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How to Choose and Use a Portable Power Generator

June—Field Day month—gives us a great excuse to operate from woods, mountain peaks or jungles (concrete or otherwise) in an age-old exercise to improve our emergency communication skills. But what about electrical power? If you're operating "off the grid," a portable generator may be just what you need. Here's some practical advice about choosing the right generator and using it safely.

Setting up a radio station at the local park and working stations here, there and everywhere with a bunch of your best radio buddies is what makes Field Day special. That, and the beer, hamburgers or whatever you're serving in your neck of the radio woods. In addition to a weekend of fun and camaraderie, we improve our ability to serve the public in times of need—and our operating skills probably inch up a notch or two as well.

If you're new to this game you may be wondering about how everything is powered. And even if your operating site has electrical power (campground, softball park, courthouse lawn, etc), you may not want to avail yourself of its convenience. Field Day is ostensibly about practicing for communication emergencies when the ac mains might be out of commission.

Common power sources include batteries, vehicle alternators, wind-powered alternators, solar panels and engine-driven portable power generators. And speaking of portable power generators (PPGs for short), we see them at golf courses, in hardware stores and on TV news reports during floods and ice storms—but we don't see much about them in Amateur Radio publications!

I hope this article gives you a leg up on choosing and using the right portable power generator for your applications, Field Day or otherwise. Pay special attention to the safety issues. Generators—like all engine-powered devices—can injure or even kill you if you don't respect them. And unlike your garden tractor, these power-houses can *electrocute* you (or others). Don't be afraid—but do pay attention!

Figure 1—The author tested these four portable power generators during the creation of this article. See Table 1 and the "Resources" sidebar for more information. (All photos by the author)

The most basic units have preset throttle/engine speeds that can be adjusted to match required loads. These are most useful for powering incandescent lights or small ac motors (saws, drills, etc), which can safely tolerate "cruddy power." Use them to power solid-state devices at your own risk!

Because there are no free lunches, PPGs that offer better regulation and greater output power cost more money. Units that have little or no automatic regulation and less capacity are more affordable—unless you're talking about the tiny "hand-held" units that weigh in at 25 to 60 pounds, which cost more than some higher-powered, beefier, standard models!

And as if that's not enough, in addition to power capacity and regulation, there are other factors to consider such as engine type, noise level, fuel options, fuel tank capacity, run time, size, weight, cost, connectors, miscellaneous bells and whistles, etc.

Buying a Portable Power Generator

Before you run down to your local hardware superstore and buy the first PPG that catches your eye, consider the following items in light of your personal requirements. Sure, you'll use the generator for Field Day, but don't forget to factor in other possible uses such as camping, power outages, and so on. Try to do some research of your own. Your exact requirements may vary, and you may need a solution that fits.

The generators we're discussing here are designed for consumers, contractors and farmers. They're designed for occasional use, not for continuous, long-term applications. Units designed for continuous service and ultra-reliability (for marine, medical and telecommunication systems) are available through specialty suppliers, but the prices are prohibitive for casual users.

PPGs powered by diesel, kerosene, propane and natural gas are also available (at similarly high prices), as are ultra-quiet, liquid cooled, and specially sized and shaped generators. The PPGs we'll be considering are air-cooled and powered by gasoline. The four PPGs I tested while writing this article are shown in Figure 1.

Capacity

To be useful, your generator must be able to safely power all of the devices that will be attached to it. On a basic level that's just common sense. Simply add up the power requirements of *all* the devices, add a reasonable safety margin (25 to 30%) and choose a suitably powerful generator that meets your other requirements.

When you read the fine print, however, things get tricky. Some devices—most notably motors—take a lot more power to start up than they do to keep running. For example, a motor that takes 1000 W to run may take 2000 to 3000 W to start. Light bulbs, soldering irons, space heaters and most radios don't require extra start-up power, but be sure to plan accordingly.

Size and Weight

PPG size and weight usually vary according to power output—

low-power units are lightweight and physically small, while beefier models are larger and weigh more. Some models are wrapped in a large protective frame while others have less "air space" inside the "cage."

Tiny camper models (800 to 1000 W output) are amazingly small and lightweight, but some units lack sufficient regulation and may not be recommended for powering solid-state devices. On the other hand, some teeny gens can put out a whopping 70 A of 12-V dc for charging batteries. If your gear is battery-powered, you may still be in luck.

Engines and Fuel

Most portable generators are driven by small gasoline engines similar to those used to power lawnmowers or go-carts. Basic models are powered by standard side-valve engines. These often make more noise, need more-frequent servicing and often don't live very long. More expensive models have overhead-valve (OHV) engines, pressure lubrication, low-oil shutdown, cast-iron cylinder sleeves, oil filters and electronic ignition systems. These features may be overkill if your generator will be used only occasionally. But if your generator needs are more consistent, "upgrade" models may offer much better service.

Run Time

Let's face it: Filling the generator's gas tank every hour can be a hassle—especially if you do it safely by shutting off the engine and letting it cool briefly before carefully pouring in more gas.

As a rule, smaller PPGs have smaller gas tanks (and vice versa)—but that doesn't necessarily mean that they need more frequent refueling. Some small engines are more efficient than their larger counterparts and may run for half a day while powering small loads.

When you look at generator specs, remember that the run times for most units are shown for 50% loads. If you're running closer to max capacity, your run times may be seriously degraded. The opposite is also true. "Extended Run" models usually have more efficient engines and larger gas tanks. The generator unit, however, is usually unchanged.

Typical PPGs run from three to nine hours on a full tank of gas at a 50% load.

Noise

Subject to a few exceptions, generators are almost always too loud. That is, we'd always prefer them to be less obvious. If you're set up for Field Day way out in the woods, generator noise probably isn't a problem. If you're set up in a campground or other more-public space, however, PPGs can sound like a rock concert. Keeping the things quiet isn't always possible!

Noise levels for many models are stated right on the box, but because there's no set standard for measuring generator noise, take these with a grain of salt and try to test them yourself before buying.

Was the PPG three feet away from the sound level meter, or was it 10 or 20? Was the muffler facing the test set, or was it hiding behind the unit's engine? Did the noise tests take place in an open field, or were buildings or other reflective structures nearby? You get the idea!

That said, some models are definitely quieter than others. Some gens *do* have quieter engines and muffler systems, but most of the noise is actually produced by rotating generator parts and vibrating sheet metal. If you take great pains to make the exhaust quieter—as some users attempt—you may be shocked to discover that your improved "stealth generator" is only marginally less noisy!

Water-cooled PPGs (rare and somewhat expensive) produce less noise, as do units designed to be housed in special compartments found in boats and RVs. They're not a free lunch, though. RV gens are expensive and heavy.

Regulation

As previously mentioned, voltage and frequency regulation—or lack thereof—may significantly influence your buying decision. The bottom line is that *any* PPG can safely power lightbulbs, heating elements and power saws, but when it comes to computers, TVs and expensive ham radios, units with mechanical or electronic regulation may be required, if only for peace of mind! (All of the gens I tested safely powered solid-state devices. Initial tests, however, were made with a small TV set I'd purchased for $5 at a garage sale, just to be sure!)

Figure 2—Prized by RVers, PowerWatch Technologies' *Good Governor* is a handy unit that visually indicates ac wiring faults and accurately displays the voltage and frequency of the ac line source it's plugged into. If you can't find one at your local RV dealership, contact the manufacturer at PO Box 22988, Denver, CO 80222.

Unloaded generators may put out 130 V at 62-63 Hz. As loads increase, frequency and voltage decrease. Under full load, output values may fall as low as 105 V at 58-59 Hz. Normal operating conditions are somewhere in between.

To add an extra measure of safety, consider inserting an uninteruptable power supply (UPS) or a line conditioner between the generator and your sensitive gear. These devices are often used to maintain steady, clean ac power for computers and telecommunication equipment. As the mains voltage moves up and down, a line conditioner bucks or boosts accordingly. UPSs, with internal gel-cell batteries, provide power to the load if the ac mains (or your generator) go down.

If "electronic voltage regulation" isn't mentioned on the box, consider calling the manufacturer before you buy. And although you might get lucky, don't expect expert help from the salesperson at your local hardware store—they're used to helping contractors who want to power lights and saws. (To improve your odds of getting a unit with electronic regulation, consider buying a PPG intended for sale in Canada. Two manufacturers suggested that all Canadian PPGs must have electronic regulation.)

Dc Output

Some PPGs have 12-V dc outputs for charging batteries. These range from 2-A trickle chargers to 100-A powerhouses. Typical outputs run about 10 to 15 A. As with the ac outputs, be sure to test the dc outputs for voltage stability (under load if possible) and ripple. Batteries—especially when your car is stranded in a blizzard—aren't too fussy about a little ripple in the charging circuit, but your radio might not like it at all! It's better to be safe than sorry.

Miscellaneous

Other considerations include outlets (120 Vac, 240 Vac, 12 V dc, etc), circuit breakers (standard or GFCI), fuel-level gauges, handles (one or two), favorite brands, starters (pull or electric), engine operating speeds (faster means more noise, less weight and a shorter lifespan, and vice versa), wheels, handles or whatever you require.

Using Your Generator

Before we can connect "real" electrical loads in a Field Day situation we need to choose a grounding method—a real controversy among campers, RVers and home-power enthusiasts.

To complicate matters, almost all PPGs have ac generator grounds that are connected to the units' metal frames, but some units do not "bond" the ac neutral wires to the ac ground wires (as is done in typical house wiring). Although they might safely power your ham station all day long, units with "unbonded neutrals" may appear defective if tested with a standard outlet "polarity" tester.

Some users religiously drive copper ground rods into the ground or connect the metal frames of their generators to suitable existing

Table 1

Measurements and Data from the PPGs Shown in Figure 1

Model	*Output Surge & Cont*	*Run Time @ 50% load (hours/gals)*	*V/f @ 0 W 500 W 1000 W*	*Reg. Method*	*Engine Type & Size*	*Weight (lb)*	*Price (Street)*	*Notes*
Coleman Vantage 3500	4375 3500	9/3	128/63 125/62 125/62	Elect.	OHV 5.5 hp	110	$1049	1,2,3,4 5,6,8,9
Coleman Pulse 1750	1750 1400	5/0.9	133/63 130/62 125/60	None	Std 3 hp	65	$499	1,2,5,7,9
Homelite LR2500	2500 2300	7.2/3	157/64 151/64 149/64	Mech	Std 5 hp	87	$479	2,5,9
Honda EZ2500A	2500 2300	2.6/1	124/63 122/61 119/60	Elect.	OHV 5.5 hp	81	$789	5,6,7,8,9

1—Has 15-A, 12-V dc output.
2—"Extended Run" model.
3—Unit intended for sale in Canada.
4—Engine automatically idles when no loads are attached.
5—Unit has low-oil shutdown.
6—Unit has electronic ignition.
7—Unit is physically compact.
8—Unit is noticeably quieter than typical units in its class.
9—Unit should be adjusted for best voltage and frequency before regular use.

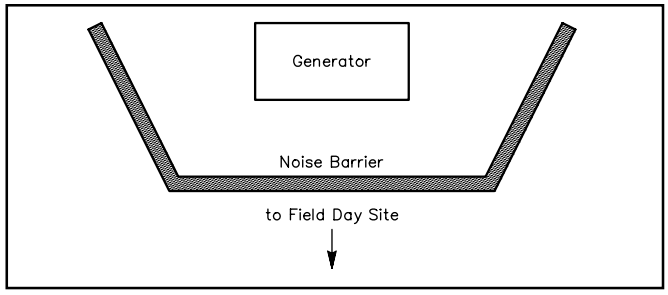

Figure 3—A two- or three-sided "room divider"-style noise shield is a handy, low-tech way to put a barrier between you and your Field Day generator. Use cardboard or carpet-covered plywood (with hinges, perhaps?), but don't put the generator in a covered box!

grounds, while others vigorously oppose this method and let their gens float with respect to earth ground. Some user manuals insist on the ground connection, while others don't. The same is true for various electrical codes.

Follow the instructions in your user's manual and comply with local electrical codes. Grounding can also be a consideration with respect to lightning protection. See the ARRL Technical Information Service package on lightning-protection methods at **http://www.arrl.org/tis/info/lightnin.html**.

Regardless of the grounding method you choose, a few electrical safety rules remain the same. Your extension cords *must* have intact, waterproof insulation, three "prongs" and three wires, and must be sized according to loads and cable runs. Use 14-16 gauge, three-wire extension cords for low-wattage runs of 100 feet or less. For high-wattage loads, use heavier 12-gauge, three-wire cords designed for air compressors, air conditioners or RV service feeds. If you use long extension cords to power heavy loads, you may damage your generator and/or your radio gear. When it comes to power cords, think *big*. Try to position extension cords so they won't be tripped over or run over by vehicles. And don't run electrical cords through standing water or over wet, sloppy terrain.

During Field Day operations, try to let all operators know when the generator will be shut down for refueling so radio and computer gear can be shut down in a civilized manner. Keep the loads disconnected at the generator until the generator has been refueled and restarted. And keep a sharp eye out for late night ops who try to sneak space heaters, leg warmers or coffee makers into the tents. An extra 1500 W of power draw can crash the generator in a hurry!

Resources

If you can't find a decent selection of PPGs at your local hardware superstore (with the Y2K craze, PPGs are in short supply everywhere), call Northern Hydraulics (800-533-5545) or Harbor Freight Tools (800-423-2567) and request catalogs. They're handy for other items, too!

For more information on the generators I mention in this article, surf or call: Honda generators, **http://www.honda-generators.com/generators/index.html**; Coleman generators, 800-445-1805; Home-lite generators, **http://www.homelite.com/homelite/products/**.

For information on UPSs, line conditioners and inverters, start with Statpower (**http://www.statpower.com/home.htm**) and American Power Conversion (APC) **http://www.apcc.com/**.

Handy Tips

Ask any Generator Elmer and you'll get a flood of helpful hints—many learned the hard way. Here are a few:

Light Bulb Load Stabilizer

To keep generator output as stable as possible when switching loads on and off (keying a transmitter, for example), try keeping a small load (two light bulbs, for example) connected for the duration. The constant load can reduce power swings while the engine governor "hunts" to maintain proper shaft speeds.

Noise Reduction

According to many trial-and error users, the best way to tame a noisy PPG during Field Day is to set it up in an out-of-the-way area and make a two- or three-sided sound shield from carpet-covered plywood or stiff cardboard (these look like small, folding room dividers). Keep the sound absorber/reflector between you and the gen. Do *not* make a four-sided shield or put the generator into any type of box. Gens need airflow to keep cool. See Figure 3.

Storage

When Field Day fun is over, don't just shove your generator into a dark corner of the garage. Follow the user manual's storage procedures and consider adding a small amount of gasoline stabilizer to keep the gasoline from oxidizing and gumming up the carburetor.

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