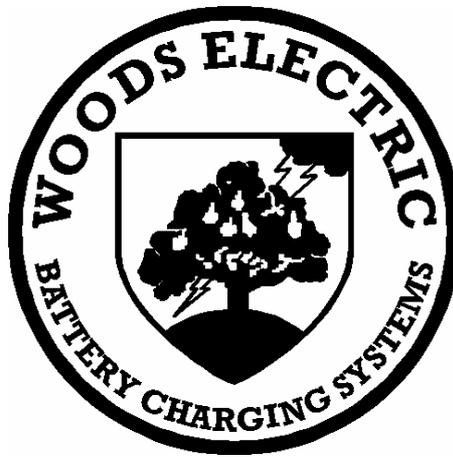


WOODS ELECTRIC



BATTERY CHARGERS
And
PORTABLE GENERATOR
SETS

USING BATTERY CHARGERS with PORTABLE GENERATORS

IN BRIEF:

- Some battery chargers perform erratically, or suffer damage, when run from portable petrol generators.
- This is due to poor waveform quality from small portable generators, particularly when lightly loaded.
- Either apply an additional load to the generators when running battery chargers, or get a better generator set.
- The generator VA rating should be at least FOUR times the battery voltage multiplied by the charger current.

THE PROBLEM – MORE DETAIL

In recent years, Woods Electric have been seeing an increasing number of chargers which have been damaged by poor power quality.

In all cases, power has been supplied by portable generators (“Gen-sets”) of less than 5kVA rating.

Almost all of the damaged chargers have been Woods “Dialomatic” types, since these are the style most likely to be used with small gen-sets.

Power from gen-sets of 7kVA and higher seems to be of good quality. No problems have been reported from using chargers with these larger gen-sets.

Similarly, few problems have been noted in Woods “Automatic” and “Neptune” chargers, simply because these are not generally used with small gen-sets.

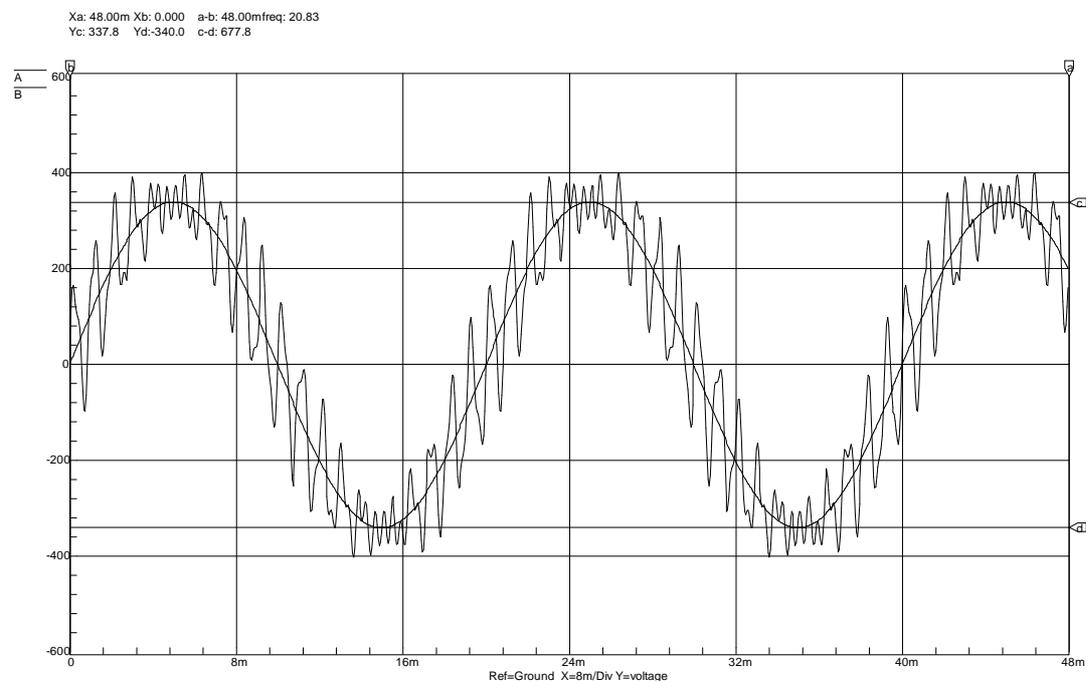
Although most appliances are not affected by the poor waveform quality from smaller gen-sets, those appliances which use “Phase Power Control” are particularly affected. “Phase Power Control” is used in Woods battery chargers, in speed controls for power tools, and in domestic lighting dimmers.

THE CAUSE – MORE DETAIL:

The generators in many small gen-sets produce highly distorted waveforms.

Although meters are readily available to measure generator output voltage and frequency, it is rare to see meters for output distortion measurement. The easiest way to view a generators’ output is to use an oscilloscope. This will not directly measure distortion, but it will give a good visual indication of the degree of distortion.

Here is the (simulated) waveform of a typical “cheap and nasty” generator, shown against a pure 240V 50Hz sinewave:



This particular waveform exhibits a distortion of around 25%.

Ideally, mains power (and gen-set output power) would be a pure sine-wave. In fact, mains power may have up to 5% distortion. This level of distortion does not create any misbehaviour in Dialomatic chargers.

Some gen-sets, however, produce power with more than 20% distortion (sometimes as high as 25%!).

The distortion is due to the design of the generator. The engine driving the generator is not responsible.

The phase-control circuits in Woods Dialomatic chargers manufactured before 2001 cannot cope with more than 8% distortion. The circuits in new Dialomatic chargers can cope with up to 15% distortion.

Woods Dialomatic battery chargers are generally quite tolerant of the variations in frequency and voltage produced by gen-sets, but they don't cope with high distortion levels.

SOLUTIONS – MORE DETAIL:

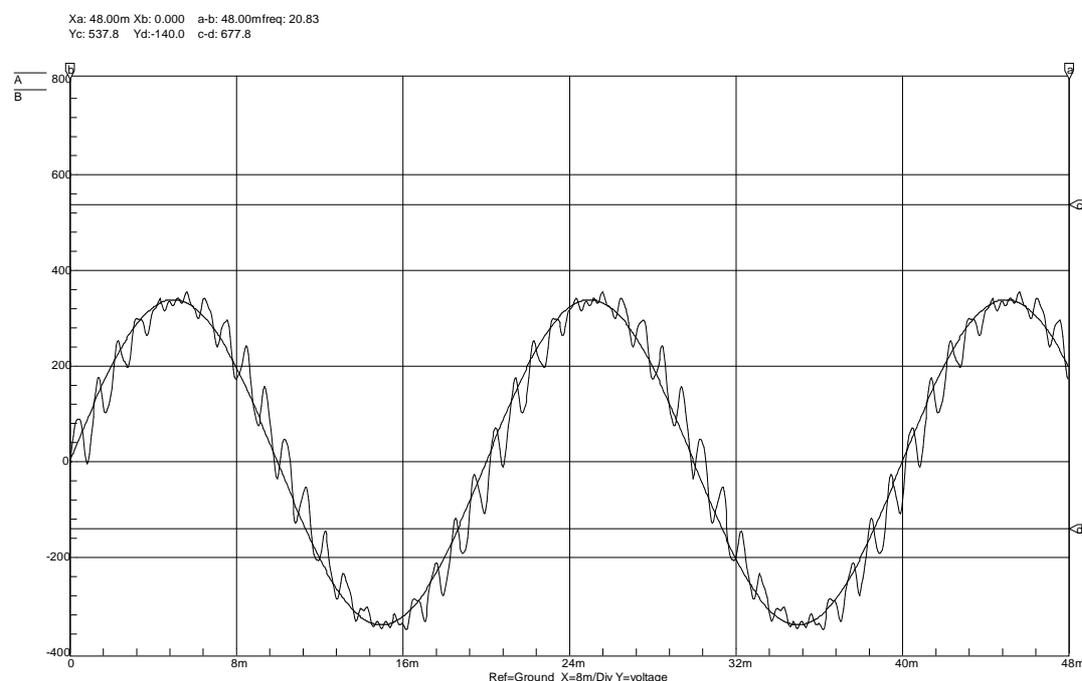
We have found that the distortion produced by gen-sets may be reduced to useable levels by loading the generator with a resistive load, in addition to the battery charger.

Loads of between 500 watts and 1500 watts will generally reduce the generators' distortion sufficiently. The load must be resistive, and it must be constant.

Good examples include 500W incandescent floodlights, and bar-element radiators.

Fluorescent lighting, refrigerators and stoves are unsuitable – either because they are not resistive, or because they are thermostatically controlled and may cut out at any time.

Here is the (simulated) waveform of the same generator as before, now loaded with a 1000 watt resistive load:



The degree of distortion reduction is immediately apparent – it is now down to 12%.

This “resistive loading” technique works well - but the operator must locate suitable loads (and remember to use them each time!), and the engines' fuel consumption will increase.

It may be viable to upgrade your generator set, instead.

There are a number of gen-sets available in ratings of 5kVA and lower, which have both good fuel efficiency AND low distortion.

Examples include Meccalte generators (which specify less than 8% distortion), and Honda “i” series generators (eg. the 900i) which have a low-distortion inverter built in.

We will include other examples of low distortion gen-sets here, when they are bought to our attention.

GENERATOR POWER RATING:

In general, a good rule-of-thumb is that the generator VA rating should be at least FOUR times the battery voltage multiplied by the charger current.

For example, a gen-set for a Woods 1230A would need to have [4 x 12v x 30A] or 1440 VA capacity.

Similarly, a gen-set for a Woods 2460A would require [4 x 24 x 60] or 5760 VA capacity.

The “factor of four” has been chosen to take into account a variety of effects.

Firstly, a charger must produce significantly more voltage and current than its nominal rating would suggest. For example, a 12V 30A charger must produce up to 14.6 volts at output currents of up to 55 amps RMS – a total of 800 watts output. The charger may draw over 900VA under these conditions.

(Note: Refer to Woods Electric’s Little Black Book of Battery Charging for the difference between average current and RMS current).

With a consumption of 900VA, a 1400VA gen-set will have only a small margin of headroom.

In addition, the current drawn by the charger will vary in phase angle, depending on the chargers’ current delivery to the battery. Some generators are less able to cope with these variations than others.

WOODS Charger model	Maximum Charger Consumption (VA)	Recommended minimum generator capacity (VA)
W1220 1215A, 1215N 2407A, 2407N	450VA	700VA
W1240, W2420 1230A, 2415A 1230N, 2415N	900VA	1400VA
W1280, W2440, W3630 1260A, 2430A, 3620A 1260N, 2430N	1700VA	2800VA
W2480 2460A, 4830A 2460N, 4830N	3500VA	5600VA