# Using Alternate Energy Generation to Power Fisher & Paykel Appliances Ltd. Domestic Appliances

## INTRODUCTION

**Fisher & Paykel Appliances Ltd's products (F&P Products) are designed to be powered from the national electricity supply grid. Connection to alternative energy sources may interfere with the operation of F&P Appliances and any damage caused by connection to such a power source will not be covered by the manufacturer's warranty.**
However, some F&P Products can be, and have been, successfully operated when connected to sources of electricity other than the national electricity supply grid (**Alternative Electricity Supply**). This document contains a brief collection of facts and field observations to assist in implementing alternative energy supply connections to F&P Products.

## PRODUCT FACTS

### Average Power Draw

Fisher & Paykel Products have a power rating printed on the serial plate. This is an average power rating, calculated over a period of use depending on the class of product. This is intended to assist the user in determining the energy usage of the product, and is not particularly useful to help sizing an inverter for power delivery.

### Peak Power Draw

Peak power draw is the maximum instantaneous power that the product will use during operation. The peak power usage will generally be a lot higher than the serial-plate average rating, though only for a short time.

### Motor Starting Current

Products which use induction motors can be affected by a phenomenon called "inrush surge" where the product draws a brief pulse of high current when the motor is first energised. This can cause problems for some alternative energy sources if they cannot supply the required surge current.
For example, many refrigerators will draw around 1.1A maximum during normal running. However when the compressor starts, the refrigerator can draw nearly 10A for a few seconds.
Many F&P Products (e.g. Smartdrive™ clothes washers and Dishdrawer™ dishwashers) use electronically controlled inverter-driven motors for increased efficiency. These products are not affected by inrush surge.

## ELECTRICAL SPECIFICATIONS

General electrical environmental specifications for F&P Products are given in the following tables.

### Specifications for 230V Markets (NZ, Australia, Europe)

| | |
|---|---|
| RMS Voltage | 230V RMS ± 10% (207 – 253V RMS) Pure Sinusoidal |
| Frequency | 50Hz ± 5% (47.5 – 52.5Hz) |

### Specifications for 120V Markets (USA, Canada)

| | |
|---|---|
| RMS Voltage | 120V RMS ± 10% (108 – 122V RMS) Pure Sinusoidal |
| Frequency | 60Hz ± 5% (57 – 63 Hz) |

## USING AN INVERTER DRIVEN ELECTRICITY

There are many different brands and models of Inverters available in the market today and often their output voltage waveform is modified or non-sinusoidal. We sent an enquiry to an Inverter manufacturer about whether an inverter output had to comply with any regulatory standards or guidelines. The reply read:

*"There are no guidelines that modified sine wave inverters are required to follow as pertains to the amplitude, quality or shape of the output waveform. The only regulatory guidelines we choose to follow are safety guidelines."*

As such F&P Appliances cannot guarantee the operation of F&P Products running from an inverter supply if it does not comply with our Electrical Specifications listed in the preceding section.

**ARE THERE EXISTING CUSTOMERS WHO ARE SUCCESSFULLY RUNNING FISHER & PAYKEL PRODUCTS FROM AN INVERTER SUPPLY?**

**Short answer – YES!**

There are many installations where F & P Products are successfully operating on an inverter supply. In our experience if the following technical criteria are met by an inverter then operation and reliability should not be an issue:

| | 230V Market Products | 120V Market Products |
|---|---|---|
| **RMS Voltage:** | AC 230V RMS ± 10%<br>(207 – 253V RMS) | AC 120V RMS ± 10%<br>(108 – 122V RMS) |
| **Frequency:** | 50Hz ± 5%<br>(47.5 – 52.5Hz) | 60Hz ± 5%<br>(57 – 63 Hz) |
| **Peak Voltage:** | Less than 400V peak | Less than 200V peak |
| **Power Rating:** | 2kVA (2,000VA) minimum for Clothes Washers<br>2.5kVA (2,500VA) minimum for Clothes Dryers<br>1kVA (1,000VA) minimum for Refrigeration products<br>2.5kVA (2,500VA) minimum for Dishwashing products | |

Inverter output wave shape must be of the "Pure Sine" type, which output a pure sinusoidal waveform, the same as is supplied by the utility mains. Some lower-cost inverters use a "Modified Sine" or "Square Wave" type output, these are likely to cause problems with the operation of F & P Products.

**DOES FISHER & PAYKEL APPLIANCES RECOMMEND A BRAND AND MODEL OF INVERTER TO USE?**

**Short answer – No.**

Due to the large number of brands and models it is impractical, not to mention inappropriate, for us to attempt to approve or disapprove the use of any particular inverter. We simply recommend that you do everything possible to ensure any inverter you use complies with the preceding technical recommendations.

### DOES FISHER & PAYKEL APPLIANCES PROVIDE A GUARANTEE FOR F&P PRODUCTS WHEN RUN FROM AN INVERTER SUPPLY?

**Short answer – No.**

Even though the design of inverters has improved immensely over the last few years, and the incidence of reported problems is very low, we do not know the "quirks" of individual inverters. If an inverter output should go outside our voltage recommendations then it may cause damage to the product.

## USING A MOTOR DRIVEN GENERATOR ELECTRICITY SUPPLY

### DOES FISHER & PAYKEL APPLIANCES PROVIDE A GUARANTEE FOR ELECTRONIC MODULES WHEN RUN FROM A MOTOR DRIVEN GENERATOR SUPPLY?

**Short answer – No.**

Motor driven generators typically generate a sinusoidal voltage output. Whilst the voltage shape is often better defined than an inverter, a generator can still develop high voltage pulses due to such things as:

- Noise of brushes
- Surges due to other equipment coming on/off line ("load-dump")
- Surges due to start up - power down.

In particular, "load-dump" - where the generator voltage can rapidly increase to a very high value when a large load is disconnected – has been known to cause damage in F&P Products.
For the same reason as with inverter driven supplies, Fisher & Paykel Appliances cannot and does not provide a guarantee for F&P Products that are connected to a motor driven generator.

### DOES FISHER & PAYKEL APPLIANCES RECOMMEND A BRAND AND MODEL OF GENERATOR TO USE?

**Short answer – No.**

Fisher & Paykel Appliances does not recommend a brand or model of generator for the same reasons that it would be inappropriate for us to recommend a brand or model of inverter. In our experience if the following technical criteria are met then operation and reliability should not be an issue:

- Only generators that use a Pure Sine inverter output should be used to. Generators without an inverter output can generate surges which cause damage to the F&P Product
- F&P Products should not be connected to the generator output while the generator is being started or shut down. The generator should be started and allowed to stabilise before the product is connected, and the product should be disconnected before the generator is shut down.

## GLOSSARY OF TERMS

**Apparent Power:** A measure of power used in AC electrical systems. Apparent Power is expressed in VA. Apparent power is often used to size inverters and transformers. The Apparent Power rating for most loads will be higher than the Real Power rating by between 1 and 1.5 times.

**Generator:** An electro-mechanical machine that generates electricity from mechanical movement. Generators can be powered from any source of mechanical movement such as a gasoline engine or a water or wind turbine.

**Inverter:** An electronic device that converts DC electricity, such as from a battery or solar cell, to AC electricity used to power appliances. Inverters are commonly found in alternative energy installations to convert electrical energy into the form that is required by equipment such as home appliances.

**Modified Sine:** A type of inverter output waveform. The waveform is closer to a sine wave than Square Wave type output waveforms, but has significant amounts of distortion. Most Modified Sine inverters are lower cost than Pure Sine types, but the power quality is inferior. Fisher & Paykel recommends against the use of Modified Sine inverters with our products.

**Pure Sine:** A type of inverter output waveform. The waveform is a pure sine wave with very little distortion. This type of output is the closest to the utility mains, and should cause the least problems with the operation of equipment. Pure sine inverters are often a little more expensive than other types.

**Real Power:** A measure of energy used over time. Real Power is expressed in units of Watts.

**Square Wave:** A type of inverter output waveform. Square wave inverters are the simplest type of inverter. The waveform is very distorted and will often cause problems with any equipment that is much more complicated than simple lighting or heating appliances. Fisher & Paykel recommends against the use of Square Wave inverters with our products.

**Surge:** An event which occurs in an electrical power system which causes the voltage to rise to levels that are much higher than normal. Surges are short in duration – from a few milliseconds up to a few seconds maximum, depending on the cause.