Technical Note

Inverters

512-0098-01-01 Rev 1

Running Air Conditioners on Inverter Power

Introduction

In some parts of the world, air conditioners are used for convenience as well as necessity. They are also a large consumer of electrical energy. Large inverters can properly power medium-size air conditioners, but both the AC and DC electrical systems need to be designed to properly accommodate the large energy demand.

AC Load

Air conditioners up to about 12,000 BTUs can be run successfully on an inverter. These units require approximately 12 amps AC (1.4kw) when they are running. At startup however, they need up to 5 times as much power for a few seconds to get going. This requires an inverter that has a high surge rating as well as a fairly robust continuous rating. The Freedom 25 for example has a continuous rating of 2,500 watts and a surge rating about three times that. It can start and run most air conditioners of this size, but a large amount of DC power is required to generate this much AC power.

DC Load

As a rule of thumb, 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. But the inverter is about 90% efficient, so that is why the 11 to 1 ratio is used as a guideline. This means that an air conditioner that draws 12 amps AC from the inverter is causing a 132-amp load on the DC system (12 amps x 11). At this rate, batteries are not going to last very long. For this reason, it is recommended that air conditioners running on inverter power only be used while underway, and a fairly powerful DC generation and storage system needs be provided. When it comes time to stop the engine, it's time to shut down the air conditioner, or switch the air conditioner over to another source of AC power such as shorepower 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 air conditioner's 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 usually externally regulated, so a good three-stage regulator such as an InCharge or Link 2000R is also recommended. Since the battery bank will be called on to source the DC loads during low RPMs and short duration engine shutdowns, and it needs to be sized

appropriately to accommodate the high output potential of the alternator and charger, the battery bank should also be quite large. About 600-amp hours should be considered the minimum bank size.

Technical Note: *Running Air Conditioners on Inverter Power* © December 1997 Xantrex International

Part number: 512-0098-01-01 Rev 1

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