



Understanding Critical Loads

There are a few important items to consider when estimating critical 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. Generally, greater battery capacities allow a greater number items that can be powered on simultaneously, as well as allow for longer periods of running time during a grid power outage.

What are critical (essential) electrical items needed during an emergency grid power outage?

NOTE

crit-i-cal

adjective

of decisive importance with respect to the outcome; crucial.

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 critical 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 critical loads during an outage is based on the amount of energy being used and how much battery capacity is available.



E-GEAR™ Battery Energy Storage Systems have the following maximum power ratings, based on kWh battery capacity installed.

Maximum Power Ratings			
System Size	Max Output Wattage	Max Surge Wattage (30 Minutes)	Max Surge Wattage (3 Seconds)
6.4 kWh Capacity	3,000 Watts	3,000 Watts	3,000 Watts
9.6 kWh Capacity	4,500 Watts	4,500 Watts	4,500 Watts
12.8 kWh Capacity	5,000 Watts	6,000 Watts	6,000 Watts
16 kWh Capacity	5,000 Watts	6,000 Watts	7,500 Watts
19.2 kWh Capacity	5,000 Watts	6,000 Watts	8,500 Watts

The energy component (consumption) of an appliance is also based on its individual run time. For example, a 800W microwave running at 100% power for 3 minutes consumes roughly the same amount of energy as a 40W light bulb for an entire hour of operation.

Critical Loads Worksheet Instructions

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

Step 1 Determine the critical 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 "Critical 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.

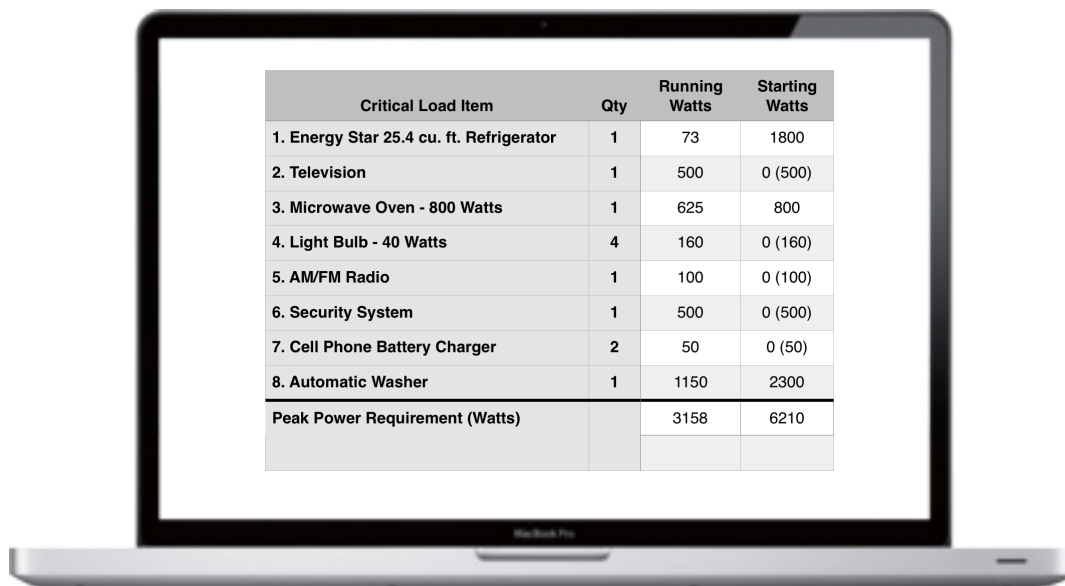
Step 3 Add the Starting Watts values for the critical load items you want to power. This will provide the total of these items' peak power requirement, when used simultaneously.

Step 4 Add the Running Watts of the critical 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" in the row of your selected battery size in the "Maximum Power Ratings" table above, you must do one of the following:

- Remove one or more Critical Load Items.
- Choose a larger-capacity battery size.

example:



Critical Load Item	Qty	Running Watts	Starting Watts
1. Energy Star 25.4 cu. ft. Refrigerator	1	73	1800
2. Television	1	500	0 (500)
3. Microwave Oven - 800 Watts	1	625	800
4. Light Bulb - 40 Watts	4	160	0 (160)
5. AM/FM Radio	1	100	0 (100)
6. Security System	1	500	0 (500)
7. Cell Phone Battery Charger	2	50	0 (50)
8. Automatic Washer	1	1150	2300
Peak Power Requirement (Watts)		3158	6210

to use the easy critical loads calculator go to: e-gear.us/criticalloads

FAQs

Q: How many watts does it take to power basic items in an average size house?

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.

Wattage Estimates

Storm / Emergency Use

	Starting Watts	Running Watts
Essentials:		
Incandescent Light Bulb-60 Watt	60	60
CFL Light Bulb-60 Watt Equivalent	15	15
LED Light Bulb-60 Watt Equivalent	8	8
Refrigerator/Freezer	2,200	700
Refrigerator/Freezer-Energy Star	1,200	200
Sump Pump-1/3 HP	1,300	800
Sump Pump-1/2 HP	2,200	1,050
Water Well Pump-1/3 HP	1,400	750
Water Well Pump-1/2 HP	2,100	1,000
Electric Water Heater	4,000	4,000
Heating/Cooling:		
Space Heater	1,800	1,800
Humidifier-13 Gal	175	175
Furnace Fan-gas/oil-1/8 HP	500	300
Furnace Fan-gas/oil-1/6 HP	750	500
Furnace Fan-gas/oil-1/4 HP	1,000	600
Furnace Fan-gas/oil-1/3 HP	1,400	700
Furnace Fan-gas/oil-1/2 HP	2,350	875
Window AC-10,000 BTU	1,800	1,200
Window AC 12,000 BTU	3,950	3,250
Central AC-10,000 BTU	2,200	1,500
Central AC-20,000 BTU	3,300	2,500
Central AC-24,000 BTU	4,950	3,800
Central AC-32,000 BTU	6,500	5,000
Central AC-40,000 BTU	7,800	6,000
Heat Pump	4,500	4,700
Portable Box Fan-20"	200	200
Kitchen:		
Microwave Oven-650 Watts	1,000	1,000
Microwave Oven-800 Watts	1,300	1,300
Microwave Oven-1000 Watts	1,500	1,500
Coffee Maker-4 cup	600	600
Electric Range-6" Element	1,500	1,500
Electric Range-8" Element	2,100	2,100
Electric Fry Pan	1,500	1,500
Electric Grill (tabletop)	1,650	1,650
Slow Cooker	270	270
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

	Starting Watts	Running Watts
Laundry Room:		
Iron	1,200	1,200
Washing Machine	2,250	1,150
Clothes Dryer-Electric	1,350	5,400
Clothes Dryer-Gas	1,800	700
Electronics:		
AM/FM Radio	100	100
Stereo Receiver	450	450
CD/DVD Player	350	350
TV-Tube Type	300	300
TV-Flat Screen-20"	120	120
TV-Flat Screen-46"	190	190
X-Box, PlayStation, Wii, etc	40	40
Cell Phone Charger	25	25
Computer-Laptop	250	250
Computer-Desktop	800	800
Monitor (LCD)	30	30
Printer	600	600
Home Entry:		
Home Security System	500	500
Garage Door Opener-1/4 HP	1,100	550
Garage Door Opener-1/2 HP	1,400	725
Personal Care:		
Hair Dryer 1250 Watt	1,250	1,250
Power Tools:		
Hand Drill 1/4"	350	350
Hand Drill 1/2"	600	600
Circular Saw 6-1/2"	500	500
Circular Saw 8-1/4"	1,400	1,400
Table Saw 10"	6,300	1,800
Band Saw 14"	2,500	1,100
Air Compressor 1/2 HP	3,000	1,000
Air Compressor 1-1/2 HP	8,200	2,200
Quartz Halogen Work Light, 1000	1000	1000
Submersible Pump 400 gph	600	200
High Pressure Washer 1/2 HP	3,150	950
High Pressure Washer 1 HP	6,100	1,600
Wet Dry Vac 1.7 HP	900	900

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.

My Critical Loads Worksheet

EXAMPLE		
APPLIANCE OR TOOL	Starting Watts	Running 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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ALTERNATE PLAN

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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ALTERNATE PLAN

MY CRITICAL LOAD POWER NEEDS		
APPLIANCE OR TOOL	Starting Watts	Running Watts
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PEAK POWER REQUIREMENT (WATTS)

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