Problems with wind generators

In an article entitled "Windmill Power for Australia: Part 2" ("Electronics Australia", July 1978, p 42), John Andrews described how to rewind a Bosch 12V car alternator, for use in conjunction with a direct drive 2m-diameter two-bladed propeller windmill.

In general, car alternators are designed to work in the range of 1000 to 10,000rpm. Consequently, it is necessary to change the characteristics of the alternator, if it is to be used in wind-generator applications where rotational speeds of 300-1000rpm are frequently encountered.

Since 12V car alternators are readily available, John Andrews' article aroused considerable interest among several members of the recently formed Australasian Wind Energy Association (AUSWEA). In particular Peter Cole (Colepower Marine Engineering, Brooklyn, NSW, 2253) rewound several Bosch alternators, for use in conjunction with 2m-diameter propellers.

In December 1980 we purchased a rewound alternator from Peter Cole and subjected it to several bench tests. The results obtained may be of interest to your readers. Unfortunately the measured power outputs are disappointingly low in the frequency range 300-1000rpm.

The rewound Bosch alternator was a nine-diode alternator of the LJ series, rated at 420W. It is equipped with a solid-state regulator which adjusts the current through the excitation coils until the output reaches the required 12V for battery charging. In the tests, the regulator was removed in order to allow clear recognition of the alternator's characteristics, free from feedback effects. Because of this it was necessary to supply the static excitation coils with a separate power supply.

The results of our tests are as follows:

- The magnetic induction produced by the excitation current begins to saturate at currents above 2A. In general, therefore, there is little point in using excitation currents much in excess of 2A at low rotational speeds;
- Maximum power transfer occurs when the load resistance is approximately 5 ohms;
- Maximum power output increases almost linearly with rotational speed, reaching 400W at approximately 2500rpm;
- The net power output of 13W for a rotational speed of 417rpm is disappointingly low;

● There is a substantial drop in power output when the alternator is used in the self-excited mode. In this regard, it should be noted that an external power source, such as a battery, is necessary to initiate the excitation current for a short time during run-up. Once the unit is producing power, the battery can be disconnected.

In summary, we believe that the rewound Bosch alternator is still essentially a high speed device and is therefore not well suited to direct drive wind generators. One way of improving the situation would be to equip the alternator with a 3:1 speed increaser. This would bring about a substantial increase in power output (approximately 400W at 800rpm), while at the same time relieving the generator of axial thrust, for which it is not designed.

However, for the beginner, the incorporation of a 3:1 speed increaser represents a severe hurdle, since it requires a suitable support structure and oil-tight seals.

Unfortunately we do not know of a suitable direct drive "multiple generator" in the 100-500W range, which is easily accessible in Australia and would be compatible with the wind generator described by John Andrews in his article. If any of your readers know of such generators, we would be very pleased to hear from them.

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