

Portable Generator Selection

WHITE PAPER

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Introduction

For many people looking to purchase a portable generator, sifting through the myriad of styles, ratings, features and accessories can be a daunting task. Further confusing matters are the different power ratings that manufacturers advertise: surge or peak power versus rated or running power. Add into the mix the various fuel types, styles of construction, and widely different price points and even a generator expert can agonize over making the right choice.

A prospective buyer also has to consider the multiple different applications and types of loads that they want to power with their portable generator: from powering their RV or campsite to powering their home during an emergency power outage, to using that same generator for a workshop or construction site.

It may seem that one needs to be a master electrician to decipher all the different electrical outlets with their various ampacities and voltages and somehow figure out if those outlets are compatible with their loads. And what about all those accessories...which ones do you really need?

This white paper seeks to make the process of sizing and selecting a portable generator as simple and straightforward as possible, with a step-by-step instructions, and detailed explanation of the various options, accessories, and key considerations when making a purchase decision.

Selecting the Right Style of Generator

To begin narrowing down the list of potential generators to choose from, one of the first steps a buyer can take is to decide what 'style' of generator best meets their needs. There are two fundamental types of engine-powered generators available in the market today: inverter generators and traditional generators.

Traditional generators, sometimes called "open-frame" generators are designed to meet basic power needs at a reasonable price. This type of generator is easily identified by its design, with an open tubular steel frame inside of which mounts an air-cooled engine coupled to an alternator that produces electricity, along with a basic control or display, fuel tank, and various breaker-protected power outlets. For a traditional portable generator the alternator will transform the engine's mechanical power to electrical power at a fixed engine speed, typically 3600 rpm, at a frequency of 60Hz, the standard for North American electricity.

Inverter generators on the other hand, are designed to meet a higher standard for noise reduction, power quality, and fuel efficiency. An inverter generator also utilizes an air-cooled engine, but the engine is governed such that it can operate at a range of

speeds, typically between 3000 to 3800rpm, based on the amount of electrical load demand. The benefit of a variable-speed engine is such that the engine can spin slower at lighter loads and faster speeds under higher loads, thereby consuming less fuel and generating less noise than a fixed speed engine. The inverter generator utilizes an alternator with a direct current output that feeds an inverter module that uses power electronics to "reconstruct" the electrical output to a cleaner sine wave than can be achieved with a traditional style generator. This cleaner output is often described by a Total Harmonic Distortion (THD) percentage value that identifies the percentage deviation from a perfect sine wave. Inverter generators provide output power with THD as low as 3%, whereas a traditional portable generator produces THD of 20% or more. Higher THD can put more stress on sensitive electronic loads like TVs and computers. Further, most inverter generators are completely encased in a plastic housing with sound-attenuating material for additional noise reduction. Due to the higher level of engineering and power electronics involved, an inverter generator can cost two or three times more per unit of power output (watts) versus a similarly rated traditional generator.

Identifying the Right Electrical Outlets

The other factors to consider when selecting a generator are the voltage requirements of the items you intend to power. Most smaller portables rated for 6,000 watts or less, whether traditional or inverter style, will only offer 120V outlets, whereas larger generators typically offer both 120V and 120/240V outlets. Cummins Onan generators in this 4,000 to 6000 watt range also provide for a 120V TT-30R or “Travel Trailer” outlet which may be familiar to RV enthusiasts as the standard power inlet for towable travel trailers.

120/240V plugs are typically what you find associated with larger power demand devices such as electric ranges, clothes dryers, hot water heaters,

and Level 2 EV chargers, and are usually only offered on generators with ratings greater than 6,000 watts. Some 120/240V home loads such as air conditioners are hard wired directly to your home’s distribution panel and cannot be plugged into a generator for emergency home use, instead requiring the generator to be wired directly into your home’s electrical panel via an inlet box and transfer switch. Large recreational vehicles, fifth wheels, and toy haulers may require a 120/240V power source to power larger air conditioners and appliance loads. See Exhibit 1 for a description of Cummins Onan generator models and their various types of electrical outlets.

Exhibit 1. Generator electrical outlets

Model name	P2500i	P4500i, P4500iDF	P5000 iDF EFI	P9500DF, P9500DF EFI	P11000iTF
					
Maximum surge power (watts)	2,500	4,500	5,000	9,500	11,000
Style	Inverter	Inverter	Inverter	Traditional	Inverter
Fuel(s)	Gas	Gas, Gas/Propane	Gas/Propane	Gas, Gas/Propane	Gas/Propane/ Natural Gas
AC voltage	120	120	120	120/240	120/240
Noise (dBA)	52	52	52	74	61
 20A 120V duplex outlet (5-20R)	1	1	1	2	1
 50A 120/240V outlet (14-50R)	0	0	0	0	1
 30A 120/240V outlet (L14-30R)	0	0	0	1	1
 30A 120V outlet (TT-30R)	0	1	1	0	0
 USB-A outlet (5V, 1-2.4A DC)	2	2	2	2	2
 Car charger outlet (12V, 8A DC)	1	0	0	0	0

If you intend to power devices directly from the outlets on a generator, you'll want to match the voltage and ampacity of your device to your generator's outlet or otherwise use an outlet 'adapter' or compatible extension cord. While the simplest solution is to match the plug of your device to the outlet of the generator, there are plenty of outlet adapters, extension cords, and specialized power distribution devices on the market that can convert one style of outlet to another. Exhibit 2 provides a short list and description of some types of cords, adapters, and power distribution boxes that are compatible with Cummins portable generators.

Exhibit 2. Commonly used cords, adapters, and distribution boxes

Category	Cord sets			
Accessory	L14-30P to L14-30R	L14-30P to 4 X 5-20R	TT-30 to TT-30R	TT-30P to 5-20R
Part Number	A058U969	A058U971	Various	Various
				
Usage	Connects a generator's 30A 120/240V outlet to a compatible inlet box, transfer switch or appliance	Extends a generator's 30A 120/240V outlet into multiple household 120V outlets	Connects a generator's TT-30R outlet to a travel trailer's TT-30P inlet	Converts a generator's TT-30R outlet into multiple household 120V outlets
Compatible Models	P9500DF P9500DF EFI P11000iTF	P9500DF P9500DF EFI P11000iTF	P4500i P4500iDF P5000iDF EFI	P4500i P4500iDF P5000iDF EFI

Category	Plug adapters			Power distribution boxes	
Accessory	L14-30R to 14-50R	L14-30P to 4 X 5-20R	L14-30P to TT-30R	TT-30P to L14-30R	L14-30P to L5-20P/ 5-20P/CS6369
Part Number	Various	Various	Various	Various	Various
					
Usage	Converts a generator's L14-30R outlet to a 14-50R outlet for a compatible cord, inlet box or appliance	Converts a generator's 30 A 120/240V outlet into multiple household style 120V outlets	Converts a generator's L13-30P (120/240V) outlet to a TT-30P (120V only) outlet	Converts a generator's TT-30R outlet to a L14-30R (120V only) outlet	Converts a generator's 30A 120/240V outlet to 8 or more various outlet types for construction or special event applications
Compatible Models	P9500DF P9500DF EFI P11000iTF	P9500DF P9500DF EFI P11000iTF	P9500DF P9500DF EFI P11000iTF	P4500i P4500iDF P5000iDF EFI	P9500DF P9500DF EFI P11000iTF

CHOOSING YOUR FUEL TYPE

A prospective buyer must also decide which type of fuel they will use to power their generator. While all portable generators typically run on gasoline, there are many options in the market today that also offer propane fuel or natural gas fuel alternatives. Typically, those other fuel options come with a power derate, so a prospective owner should reference the power output of the generator on their intended fuel when sizing their generator. On the other hand, choosing propane or natural gas often results in reduced maintenance and longer generator run times. See Exhibit 3 for a general comparison of the advantages and disadvantages of different portable generator fuel types.

Cummins portable generator models offer gasoline-only, dual-fuel (gasoline + propane), or even tri-fuel (gasoline + propane + natural gas) capability. Cummins dual fuel generators come with a propane hose and propane regulator included, which is specifically designed to attach to a 20lb or larger propane tank commonly used for outdoor grills and fire pits.

Cummins tri-fuel generators, such as the P11000iTF (release pending in 2026), can also operate on natural gas using a quick-connect adapter for use with a flexible fuel hose (sold separately) that connects on the opposite end to an outdoor natural gas fitting (not included) that may already exist in some homes as a fuel source for an outdoor grill or fire pit.

Sizing a Portable Generator

One of the most confusing aspects of selecting a portable generator is identifying your power requirements based on the items you intend to power. Select a generator that is too large, and you end up paying more than necessary for a much larger and heavier generator. Select a generator that is too small, and you'll see an 'overload' light illuminate and shut down your generator regularly, which can damage the power electronics in your generator. It is important to note that most retailers won't accept returns of generators that have had oil and gasoline added to them because those materials are considered hazardous for shipment and subject to rejection by freight carriers.

Unfortunately, many generator sizing tools and guides on the internet do not provide an accurate approach to generator sizing. If a website instructs you to

Exhibit 3. Fuel tradeoffs

	Gasoline	Propane	Natural gas
Easily Stored	■ ■ ■	■ ■ ■	■ ■ ■
Easily Transported	■ ■ ■	■ ■ ■	■ □ □
Does Not Deteriorate	■ □ □	■ ■ ■	■ ■ ■
Low Carburetor Maintenance ¹	■ □ □	■ ■ ■	■ ■ ■
Full Generator Power	■ ■ ■	■ ■ □	■ □ □
Longer Run Times ²	■ □ □	■ ■ □	■ ■ ■

1. Assumes carbureted engine. Less maintenance on gasoline when selecting a fuel-injected model. 2. Assumes a 20lb propane tank. Larger tanks can result in significantly longer run times.

simply add up all the running power requirements for your loads and match it to a generator's rated power output, then be advised that this is a likely way to get yourself into trouble! While sizing a generator isn't quite that simple, it also isn't overly complicated.

What often gets missed is that you want to size a generator that accounts primarily for your starting power requirements, and not just a running power requirement. The power required to start electrical appliances with motors or compressors is always much higher than the power required to run those appliances. In some cases, starting power for motorized devices can be three, four, or even 5 times higher than the running power of that device, and if you can't start an appliance with your generator, then you certainly can't run it. To explain why a motor load requires so much more 'oomph' to start than to run, we often use the bicycle analogy. Starting a motor load is a lot like trying to start riding a bicycle

Basic steps of portable generator sizing:

1. Identify all the loads you intend to power **at the same time.**
2. List out the running power **and starting power** required by each load, then sequence them from largest to smallest.
3. **Calculate** your generator's required **starting power** and **running power.**
4. **Select the appropriate generator** by choosing a peak/surge power rating that is greater than your loads' starting power, and a running/continuous power rating greater than your loads' running power requirements.

uphill from a dead stop: a person really needs to exert a lot of energy to get the bike moving from a dead stop, however, once the bike has a little momentum the rider can shift gears and pedal with ease. Similarly, a motor starting under load requires a large surge in power to get the momentum it needs to reach its rated speed, and once the motor is spinning at its normal operating speed it requires a lot less energy to sustain its momentum.

For most generator users, those high 'motor-starting' loads include devices that utilize an electric motor or compressor in their construction: air conditioners, sump pumps, refrigerators, power tools. For purely resistive electrical loads such as light bulbs, computers, coffee makers, and electric ranges, the starting power is the same as the running power.

For the purposes of this article, we recommend an approach that will result in a rightly sized generator for the vast majority applications.

To follow the process, we've also provided a generator sizing worksheet and instructions on how to fill it out.

Step 1: Identify your loads

Before getting started on a sizing exercise, it is critical to think through all the loads that you will want to power **at the same time.** If there are any devices that you generally don't expect to be used at the same time as your more critical devices, then you can generally omit them from your generator sizing exercise, and you'll end up with a much more economical generator. You'll also want to note whether you have any 240V loads to power: if you do then you'll want to also be sure to select generator that is capable of 120/240V output.

Step 2: List the starting and running power requirements

AIR CONDITIONER			
MODEL NO.	NAC060AKC3		
SERIAL NO.	E043350134	PART NO.	328858-4020
RATED VOLTAGE	208/230 PH 1	AMPS	50
VOLTAGE MIN.	197	PH	50
MINIMUM CIRCUIT CAPACITY	35.7	FLA	27.1
COMPRESSOR	1	FLA	144
FAN	1/3	FLA	3.7
OUTDOOR UNIT SHIPPING CHARGE	K-22	124	02

Exhibit 4. Reading an HVAC data tag

You'll want to list your largest starting load first. For most applications including homes and recreational vehicles, the largest critical load will most often be your air conditioner. You can often find either a starting power value or starting current value (sometimes called Locked Rotor Amps (LRA) or Inrush Current) printed directly on the data tag of your air conditioner's condenser. See Exhibit 4 for a typical home HVAC data tag and how to read it.

Note: Example image highlights voltage as 240V class (common for homes) which is often stated as 208/230 and 1-Phase. 120V class air conditioners (common for RVs) may display a 115 V. Separate LRA values for compressor vs. fan can be added together ($144 + 3.7 = 147.4$) for generator surge or starting current. FLA (full load amps) for compressors and RLA (running load amps) for fans can be added together ($27.1 + 1.9 = 29$) for generator running current.

If the starting and running power value on your HVAC's condenser is provided in Watts, then you don't need to convert units. If you can only find the starting current, then you can use the below formula to calculate power in watts:

$$\text{Power (Watts)} = \text{Current (Amps)} \times \text{Voltage (Volts)}$$

Where: Current = Starting Amps or 'Locked Rotor Amps'

Where Voltage = Either 120V or 240V based on load's voltage requirement



Cummins Onan P9500DF

It is always a good idea to research the labels or product specifications of the specific devices you intend to power. Many appliances' power requirements vary from one brand or model to another. To assist the reader with generalized guidelines based on "typical" appliances, Exhibit 5 on the following page can be used as a general guide for estimation purposes. For older appliances that are likely less efficient, it is a good practice to increase the reference values in the table.

Exhibit 5. Common loads and power requirements

Recreation			Home			Work		
Appliance	Running Power (Watts)	Starting Power (Watts)	Appliance	Running Power (Watts)	Starting Power (Watts)	Appliance	Running Power (Watts)	Starting Power (Watts)
RV A/C 15k BTU	2000	3300	HVAC (5-ton)*	6000	17100	Air Compressor 1.5hp	800	1500
RV A/C 13.5 BTU	1800	2800	HVAC (4-ton)*	4800	13800	Shop Vac	1440	2000
Air Blower - Bouncey	1000	2500	HVAC (3-ton)*	3600	11800	Space Heater	1500	1500
Space Heater	1500	1500	HVAC (2-ton)*	2400	7900	Battery Charger - small	60	60
Hair Dryer	1500	1500	Window AC - 10k BTU	1500	2200	Commercial Fan	160	300
Blender	750	1500	Electric Clothes Dryer*	5400	6800	Industrial Fan - XL	650	1200
Electric Grill	1500	1500	Hot Tub - 120V	2000	3500	Small Grinder	800	1300
Microwave	1200	1200	Hot Tub - 240V	3000	5000	Bench Grinder - Large	1400	2500
Inflator Pump	150	300	Electric Range*	5000	5000	Table Saw	1800	4500
Slow Cooker	250	250	Electric Water Heater - 40 Gal*	4000	4000	Circular Saw - HD	1200	2000
Flood Lights - Work	100	100	Pool Pump	1200	2500	Corded Drill	700	1000
Satellite Receiver	100	100	Dishwasher w/o heater	1800	2400	Corded Chainsaw - 2hp	1100	1300
Small Fan	50	100	Well Pump - 1/3 hp	1000	2000	Paint Sprayer	120	120
46" LED Television	80	80	Fridge - HE	500	1500	Sander	700	750
RV Lights	60	60	Garage Door Opener	700	1400	Trash Pump	800	2000
DVD Player	60	60	Sump Pump	700	1200	Chipper - 1.5hp	1600	1800
Radio	50	50	Toaster	1200	1200	Reciprocating Saw	1200	2200
String Lights	40	40	Gas Furnace	600	1000	Small Welder*	4900	4900
Cell Phone Charger	10	10	Desktop CPU w/ Monitor	800	800			
			Washing Machine	700	700			
			Gas Clothes Dryer	700	700			
			Coffee Maker	600	600			
			Deep Freezer	500	500			
			Wine Cooler	140	280			
			Laptop Computer	200	200			
			Incandescent Bulb	60	60			
			CPAP	60	60			

Step 3: List your emergency loads from largest to smallest

Once you've identified the loads you intend to power simultaneously, you'll want to list them with the largest starting load first. See Exhibit 6 below for how you'll want to set up your worksheet. Again, be sure to highlight if any of your loads operate on 240V so you can remember to select a generator capable of 120/240V output at the end of the exercise.

Exhibit 6. Generator sizing worksheet

Load	Load Description	Running Watts	Starting Watts	Note
1				Largest Starting Load
2				
3				
4				
5				
6				All Other Loads
7				
8				
9				
10				
Generator Running Power Rating				
Generator Surge Power Rating				
Generator Surge Power Rating				

To calculate starting power, add the Starting Watts of your largest single load (typically an air conditioner) to the sum total of Running Watts for all your other loads, and enter it in the 'Generator Surge Power Rating' box.

For Generator Running Power Rating, add the Running Watts of all the devices together and enter it in the Generator Running Power Rating box.

Step 4: Calculate your running and starting power

Now that you've listed out your loads in the worksheet from largest to smallest, you can calculate both your generator's starting and running power requirements.

Running Power:

To calculate total running power, simply add up the Running Watts of all the loads in your list. Simple!

Starting Power:

To calculate your generator's starting power, you want to add the starting watts for your single largest motor load (typically your air conditioner) to the total running watts of every other load you want to power. The reason you don't simply add up all the starting wattages of all loads is because it is unlikely, if not impossible, that you would be able to simultaneously turn on all of your appliances at the exact same time... and doing so would require a much larger generator.

Step 5: Select the right generator

Once you've calculated your required starting watts and running watts, you need to compare those values to the advertised power ratings of the portable generators that you are interested in. You should always select a generator that has a higher surge and running power rating than what you calculated for your needs. You should also be sure to select a generator that is capable of 120/240V output if any of your loads require it (or) if you are planning to connect your generator to your home or RV 120/240V distribution panel directly via inlet box or transfer switch. Exhibit 7 summarizes Cummins generator power ratings.

Exhibit 7. Cummins portable generator ratings

Model name	P2500i	P4500i	P4500iDF	P5000iDF EFI	P9500DF, P9500DF EFI	P11000iTF (Coming soon!)
						
Running power - gasoline (Watts)	2,200	3,700	3,700	3,900	7,500	9,000
Peak power - gasoline (Watts)	2,500	4,500	4,500	3,500	9,500	11,000
Running power - propane (Watts)	N/A	N/A	3,300	4,500	6,750	8,100
Peak power - propane (Watts)	N/A	N/A	4,050	4,050	8,550	10,000
Running power - natural gas (Watts)	N/A	N/A	N/A	N/A	N/A	7,200
Peak power - natural gas (Watts)	N/A	N/A	N/A	N/A	N/A	8,800
AC voltage	120	120	120	120	120/240	120/240



Generator sizing examples

RECREATIONAL SIZING EXAMPLE:

You have a 21 foot long towable travel trailer with a 30 Amp 120V TT-30 power inlet and an onboard propane tank. Within your trailer, you have a 5 cu.ft. refrigerator, a 40 inch LCD TV, a roof-mounted 13,500 BTU Air Conditioner, a 19,000 BTU propane furnace, an exterior porch light, a microwave, a tankless propane powered water heater, an electrically operated awning, a coffee maker, a 2-burner propane stove top, and a tankless water heater. You also have 2 kids who always seem to be charging their phones.

RV Sizing Solution: From this list of loads, we can eliminate any propane powered equipment from our exercise: water heater, furnace, and stovetop. We can also eliminate any loads that we would not use at the same time as our other applications: the awning motor.

Using our devices data tags and/or Exhibit 4 we arrive at the power needs detailed in the chart to the right:

Now we can enter these loads in the right order in our generator sizing worksheet below.

Load	Running Power (Watts)	Starting Power (Watts)
40" TV	70	70
Porch Light	60	60
A/C	1,800	2,800
Fridge	400	2000
Coffee	600	600
Phone Chargers	20	20

Load	Load Description	Running Watts	Starting Watts	Note
1	Air Conditioner	1800	2800	Largest Starting Load
2	Fridge	400	1200	All Other Loads
3	Coffee Maker	600	600	
4	TV	70	70	
5	Porch Light	60	60	
6	Cell Phone Chargers	20	20	
7				
8				
9				
10				
Generator Running Power Rating		2950		
Generator Surge Power Rating			3950	
Generator Surge Power Rating				

From this spreadsheet, we add the starting watts of our largest starting load, our air conditioner, to the running watts of all other loads. We calculate 3950 starting watts. We add all the running power values and calculate 2950 running watts.

Finally, we are able to select our Cummins generator by checking the specifications on the Cummins Portable Generator Website (also summarized in Exhibit 6).

We know we are looking for a generator with a propane fuel rating of greater than 3950 peak watts and greater than 2950 running watts. We find two options with the P4500iDF rated for 4050 peak watts and 3,300 running watts (or) P5000iDF EFI rated for 4,500 peak watts and 3,500 running watts. We know from Exhibit 1 that both generators offer a 30A 120V TT-30 outlet that matches our trailer's input. Done!

HOME SIZING EXAMPLE:

You own a 1,400 sq. ft. home that has been hit with frequent power outages. Your electrician has already installed an inlet box and manual transfer switch rated for 120/240V with a L14-30R inlet receptacle that feeds your home's distribution panel. Your electrician also recommended and installed a 'soft starter' on your air-conditioner that she explained will reduce your air-conditioner's starting power by 50% to help minimize your generator. Now you are looking for a generator to connect to your home. Your critical loads are a 40-gallon electric hot water heater, a 30-amp 240V EV Charger, a garage door opener, a 2-ton air conditioner, a large refrigerator, a 46 inch LCD TV, 8 x LED light bulbs, and a cell phone charger. You plan on using gasoline to power your generator, same as your lawn mower.

We researched and organized these loads in the chart to the right:

Load	Running Power (Watts)	Starting Power (Watts)
2-ton A/C	2400	7900 x 50% = 3950
46" TV	80	80
8 x LED Bulbs	72	72
Water Heater	4,000	4,000
Fridge	500	1,500
Garage Opener	700	1,400
EV Charger	40 x 240 = 7200	7,200
Phone Chargers	10	10

After reviewing the starting loads, we see that the EV Charger is driving the largest starting power, and in retrospect, we expect to only charge the EV overnight after turning off our A/C. Also, we don't expect to use the garage opener but a few times per day and we eliminate it from our sizing exercise.

Load	Load Description	Running Watts	Starting Watts	Note
1	Water Heater*	4000	4000	Largest Starting Load
2	2-ton AC w/ soft starter*	2400	3950	All Other Loads
3	Fridge	500	1500	
4	TV	80	80	
5	8 x LED Bulbs	72	72	
6	Cell Phone Chargers	10	10	
7				
8				
9				
10				
Generator Running Power Rating		7062		
Generator Surge Power Rating			7062	
Generator Surge Power Rating				
* 240V loads				

Here we find that we need a generator with around 7062 starting watts and about the same running watts. It appears that in this case, the Cummins P9500DF has us covered with a surge rating of 9,500 watts and running power of 7,500 watts. We also realize that our HVAC and water heater both require 120/240V power, which this generator provides with a compatible L14-30R outlet rated for 30Amps and 120/240V which can be used to connect to the inlet box that our contractor installed. It is important to note that without the soft starter on our air conditioner (installed for ~\$250) we'd be looking for a significantly larger generator that may add \$1000 or more to our generator cost!

WORK SIZING EXAMPLE:

You have your own construction company, and you are looking for a portable gasoline generator that you can mount to the frame of your work truck to provide job site power. You have a 3-man crew that uses a variety of tools at any given time including: 1.5 gal. air compressor for pneumatic nailers, two 60 Amp battery chargers for handheld electric tools, a electric table saw, a electric circular saw, an electric sander, and 3 x 100 Watt work lights.

We have detailed the loads in the chart to the right:

With this information we can now calculate our starting and running power requirements.

Load	Running Power (Watts)	Starting Power (Watts)
Air Compressor	800	1,500
2 x Battery Chargers	80	80
Table Saw	72	72
Circular Saw	4,000	4,000
Sander	500	1,500
3 x Work Lights	700	1,400

Load	Load Description	Running Watts	Starting Watts	Note
1	Table Saw	1800	4500	Largest Starting Load
2	Circular Saw	1200	2000	All Other Loads
3	Air Compressor	800	1500	
4	Sander	700	750	
5	3 x Work Lights	300	300	
6	2 x Battery Chargers	120	120	
7				
8				
9				
10				
Generator Running Power Rating		4920		
Generator Surge Power Rating			7620	
Generator Surge Power Rating				



Here we find that we need a generator with a surge power of 7620 watts and running power of 4920 watts, and can choose either the P9500DF or the P11000iTF. While all of our tools operate off of 120V, we are not forced into buying a generator with a 240V receptacle, however, for worksite applications, since much of our tools are working in similar areas, we could choose to use the generator's 120/240V outlet to connect to a power distribution box or 'spider box' which provides multiple localized 120V outlets from the generator's 30A 120/240V outlet, which results in a lot less cabling to our tools.

RECREATION SIZING EXAMPLE #2:

You recently purchased a 23 foot, 5000 lb travel trailer from your local RV dealer. Your trailer uses a 120V TT-30P inlet and includes a single 15,000 BTU air conditioner, a microwave, outlets for personal electronics, a TV, and small fridge. Your RV dealer explained that your air conditioner does not include any “soft starter” installed and they provided the below list of included appliance data. You expect to often have all of these appliances running at the same time, and plan on using a gasoline fueled generator.

We have detailed the loads in the chart to the right:

Load	Running Power (Watts)	Starting Power (Watts)
Air Conditioner	2,000	3,300
Microwave	1,200	1,200
Computer	200	200
Cell Phone Charger	20	20
TV	80	80
Fridge	500	1,200

Again, we are able to calculate our starting and running power needs using the worksheet below.

Load	Load Description	Running Watts	Starting Watts	Note
1	15k BTU Air Conditioner	2000	3300	Largest Starting Load
2	Microwave	1200	1200	
3	Fridge	500	1200	
4	Computer	100	100	
5	TV	80	80	
6	Cell Phone Charger	20	20	
7				
8				
9				
10				
Generator Running Power Rating		3900		
Generator Surge Power Rating			5200	
Generator Surge Power Rating				

Here we find that we need a generator with a surge power of 5200 watts and running power of 3900 watts. Checking the Cummins model ratings we find that the P5000iDF EFI is slightly undersized at 3900 running and 5000 starting watts. Since the next larger generator is an open frame unit that is not so campground friendly, we can select the P11000iTF and sleep well at night knowing we have plenty of excess power. However, then we notice that the larger generator selection costs nearly \$1250 more than the 5000 watt generator! Is there an option B that may be better for our pocketbook? Remember that your dealer mentioned “no soft starter”? In this case, it would be a better option to have the dealer install a soft starter (\$300-500 installed, reduces starting



power by ~ 50%) and pick a more economical generator. This reduces our net expense by nearly \$1000 and gives us peace of mind that we won't wear out our generator prematurely. Here is what our generator sizing looks like now...a much better match to the P5000iDF EFI.

Load	Load Description	Running Watts	Starting Watts	Note
1	15k BTU Air Conditioner	2000	1650	Largest Starting Load
2	Microwave	1200	1200	
3	Fridge	500	1200	
4	Computer	100	100	
5	TV	80	80	
6	Cell Phone Charger	20	20	
7				
8				
9				
10				
Generator Running Power Rating		3900		
Generator Surge Power Rating			3550	
Generator Surge Power Rating				

Selecting accessories

When choosing a generator, often times you are presented with a myriad of different accessory options. These options often include such items as maintenance kits, storage covers, weather protective covers, paralleling kits, high altitude kits, and more. If you are a hands-on type of person who is somewhat mechanically inclined, performing basic maintenance on your generator is fairly easy. With detailed instructions provided in your owner's manual you can save yourself the cost and time of bringing your generator into a service dealer for maintenance.

Storage covers provide debris protection while storing your generator for long periods of time, while running covers enable you to use your generator during severe rain or snowstorms without fear of water ingress into the electrical outlets or air intake. Weather protective covers also encourage moving the generator away from awnings, overhangs, and garages during severe weather to prevent carbon

monoxide poisoning, which is a deadly hazard. Note that all generators carry warnings about operation at safe distances from all doors and windows. Also, note that some Cummins models including all EFI models come with carbon monoxide detection and shutdown for safety purposes.

Paralleling kits make sense when you want the flexibility of carrying two smaller generators but need the power output of a larger generator (or) you have a variety of home, work, and recreational applications where you want maximum flexibility.

High altitude carburetor kits are typically required for carbureted engines operating above 2,000 ft altitude, although they are not required on electronically fuel injected models (P5000iDF EFI, P9500DF EFI). All propane fuel models require high altitude propane regulator kits above 2000 ft to ensure proper fuel flow. Exhibit 8 on the following page summarizes all accessory options available with Cummins generators. Owner's manuals can also be a reference for maintenance parts and schedules.

Exhibit 8. Portable generator accessories

	Item number	P2500i	P4500i	P4500iDF	P9500DF
Paralleling kits					
P2500i 30A Paralleling Kit	A058U945	■			
50A Inverter Generator Paralleling Kit	A058M290	■	■	■	
Accessory covers					
Small Generator Storage Cover	A058U947	■			
Large Generator Storage Cover	A058U957		■	■	■
Inverter Generator Running Cover	A076C160		■	■	
Open Frame Generator Running Cover	A076C159				■
Cords					
30A 120/240V Manual Transfer Switch Cord	A058U969				■
30A 120V Power Distribution Cord	A058U971				■
High-altitude carburetors					
P2500i 98cc High Altitude Carburetor Kit (units built 09/2020 and prior)	A058V023	■			
P2500i 98cc High Altitude Carburetor Kit (units built after 09/2020)	A066Z194	■			
P4500i/P4500iDF 224cc High Altitude Carburetor Kit	A058V024		■	■	
P9500DF 420cc High Altitude Carburetor Kit	A058V084				■
High-altitude regulator kits					
P4500iDF High Altitude Propane Regulator Kit	A073Z778			■	
P9500DF High Altitude Propane Regulator Kit (units built 07/19/19 and prior)	A058V085				■
P9500DF High Altitude Propane Regulator Kit (units built after 7/19/19)	A065P007				■
Maintenance kits					
P2500i Maintenance Kit	A058U946	■			
P4500i/P4500iDF Maintenance Kit	A058U956		■	■	
P9500DF Maintenance Kit	A058U972				■
Air elements					
P2500i Air Filter Element	A058U954	■			
P4500i/P4500iDF Air Filter Element	A058U960		■	■	
P9500DF Air Filter Element	A064D487				■
Key fobs					
P4500i/P4500iDF Replacement Key Fob	A058U958		■	■	
P9500DF Replacement Key Fob	A058M291				■
Batteries					
P4500i/P4500iDF Replacement Starting Battery	A058U961		■	■	
P9500DF Replacement Battery	A064N119				■

Generator maintenance

Even if you don't use your portable generator regularly, basic maintenance and proper storage practices are essential to ensure that your generator is in working order when it is needed. Proper portable generator also ensures fuel efficiency and an extended lifespan. Now that you've selected which generator to buy, we'll explore basic maintenance that you can perform yourself to ensure smooth operation for years to come. If you aren't at all mechanically inclined, you'll always have the option to hire a Cummins service dealer. If you are mechanically inclined, your Owner's Manual has much of the below details available and illustrations to help guide you.

It is important to note several safety precautions that should be taken before you begin any maintenance activities:

1. Wear protective equipment: Use tear-proof work gloves and safety glasses to protect hands and eyes. If gasoline or oil comes into contact with skin, wash immediately to avoid skin irritation or adverse reaction.
2. Disconnect the spark plug boot(s): One should never keep the spark plug boot connected during maintenance to avoid injury from accidental starting.
3. Allow equipment to cool: Plan for a minimum of 30 minutes of cooldown time if you plan on performing maintenance immediately after using your generator to avoid burns from hot surfaces. Engine oil should remain warm enough to drain when conducting an oil change.
4. Keep generator level and on a level surface: Never up-end or place the generator on its side as fuel or oil can leak or damage certain components.

Below is a typical maintenance schedule for Cummins portable generators. Always check your specific equipment manual to ensure you are following the proper guidelines for your make and model of generator.

Exhibit 9. Cummins Onan portable generator maintenance schedule

Before each use	After first 25 hours or first month	After 50 hours or every 6 months	After 100 hours or every 6 months	After 300 hours or every year
Check engine oil	Check engine oil	Change engine oil ¹ Clean air filter ²	Inspect/clean spark arrestor Inspect/clean spark plug Replace fuel filter ³ Inspect/adjust valve clearance ³	Replace spark plug Replace air filter

1. Increase oil change interval to every month when operating under high loads or in high ambient temperatures. 2. Clean more often when operating in dirty / dusty conditions, and consider air filter replacement instead of cleaning if the filter cannot be adequately cleaned. 3. It is recommended to use an authorized service dealer when performing these maintenance items.

Changing engine oil is best done with a warm engine so that the oil can drain more easily. It is recommended to allow the generator to run for a short period of time, but allow 30 minutes for the engine to cool off. Remove the oil fill cap / dipstick. Use an oil pan or suitable container to capture the oil, and position the oil drain tube to avoid spills. Be sure to twist the oil drain cap (counterclockwise) as opposed to pulling / tugging it off to avoid damaging the tube or plug threads. Give your generator plenty of time to drain until you don't see

any more oil dripping into the pan. Use the provided oil fill funnel to keep your machine clean when refilling, and pour slowly, a little at a time, to give the oil a chance to settle.

When replacing spark plugs it is important to always use the same Cummins spark plug that comes with the applicable Maintenance Kit Accessory or by ordering the Cummins part number identified in your owner's manual. Otherwise, always follow the spark plug spec in your Owner's Manual.

Cummins uses non-resistor type spark plugs, and use of resistor-type plugs can result in a no-start, rough idling, misfire, or even engine damage. Cummins includes a compatible spark plug wrench with every new generator, so be sure to stow it somewhere where it cannot be lost. While unscrewing the spark plug from its threaded hole, take care not to bend or apply side load while removing it to avoid damage to the electrode. When inspecting the spark plug, take special care to observe any pitting, burn marks, or cracks to the insulation that are a cause for early replacement versus cleaning and reusing.

Most Cummins portable generators come with a reuseable foam air filter that can be cleaned at several 50 hour intervals before replacement becomes necessary. Use a mix of detergent and water to gently soak and squeeze clean, followed by a soak and squeeze in pure water. Let foam air filters completely dry before reinstalling in the generator. If you observe any tears or damage to

the filter, replace immediately. Larger models such as the P9500DF EFI come with a pleated air filter that is best cleaned of debris using compressed air prior to rinsing with water and drying. Of course, if you are using your generator in a dirty dusty environment such as a construction site, it is recommended to perform maintenance and replacement at a shorter interval.

Fuel filter replacement and valve adjustments can be a bit more involved with more generator disassembly required. For 100+ hour maintenance items, it is often a good idea to look up your local Cummins portable generator service location for support to help identify the most current parts for your generator, or to perform the work on your behalf. When you come across fault indicators or when you've exhausted troubleshooting regarding starting problems, a dealer is also a good option. You can find your nearest service location using the dealer finder on our website at:

cummins.com/na/generators/portable-generators

Conclusion

Choosing the right portable generator for your needs used to be intimidating. Now you are an expert on all aspects of portable generator selection: from the right style of generator, the right fuel type, the right power ratings, the right accessories, and the right maintenance. Now get out there and buy with confidence. Power Onward!

About the author



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Nick holds a BSE in Mechanical Engineering from the University of Iowa and MBA from Purdue University. Nick has spent twenty-five years working in Power & Energy markets across North America, South America, and Europe. Prior to his current role, Nick has worked in various positions including Maintenance & Repairs Manager, Marketing Manager, Strategy Consultant, Sales Manager, and Marketing Communications Consultant.



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