more than enough power.

Few of us have the expertise or the tools to repair or even check out a suspected faulty alternator. Here are two things you can do. One: Clean all the electrical connections you can find on your alternator. Two: Install an ammeter in series with the lead going to the battery (but NOT the lead going to the starter). This meter tells you whether current is going into or coming out of your battery. The ideal condition is a zero reading meaning that the alternator is supplying all the load, and the battery is fully charged.

Finally, if you use your car a lot and need it to be really reliable, install a rebuilt alternator commonly available from \$30 on up.

Ron and Dick are awaiting your questions on really tough technical issues. No trouble too tough, no problem too pickey. We Can Handle It. Write, phone or e-mail. We are in the roster.