

Power Inverter FAQ - Don Rowe.com

What size inverter should I buy?

We carry many different sizes, and several brands of power inverters. See our Inverters Page for specifications on each of our models.

Short Answer: The size you choose depends on the watts (or amps) of what you want to run (find the power consumption by referring to the specification plate on the appliance or tool). We recommend you buy a larger model than you think you'll need (at least 10% to 20% more than your largest load).

Example: You want to power a computer with a 17" monitor, some lights, and a radio.

Computer:	300 Watts
2 - 60 Watt lights:	120 Watts
Radio:	10 Watts
Total Needed:	430 Watts

For this application, you would minimally need a 500 W inverter, and should give some thought to a larger one, as there will likely be a time when you wish you'd bought a bigger model ... in this example, you might decide you'd like to run a fan while you compute, or let the kids watch TV.

Longer Answer: Determine Continuous Load and Starting (Peak) Load: You need to determine how much power your tool or appliance (or combination of them that you would use at the same time) requires to start up (starting load), and also the continued running requirements (continuous load). What is meant by the terms "continuous-2000 watts" and "peak surge-4000 watts" is that some appliances or tools, such as ones with a motor, require an initial surge of power to start up ("starting load" or "peak load"). Once started, the tool or appliance requires less power to continue to operate ("continuous load")

Helpful formulas:

To Convert AMPS to WATTS:

Multiply: AMPS X 120 (AC voltage) = WATTS

This formula yields a close approximation of the continuous load of the appliance

To Calculate approximate Startup Load:

Multiply: WATTS X 2 = Starting Load

This formula yields a close approximation of the starting load of the appliance, though some may require an even greater starting load. NOTE: Induction motors such as air conditioners, refrigerators, freezers and pumps may have a start up surge of 3 to 7 times the continuous rating.

Most often the start up load of the appliance or power tool determines whether an inverter has the capability to power it.

For example, you have a freezer with a continuous load of 4 amps, and a start up load of 12 amps:

4 amps x 120 volts = 480 watts continuous

12 amps x 120 volts = 1440 watts starting load

You would need an inverter with peak-surge rating greater than 1440 watts.

FORMULA to convert AC Watts to DC Amps:

AC Watts divided by 12 x 1.1 = DC Amps

(this is the size vehicle alternator you would need to keep up with a specific load; for example, to keep up with a continuous draw of 1000 watts, you would need a 91 amp alternator)

How Many Watts Do You Need?

To select an inverter from DonRowe.com that has enough power for your application, add the watts for items you may want to run at the same time. Use the total wattage, plus 20%, as your minimum power requirement.

Note: The wattage's given below are estimates. The actual wattage required for your appliances may differ from those listed. Check the nameplate on the appliance to determine the actual wattage required.

* Appliances and tools with induction motors (marked * in tables) may require from 3 to 7 times the listed wattage when starting. The start-up load of the appliance or tool determines whether an inverter has the capability to power it. Be sure to check the specific wattage requirements and operating instructions for appliances / tools to be used.

F.Y.I. (conversion formula: Watts ÷ 120 = Amps Amps x 120 = Watts)

Common Appliances

Appliance	Estimated Watts	Appliance	Estimated Watts
Coffee pot (10 cup)	1200	VCR	40-60
Coffee pot (4 cup)	650	CD or DVD Player	35
Toaster	800-1500	Stereo	30-100
Cappuccino Maker	1250	Clock Radio	50
Coffee Grinder	100	AM/FM car cassette	8+
Blender	300	Satellite dish	30+
Microwave (600 to 1000 W cooking power)	1100-2000W (elec. consumption)	Vacuum cleaner	300-1100
Waffle iron	1200	Mini Christmas lights (50)	25
Hot plate	1200	Space Heater	1000-1500
Frying pan	1200	Iron	1000
Toaster Oven	1200	Washing machine	920
Blow dryer	900-1500	12" 3 speed table fan	230
Computer		TV - 25" color	300
- laptop	50-75	- 19" color TV or monitor	160
- pc & monitor	200-400	- 12" b&w	30
- printer-inkjet	60-75	13" color TV/VCR Combo	230
*Refrigerator/Freezer	600	Game Console (X-Box)	100
*Freezer	500-800	*Furnace Fan (1/3hp)	1200

Common Tools

Tool	Estimated Watts	Tool	Estimated Watts
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Jig Saw	300	1/4" drill	250
Band Saw	1200	3/8" drill	500
Table Saw	1800	1/2" drill	750
6 1/2" circ. saw	1000	Shop Vac 5 hp	1000
7 1/4" circ. saw	1200+	*Sabre Saw	500
8 1/4" circ. saw	1800	*Portable Grinder	1380
Disc Sander	1200	*Electric Chain Saw 14"	1200
Makita Chop Saw	1550	*Airless Sprayer 1/2 hp	600
Makita Cut Off Saw	1000	*Air Compressor 1 hp	2000

Pumps and Air Conditioners

Pump	Running	Starting	Air Conditioner
*Well Pump 1/3 hp	750	1400-3000	*7000 BTU to 10000 BTU Running: 1000-1500. Starting: 2200-5000. (A/C's are a very difficult load because of the high start-up surge. Use the Locked Rotor Amps to determine the start up surge requirement).

Do I need Modified Sine Wave, or Pure Sine Wave?

Advantages of Pure Sine Wave inverters over modified sine wave inverters:

- a) Output voltage wave form is pure sine wave with very low harmonic distortion and clean power like utility-supplied electricity.
- b) Inductive loads like microwave ovens and motors run faster, quieter and cooler.
- c) Reduces audible and electrical noise in fans, fluorescent lights, audio amplifiers, TV, Game consoles, Fax, and answering machines.
- d) Prevents crashes in computers, weird print out, and glitches and noise in monitors.
- e) Reliably powers the following devices that will normally not work with modified sine wave inverters:
 - Laser printers, photocopiers, magneto-optical hard drives
 - Certain laptop computers (you should check with your manufacturer)
 - Some fluorescent lights with electronic ballasts
 - Power tools employing "solid state" power or variable speed control
 - Some battery chargers for cordless tools
 - Some new furnaces and pellet stoves with microprocessor control
 - Digital clocks with radios
 - Sewing machines with speed/microprocessor control
 - X-10 home automation system
 - Medical equipment such as oxygen concentrators

We carry a full line of Pure Sine Wave Inverters here at DonRowe.com, though most of the inverters we carry are Modified Sine Wave inverters. Modified Sine Wave works well for most uses, and is the most common type of inverter on the market, as well as the most economical. Pure Sine Wave inverters (also called True Sine Wave) are more suited for sensitive electrical or electronic items such as laptop computers, stereos, laser printers, certain specialized applications such as medical equipment, a pellet stove with an internal computer, digital clocks, bread makers with multi-stage timers, and variable speed or rechargeable tools (see "Appliance Cautions" below). If you wish to use those items with an inverter, then choose a Pure Sine Wave inverter. If you mostly want to run lights, TV, microwave oven, tools, etc, a Modified Sine Wave inverter is fine for your needs.

We often are asked if computers will work with Modified Sine Wave. It's been our experience that most (with the exception of some laptops) will work (though some monitors will have interference such as lines or a hum). However, if you have any doubt about any appliance, tool or device, particularly laptop

computers and medical equipment such as oxygen concentrators, we recommend that you check with its manufacturer to be sure it is compatible with a Modified Sine Wave inverter. If it is not, choose one of our Pure Sine Inverters instead.

The difference between them is the Pure Sine Wave inverter produces a better and cleaner current. They are also considerably more expensive. You might find it practical to get a small Pure Sine Wave inverter for any "special need" you may have, and also a larger Modified Sine Wave inverter for the rest of your applications.

How do I hook up the Inverter? What size cable should I use, and is it included?

Many small inverters (450 watts and under) come with a cigarette lighter adapter, and may be plugged into your vehicle's lighter socket (although you will not be able to draw more than 150 to 200 watts from the cigarette lighter socket). The small units also come with cables that can be clamped directly to a battery. If you want an inverter that will plug into your cigarette lighter, you must choose one that is 450 watts or less.

Larger inverters (500 watts and over) must be hard-wired directly to a battery. The cable size depends on the distance between battery and inverter, and will be specified in the Owner's Manual.

When connecting the inverter to the battery use the thickest wire available, in the shortest length practical.

See our Cables Page for recommendations for each of the inverters we sell.

General recommendations:

Inverter Size	< 3 ft	3ft - 6ft	6ft - 10ft
400 Watts	8	6	4
750 Watts	6	4	2
1000 Watts	4	2	1/0
1500 Watts	2	1	3/0
2000 Watts	1/0	2/0	250
2500 Watts	1/0	3/0	350
3000 Watts	3/0	4/0	500

NOTE: These are general recommendations for inverters that utilize a single cable set (one positive and one negative cable) only and may not be correct for all inverters or applications. Additionally, some inverters require two or more cable sets and therefore may require a different cable size than listed. Cable size recommendations may vary among inverter brands and models; check the Owner's Manual for the model you purchase before you buy the wire for it.

The maximum length generally recommended is 10', and shorter is better. If you need more length, it is much better to put it on the AC side (as with an extension cord from inverter to appliance) than on the DC side.

Cables with battery terminals (ring terminals or stud terminals) to hook up your inverter are available [here](#).

What type of battery should I use (automotive or deep cycle)?

Small Inverters: Most automobile and marine batteries will provide an ample power supply for 30 to 60 minutes even when the engine is off. Actual time may vary depending on the age and condition of the battery, and the power demand being placed on it by the equipment being operated by the inverter. If you use the inverter while the engine is off, you should start the engine every hour and let it run for 10 minutes to recharge the battery.

500 Watt and larger Inverters: We recommend you use deep cycle (marine or RV) batteries which will give you several hundred complete charge/discharge cycles. If you use the normal vehicle starting

batteries they will wear out after about a dozen charge/discharge cycles. If you do not have a deep cycle battery, we recommend that you run the engine of your vehicle when operating the power inverter. When operating the inverter with a deep cycle battery, start the engine every 30 to 60 minutes and let it run for 10 minutes to recharge the battery.

When the inverter will be operating appliances with high continuous load ratings for extended periods, it is not advisable to power the inverter with the same battery used to power your car or truck. If the car or truck battery is utilized for an extended period, it is possible that the battery voltage may be drained to the point where the battery has insufficient reserve power to start the vehicle. In these cases, it's a good idea to have an extra deep cycle battery for the inverter (installed close to the inverter), cabled to the starting battery. It is recommended to install a battery isolator between the batteries.

How long can I run the inverter on my battery?

Use these formulas to calculate how long your appliance will operate on your battery.

For a 12 Volt System:

$$(10 \times (\text{Battery Capacity in Amp Hours}) / (\text{Load Power in Watts})) / 2 = \text{Run Time in Hours}$$

For a 24 Volt System:

$$(20 \times (\text{Battery Capacity in Amp Hours}) / (\text{Load Power in Watts})) / 2 = \text{Run Time in Hours}$$

Tip: Deep cycle (marine) batteries generally have the highest reserve ratings. They are also capable of withstanding repeated drains of power and recharging.

Tip: Engine start batteries should not be discharged below 90% charged state, and marine deep cycle batteries should not be discharged below 50% charged state. Doing so will shorten the life of the battery based on most battery manufacturers recommendations.

Note: If you intend to use power tools for commercial use, or any load of 200W for more than 1 hour regularly (between battery recharging) we recommend installing an auxiliary battery to provide power to the inverter. This battery should be a deep cycle type and sized to meet your run time expectations with the engine off. The auxiliary battery should be connected to the alternator through an isolator module to prevent the inverter from discharging the engine start battery when the engine is off.

How do I connect two or more batteries?

It may be advisable to operate the inverter from a bank of 12 Volt batteries of the same type in a "parallel" configuration. Two such batteries will generate twice the amp/hours of a single battery; three batteries will generate three times the amp/hours, and so on. This will lengthen the time before your batteries will need to be recharged, giving you a longer time that you can run your appliances. You can also connect 6 Volt batteries together in "series" configuration to double the voltage to 12 volts. Note that 6 Volt batteries must be connected in pairs.

12 Volt Batteries connected in Parallel to double the current (amp/hours)	6 Volt Batteries connected in Series to double the voltage to 12 Volts
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Operating a Microwave with a Power Inverter

The power rating used with microwave ovens is the "cooking power" which refers to the power being "delivered" to the food being cooked. The actual operating power requirement rating is higher than the cooking power rating (for example, a microwave with "advertised" rating of 600 watts usually corresponds to almost 1100 watts of power consumption). The actual power consumption is usually stated on the back of the microwave. If the operating power requirement cannot be found on the back of the microwave, check the owner's manual or contact the manufacturer.

Television and Audio Suggestions

Although all our inverters are shielded and filtered to minimize signal interference, some interference with your television picture may be unavoidable, especially with weak signals.

Here are some suggestions that may improve reception:

1. First make sure that the television antenna produces a clear signal under normal operating conditions (i.e., at home plugged into a standard 110AC wall outlet). Also insure that the antenna cable is properly shielded and of good quality.
 2. Change positions of the inverter, antenna cables and television power cord.
 3. Isolate the television, its power cord and antenna cables from the 12 volt power source by running an extension cord from the inverter to the TV set. Insure that any excess AC power cord is a distance away from the TV set.
 4. Coil the television power cord and the input cables running from the 12 volt power source to the inverter.
 5. Attach a "Ferrite Data Line Filter" to the television power cord. More than one filter may be required. These are available at electronic supply stores including Radio Shack (Radio Shack Part No. 273-105)
- NOTE: Some inexpensive audio systems may discharge a slight "buzzing" sound when operated with an inverter. This is caused by deficient filters in the audio system. The only solution to this problem is using a sound system with a higher quality power supply.

Appliance Cautions (for Modified Sine Wave Inverters):

DO NOT plug small appliances into the inverter AC receptacles to directly recharge their nickel-cadmium batteries. Always use the recharger provided with that appliance.

DO NOT plug in battery chargers for cordless power tools if the charger carries a warning that dangerous voltages are present at the battery terminals.

Not all fluorescent lamps operate properly with a modified sine wave inverter. If the bulb appears to be too bright, or fails to light, do not use the lamp with the inverter.

Some fans with synchronous motors may slightly increase in speed (RPM) when powered by a modified sine wave inverter. This is not harmful to the fan or to the inverter.

Certain rechargers for small nickel-cadmium batteries can be damaged if plugged into a modified sine wave inverter. In particular, two types of appliances are susceptible to damage:

- Small, battery-operated appliances such as flashlights, cordless razors and toothbrushes that can be plugged directly into an AC receptacle to recharge.
- Certain battery chargers for battery packs that are used in some cordless hand-tools. Chargers for these tools have a warning label stating that dangerous voltages are present at the battery terminals.

DO NOT use a modified sine wave inverter with the above two types of equipment.

The majority of portable appliances do not have this problem. Most portable appliances use separate transformers or chargers that plug into AC receptacles to supply a low-voltage DC or AC output to the appliance. If the appliance label states that the charger or adapter produces a low-voltage DC or AC output (30 volts or less), there should be no problem powering that charger or adapter.

Safety Warning: 110 Volts of current can be lethal. Improper use of a power inverter will result in property damage, personal injury, or loss of life. Please read and follow carefully the instructions in the Owner's Manual provided with every inverter for important safety considerations and precautions.

General Safety Precautions and Installation Tips:

- Place the inverter on a reasonably flat surface, either horizontally or vertically.
- The inverter should not be installed in the engine compartment, due to possible water/oil/acid contamination, and excessive heat under the hood, as well as potential danger from gasoline fumes and the spark that an inverter can occasionally produce. It's best to run battery cables to a dry, cool inverter mounting location.
- Keep the inverter dry. Do not expose it to rain or moisture. DO NOT operate the inverter if you, the inverter, the device being operated, or any other surfaces that may come in contact with any

power source are wet. Water and many other liquids can conduct electricity which may lead to serious injury or death.

- Avoid placing the inverter on or near heating vents, radiators or other sources of heat. Do not place the inverter in direct sunlight. Ideal air temperature is between 50° and 80° F.
- In order to properly disperse heat generated while the inverter is in operation, keep it well ventilated. While in use, maintain several inches of clearance around the top and sides of the inverter.
- Do not use the inverter near flammable materials. Do not place the inverter in areas such as battery compartments where fumes or gases may accumulate.