

Generator Sizing Guide



GENERAC[®]
POWER SYSTEMS, INC.

IMPORTANT NOTICE:

This booklet is designed to familiarize estimators and installers with proper sizing guidelines for residential and commercial generators. The information is not comprehensive, nor does it replace or supersede any material contained in any of the written documents shipped with the equipment. This booklet should only be used in conjunction with the Owner's Manual, Installation Manual and other technical documents shipped with each product. Always read all accompanying documentation carefully before attempting to install any generator, transfer switch or related equipment.

HOW TO USE THIS BOOKLET:

Within this booklet, you will find electrical load information, plus an outline of generator surge capability, fuel pipe sizing, liquid propane tank sizing, and UPS / generator compatibility. The final pages are perforated for easy removal and can be photocopied to create additional Onsite Estimating Sheets for use with individual jobs.

SAFETY INFORMATION:

Proper sizing of the generator is crucial to the success of any installation and requires a good working knowledge of electricity and its characteristics, as well as the varying requirements of the electrical equipment comprising the load. When analyzing the electrical load, consult the manufacturer's nameplate on each major appliance or piece of equipment to determine its starting and running requirements in terms of watts, amps and voltage. When choosing the generator output for commercial or industrial applications, select a rating that is approximately 25% higher than the peak load (for example, if the load is about 40 kilowatts, select a 50 kW genset). A higher rated generator will operate comfortably at approximately 80% of its full capacity and will provide a margin of flexibility if the load increases in the future.

For safety reasons, Generac recommends that the backup power system be installed, serviced and repaired by a Generac Authorized Service Dealer or a competent, qualified electrician or installation technician who is familiar with applicable codes, standards and regulations.

It is essential to comply with all regulations established by the Occupational Safety & Health Administration (OSHA) and strict adherence to all local, state and national codes is mandatory. Before selecting a generator, check for municipal ordinances that may dictate requirements regarding placement of the unit (setback from building and/or lot line), electrical wiring, gas piping, fuel storage (for liquid propane or diesel tanks), sound and exhaust emissions.

If you have a technical question regarding sizing or installation, contact Generac's Technical Service Center toll free at 888-GENERAC during normal business hours (8 a.m. to 5 p.m. CST).

TABLE 1 MOTOR LOAD REFERENCE

AC & Heat Pumps

Description	Hp	Running Load				Starting Load			
		Running kW	Amps at 240V 1ø	Amps at 208V 3ø	Amps at 480V 3ø	Starting kW	LR Amps at 240V 1ø	LR Amps at 208V 3ø	LR Amps at 480V 3ø
1 Ton (12,000 BTU)	1	1	5	3	1	3	25	17	7
2 Ton (24,000 BTU)	2	2	10	7	3	6	50	33	14
3 Ton (36,000 BTU)	3	3	15	10	4	9	75	50	22
4 Ton (48,000 BTU)	4	4	20	13	6	12	100	67	29
5 Ton (60,000 BTU)	5	5	25	16	7	15	125	83	36
7.5 Ton (85,000 BTU)	7.5	7.5	37	24	11	17	188	125	54
10 Ton (120,000 BTU)	5 Hp (x2)	10	49	33	14	15	125	83	36
10 Ton (120,000 BTU)	10 Hp	10	49	33	14	20	250	167	72
15 Ton (180,000 BTU)	7.5 Hp (x2)	15	74	49	21	17	188	125	54
15 Ton (180,000 BTU)	15 Hp	15	74	49	21	30	375	250	108
20 Ton (240,000 BTU)	10 Hp (x2)	20	98	65	28	20	250	167	72
20 Ton (240,000 BTU)	20 Hp	20	n/a	65	28	40	500	333	144
25 Ton (300,000 BTU)	25	25	n/a	82	35	50	625	416	180
30 Ton (360,000 BTU)	15 Hp (x2)	30	n/a	98	42	30	375	250	108
30 Ton (360,000 BTU)	30 Hp	30	n/a	98	42	60	750	500	217
40 Ton (480,000 BTU)	20 Hp (x2)	40	n/a	131	57	40	500	333	144
40 Ton (480,000 BTU)	40 Hp	40	n/a	131	57	80	1000	666	289
50 Ton (480,000 BTU)	25 Hp (x2)	50	n/a	163	71	50	625	416	180
50 Ton (480,000 BTU)	50 Hp	50	n/a	163	71	100	1250	833	361

General Residential

Description	Hp	Running Load			Starting Load		
		Running kW	Amps at 120V 1ø	Amps at 240V 1ø	Starting kW	LR Amps 120V 1ø	LR Amps 240V 1ø
Refrigerator, Sump Pump, Furnace, Garage Opener	0.5	0.5	4.9	2.5	1.5	25	13
Freezer, Washer, Septic Grinder	0.75	0.75	7.4	3.7	2.3	38	19
General 1 Hp	1	1	9.8	4.9	3	50	25
Well & Septic Lift Pump	2	2	19.6	9.8	6	100	50

TABLE 2 NON-MOTOR LOAD REFERENCE

General Residential

Description	Running Load		
	kW	Amps at 120V 1Ø	Amps at 240V 1Ø
Electric heat per 1000 ft. ²	12	n/a	50
Heat pump elements per 1000 ft. ²	7	n/a	29
Dryer	5.5	n/a	23
Hot tub	5	n/a	21
Range oven	5	n/a	21
Hot water	4.5	n/a	19
Stove top per burner	1.5	n/a	6
General receptacles per 1000 ft. ²	1	8.3	n/a
Lighting per 1000 ft. ²	0.75	6.3	n/a
Blow dryer	1.25	10.4	n/a
Dishwasher	1.5	12.5	n/a
Microwave	1	8.3	n/a
Toasters	1	8.3	n/a

TABLE 3 SURGE CAPABILITY

Generac QT Series Generators Operating at < 3600 RPM

Size (kW)	Rated Output			Surge Capability			Surge Capability		
	(Running Amps)			LR Amps at 15% Voltage Dip			LR Amps at 30% Voltage Dip		
	240V 1Ø	208V 3Ø	480V 3Ø	240V 1Ø	208V 3Ø	480V 3Ø	240V 1Ø	208V 3Ø	480V 3Ø
25	104	87	38	71	47	26	133	89	52
30	125	104	45	113	75	43	225	150	87
40	167	139	60	129	86	49	254	169	97
55	229	191	83	196	130	76	392	261	150
70	292	243	105	275	183	106	550	366	212
80	333	278	120	275	183	106	550	366	212
100	417	347	150	371	247	142	738	491	284
130	542	451	195	546	364	209	1088	724	419

Generac QT Series Generators Operating at 3600 RPM

Size (kW)	Rated Output			Surge Capability			Surge Capability		
	(Running Amps)			LR Amps at 15% Voltage Dip			LR Amps at 30% Voltage Dip		
	240V 1Ø	208V 3Ø	480V 3Ø	240V 1Ø	208V 3Ø	480V 3Ø	240V 1Ø	208V 3Ø	480V 3Ø
7	29	24	11	23	n/a	n/a	46	n/a	n/a
10	42	35	15	31	n/a	n/a	63	n/a	n/a
13	54	45	20	38	n/a	n/a	75	n/a	n/a
16	67	56	24	46	n/a	n/a	92	n/a	n/a
20	83	69	30	63	42	24	121	80	47
25	104	87	38	71	47	26	138	92	53
35	146	121	53	104	69	40	204	136	78
45	188	156	68	146	97	57	292	194	112
50	208	173	75	146	97	57	292	194	112
60	250	208	90	179	119	69	354	236	136
70	292	243	105	246	164	95	496	330	190
100	417	347	150	333	222	128	663	441	255
150	625	520	226	558	372	215	1121	747	431

Note: All kW models listed above are based on nominal LP rating.

TABLE 4 FUEL PIPE SIZING

Natural Gas

kW	Pipe Size (in.)						
	0.75"	1"	1.25"	1.5"	2"	2.5"	3"
7	55	200	820				
10	20	85	370	800			
13	10	50	245	545			
16		40	190	425			
20		20	115	265	950		
25		10	75	180	660		
30			60	150	565	1380	
35			35	95	370	915	
40			25	75	315	790	
50			10	50	220	560	
60				25	145	390	1185
70				5	75	225	710
80					65	195	630
100					40	140	460
130						50	215
150						30	150

LP Vapor (LPV)

kW	Pipe Size (in.)						
	0.75"	1"	1.25"	1.5"	2"	2.5"	3"
7	165	570					
10	70	255	1000				
13	45	170	690				
16	30	130	540				
20	15	80	340	745			
25		50	235	520			
30		40	200	445			
35		20	125	290	1030		
40		15	107	250	890		
50			70	170	635		
60			45	115	445	1095	
70			20	60	260	660	
80			15	50	230	590	
100				30	165	430	1305
130					70	205	660
150					45	150	490

Note: – Table values are maximum pipe run in feet.
 – Pipe sizing is based on .5" H₂O pressure drop.
 – Sizing includes a nominal number of elbows and tees.
 – Please verify adequate service and meter sizing.

TABLE 5 LP VAPOR (LPV) TANK SIZING

Vapor Withdrawal

Tank Capacity Total (Gal.)	Tank Capacity Useable (Gal.)	Length (Inches)	Diameter (Inches)	Overall Ht. (Inches)	Minimum Temp (°F)	Tank Capacity (btu/hr.)
120	72	57	24	33	40	246,240
					20	164,160
					0	82,080
150	90	68	24	33	40	293,760
					20	195,840
					0	97,920
250	150	94	30	39	40	507,600
					20	338,400
					0	169,200
325	195	119	30	39	40	642,600
					20	428,400
					0	214,200
500	300	119	37	46	40	792,540
					20	528,360
					0	264,180
850	510	165	41	50	40	1,217,700
					20	811,800
					0	405,900
1000	600	192	41	50	40	1,416,960
					20	944,640
					0	472,320

LP Vapor (LPV) Withdrawal Fuel Consumption

Load (kW)	BTU / Hr	Gal / Hr
7	110,000	1.2
10	190,000	2.1
15	240,000	2.7
20	340,000	3.8
25	390,000	4.3
30	440,000	4.9
35	500,000	5.5
40	550,000	6.1
50	675,000	7.5
60	800,000	8.8
70	950,000	10.5
80	1,100,000	12.2
90	1,250,000	13.8
100	1,400,000	15.5
110	1,550,000	17.1
120	1,675,000	18.5
130	1,800,000	19.9
140	1,925,000	21.3
150	2,050,000	22.7
200	2,800,000	30.9
300	4,100,000	45.3

Note: Tank BTU capacity and generator run times based upon maintaining a minimum tank fuel level of 20%.

Note: Fuel consumption based on a generator 80% loaded.

UPS - GENERATOR COMPATIBILITY

Passive (also referenced as standby or off-line) and Line-Interactive

These technologies are most common for personal workstations and point of sale applications. They are typically single phase equipment with size ranges of 350 VA - 2000 VA for passive and 500 VA to 5000 VA for line-interactive.

Passive UPS's are the simplest type. Under normal conditions AC power passes straight through to the UPS load. When the input power supply goes outside of specifications, the UPS transfers the load from input power to the internal DC to AC power inverter. Passive UPS's do not correct for voltage or frequency deviations under "normal" operation.

Line-interactive is similar to the passive technology except it has circuitry that attempts to correct for standard voltage deviations. Frequency deviations under "normal" power operation are not corrected.

Equipment Notes:

These devices tend to be electrically / harmonically very noisy. A single small UPS is not a significant concern, but applications with multiple UPS's can be problematic.

Passive UPS technology typically has normal tolerances of 10-25% on voltage and 3 hertz on frequency. If the input source goes outside of these tolerances, the UPS will switch onto the UPS battery source. Some line-interactive units may have frequency tolerances factory set to .5 hertz. These units will need to have their frequency tolerance increased to a minimum of 2 hertz.

Generator Sizing Recommendation:

Limit the total UPS loading to 15% - 20% of the generator capacity.

Double-Conversion

This technology is most common for critical load applications. Double-conversion UPS's constantly rectify AC to DC and then invert the DC back into AC. This configuration results in an output that corrects for voltage and frequency deviations.

There are single and three phase models covering small through large applications. Most UPS applications larger than 5000 VA use double conversion technology. This approach is also the preferred technology for generator applications.

Equipment Notes:

Double-conversion UPS's that are single phase or unfiltered three phase models tend to create a significant level of electrical/ harmonic noise. This is illustrated by harmonic current distortions that are greater than 35%. When three phase models are supplied with harmonic filters (current distortion less than 10%), this concern is no longer an issue.

Generator Sizing Recommendation:

Single phase models: limit the total UPS loading to 25% of the generator capacity.

Three phase models without filters (current distortion > 30%): limit the UPS loading to 35% of the generator capacity.

Three phase models with filters (current distortion < 10%): limit the UPS loading to 80% of the generator capacity.

Supplier(s)	Passive (Standby)	Line-Interactive	Double-Conversion
APC Liebert Powerware	Back-UPS Series PowerSure PST & PSP 3000 series	Smart-UPS Series PowerSure PSA & PSI 5000 series	Symmetra Series UPStation & Nfinity series 9000 series

Note: Ferrups and Delta-Conversion UPS technologies not included in discussion.

Onsite Estimating Sheet

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Contractor _____ Email _____
 Phone _____ Fax _____
 Job Name _____
 Date _____ Location _____

VOLTAGE 120/240 1Ø 120/208 3Ø 277/480 3Ø
TYPE Natural Gas LP Vapor (LPV)
ELEC. SERVICE 100 Amp 200 Amp 400 Amp 600 Amp Other _____

Before installation contact local jurisdiction to confirm all requirements are met. Jurisdictions may vary. Generac recommends contacting local authorities prior to installation.

LOADS: Look for heavy building loads such as refrigeration, air conditioning, pumps or UPS systems.

Use the following for sizing and determining generator kW.

TABLE 6		Motor Load Table (refer to Table 1)			
Device	HP	RA	LRA	kW Running (= HP)	Starting kW ¹

¹ Starting kW for HP < 7.5 starting kW = HP x 3
 Starting kW for HP > 7.5 starting kW = HP x 2
 Starting kW for loading with no listed HP, calculate HP based on running amps in the chart on the right

QT Upgrade Required

These applications require an upgrade from the QT Series:

- NEC 695 Fire Pumps
- NEC 700 Emergency Systems
- NFPA 20 Fire Pumps
- NFPA 99 Healthcare
- NFPA 110 Emergency Systems

Reference Codes

Related Codes and Standards:

- NEC 225 Branch Circuits and Feeders
- NEC 240 Overcurrent Protection
- NEC 250 Grounding
- NEC 445 Generators
- NEC 701 Legally Required Standby
- NEC 702 Optional Standby
- NFPA 37 Installation & Use of Stationary Engines
- NFPA 54 National Fuel Gas Code
- NFPA 58 LP Gas Code

To Calculate kW (refer to page 2 for shortcut)

120 V 1Ø	Amps x 120/1000 = kW
240 V 1Ø	Amps x 240/1000 = kW
208 V 3Ø	Amps x 208 x √3 x PF/1000 = kW
240 V 3Ø	Amps x 240 x √3 x PF/1000 = kW
480 V 3Ø	Amps x 480 x √3 x PF/1000 = kW

PF is application power factor (worst case 1.0)

Resources in Sizing Guide

- Surge Capability Chart – References running amps of units and LRA
- Propane Tank Sizing Chart – Measures fuel consumption of generator units
- Motor Load Reference Guide – Reference guide for basic motor loads
- Non-Motor Load Reference Guide – Reference guide for non-motor loads
- Fuel Piping Sizing Chart – Assists in calculating adequate pipe size for natural gas and propane
- UPS - Generator Compatibility

TABLE 7		Non-Motor Load Table (refer to Table 2)	
Device	Amps	kW	

UPS Information

1.5 x kVA rating for a filtered system
 3 – 5 x kVA rating for an unfiltered system

Generac recommends you refer to the Generac UPS Generator Compatibility sheet and notify the manufacturer of the UPS system to assist in your installation.

Transfer Switch Availability

SE-RTS – 100 and 200 Amp service entrance rated

RTS – 100, 200, 400 Amp
RTS switch only works with R100 controller.

HTS – 100, 150, 200, 300, 400, 600, 800 Amp
HTS switch only works with H100 controller. Avail. in NEMA 1, NEMA 3R and NEMA 12. Refer to Generac product catalog for the appropriate transfer switch.

Recommended Generator Size _____ Refer to Generator Sizing Instructions on other side of this sheet.

INSTALL NOTES:

- Suggested concrete pad minimum thickness of 4" with 12" overhang on all sides. Fiberglass pad included with air-cooled products.
- Consult manual for installation recommendations.
- Consult local authority having jurisdiction for local requirements.

