EXPLANATION OF FREQUENCY CONVERSION

WHAT IS MY FREQUENCY?

The Electric Utilities in the United States, Canada and Central America produce power at a frequency of 60Hz. This excludes some of the very old and still in operation Hydro Plants that produce power with at 25HZ. Most of the other countries throughout the world produce power at a frequency of 50Hz, with few exceptions, like Japan where they have both (Eastern Japan 50HZ, Western Japan 60HZ) and South America where it is split with Brazil and the North Eastern countries being 60HZ and the rest operating with 50HZ.

WHY DO I NEED A FREQUENCY CONVERTER?

For small components like computers and small electronics, they operate with what are called switch mode power supplies, that are capable of operating at both 50HZ and 60HZ and as such, they only item you may need is a plug converter as 50HZ outlets are not the same as 60HZ outlets for this very reason. You do not want to plug equipment into the wrong power source or you run the risk of allowing the smoke to escape from your equipment. And the smoke is like “a genie in a bottle”, once it escapes from the electronic device, you cannot put it back in…Larger and 3 phase equipment cannot operate on the wrong frequency as the incorrect frequency can cause damage or premature wear on the equipment. The equipment has been designed to operate at 50 Hz and is incorrectly connected to 60 Hz will cause the equipment to operate outside its design criteria, most likely damaging the equipment immediately (remember the smoke) or causing it to fail over time from overheating. With our ever growing global economy, equipment from other parts of the world are being used more frequently in countries that they were not manufactured in. This usually results in the need of a Frequency Converter to change the local utility’s frequency (and sometime its voltage) so it will be compatible with the power requirements of the equipment you are trying to operate (load).

Specific industries have unique frequency requirements and this is based on how they supply power to their equipment. Aviation and some Weapons systems requires 400Hz, therefore when the equipment is one the group or not operating on the 400HZ being produced on-board, ground power support is needed for the electrical system.

400Hz is also used in many airport and military radar applications. Rail utilize 25, 91.66 or 100Hz to run their signaling systems. Ship yards and docks require frequency conversion of shore power as most ships are built in 50HZ countries, which means the base power systems on the ships will be 50HZ, therefore they will need a frequency converter to match the electrical needs of ships being built, repaired or docked. There are also many unique and/or variable frequencies needed in laboratories and testing facilities.

WHAT ARE THE TYPES OF FREQUENCY CONVERTER?

Some applications are better suited for Rotary (sometimes called Motor Generator) Frequency Converters, while others may be more suitable for Static (sometimes called Solid State) Frequency Converters. Each type has its benefits and shortcomings. That is why some companies will build types of equipment. This allows the customers to select what they need as well as not deal with a company that has a vested interest in recommending one version over another. These companies tend to be a more reliable source for the solution as they will recommend the best possible conversion solution for a given application. Frequency Converters are usually built to any size, which is based on the load

A Rotary Frequency Converter utilizes a generator to produce a true output sine wave at the desired frequency – much like a utility. A Static Frequency Converter utilizes a double conversion process with a rectifier that changes the AC input to DC then an inverter to convert it back to an AC output – this process modifies the frequency (and output voltage if necessary) which results in a re-created sine wave. The resulting frequency and/or voltage conversion from either type of unit is suitable for most applications. Price, longevity, serviceability, size, noise, and preference then become the deciding factors.

RFC – Four Bearing Belt Driven

A Rotary Frequency Converter (RFC) consists of a motor coupled to a generator with a belt. There are two bearings in the induction or synchronous motor and two bearings in the synchronous generator. Typically the motor and generator are positioned side by side with a control cabinet alongside or on top of the unit. This is a simple and reliable configuration and also the least expensive approach. In addition to frequency conversion it can also change the voltage if necessary. The generator acts as a rotating filter and provides protection against utility transients, brown outs and spikes. Maximum size would be upwards to 300kVA.

RFC – Four Bearing Coupled Shaft

The motor and generator shafts can be mechanically coupled together in a horizontal front-to-back configuration with the control cabinet on the generator end. Otherwise, similar to the belt driven models. As the kVA rating of the RFC increases, there is less stress on the bearings utilizing this approach and maximum size is in the 500kVA range.

RFC – Two Bearing Common Shaft

Recommended for the most demanding requirements and for larger units. The motor and generator utilize the same shaft and are built together from the start. The use of a single shaft provides for increased reliability and complete electrical isolation. It is essentially a Motor-Generator (M-G) Set. With a synchronous motor and a synchronous generator, it will provide a very precise output. Many 400Hz applications utilize this configuration which can be built as horizontal or vertical units. Very large kVA requirements can be met with these units.

SFC – Static Frequency Converter

A solid state or Static Frequency Converter (SFC) can be provided as an alternative to the rotary units. The SFC converts the incoming utility AC power to DC with a rectifier and utilizes an inverter to reconvert it back to AC at the desired frequency (and voltage). Our design uses the latest electronic and digital advancements to ensure an extremely reliable and very cost effective unit. All SFCs come with standard LCD displays and are available in 1 to 2000kVA sizes.

Below is a picture of a typical Rotary Converter and Static Converter

Rotary

Static