The Ultimate Emergency Generator Guide

Greetings, and welcome to my Emergency Generator Guide. This tool empowers you to choose and implement the best option to provide you and your loved ones with needed electricity during a crisis.

Emergencies and disasters can strike at any moment, often with little warning. From natural disasters to power outages, having a well-thought-out emergency power plan is essential for ensuring your family's safety and well-being. As the creator of this plan, I've drawn upon my over 13 years of experience in disaster preparedness, survival research & information, incident management, and disaster response. I have witnessed firsthand the devastation of Fires, Floods, Hurricanes, Tornados, Storms, and other critical events. With my disaster response experience, I've had to power disaster deployment sites with multiple trailered 3-phase diesel generators up to 250Kw, (the size of a large SUV) down to running the lights on a small mobile command trailer with a 2Kw inverter generator (about the size of a cat carrier).

This document is meant to be used as a guide to preparing for a power outage by understanding the options for Emergency Power Generation.

Document History

Date	Revision History
10/18/2025	Added info on Base Power & Virtual Power Plant (VPP) Batteries
05/05/2025	Version 1.1 - Updated and expanded.
10/28/2023	Document Formalized - V1

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NOTICE

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Always follow the safety instructions of all equipment, fuels, batteries, control mechanisms, etc. Don't modify any components without consulting the manufacturers. Hire installers when needed. Follow national and local electrical codes. Do things correctly and before a disaster strikes, not during a disaster. Failure to follow safety standards and the above can lead to property damage and death.

A WELL-ROUNDED PREPAREDNESS PLAN WITH A GENERATOR

It is very important to have a well-rounded **preparedness plan**. When it comes to an emergency or backup generator, the generator becomes completely useless if it can't be turned on because the gas went bad in the carburetor or if you are away and your spouse doesn't know how to hook up or start the generator.

You also don't want the fact that you have a generator to become a single point of failure in your preparedness, meaning that you should have other options for cooking food than just an electric stove dependent on your generator starting and running. You must carefully consider battery and solar options because batteries can drain very quickly and solar recharging can be unexpectedly slow.

A well-rounded and implemented emergency generator preparedness plan includes:

- Proper routine maintenance.
- Scheduled generator exercise.
- Printed instructions for hookup and starting that you and your spouse could follow, even under stress. Both you and your spouse should test the plan.
- Adequate and/or diverse fuel plan that includes stabilizer and rotating out fuel - you should also be able to answer how long your generator will run based on load, and how you will procure additional fuel to continue to run your generator for extended periods.
- Labeled electrical breakers that are easy to read (for maintaining the load below the generator's maximum output).
- Supplies such as new oil (and oil filter if required) to be able to run your generator for extended periods.
- Back up food preparation plan rather than just relying on an electric stove powered by your generator (a propane camp stove and solar oven should be considered).
- Following the break-in process of your generator, which includes a minimal load and the first oil change.
- Fully testing your generator with a power outage simulation, running the loads you would run in both hot and cold weather situations (to test the entire system, including a propane system for freezing).

MY SETUP - A COST-EFFECTIVE HOME EMERGENCY BACKUP GENERATOR

There are so many different options and ways to hook up a generator to a home, but the reason I went with the system I have is a balance of cost, power and noise. Let's first talk about my situation and the requirements that I have.

- I have an energy-efficient, fully electric 1,500 square-foot wood frame home near Austin.
- A single 2-ton Heat Pump HVAC unit.
- All LED lighting.

Because your situation is going to be different than mine, you are going to need to adjust your power solution to meet your requirements, but here is what I was looking for:

- A backup generator (meaning it was not a standby generator, which is constantly monitoring the power and will kick in automatically).
- A setup that was easy to connect or already connected (ready to be manually turned on).
- Quiet enough to run and not disturb the neighbors, especially if it was hot out and the neighbors had their windows open at night.
- Large enough to power our HVAC system for cooling.
- Supply power to our entire electrical panel so I could easily choose which circuits to power on.

Here is the solution I came up with:

- Firman 7500W Portable Tri-Fuel Generator from Costco.
- **MicroAir Easy-Start** installed on my HVAC Compressor so that my HVAC can ramp up power slowly enough to be powered by our 7500W generator.
- An uninterruptible power supply (a computer-style battery backup) to power our fiber internet router, WiFi, security system, and other critical loads, at least until the generator is turned on.
- A shed to house the generator inside. I highly modified the shed and generator to allow me to run the generator inside the closed shed:
    - A sealed exhaust pipe venting out of the back of the shed.
    - A fresh air intake cut in the left side of the shed.
    - A 120-volt hot-air exhaust output fan with louvers is installed on the right side of the shed.
    - Sound baffles inside the shed, allowing airflow but reducing the sound signature when the shed is closed.
    - A grounding rod outside the shed with an 8 gauge wire leading into the shed with a cable lug on the end to connect to the grounding lug on the generator.
    - A set of (4) 6-AWG copper conductor wires from the generator to the main electrical panel, capable of carrying 50 amps (generator/plug maximum capacity).
- A secondary generator - one that is smaller so we can't run our entire house, but it has a high output for its size and could run our refrigerator and critical electronics. Example.
- Finally, I added a EcoFlow that has a Lithium iron Phosphate battery (LiFePO 4) to give us the quick and instant power backup setup and for overnight running of small electronics so that we won't have to run our generator 24/7. We have a folding solar panel to recharge the battery during the day if for

some reason our primary method of plugging the battery into the generator won't work.

Carbon Monoxide and CO Alarms

Fuel-burning engines produce Carbon Dioxide (CO_2) from complete combustion and dangerous Carbon Monoxide (CO) from incomplete combustion. But when a generator has insufficient oxygen, as in an enclosed space, the amount of Carbon Monoxide or CO significantly increases, and quickly. Without working carbon monoxide alarms, you will not realize you are getting sick and dying from carbon monoxide poisoning.

Because all fuel-powered generators produce carbon monoxide, I highly recommend a good carbon monoxide alarm, and to have it monitoring inside the living area when the generator is running. Carbon Monoxide is a colorless, odorless gas that is produced by the burning of fuels, and can be deadly. One of the leading causes of death during disasters is carbon monoxide poisoning because of improper generator usage. Even if you don't smell the fumes from a generator, you are still at risk of carbon monoxide buildup. The closer the generator is to the living space, the greater the likelihood of carbon monoxide buildup inside the home. Follow the generator manufacturer's guidelines for the minimum distance between the generator and the home. Never run a generator inside an enclosed or semi-enclosed space like a garage or carport, and keep the generator away from open windows or doors. Place a CO alarm inside the living area following the CO alarm's instructions. You may even want to move the CO alarm to different rooms to test different areas for potential intrusion of CO into the living area. For more information on carbon monoxide risks, go to takeyourgeneratoroutside.com.

Carbon Monoxide Levels

0	Recommended Safe Level	
6	WHO 24 Hour Average	
9	EPA 8-Hour Average ASHRA 8-Hour Average NAAQS 8-Hour Average WHO 8-Hour Average	
25	ACGIH 8-Hour Average	
30	WHO 1-Hour Average	
35	NIOSH 8-Hour Average	Physical Symptoms after 6 - 8-Hours
50	OSHA 8-Hour Average	
69	UL 30-Day Alarm	
87	WHO 15-Minute Average	
149	UL 1 - 4-Hour Alarm	
200	NIOSH 15-Minutet STEL	Physical Symptoms after 2 - 3-Hours
399	UL10 - 50-Minute Alarm	Physical Symptoms in 1 - 2-Hours Life Threatening in 3-Hours
400	UL 4-Minute Alarm	Physical Symptoms in 45-Minutets. Unconscious in 2-Hours. Fatal in 2 - 3-Hours.
800		Physical Symptoms in 20-Minutes. Fatal within 1-Hour.
1600		Physical Symptoms in 5 - 10-Minutes. Fatal within 25 - 30-Minutes
3200		Physical Symptoms in 1 - 2-Minutes. Fatal within 10 - 15-Minutes
6400		
12,800		Fatal within 1 - 3-Minutes

GENERATORS

Generator Sizing

Generators come in different sizes, and are rated in Watts or Kilowatts (kW) meaning 1,000 watts. Each generator will have two “Watt” numbers associated with it, a running watts number and a higher, starting watts number. Be careful to compare apples to apples as different generator manufacturers will use either the starting watts or the running watts as the “size” of the unit. Running Watts refers to the power required to continuously run an electrical device after it has already started. Starting Watts on the other hand refers to the momentary surge of power required to get some appliances running.

The typical range for a portable generator is from 1Kw (or 1000 watts) up to 10Kw. Standby generators for homes are typically larger and generally range from 5Kw to 24Kw. The larger the generator, the more appliances the generator can run at once, but the more fuel the generator will consume.

Comparing Fuel Powered Generators & Battery Power Stations

	Gas Powered Generator	Battery Power Station	Battery Power Station **+** Fuel Powered Generator
Runtime	As long as you have fuel	Greatly dependent on the load on the battery. (see the chart below)	Long runtime when cycling the generator on to re-charge the battery power station
Noise	65-100db, depending on the type and make of the generator.	Almost silent, some have a battery cooling fan.	The generator is loud when re-charging the battery or running large appliances then nearly silent running on battery.
Recharge/Refueling Time	1-5 Minutes	Generally several hours on grid power - if the power comes back on. Recharging time from solar panels varies greatly. It takes a lot of solar to recharge large batteries.	Recharging the battery power station from a generator can be the same as plugging it into the house.
Lifespan	Some manufacturers state their generators are made to surpass 1,000 hours (regular Maintenance required.	Depends on battery material and storage	
Cost	• $500-$2500 (portable generator) • $5,000-20,000 (Automatic Standby)	• $500-$4,000 (Single Unit) • $5,000-up (Multiple Batteries and Solar)	$3,400-up ($900 portable generator + $2500 battery)

Small Battery Power Stations

Often marketed as portable “Battery Powered Generators”, these products don’t actually create electricity using a fuel source, they store energy obtained from other sources, such as solar panels, the power grid and even fuel-powered generators. They certainly serve a great purpose in emergency and disaster situations, but battery power stations should be considered as part of a larger approach to provide your family's power needs. It is important to understand the difference between Watts and Watt-Hours. Watts is how much power is used or produced and Watt-Hours is how much energy a battery can store.

For example, there is a popular power station with an MSRP of $3,700 that has a 3,600Wh battery, this will run a 700W refrigerator overnight for 5–12 hours, depending on the situation. In the morning, the battery will need to be recharged, this can require high amp grid or fuel-powered generator power for a 2-hour re-charge, or in perfect conditions, several hours using solar panels (not included in the cost). For some people, a single solar panel on their apartment balcony is the only option for them. If you can have a generator, I would not start with batteries/solar or think of solar as your only plan, because emergencies don’t happen at the perfect time, when the sun is out.

When used in combination with a generator and solar panels, battery power stations come in handy to keep CPAP machines, medications safe in a small refrigerator, mobile devices charged, WiFI connectivity and small appliances running in an emergency, and allow you to cycle a fuel-powered generator on and off to conserve fuel. They can be used indoors, and are clean and quiet. I'm not against battery power stations, on the contrary, we own a EcoFlow, but this unit fits into our overall power strategy, we are not solely dependent on this battery power station and we purchased it after we had a generator.

Whole Home Batteries

There is an emerging market where people are purchasing large battery banks - often multiple batteries stacked together and even multiple stacks to create a longer run time and a system that is capable of 220 volts to run some larger appliances and it's not uncommon to see 12+ kW battery banks that have a 10+ year lifespan on the batteries and a manual or automatic transfer switch. The downside of this kind of system is generally the high out-of-pocket cost for the batteries and installation that have a break-even cost at 5 to 15 years.

Base Power Systems - Virtual Power Plant (VPP) - Texas

For the deregulated energy areas of Texas there is a solution called Base Power and I’ll be testing this system out on our home. Base involves switching energy providers to Base Power and they will install one or two large batteries totaling 50 kWh. With an installation cost of the leased batteries of less than $1000 for the dual battery system. Base power then manages and maintains the entire system for the $19-29/month membership fee and gives you great rates on electricity that ends up saving a few hundred dollars per year. I have gained a large battery backup for our house that will last 15-24 hours with typical usage or up to 48 hours with reduced electrical usage, like just running the refrigerator and some lights/fans. A generator can still be used as part of this system - either with your existing setup straight into your electrical inlet or with the addition of a connection directly to the Base battery system.

Watt Hours = Power Over Time
Amp Hours = Current Over Time

	3000-Watt Load (2) 15 amp circuits	1000-Watt Load	100-Watt Load	10-Watt Load
		Microwave	Charging a MacBook	Slow charging a phone
Conversion to Amps (A)	25 amps	8.333 amps	0.833 amps	0.083 amps
Battery Runtime				
250 Wh Battery Power Station (67,500mAh)	🚫	12.5 minutes	2 hours	25.25 hours
1,002 Wh Battery Power Station (1.0 (kWh)	0.33 hours	0.85 hours	8.5 hours	85 hours
3,600 Wh Battery Power Station (3.6 kWh)	1.2 hours	3 hours	30 hours	306 hours
25,000 Wh Battery (25.0 kWh)	7.5 hours	22.5 hours	24 hours	24 hours
50,000 Wh Battery (50.0 kWh)	14.5 hours	44 hours	48 hours	48 hours

Generator Sizing & Wattage Quick Reference Guide

Quick Reference Guide - Google Sheets Fillable Calculator
Calculation: Watts used by device = Voltage x Amperage
If a vacuum is 120V and 9.5A, it uses 1,140W

Quick Reference Wattage

Power Rating		Tool or Appliance	Running Watts	Starting Watts
1200 - 1800 Running Watts	☐	Blender	300	650
	☐	Coffee Maker	1,500	
	☐	Drill	600	900
	☐	Fan	200	
	☐	Furnace 1/4 hp	600	1,000
	☐	Game console	150	
	☐	Hand sander	600	1,200
	☐	Hedge trimmer	450	1,200
	☐	Lamp	100	
	☐	Laptop	800	
	☐	LED/LCD TV	150	
	☐	Microwave	1,000	
	☐	Modem/router	20	
	☐	Paint sprayer	600	600
	☐	Radio	100	
	☐	Slow cooker	200	200
	☐	String trimmer	350	875
	☐	Sump Pump 1/3 hp	800	1,300
	☐	Work light	1,000	
2800 - 3800 Running Watts	☐	Belt sander	1,200	2,400
	☐	Chainsaw	1,200	2,400
	☐	Circular saw	1,200	2,000
	☐	Edger	950	2,400
	☐	Electric grill	1,650	
	☐	Lawn mower	1,200	2,400
	☐	Pressure washer	1,200	2,400
	☐	Refrigerator	700	2,200
	☐	Washing machine	1,150	2,250
	☐	Well pump	1,000	2,100
	☐	Window AC 13k BTU	1,800	2,800
5500 - 12,000 Running Watts	☐	Air compressor 1hp	1,600	4,500
	☐	Central AC 3 ton	5,400	7,200
	☐	Electric Dryer	5,400	6,750
	☐	Heat Pump 3 ton	3,400	6,500
	☐	Water heater	4,000	

How to Calculate Manually

Running Watts Needed: Total running wattas of ALL items to be powered by the generator.

Starting Watts Needed: Add the highest SINGLE starting watt to the total running watts needed above.

Single-Fuel, Dual-Fuel & Tri-Fuel Generators

There are several different kinds of generators. Single-fuel fuel generators will only run on one source, typically a single source like gasoline, propane, natural gas, or diesel. Duel-fuel generators can run gasoline, and typically propane. Tri-fuel generators can run gasoline, propane, and natural gas. A dual-fuel or tri-fuel generator will have the added benefit of being able to run different fuels in an emergency where a particular

source of fuel is not available. They will have a selector switch to allow you to switch fuels, and some generators will even switch automatically. 3rd party conversion kits may be available online for some gasoline generators to convert them to propane or natural gas, but this can mean disassembling parts of the generator and can void the warranty. When running a tri-fuel generator on Propane or Natural Gas the generator's rated output in watts is lower than running on gasoline and the fuel consumption depends on the type of fuel and the load on the generator.

Generator Output & Fuel Consumption on 3 Fuel Types - Firman Tri-Fuel

	Gasoline	Propane	Natural Gas
Starting Watts	9400	8450	6900
Running Watts	7500	6750	5500
Fuel Consumption @ 0% load		**0.42gal/hr** 15.6ft3/hr(1.6L/hr)	72ft3/hr(2m3/hr)
Fuel Consumption @ 50% load	**0.67gal/hr** (12 hour runtime on 8gal tank)	**0.85gal/hr** 31ft3/hr(3.2L/hr)	86ft3/hr(2.4m3/hr)
Fuel Consumption @ 100% load	**1.40gal/hr** (5.7 hour runtime on 8gal tank)	**1.40gal/h** (2.68 hour runtime on a 20lb (4.6 gal) propane tank in warm weather) 50.8ft3/hr(5.3L/hr)	101ft3/hr(2.9m3/hr)

Fuel Consumption Per Hour at Different Loads

Larger generators are capable of powering more appliances simultaneously but have the downside of requiring more fuel. A small inverter generator just powering your refrigerator and a few lights will only require 0.08 gallons per hour. But a larger generator can have a consumption of 1.4 gallons per hour. Translate this into days, you would need to store as much as 50 gallons or 10, 5-gallon fuel containers (running 100% load for 12 hours a day for 3 days). Also, the more load a given generator has, the more fuel consumption increases. I highly suggest that you calculate your generator fuel consumption based on your planned usage and look at expanding your emergency power plan by adding battery capacity, like an EcoFlow.

At 50% load, a Firman 7500W generator will use 0.67 gallons per hour, but at 100% load, it uses 1.4 gallons per hour.

Inverter Generators vs Open Frame Standard Generators

A typical job site or portable generator is an open-frame non-inverter generator. These are typically much louder, less fuel efficient, and the electricity produced is not as "clean". An inverter generator is typically

surrounded by plastic panels to reduce the noise signature, is more fuel efficient, and will produce a cleaner, more pure electrical sine wave that is closer to typical grid power. This means it is safer for sensitive electronics, and LED lights are less likely to flash/strobe.

Inverter Generators have a lower Total Harmonic Distortion (THD) than standard generators, this makes Inervert Generator's power cleaner and more true to a pure signwave. Total harmonic distortion (THD) is the amount of harmonics on a line compared to the line fundamental frequency, e.g., 60Hz. The THD of a pure sine waveform with no higher harmonics, such as the ideal voltage supply, is 0%. A value of THD greater than zero means the sine waveform has become distorted. The lower the THD, the lower the distortion and the less likely you will have issues with sensitive electronics or even LED lights pulsing or strobing. Inverter Generators will sometimes be in the 3% THD range and standard generators can be as much as 14%.

Noise Signature & Security Considerations

For larger disasters or disasters that require running an emergency generator for a long period of time, a security risk can develop because of the loud noise signature of a generator. People get desperate the longer a disaster goes on and this desperation means that you can become a target of theft or violence. Most inverter generators are significantly quieter than an open-frame standard generator. A decibel rating, or the level of how loud a sound is, is a logarithmic scale, so the difference between 70 dB and 80 dB is massive. Some generators are 100 dB when standing right next to the unit, which is equivalent to a rock concert.

Here's an example situation - you are running your generator at night to keep your air-conditioning running, but your neighbor can't sleep because your generator is roaring as they try to sleep in their bedroom 50 feet away, with windows open to keep cool. Also, have a plan for what you would do if somebody asked you for power, or be proactive and tell your neighbors that you will have a power strip on your front porch so people can charge their portable devices.

If you are in an urban environment, you can become a target, especially with louder generators being able to be heard from a longer distance. One way to reduce the noise signature is to place the generator inside a noise-reduction enclosure called a **zombie box**. Some people have even built their own noise-reduction enclosure. Examples can be found online. Each one requires proper exhaust output, air intake, and heat venting, along with noise baffles to decrease the noise signature.

Floating Neutral vs Bonded Generators

Most portable generators (often called job site generators) are wired in such a way that the neutral and the ground are wired or "bonded" together. This is exactly what you want when a portable/job site generator is used with extension cords. When the same generator is plugged into a home, it creates a situation that would not pass the National Electrical Code. In this situation, the neutral-to-ground bond wire inside your generator should be disconnected or a different generator should be used. Disconnecting this bonding wire can be as easy as 5 minutes with a few tools, and watching a YouTube video. Note: Disassembling part of your generator may void its warranty, but in some cases, generator manufacturers **give instructions** on how to remove this bonding wire. If you ever need to use a floating neutral generator with only extension cords, a simple DIY or store-bought Generator Bonding Plug for about $10 converts your generator back into a bonded neutral, portable/jobsite generator. Want to learn more? Watch this YouTube Video.

Maintenance

If you have a generator to be used during emergencies, you must do proper maintenance on it. This is a routine schedule of starting the generator every 30 days and running it for at least 10 to 15 minutes and then shutting it down. Some automatic standby generators can be set up to automatically cycle on for a few minutes each week. You will also need to follow the schedule of oil changes, especially because most portable generators do not have built-in oil filters. Follow the generator manufacturer's maintenance routines for air filters, spark plugs, batteries, fuel filters, etc. If your lawnmower does not start, your grass doesn't get mowed. If your generator doesn't start in an emergency, it can be a very uncomfortable situation for your entire family, especially if you are relying on this for cooking, heating, and lighting.

You should consider storing a quantity of motor oil for your generator. If a power outage extends to a multi-day outage, you can quickly reach the generator's routine maintenance schedule inside the period of the power outage, requiring you to shut down your generator, let it cool, and change the engine oil. Also, consider storing a **funnel**, **mechanics gloves**, and a **container** to store and properly dispose of the used oil.

FUEL CONSIDERATIONS

Gasoline

Gasoline is among the most volatile fuels, and is probably the most difficult to store out of all of the fuel types. Gasoline has a shelf life that can be extended by **purchasing non-ethanol fuels**, and/or by adding additives to the fuel like Ethanol Shield Fuel Stabilizer, to stop the fuel from deteriorating. One option is to rotate out the fuel by putting 3-month-old gasoline that is treated and still usable into your car and buying fresh gas. If a power outage affects a large area, it can be difficult to buy or pump gas. Having a backup option is recommended. You may also need to drain the gas out of your generator's carburetor so that buildup does not occur. Fuel treated with Ethanol Shield can last at least 6 months and in some cases, up to 3 years.

Propane (LP or LPG)

Propane is much easier to store than gasoline but it's just as flammable. Propane containers can be as small as a 20-pound BBQ-style cylinder or quite large, such as a 2500-gallon propane tank. You may be able to have a T-off connection installed on an existing above-ground or below-ground propane tank that is already hooked up to your home. Just make sure it's appropriately sized for your generator so that it does not empty the tank too quickly and it leaves you with no propane for cooking. Propane has a lower output rating than gasoline, so the same generator running on gas will output a higher watt rating. Note: propane tanks can only be filled to 80% of their total capacity. Another consideration is that propane works better in warm or hot temperatures than it does in cold temperatures, and propane can freeze. Also, in low temperatures, the pressure inside of propane tanks decreases, meaning that the volume of propane that can be expelled from a tank is lower. When propane is being consumed, it creates a chilling effect on the propane tank and lines. When you combine all of the negative effects of using propane in extremely cold weather, it can easily cause icing on the propane lines and could cause a blockage of the propane tank line to the house that could cut off the flow of propane until things warm up, stopping you from cooking or heating. Properly **insulating the lines** can be very important. For above-ground propane tanks, a **heater blanket** can be installed. It's critical to

keep an eye on your propane tank level, especially in winter, when you would also be using your propane heater, along with knowing your propane consumption rate. Generator Output & Fuel Consumption on 3 Fuel Types - Firman Tri-Fuel

Diesel

Diesel stores much longer than gasoline, it does not gum up as easily as gasoline, diesel is also easier to work with in extremely cold weather by simply adding cold weather additives so that it does not gel up**.** Diesel is also a much safer fuel to store than gas or propane. Diesel generators are more expensive and are more common for larger applications, such as commercial backup and emergency standby generators or diesel motorhomes, where the generator draws from the same diesel tank as the coach. Diesel can be stored for a year using fuel stabilizers.

Natural Gas

With natural gas, it's always piped in and not stored so you don't have to worry about tanks of flammable products. However, in larger disasters, where many people are utilizing their heat to the maximum capacity, in addition to people using natural gas-powered emergency generators, gas pressure can drop or have the potential to be unavailable. This can also be true in extremely cold weather where pipes can freeze or in earthquake-prone areas where natural gas lines can break. Because of this, I recommend having a backup solution instead of solely relying on natural gas. A generator running on natural gas has the lowest power output between gas, propane and natural gas. Generator Output & Fuel Consumption on 3 Fuel Types - Firman Tri-Fuel

ELECTRICAL

Electrical Permitting & Electrical Contractors

Follow the National Electrical Code, and your local electrical code and permit process, Homeowners Association rules, and your generator manufacturer's installation and running instructions. Some areas require a permit to be pulled by a licensed electrician. In some cases, the installation of a generator hookup sounds relatively straightforward for the advanced do-it-yourselfer and some people may choose to do a DIY installation. Please keep in mind that installing a generator can be very dangerous, and if wired improperly a generator can be powered by the city electrical grid and explode, fuel and all. If no safety mechanism is installed to stop the back feed of electricity from your generator to the grid, it can kill a linesman who is trying to bring the grid back online, or a generator can be running a home and when the grid comes back on, your generator suddenly becomes a bomb. I suggest talking with an electrical contractor, and asking the following:

- Ask what their qualifications are (Master Electrician vs just a Department of Licensing and Regulation license)
- Clearly define what you want the contractor to do (a turn-key install vs just an inlet and interlock).
- Let them know if you want them to completely re-due the printed electrical panel circuit directory or just pencil in the changes.
- Confirm they know about floating vs bonded generators.

Grounding Requirements

Portable generators and backup generators should be grounded using a grounding rod in accordance with the generator manufacturer's guidelines and local electrical code. This reduces the likelihood that a lightning strike or other electrical fault can damage the system. Failure to ground a generator is hazardous and can lead to electrical overload on your generator which can damage the wiring or other sensitive parts of the electrical system, and electrocution from touching ungrounded metal. It's important to push the grounding rod deep into the ground, following local code, because dry rocky soil has a higher resistance than moist dirt deeper down to provide a low resistance path for the current to flow when a fault occurs. You can buy grounding rods from local hardware stores or electrical supplies shops. Depending on what your soil condition is, you may need to buy or rent special tools to hammer a grounding rod deep enough or have someone with the proper tools install it for you. You can buy Grounding Rod Drivers for $30-$100 that attach to special hammer drills.

Electrical Panel Circuit Directory

The National Electrical Code requires each circuit to be distinguishable from all others in the way it is documented on the panel directory or panel schedule. By adding a generator interlock, this can drastically change the electrical panel directory because the back-fed breaker from the generator must be placed immediately next to the main breaker. If you have an electrician install the interlock, I recommend including a new circuit directory as part of the scope of work for the installation. Some electricians will simply pencil in or write in sharpie any changes to the panel schedule, though this may be acceptable, you may prefer a completely updated and printed panel schedule. Download a free Circuit Panel Directory Template.

Electrical Loads

Depending upon the size of your generator and the electrical load applied, your generator may shut off or the generator's breaker may trip because the electrical demand is too high for the generator. Adjusting the load by turning off certain appliances will be required to maintain power when running on an emergency generator. For example, an electric water heater plus an electric oven/stove and HVAC can easily exceed the capacity of a medium-sized generator. Balancing the load, by turning off the breaker to the electric water heater so that you can have heat and cook, would be required. Generator Sizing & Wattage Quick Reference Guide

DIRECT TO APPLIANCE CONNECTIONS (USING EXTENSION CORDS)

One of the easiest ways of using a portable generator is by running extension cords. You can run extension cords from your portable generator placed outside your home, run the cables inside, and plug devices into the end of the extension cord. This must be done carefully, as this can be dangerous and even life-threatening because of carbon monoxide entering through the space the extension cord is entering and the trip hazard that extension cords have. This may be your only option if you are actively in a disaster. You can also install a Portable Generator Through-The-Wall PWR Multi-Outlet Kit or a single 120v passthrough. They are both isolated outlet plugs, bypassing your home's electrical system, and giving you wall outlet(s) that you plug devices into without running electrical cords through open windows or doors.

Considerations:

- Extension cords can overheat and cause fires when used improperly.
- Never use an indoor-rated extension cord outside.
- Extension cords can quickly be a trip hazard running into and throughout the house.
- The generator must be placed far enough away that carbon monoxide doesn't enter through a window or door that is propped open for the extension cords.
- The portable generator must have a bonded neutral to ground.
- Grounded (three-prong) electrical cords must be used.
- Extension cords must be rated for the load - light-duty (16-gauge, 13amps), medium-duty (14-gauge, 15 amps) and heavy-duty (10 or 12-gauge extension cords)
- Open windows and doors can increase the risk of an intruder or unwanted pests invading your home.

Rated Amps & Watts for 3-Prong Extension Cords					
Gauge	**Usage**	**25/50 ft**	**100 ft**	**150 ft**	**200 ft**
16 Gauge	Fans TVs Small appliances Space Heaters	13 max amps 1560 max watts	10 max amps 1200 max watts	🚫	🚫
14 Gauge	Drills Belt Sanders Routers Table Saws Vacuums	15 max amps 1800 max watts	13 max amps 1560 max watts	7 max amps 840 max watts	🚫
12 Gauge	Circular Saws Chain Saws Grinders	20 max amps 2400 max watts	15 max amps 1800 max watts	10 max amps 1200 max watts	8 max amps 960 max watts
10 Gauge	Compressors Generators	20 max amps 2400 max watts	20 max amps 2400 max watts	15 max amps 1800 max watts	10 max amps 1200 max watts

GENERATOR TO ELECTRICAL PANEL OPTIONS

There are several options for the connection between your generator and your home's electrical panel, and the best option for you depends on what features you want.

GenerLink

A GenerLink is a small device that is installed between your electrical meter and the electrical meter box coordination by a qualified electrician and power company technician - but you don't have to be home for the installation. Some electrical municipalities will not allow the installation and some do. The best option is to call your electrical provider or the GenerLink manufacturer to find out. Generlink does not advertise the price but generally sells for around $600-1300 plus installation. A 20' cable that plugs into the GenerLink and into your generator comes free with the unit and longer cables can be substituted or ordered separately. No rewiring or installing of a subpanel is required. Your electrical provider will come and remove the electrical meter and your electrician will then install the GenerLink and the electrical provider will then reinstall the meter. This is typically a very quick operation and can happen in a matter of minutes. This option powers your entire electrical panel and prevents back-feeding the electrical grid, so it is completely safe but does not automatically transfer your house back to grid power when electricity is restored, so you must rely on manually checking to see if there is grid power, or a text message notification from your provider notifying you service has been restored. Per code, GenerLink requires your generator to be wired as a Floating Neutral Generator.

Electrical Inlet Port

An electrical inlet port (with interlock installed on your main electrical panel) is a relatively easy install option. The benefit, like the GenerLink, is that it provides power to the entire electrical panel, so that all circuits have the capability of being energized. You control what you want energized from wall switches in your home or, unplugging unneeded items, or, for larger appliances like an electric water heater, the breaker in your electrical panel can be turned off. Oftentimes, the balancing of loads must be done as a home that has everything running can quickly exceed the output of a generator, causing a breaker to trip or the generator to shut down. This type of hookup does not, however, transfer your home back to the electrical grid automatically when grid power is restored, so you must rely on manually checking to see if there is grid power, or a text message notification from your provider notifying you service has been restored. Here is a DIY Video installing an Inlet Port & Interlock. Per code, an Inlet Port requires your generator to be wired as a Floating Neutral Generator.

Multi-Circuit Transfer Switches

Multi-circuit manual or **automatic transfer switches** allow you to select a set number of predetermined circuits that you wish to energize when the grid loses power. This is typically 6 to 10 circuits, depending upon the transfer switch model. When your home loses power, the input from the generator can be switched on to provide power to just the circuits that are wired to the transfer switch. An automatic transfer switch can be combined with a large **high-output battery** (anywhere from $800 to $3,500 - or pricier for a large multi-battery setup) to provide critical loads with instantaneous, always-ready power. You must confirm if the transfer switch requires your generator to be wired as a Floating Neutral or Bonded Neutral Generator.

Whole Home Transfer Switches

Whole home manual or automatic transfer switches combined with a **whole home generator** powers all of your electrical panel. An automatic transfer switch, combined with an automatic standby generator, will kick on automatically to power your entire house if grid power goes off. This is the most complex and expensive

installation, and it includes adding a new large transfer switch l panel that takes both the city grid power and the generator input into one panel. It must be sized to match your existing main electrical panel as the city grid power flows through it full-time, until an outage when your generator takes over. This system can also be combined with solar panels and batteries so that everything stays running, giving your entire home the instant transfer to battery power and the solar + generator battery recharging.

RUNNING YOUR HVAC ON GENERATOR POWER

Be aware that smaller generators are not capable of running an air conditioner. Medium size generators can be capable of running the cooling of an air conditioner, and the largest of generators can run the cooling of an air conditioner, but are less fuel efficient.

Heat Pump

If your air conditioner is a fully electric heat pump air conditioner, they still may use a high-amp heat strip for supplemental heat that is beyond the capacity of most portable generators, requiring over 40amps of power. Fully electric heat pumps often have an “Emergency Heat” function at the thermostat that kicks off the heat pump and only uses the heat strip.

Fully Electric HVAC

If your system is a standard fully electric HVAC, you will most likely not be able to run your heating from a generator, unless you buy something like a whole-home standby generator. These can cost $5,000 to $10,000 for the generator, plus installation. Additionally, you may need to purchase a propane tank and have that installed (and filled) as well.

Propane or Natural Gas Heating

If your HVAC system is propane or natural gas for heating, there is a high likelihood that simply running the 120v electric blower motor of your HVAC combined with the natural gas or propane heating source of the HVAC system will run just fine.

MicroAir Easy Start - HVAC Add-On

The **Micro-Air EasyStart** is a device that is permanently installed and wired into your air conditioner that significantly reduces the starting amps, by ramping up the voltage over a slightly longer period of time. It also turns on the fan motor and runs it for a few seconds prior to powering up the compressor. This device works all the time, working to extend the life of the compressor and acting as a sacrificial device in an electrical power surge. Without such a device installed, there would be a requirement for a significantly larger generator that can handle the starting amps of the compressor and fan motor at the same time. The MicroAir Easy Start does not cut down the running amps of heat pumps or fully electric heating, so this would mean you need to A) Plan for an alternative heat source or B) buy a generator with enough amps to cover the electric heating. More Info

TERMINOLOGY

- Amp: The amount of electricity or current flowing through a wire, like to the flow of water through a hose.
- Back feed: A condition where electricity is being generated from a source outside the utility power grid and is feeding/traveling back into the power lines.
- Breaker Panel: The main circuit breaker panel (or fuse box) is where all the circuits/fuses connect to the incoming electrical supply line from the utility.
- Breakers: See Circuit Breaker
- Capacity: The amount of power, expressed in watts, kilowatts or megawatts, that a device can provide at any given instant. Or The maximum load of electricity that equipment can carry.
- Circuit: A continuous loop of current.
- Circuit Breaker: The most common type of “overcurrent protection.” A resettable switch that trips when a circuit becomes overloaded or shorts out.
- Connection Cord: An electrical receptacle and plug wired to a length of flexible electrical cord.
- Continuous Output: The amount of power produced continuously as opposed to the maximum output, which can only be produced for short periods of time.
- Current: The rate at which electricity flows, measured in amperes.
- Electric Panel: See Breaker Panel
- Fuses: Removable devices that link a circuit at the fuse box. A non-resettable overcurrent device.
- Generator: A machine that converts mechanical energy into electrical energy.
- GenerLink™: A five-inch collar-like device installed behind your electric meter, which allows you to easily and safely connect a portable generator to your home’s existing wiring system.
- GenerLok™: GenerLok™ is a unique fitted locking connector, exclusively available for GenerLink™.
- Hardwire: Process of wiring electric appliances directly into the electric power supply.
- Load Watts: See Start-up Wattage
- Loads: A source drives a load. An appliance, component or other device that requires current to operate.
- Meter: Any electrical or electronic device used to measure the amount of electricity consumed.
- NEMA: National Electrical Manufacturers Association. A standard which specifies the electrical connectors used on plug-in equipment.
- Overload: A condition that occurs when the load is greater than the system/device is designed to handle.
- Power Cord: See Connection Cord
- Power Outage: A temporary loss of electric power or temporary disconnection from the electric utility.
- Running Wattage: The amount of energy necessary to continue running an appliance once it has started.
- Status Lights: GenerLink™ status lights are designed to display power conditions with the GenerLink unit, the utility and the portable generator.
- Start-up Wattage: The amount of energy needed to first start an appliance. This amount is usually larger than the running wattage for appliances with motors (refrigerator). It is usually the same for appliances without motors (lights).
- Sub Panel: Device used in connection with a transfer switch designed to bypass a breaker panel and limits the amount of load or number of appliances that can be placed on a generator.
- Surge: A power disturbance known also as a transient voltage. Or A brief but extreme burst of energy.

- Surge Protection: Any device designed to limit or eliminate transient voltages from entering power, signal, telephone or data lines.
- Transfer Switch: Used in conjunction with a sub panel. Device installed by a licensed electrician designed to allow interconnection of a portable generator with limited appliance availability.
- Utility's Electric Distribution System: A network of power lines and associated equipment used to transmit and distribute electricity over a geographic area.
- Voltage: Electrical potential or force that causes current to flow through a conductor.