



Output Derating Of Our Generators

◆ When is the efficiency of a generator highest?

- ◆ Generators are typically designed to run most efficiently at or near sea level under standard conditions of temperature and pressure (STP). Any fluctuation from STP conditions can impair generators and cause decreased output. For most applications, many of these factors are relatively minimal unless the generator set is run at elevations over 5000 feet above sea level, or has ambient temperatures that remain over 100 degrees Fahrenheit for a significant length of time. ESL offers useful advice to the owners / users with regard to selection of equipment and / or its subsequent use under circumstances other than those at STP.
- ◆ Actually, the derating factor is a function of the design of both the generator and the prime mover (engine, turbine, or whatever is driving the generator). In most cases, the capability of the prime mover varies more with ambient conditions than would the capability of the generator. The best way to determine derating factors is to ask the equipment manufacturer. While there may be industry standards (especially on generators), actual derating factors for prime movers may be more often a function of the proprietary design of a specific manufacturer.

◆ Environmental Factors That Affect Output Derating Of Generators

◆ Altitude

- ◆ In areas of high altitude, air pressure drops reducing the air density resulting in lower oxygen content. This can create problems with generator start up if not accounted for since air is crucial for ignition in any type of generator. Another factor that gets affected is availability of ambient air to facilitate heat dissipation from the generator. A lot of heat is created during the combustion process and needs to be dissipated into the environment to reduce engine temperature. At high altitudes, due to the low air density, heat dissipation occurs at a much slower rate than it would at sea levels, resulting in high engine temperatures for a sustained period of time. The engine remains hot and overheating is a common problem in such cases.

◆ Temperature

- ◆ High temperatures are also associated with lower air density and can cause similar ignition problems due to inadequate air supply. This can burden the engine which pushes itself to deliver the power it is designed to. However, due to inadequate oxygen levels available for combustion, it fails to do so. In many such instances, the engine gets overheated and sometimes collapses altogether.

◆ Humidity

- ◆ Humidity is the measure of water content in a given volume of air. In conditions of extreme humidity, water vapor in the air displaces oxygen. Low oxygen levels impair ignition, since oxygen is the element in air that is ignited in an engine for the burning of fuel.

◆ Rating Generators

- ◆ Generators come in various sizes. Each of them is preset for particular output levels. Generators are selected and installed based on the power requirements of any facility. A typical generator is ideally set to run at 80% of its capacity for continuous usage. In an emergency, it may be utilized for 100% efficiency.



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◆ Derating Generators

- ◆ We have seen above how non-standard environment conditions can reduce generator power output. In such cases, how does one guess the new output levels? A technique called "Derating" is employed to determine the generator's performance under new ambient conditions. Derating is defined by Wikipedia as "the technique employed in power electrical and electronic devices wherein the devices are operated at less than their rated maximum power dissipation".
- ◆ Derating a generator depends on the manufacturer of the unit. Different manufacturers design generators using materials from different sources. Also, design developments are non-similar and so is the technique in many cases. All these can contribute to overall generator efficiency. Therefore, derating a generator is dependant on the manufacturing process. Different brands have different derating factors for estimating generator output under non-standard ambient conditions.
- ◆ However, a general formula can be used to calculate close estimates for the output levels. The standard derating formula states that for every 1000 ft above sea-level, a gasoline, diesel, or liquid propane generator usually should be derated by 2–3% of its standard output. In case of generators using natural gas, the derating factor is typically closer to 5%.

◆ What are the fuel problems associated with environmental factors?

- ◆ At low temperatures, along with inadequate oxygen levels, which cause problems in start-up, another common problem that occurs is the gelling of diesel fuel. Low temperatures cause diesel to gel, altering the flow characteristics of the fuel. This gelling is attributed to the paraffin content in diesel. When the fuel filters get clogged, additional fuel cannot enter the combustion chamber with ease and the air to fuel ratio changes leading to inadequate combustion. In such conditions, the generator engine may fail to start. In order to avoid gelling, two methods are generally used:
 - a) winterizing of fuels which entails decreasing the overall paraffin content of the fuel by mixing it with more refined fuel in pre-determined ratios and
 - b) adding anti-gelling additives to the fuel to prevent paraffin crystallization.

◆ Load Considerations

- ◆ As discussed in the previous sections, it is understood that STP conditions enhance generator power output due to maximum air availability and desired flow quality of the fuel. Although designed to bear 100% load during standard conditions, it is typically advised that generators be run around 80% of their total capacity for maximum and continuous usage. In times of emergencies, however, the generator can be pushed to deliver 100% output for critical circuits. From a maintenance point of view, this does not overload a generator and the life span of the genset is not affected negatively.

◆ Summary

- ◆ In totality, it is best to use generators with the specifications they come with from the manufacturer at conditions of STP. In non-standard conditions, it is advised to derate the generator as per the manufacturer's derating formula and operate the unit accordingly so as to avoid overburdening the generator. Regular maintenance and repairs must be taken care of to enhance the life span of the generator since a well maintained generator is a valuable investment that can save you from precious losses in times of power failure. Please contact ESL in case any further advice is required with regard to operations of generators under harsh, hot, humid conditions or at high altitudes.