



Calculating Home Protected Loads for Emergency Backup Purposes - Enphase

There are a few important items to consider when estimating protected loads for your battery energy storage system:

- **Max Running Wattage.** This is the average sustained power that an electrical load consumes while operating.
- **Starting Wattage.** When devices with inductive motors are powered on, they will briefly draw initial current and power (“surge”) that is higher than their Running Wattage. For example, a refrigerator with a compressor will switch its compressor on and off continuously to maintain temperature. The appliance’s “Power/Ratings” will generally include the maximum Starting Wattage information.
- **Run Time.** This is the time that a load is drawing power (powered on).

These wattage worksheet instructions focus on determining your estimated total wattage requirements that prevent or minimize nuisance power trip events during a power outage. Nuisance power tripping occurs when instantaneous power demand exceeds the peak power output capabilities of the energy storage system while in backup mode. Generally, greater battery capacities allow for longer periods of running time during a grid power outage.

Since your home will still be grid-connected with battery backup (and you are not going completely off-grid), it is possible to install a battery that is relatively small and affordable. First, it is necessary to determine what items in the home are most essential to keep powered, when a power outage occurs. The battery system will not be able to provide or sustain all the power needs of your home during a power outage, so it is necessary to plan for the amount of energy that is absolutely necessary during these critical events.

There is a technical limit on the amount of power that can be drawn from battery systems during a grid outage. These ratings are listed in the chart that follows. The length of time that the batteries can supply power to protected loads during an outage is based on the amount of energy being used and how much battery capacity is available.

Enphase Encharge Battery Energy Storage Systems have the following maximum power ratings while in backup mode.



Battery Size	Running Wattage	Starting Wattage (10 Secs)
10kWh	3,840 Watts	5,700 Watts
20kWh	7,680 Watts	14,400 Watts
30kWh	11,520 Watts	17,100 Watts
40kWh	15,360 Watts	22,800 Watts

FAQs

Q: Will my entire home be powered during a grid outage?

A: Unfortunately, no. Emergency power is limited to items that are either plugged into or hard wired to the protected loads panel.

Q: How many watts does it take to power essential items during a grid outage?

A: In a typical home, essential items will average 3000 – 5000 watts of power to run. To run the entire home will require much more power than is practical for a standby/backup battery energy storage system.

Q: What is the difference between running watts and starting watts?

A: Running, or rated watts are the continuous watts needed to keep items running. Starting watts are extra watts needed for two to three seconds to start induction motor-driven products like a refrigerator or circular saw — this is the maximum wattage the system will be loaded with.

Q: What if I can't determine the running or the starting watt requirement for an appliance?

A: If the running watts are not on the appliance, you may estimate using the following equation: $WATTS = VOLTS \times AMPS$. Only motor driven items will require starting watts. The starting watts required may also be estimated at 1-2x the running/rated watts, but may be as high as 7x.

Q: What happens if I do experience nuisance power tripping?

A: The energy storage system will automatically reset after a short period of time and reattempt to meet the power requirement. You may need to reduce the power requirement by turning off some devices to prevent further power tripping events.

Protected Loads Worksheet Instructions

Choosing items for a backup load circuit and managing its use is a matter of prioritization and budgeting power.

Step 1

Determine the essential items you wish to power simultaneously. It is best to get the information directly from the actual appliance you intend to use, but you can also refer to the following chart to assist in estimating this information. Fill-in the running watt and starting watt requirements on the "Essential Loads Worksheet."

Step 2

For load items that don't have a higher Starting Watts value, use the Running Watts as the Starting Watts value.

Step 3

Add the Starting Watts values for the protected load items you want to power. This will provide the total of these items' peak power requirement, when used simultaneously.

Step 4

Add the Running Watts of the protected load items you wish to power. Enter this number in the Total Running Watts column. This is the sustained power requirement to support all of these devices at one time.

Step 5

Choose the higher of the two values, "Starting Watts" and "Running Watts", and enter it into the box labeled "Minimum Power Requirements". If this value is larger than the "Max Output Wattage", you must remove one or more protected load items.

	Running Wattage	Starting Wattage (3 Secs)	Surge Wattage (30 Mins)
PowerBlocks Max Ratings	5,000 Watts	8,000 Watts	6,000 Watts

EXAMPLE		
APPLIANCE OR TOOL	Running Watts	Starting Watts
1. Energy Star 25.4 cu. ft. Refrigerator	73	1800
2. Television	500	500
3. Microwave Oven-800 Watts	625	800
4. Incandescent Light Bulb-40 Watt x 4	160	160
5. AM/FM Radio	100	100
6. Security System	500	500
7. Cell Phone Battery Charger x 2	50	50
8. Automatic Washing Machine	1150	2300
9.		
10.		
TOTALS	3158	6210

PEAK POWER REQUIREMENT (WATTS)

Larger of "Starting Watts" and "Running Watts"	6210
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MY CRITICAL LOAD POWER NEEDS		
APPLIANCE OR TOOL	Starting Watts	Running Watts
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
TOTALS		

PEAK POWER REQUIREMENT (WATTS)

Larger of "Starting Watts" and "Running Watts"	
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WATTAGE ESTIMATES

Storm / Emergency Use

	Starting Watts	Running Watts		Starting Watts	Running Watts
Essentials:			* Laundry Room:		
Incandescent Light Bulb-60 Watt	60	60	Iron	1,200	1,200
CFL Light Bulb-60 Watt Equivalent	15	15	Washing Machine	2,250	1,150
LED Light Bulb-60 Watt Equivalent	8	8	Clothes Dryer-Electric	1,350	5,400
Refrigerator/Freezer	2,200	700	Clothes Dryer-Gas	1,800	700
Refrigerator/Freezer-Energy Star	1,200	200	Electronics:		
Sump Pump-1/3 HP	1,300	800	AM/FM Radio	100	100
Sump Pump-1/2 HP	2,200	1,050	Stereo Receiver	450	450
Water Well Pump-1/3 HP	1,400	750	CD/DVD Player	350	350
Water Well Pump-1/2 HP	2,100	1,000	TV-Tube Type	300	300
* Electric Water Heater	4,000	4,000	TV-Flat Screen-20"	120	120
Heating/Cooling:			TV-Flat Screen-46"	190	190
Space Heater	1,800	1,800	X-Box, PlayStation, Wii, etc	40	40
Humidifier-13 Gal	175	175	Cell Phone Charger	25	25
Furnace Fan-gas/oil-1/8 HP	500	300	Computer-Laptop	250	250
Furnace Fan-gas/oil-1/6 HP	750	500	Computer-Desktop	800	800
Furnace Fan-gas/oil-1/4 HP	1,000	600	Monitor (LCD)	30	30
Furnace Fan-gas/oil-1/3 HP	1,400	700	Printer	600	600
* Furnace Fan-gas/oil-1/2 HP	2,350	875	Home Entry:		
Window AC-10,000 BTU	1,800	1,200	Home Security System	500	500
* Window AC 12,000 BTU	3,950	3,250	Garage Door Opener-1/4 HP	1,100	550
Central AC-10,000 BTU	2,200	1,500	Garage Door Opener-1/2 HP	1,400	725
* Central AC-20,000 BTU	3,300	2,500	Personal Care:		
* Central AC-24,000 BTU	4,950	3,800	Hair Dryer 1250 Watt	1,250	1,250
* Central AC-32,000 BTU	6,500	5,000	* Power Tools:		
* Central AC-40,000 BTU	7,800	6,000	Hand Drill 1/4"	350	350
* Heat Pump	4,500	4,700	Hand Drill 1/2"	600	600
Portable Box Fan-20"	200	200	Circular Saw 6-1/2"	500	500
Kitchen:			Circular Saw 8-1/4"	1,400	1,400
Microwave Oven-650 Watts	1,000	1,000	Table Saw 10"	6,300	1,800
Microwave Oven-800 Watts	1,300	1,300	Band Saw 14"	2,500	1,100
Microwave Oven-1000 Watts	1,500	1,500	Air Compressor 1/2 HP	3,000	1,000
Coffee Maker-4 cup	600	600	Air Compressor 1-1/2 HP	8,200	2,200
* Electric Range-6" Element	1,500	1,500	Quartz Halogen Work Light, 1000	1000	1000
* Electric Range-8" Element	2,100	2,100	Submersible Pump 400 gph	600	200
Electric Fry Pan	1,500	1,500	High Pressure Washer 1/2 HP	3,150	950
Electric Grill (tabletop)	1,650	1,650	High Pressure Washer 1 HP	6,100	1,600
Slow Cooker	270	270	Wet Dry Vac 1.7 HP	900	900
* Dishwasher-Hot Dry	1,400	1,450			
Dishwasher-Cool Dry	1,400	700			
Blender	850	400			
Toaster Oven	1,200	1,200			
Toaster	850	850			

NOTE

These wattages are estimates only. You should always check your appliance for exact wattage requirements. For exact wattages, check the data plate or owner's manual on the item you wish to power.

* Not recommended as essential loads