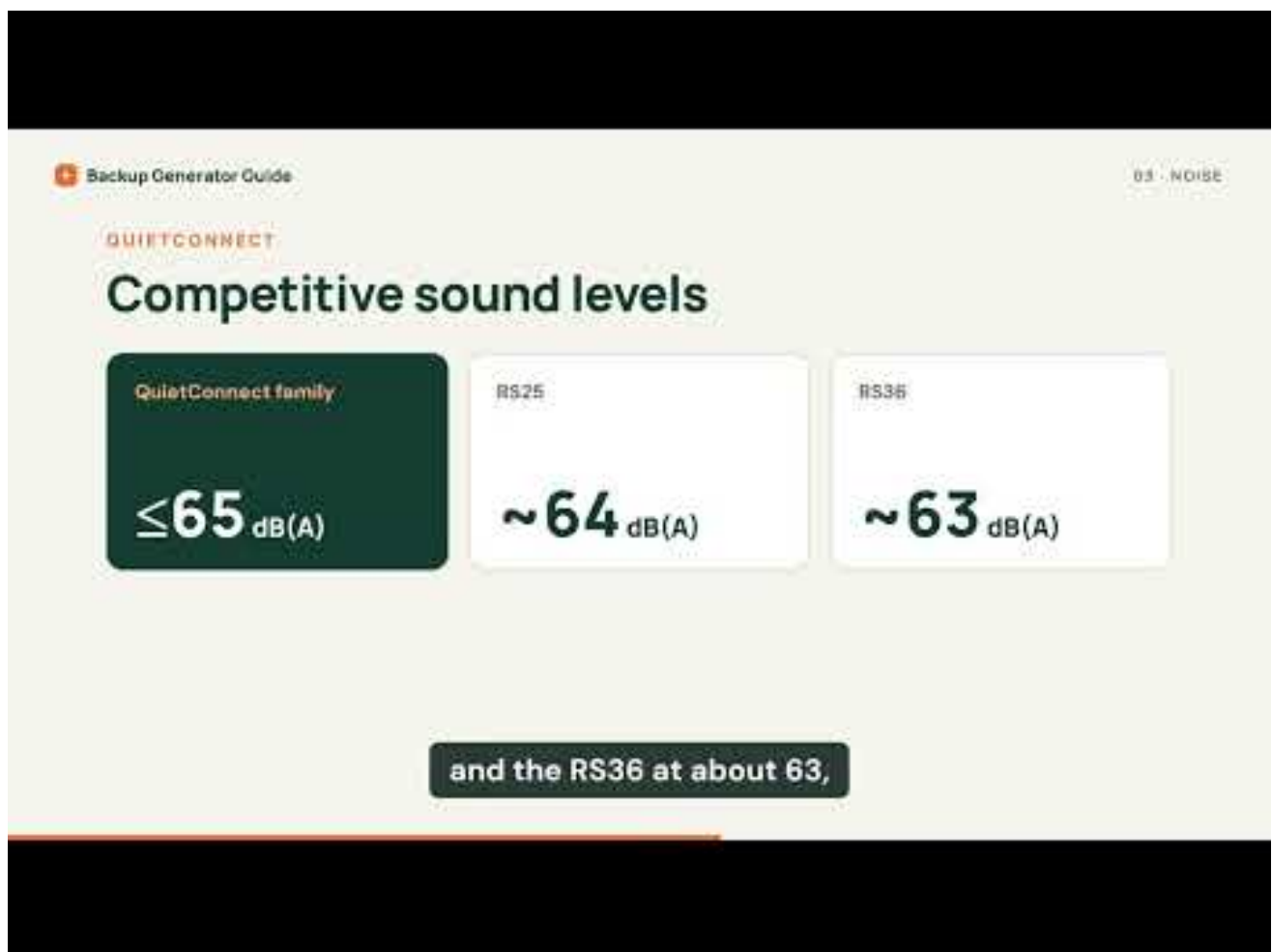


Understanding Watts, Volts, and Amps for Generator Sizing

If you have ever stared at a generator wattage chart and felt your eyes glaze over, you are not alone. The numbers on those spec sheets - watts, volts, and amps - seem like they come from a secret language. But they are really just three measurements that describe how electricity behaves. Once you understand how they relate, choosing a generator becomes a lot less guesswork and a lot more confidence.

I have been on both sides of this desk: as a guy who once bought a generator that was too small for his workshop, and later as someone who helps other people avoid that mistake. The difference between a generator that starts your well pump and one that just grunts and shuts down is often a matter of understanding watts volts and amps. It is not complicated, but it does require paying attention to a few key details.



What Each Term Actually Means

Think of electricity like water flowing through a hose. Voltage is the pressure pushing the water. Amperage is the volume of water moving past a point. Wattage is the total work done - the combination of pressure and volume. A high-pressure hose with a small stream can do different work than a low-pressure hose with a big stream. Wattage tells you the overall power, which is what really matters for running equipment.

This relationship is captured by **Ohm's Law**, which is the mathematical backbone of electrical systems. Ohm's Law says that voltage equals current times resistance. But for practical generator sizing, the simpler formula is watts equals volts times amps. That is the equation that connects all three numbers. If you know any two, you can calculate the third.

Generators produce **alternating current** (AC), which is different from the **direct current** (DC) that comes out of a battery. AC changes direction many times per second, which allows it to be transformed to different voltages and transmitted over long distances. That is why your house runs on AC, and why generators are designed to output AC power.

Why Generator Wattage Is Not a Single Number

When you look at a generator spec, you will see two wattage numbers: **running watts** and **surge capacity**. Running watts is the continuous power the generator can supply. Surge capacity is the extra power it can deliver for a few seconds to start motors, compressors, or pumps. This is critical because many appliances need two to three times their running wattage to start up.

For example, a typical well pump might run at 1,000 watts but need 3,000 watts to start. If you size a generator based only on running watts, it will stall when the pump kicks on. That is why understanding [watts volts and amps](#) is not just academic - it saves you from buying a generator that cannot do the job.

Power Factor and the Difference Between kW and kVA

Here is where things get a little more nuanced. You will see generator ratings in both **kilowatt** (kW) and **kilovolt-ampere** (kVA). For purely resistive loads like a space heater or incandescent light bulb, kW and kVA are the same. But for inductive loads like motors, compressors, and fluorescent lights, they are different. The difference is the **power factor**, which is a number between 0 and 1 that describes how efficiently the load uses electricity.

A generator rated in kVA can deliver that many volt-amperes, but the actual usable power in kW is kVA times the power factor. Most household loads have a power factor around 0.8 to 0.9. So a generator rated for 10 kVA might only deliver 8 to 9 kW of real power. If you ignore this, you can end up with a generator that is technically big enough on paper but cannot actually run your equipment.

Matching the Generator to the Load

When I help people size a generator, I always start with a list of everything they want to power. For each item, I note the running watts and the starting watts. Then I add up the running watts of everything that will run simultaneously, and I make sure the generator's surge capacity covers the largest starting load.

This is also where **voltage drop** comes into play. If you are running a long **extension cord** from the generator to your equipment, the voltage can drop along the wire, causing motors to draw more current and potentially overheat. For long runs, you need a thicker cord (lower gauge number) to minimize voltage drop. A 100-foot extension cord with a 14-gauge wire might be fine for a few hundred watts, but for a 5,000-watt load you need at least 10-gauge or even 8-gauge.

Real-World Examples from Popular Brands

Manufacturers like **Honda generators**, **Generac**, **Westinghouse**, and **DuroMax** all provide detailed specs on running watts and surge capacity. Honda's EU series, for instance, is known for clean power output and fuel efficiency, but they tend to be more expensive per watt. Generac offers a wide range of home standby units that integrate with a **transfer switch** and **electrical panel** for automatic backup power. Westinghouse and DuroMax often provide good value for portable units, with dual-fuel capability that lets you run on gasoline or propane.

I have used a DuroMax 6500-watt generator on a job site for years. It starts my 2-horsepower air compressor without complaint, but I learned the hard way that I cannot run the compressor and a large circular saw at the same time. That is a lesson in real-world wattage management: the generator has enough surge for either one, but not both at once.

Safety Considerations: Breakers, Grounding, and Ah Ratings

Every generator should have a **circuit breaker** built into the outlet panel. This breaker protects the generator and your equipment from overload. If the generator is overloaded, the breaker trips and you have to reset it. Do not bypass this breaker or run a generator with a tripped breaker - that can damage the alternator.

Ground fault protection is another important feature, especially when using a generator in wet conditions or with power tools. A ground fault circuit interrupter (GFCI) shuts off power if it detects a leak to ground, which can prevent electrocution. Many portable generators have GFCI outlets, and some standby systems include ground fault monitoring at the transfer switch.

For battery-based systems or inverter generators, you might see a rating in **ampere hour (Ah)**. This tells you how much current a battery can supply over time. A 100 Ah battery can deliver 1

amp for 100 hours, or 10 amps for 10 hours. This is more relevant for off-grid solar or inverter generator setups than for portable generators, but it is worth knowing if you are looking at hybrid systems.

Putting It All Together

The best approach to generator sizing is to do the math upfront. Write down the running watts and starting watts for each device. Add the running watts of everything you want to run at the same time. Then make sure the generator's surge capacity is at least as large as the biggest starting load plus the running watts of everything else.

Understanding watts volts and amps helps you read those spec sheets with a critical eye. When a generator says it produces 7,500 watts at 240 volts, that means it can deliver 31.25 amps ($7,500 \div 240$). If you are running a 120-volt circuit off that same generator, you only get half the wattage per leg, roughly 3,750 watts per 120-volt outlet. That matters when you are trying to balance loads across the two hot legs of a 240-volt generator.

I have seen people buy a 10,000-watt generator and still not be able to run their central air conditioner because the unit required a dedicated 50-amp 240-volt circuit and the generator only had a 30-amp 240-volt receptacle. The numbers all line up if you do the conversion: 50 amps times 240 volts equals 12,000 watts. The generator had enough total wattage but not enough amperage at 240 volts. That is the kind of mismatch that only shows up when you think in terms of watts volts and amps.

So next time you are shopping for a generator, do not just look at the big wattage number. Look at the voltage and the amperage ratings for the receptacles you need. Look at the surge capacity. And if the numbers do not make sense, ask yourself: Do I have enough pressure, enough volume, and enough total work capacity to start and run my equipment? That question, answered honestly, will keep you from making an expensive mistake.