Converting Our Generators From 60Hz to 50Hz Power

- Generator's rating is highly dependant upon the output frequency of a generator, which must be maintained at a fixed frequency, 50 Hz or 60 Hz, to match the output of a standard electrical grid or the frequency rating of the appliances. In rare situations, one may also come across different isolated sections of the same grid operating at different frequencies. It then becomes essential to vary the output frequency of the generator to match that of the appliances to be powered or of the grid to which your generator is connected.

Changing Engine Speed

- One of the most common ways of changing the output frequency of a generator is to change the rotation speed of the engine.

- The two factors are related as per the following formula –
  Generator Frequency (f) = Number of revolutions per minute of the engine (N) * Number of magnetic poles (P) / 120
  Conversely, P = 120*f/N

- As per the above formulae, a 2-pole generator producing an output frequency of 60 Hz has an engine speed of 3,600 rpm. To change the output frequency to 50 Hz for the same generator configuration, the engine speed needs to be reduced to 3,000 rpm. Similarly, for a 4-pole generator, an engine speed of 1,800 rpm produces output of 60 Hz. Reducing the engine speed to 1,500 rpm yields an output of 50 Hz.

Follow the steps given below to alter your generator frequency from 60 Hz to 50 Hz:

1. Change the governor setting.
2. Change the Under frequency Roll-of jumper (UFR) on the Automatic voltage Regulator to the right frequency.
3. Check the AC voltmeter or potentiometer as the case may be and read the voltage output of the generator. The output voltage decreases as you reduce the frequency and may be lower than the desired value.
4. Reset the voltage until you obtain the desired voltage at 50 Hz. (50Hz is usually 110v / 230 or a multiple, and 60Hz is usually 120v / 240 or a multiple.)
5. Reset the over-speed shutdown circuit. Generator controller units undertake real-time monitoring and control of your unit. Built-in protective functions automatically shut down your generator in the case of excess engine rpm or very low output frequency.

- Let us take an example of a 4 Cylinder Lister engine. The output ranges from 15KW at 50Hz/1500 R.P.M. to 25 KW at 60 Hz. 3600 R.P.M. The same basic engine is used at:

1. 1500 R.P.M. for 50Hz.
2. 1800 R.P.M. for 60 Hz.
3. 3000 R.P.M. for 50 Hz.
4. 3600 R.P.M. for 60 Hz.

- Same four pole alternator are used for 1500 or 1800 R.P.M. Same two-pole alternator are used for 3000/3600 R.P.M. The only mechanical difference, 1500/1800 R.P.M. sets have a four weight governor. The 3000/3600 R.P.M. sets have a two weight governor.

- The generator rating varies depending on service, (Standby, continuous, or prime,) voltage (120/208, 220, 240) and speed. For instance, a standby rated 4-pole set genset would use the same generator, but would have a higher output at 60 Hz. Otherwise, most genset Models are the same for 50Hz, or 60 Hz.

- The conversion from 50Hz to 60 Hz is quite simple.

1. Ratio is 50:60 or 60:50. You will change a jumper on the Automatic Voltage Regulator to configure the Under frequency Roll-Off from 50Hz. to 60 Hz.
2. The current rating stays the same. Current causes heat and is one of the limiting factors.
3. The voltage in an iron core winding (Motor, transformer, generator) may be increased in direct proportion to the frequency without flux saturation. A 10 HP motor at 50 Hz becomes a 12 HP motor at 60 HZ. i.e 10 x (60/50). The voltage may be safely increased from

220 to [220 x (60/50) = 264], - Quite safe at 240 volts.

4. As to the voltage, jumping 20% the voltage will stay at whatever the voltage regulator is set for. We usually have to change the jumper from 50Hz to 60 Hz., and reset the voltage.
5. If you run at 50 Hz with the UFR set for 60 Hz., the voltage will be unstable. If you run at 60 Hz with the UFR set at 50 Hz you will not have the full benefit of the UFR circuit. In the event that an over-load slows the engine more than about 2 Hz below rated frequency, the Under Frequency Roll-off starts to shed the load by dropping the voltage. This gives the genset a better chance to recover.
5. We should however take into account the natural frequency. In order, it not to hurt the generating set it is better to have enough play in the exhaust connection to "take the shake."

- Thus, converting 50 Hz to 60 Hz and vice versa is summarized as under:

- Current stays the same. Torque remains the same. Speed changes in the ratio of 50:60. Speed times torque equals Horse Power. Higher frequency allows higher voltage. In addition, most motors will accept 15% over voltage Or 15% under voltage. That means that a 230-volt motor will work on anything from 197 volts to 264 volts. 460-volt motors work well on 416 volts, 440 volts or 480 volts. 575-volt motors work on 550 volts or 600 volts.

Critics of conversion:

- Critics say that rerating of the 50Hz motor to 60 Hz with current constant does not seem possible though. Voltage changes with frequency, and therefore current should change by the same ratio in order to produce the same torque.

- The answer is that actually, speed changes with frequency. We have to change the voltage ourselves. Motor current has two components;

  - Current to supply losses, most of which will increase with increased voltage, and Current to supply useful work which will decrease with rising voltage. That is why motors run hotter on low voltage.

  - With fewer volts, the motor has to draw more amps to produce the same watts of work. Torque is related to current, not voltage or frequency. The same current will produce the same torque on 50 Hz or 60 Hz.

  - The catch is that when we re-rate from 50 Hz to 60 Hz, we use a ratio of 50:60. This is correct for horsepower, because the same torque times higher RPM equals more Horse Power. However, the voltage ratio is not 50:60, but 110:120, or 55:60.

For more information on conversion, please contact customercare@eslpk.com