Application Note

Running An Electric Space Heater or Water Heater on Inverter Power

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Overview

In some parts of the world, an electric space heater or water heater is not just a convenience, but a necessity. These items are also large consumers of electrical energy. Large inverters can adequately power medium sized space heaters and/or water heaters, but both the AC and DC electrical systems need to be designed to properly accommodate the large energy demand.

AC load

Space heaters or water heaters can be run successfully on an inverter. A 1500 watt heater for example, will require about 12.5 amps of AC power. If there were any other loads on the inverter, these would need to be taken into account when sizing the inverter required to carry the total AC load. The Freedom 25 for example, has a continuous rating of 2,500 watts, so it could carry the heater and a microwave at the same time.

DC load

As a rule, in a 12-volt system, it takes 11 amps of DC power to generate 1 amp of AC power. If the process of energy conversion were 100% efficient, the ratio would still be about 10 to 1. Since 12-volts is being stepped up by a factor of 10 to 120-volts, the current ratio is also 10 to 1. However, the inverter is about 90% efficient, so this is why the 11 to 1 ratio is used as a guideline. This means that a heater that draws 12.5 amps AC from the inverter is causing about a 137 amp load on the DC system (12.5 amps x 11). At this rate, batteries are not going to last very long. For this reason, it is recommended that heating elements running on inverter power only be used while underway, and a powerful DC generation and storage system will need to be provided. When it comes time to stop the engine, it's time to shut down the heating element, or switch the heater over to another source of AC power, for example, shore power or generator.

DC generation and storage

Most standard engine alternators are rated in the 35 to 65 amp range. This is a "cold" rating however, and when they are at operating temperature, they might produce between 20 to 45 amps. This is obviously not enough to keep up with the heater's power requirements, let alone other DC loads in the system or provide any battery charging. Therefore, a high output alternator should also be part of the system. A high output alternator is usually "hot" rated, so its amperage rating is usually what you can expect from it as long as the RPMs are high enough.

You will want one that is large enough to keep up with all of your DC loads, and provide enough excess current to do some significant battery charging too. These units are likely to be externally regulated, so a good three-stage regulator such as an InCharge or Link 2000R is also recommended. The battery bank will be required to

source the DC loads during low RPMs and short duration engine shut downs. It also needs to be sized appropriately to accommodate the high output potential of the alternator and charger. Therefore, the battery bank should also be quite large. Approximately 600 amp hours should be considered the minimum bank size.

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