GENERAC®

Generator Sizing Guide

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 supercede 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 worksheet pages can be removed from the book and 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 20 to 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.

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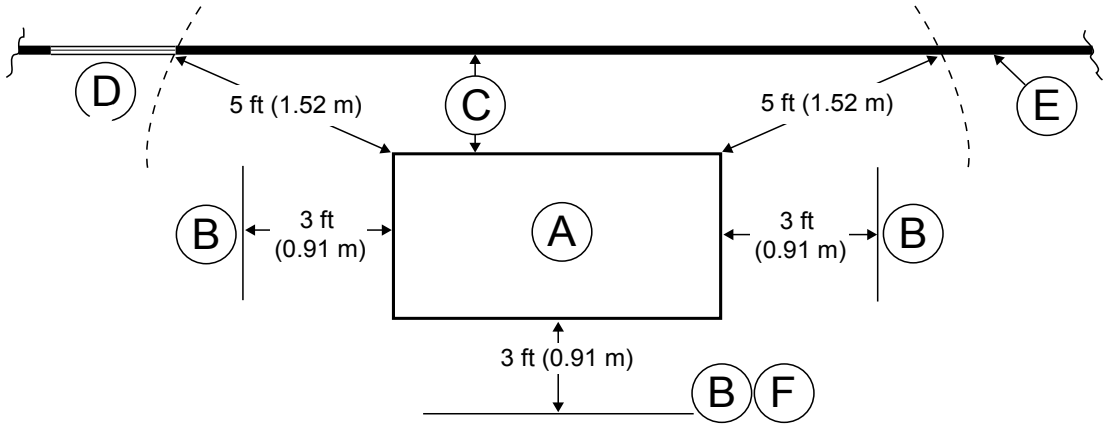
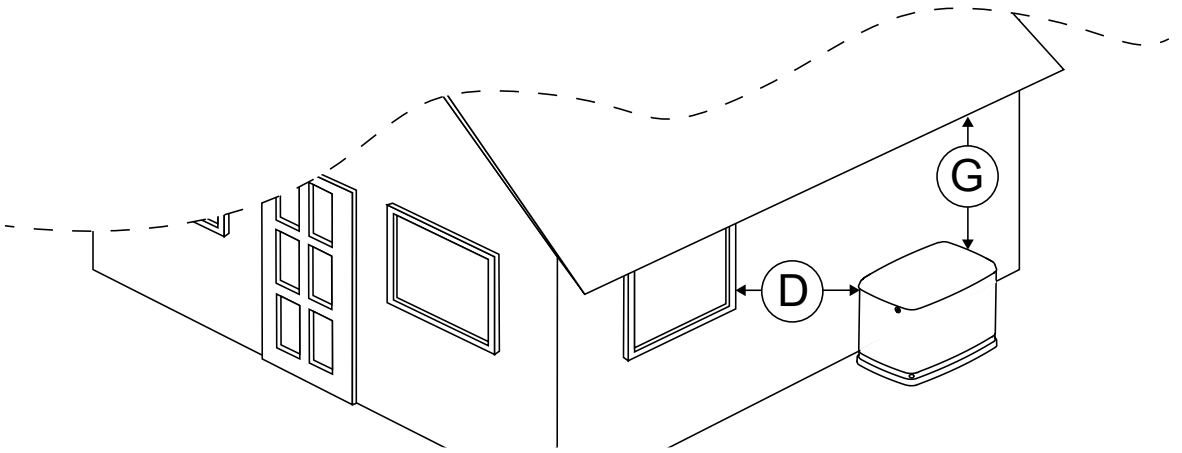
PLACEMENT DIAGRAM — AIR-COOLED GENERATORS





ID	Description	Comments
A	Top of generator	—
B	Front and end clearance	Minimum clear distances cannot include shrubs, bushes, or trees.
C	Rear clearance	18 in (45.7 cm) minimum clearance per NFPA testing, labeling, and listing, unless state or local codes dictate otherwise.
D	Windows and openings	No operable windows, doors, or openings in the wall are permitted within 5 ft (1.52 m) from any point of the generator.
E	Existing wall	One-hour fire rated walls allow closer placement of the generator set without approved enclosure. Confirm before installation.
F	Removable fence	Removable fence panels for servicing cannot be placed less than 3 ft (0.91 m) in front of the generator.
G	Overhead clearance	5 ft (1.52 m) minimum distance from any structure, overhang, or projections from the wall. DO NOT install under wooden decks or structures unless this distance is maintained.

TABLE 1 MOTOR LOAD REFERENCE

AC & Heat Pumps

		Running Load					Starting Load			
Description	**Hp**	**Running kW**	**Amps @ 240V 1Ø**	**Amps @ 208V 3Ø**	**Amps @ 240V 3Ø**	**Amps @ 480V 3Ø**	**LR Amps @ 240V 1Ø**	**LR Amps @ 208V 3Ø**	**LR Amps @ 240V 3Ø**	**LR Amps @ 480V 3Ø**
1 Ton (12,000 BTU)	1	1	5	3	3	1	33	22	19	10
2 Ton (24,000 BTU)	2	2	10	7	6	3	67	44	38	19
3 Ton (36,000 BTU)	3	3	15	10	8	4	100	67	58	29
4 Ton (48,000 BTU)	4	4	20	13	11	6	117	78	67	34
5 Ton (60,000 BTU)	5	5	25	16	14	7	145	97	84	42
7.5 Ton (85,000 BTU)	7.5	7.5	37	24	21	11	219	146	126	63
10 Ton* (120,000 BTU)	5 Hp (x2)	10	49	33	28	14	145	97	84	42
10 Ton (120,000 BTU)	10 Hp	10	49	33	28	14	250	167	144	72
15 Ton* (180,000 BTU)	7.5 Hp (x2)	15	74	49	42	21	219	146	126	63
15 Ton (180,000 BTU)	15 Hp	15	74	49	42	21	375	250	217	108
20 Ton* (240,000 BTU)	10 Hp (x2)	20	98	65	57	28	250	167	144	72
20 Ton (240,000 BTU)	20 Hp	20	n/a	65	57	28	500	333	289	144
25 Ton (300,000 BTU)	25	25	n/a	82	71	35	625	416	361	180
30 Ton* (360,000 BTU)	15 Hp (x2)	30	n/a	98	85	42	375	250	217	108
30 Ton (360,000 BTU)	30 Hp	30	n/a	98	85	42	750	500	433	217
40 Ton* (480,000 BTU)	20 Hp (x2)	40	n/a	131	113	57	500	333	289	144
40 Ton (480,000 BTU)	40 Hp	40	n/a	131	113	57	1000	666	577	289
50 Ton* (480,000 BTU)	25 Hp (x2)	50	n/a	163	142	71	625	416	361	180
50 Ton (480,000 BTU)	50 Hp	50	n/a	163	142	71	1250	833	722	361

*** For Multiple motor configurations, sequence starting is assumed.**

Air Conditioning
1 hp per 1 ton
1 ton = 12,000 BTUs

General Residential

		Running Load			Starting Load		
Description	**Hp**	**Running kW**	**Amps @ 120V 1Ø**	**4.9Amps @ 240V 1Ø**	**Starting kW**	**LR Amps @ 120V 1Ø**	**LR Amps @ 240V 1Ø**
Refrigerator pump, sump, 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

Residential

Description	Running Load*		
	kW	Amps at120V 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	10	n/a	50
Range oven/Stove top per burner	8	n/a	30
Electric hot water	4.5	n/a	19
General lighting and receptaclesper 1000 ft^2	3	24.9	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
Home Entertainment Center	1	8.3	n/a
Computer	1	8.3	n/a
Kitchen	1.5	12.5	n/a
Laundry	1.5	12.5	n/a

*Always check data plate for actual running amps.

Commercial

Please refer to equipment data plate and/or billing history for commercial details.

TABLE 3 SURGE CAPABILITY

Generac Air-cooled Generators

		Rated Output (Running Amps) LP / NG				Maximum Surge Capability (LR Amps @ 30% Voltage Dip)			
Size (kW)	RPM	240V 1Ø	208V 3Ø	240V 3Ø	480V 3Ø	240V 1Ø	208V 3Ø	240V 3Ø	480V 3Ø
7.5	3600	29/25	n/a	n/a	n/a	62	n/a	n/a	n/a
9	3600	33/29	n/a	n/a	n/a	70	n/a	n/a	n/a
11	3600	45/42	n/a	n/a	n/a	92	n/a	n/a	n/a
15 ECO	Varible	63/63	n/a	n/a	n/a	200	n/a	n/a	n/a
16	3600	66/66	n/a	n/a	n/a	130	n/a	n/a	n/a
20	3600	83/75	n/a	n/a	n/a	185	n/a	n/a	n/a
20 SYN	Varible	83/75	n/a	n/a	n/a	200	n/a	n/a	n/a
22	3600	92/81	n/a	n/a	n/a	210	n/a	n/a	n/a

Maximum power decreases about 3.5 percent for each 1,000 feet (304.8 meters) above sea level; and also will decrease about 1 percent for each 6 °C (10 °F) above 16 °C (60 °F)

Generac Liquid-cooled Generators

		Rated Output (Running Amps) LP / NG				Maximum Surge Capability (LR Amps @ 30% Voltage Dip)			
Size (kW)	RPM	240V 1Ø	208V 3Ø	240V 3Ø	480V 3Ø	240V 1Ø	208V 3Ø	240V 3Ø	480V 3Ø
RG 22	1800	92/92	76/76	66/66	n/a	135	92	80	n/a
RG 25	3600	104/104	87/87	75/75	n/a	170	130	112	n/a
RG 27	1800	113/104	94/87	81/75	n/a	170	120	103	n/a
RG 30	3600	125/125	104/104	90/90	n/a	180	155	134	n/a
RG 32	1800	133/133	111/111	96/96	48/48	180	210	182	87
RG 36	3600	150/146	125/121	108/105	54/53	240	130	115	60
RG 38	1800	158/158	132/132	114/114	57/57	180	210	182	87
RG 45	3600	188/188	156/156	135/135	68/68	240	130	115	60
RG 48	1800	200/200	167/167	144/144	72/72	195	218	189	87
RG 60	3600	250/250	208/208	180/180	90/90	320	210	182	91
QT 70	1800	292/267	242/232	210/201	105/101	356	471	408	201
QT 80	3600	333/333	278/278	240/240	120/120	435	466	404	175
QT 100	2300	417/371	347/326	300/282	150/141	413	452	392	261
QT 130	2970	542/488	451/423	390/367	195/183	648	885	767	390
QT 150	3600	625/625	520/493	451/427	225/214	1214	1334	1156	624

Temperature Deration:
3% for every 10 °C above 25 °C or 1.65% for every 10 °F above 77 °F

Altitude Deration (22, 25, 27, 30, 45,48, 70,100,130 & 150):
1% for every 100 m above 183 m or 3% for every 1000 ft above 600 ft

Altitude Deration (32,36,38, 60, & 80 kW):
1% for every 100 m above 915 m or 3% for every 1000 ft above 3000 ft

TABLE 3A SURGE CAPABILITY

Generac Protector Series Generators (diesel)

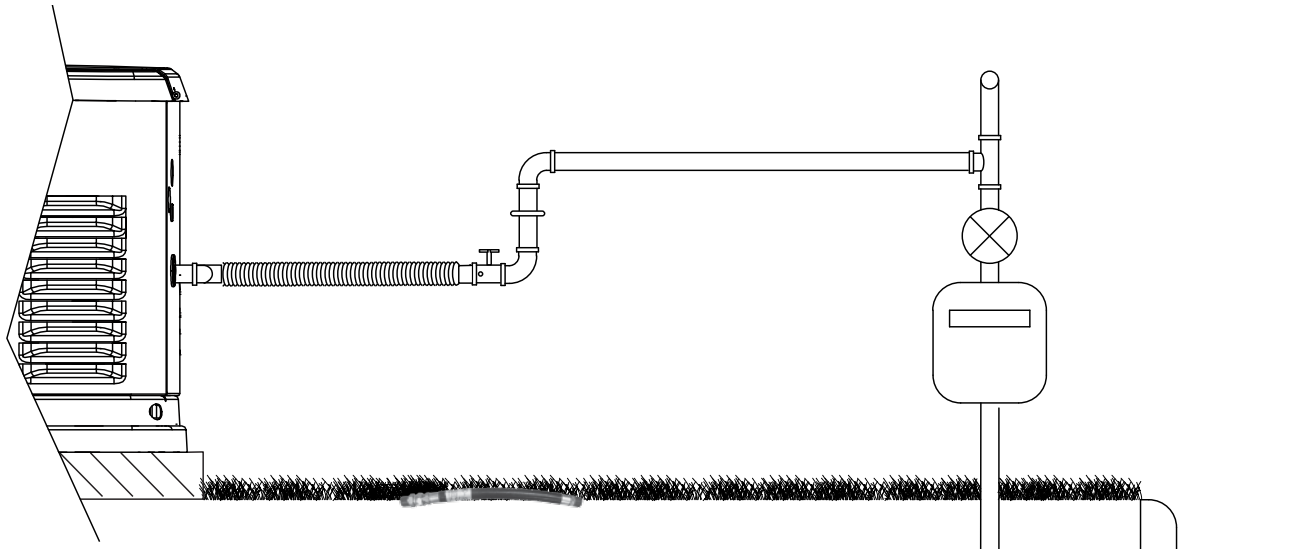
Rated Output (Running Amps)				
Size (kW)	240V 1 PH	208V 3 PH	240V 3 PH	480V 3 PH
15	62	52	45	n/a
20	83	69	60	n/a
30	125	104	90	45
48/50	200	173	150	75

Maximum Surge Capability (LR Amps @ 30% Voltage Dip)			
240V 1 PH	208V 3 PH	240V 3 PH	480V 3 PH
129	90	78	n/a
211	143	124	n/a
168	144	125	64
189	218	189	87

Fuel Consumption

Size (kW)	% of Rated Load	Gal/Hr	L/Hr	Total Capacity (Gal/L)	Usable Capacity (Gal/L)
15	25%	0.51	1.93	34 Gallons 128.7 Liters	32 Gallons 121.1 Liters
	50%	0.79	2.99		
	75%	1.14	4.31		
	100%	1.48	5.58		
20	25%	0.67	2.6	34 Gallons 128.7 Liters	32 Gallons 121.1 Liters
	50%	1.05	3.97		
	75%	1.52	5.32		
	100%	1.98	7.48		
30	25%	0.92	3.5	62 Gallons 234.7 Liters	57 Gallons 215.8 Liters
	50%	1.45	5.5		
	75%	1.96	7.4		
	100%	2.74	10.4		
48/50	25%	1.35	5.11	62 Gallons 234.7 Liters	57 Gallons 215.8 Liters
	50%	2.15	8.14		
	75%	3.06	11.58		
	100%	3.98	15.07		

NATURAL GAS INSTALLATION



FUEL INLET PRESSURE

SERIAL NUMBER 1234567

LP VAPOR
MIN. INLET PRESSURE: 10 In W.C.
MAX INLET PRESSURE: 12 In W.C.
MAX FLOW RATE: 17 Kw 325000BTY/HR

NATURAL GAS
MIN. INLET PRESSURE: 3.5 In W.C.
MAX INLET PRESSURE: 7 In W.C.
MAX FLOW RATE: 16 Kw 312000BTY/HR

FUEL PIPE SIZING NATURAL GAS

TABLE 4 Natural Gas 5" to 7" of Water Column

(½" Pressure Drop) (Table values are maximum pipe run in feet.)

5"–7" 7–22 kW
5"–14" RG22–60 kW
11"–14" 70-150 kW

kW	Pipe Size (inches)							
	0.5"	0.75"	1"	1.25"	1.5"	2"	2.5"	3"
7-9	10	60	200	750				
11		30	100	450				
15-16		10	35	140	300			
20-22		10	35	140	300			
RG 22		10	30	115	250			
25 & 30		10	50	200	450			
27			20	80	175	550		
32			20	90	175	600		
36			10	35	80	250		
38			10	70	150	500		
45				20	50	175	400	
48			10	30	75	250	600	
60				10	30	100	200	700
70				10	30	100	200	700
80				10	20	75	170	475
100				10	20	75	170	475
130					10	40	90	250
150					10	30	70	200

TABLE 4B Natural Gas 3.5" to 4.9" of Water Column

(Table values are maximum pipe run in feet.)

kW	Pipe Size (in)			
	0.75"	1"	1.25"	1.5"
7–9	20	60	175	
11		30	125	200
15–16		10	60	125
20-22		10	60	125

Natural Gas
1 cubic foot = 1,000 BTU
1 therm = 100,000 BTU
Gas consumption = 13,000-16,000 BTU per kW/hr

Pressure
1 inch mercury = 13.61 inches water column
1 inch Water Column = 0.036 psi
3.5–14 inches water column = 0.126 psi to 0.50 psi

Note:
- Pipe sizing is based on 0.5" H_2O pressure drop.
- Sizing includes a nominal number of elbows and tees.
- Please verify adequate service and meter sizing.
- Tables based on black pipe.

Note: Size the fuel pipe to the sizing charts or to local codes. When installing other than Sch. 40 black pipe, please refer to the manufactures sizing charts. The air-cooled generator is not a constant flow appliance, the fuel pipe was sized large enough to supply at least 100% of the generator BTU/hr rating.

LP VAPOR INSTALLATION

FUEL INLET PRESSURE

SERIAL NUMBER 1234567

LP VAPOR
MIN. INLET PRESSURE: 10 In W.C.
MAX INLET PRESSURE: 12 In W.C.
MAX FLOW RATE: 17 Kw 325000BTY/HR

NATURAL GAS
MIN. INLET PRESSURE: 3.5 In W.C.
MAX INLET PRESSURE: 7 In W.C.
MAX FLOW RATE: 16 Kw 312000BTY/HR

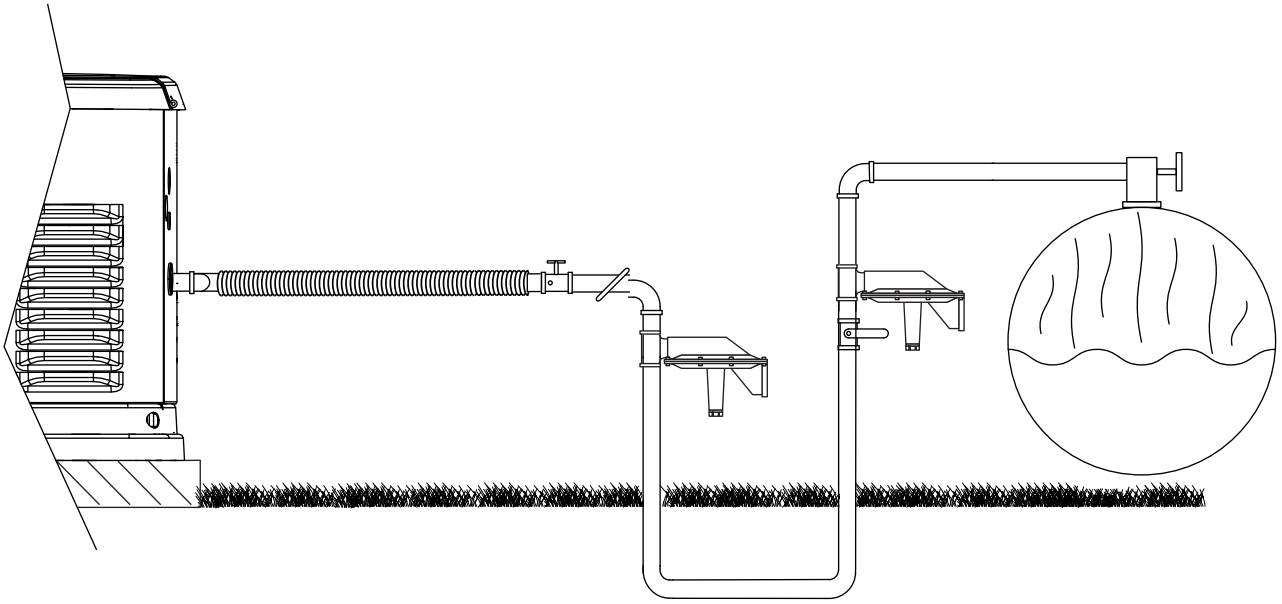


TABLE 5 FUEL PIPE SIZING LP VAPOR

kW	Pipe Size (inches)							
	0.5"	0.75"	1"	1.25"	1.5"	2"	2.5"	3"
7-9	35	175	600					
11	15	80	350					
15-16		40	175	550				
20-22		20	80	350				
RG 22		20	100	400				
25 & 30		50	200	800				
27		15	70	300	625			
32		10	60	280	550			
36			20	150	325	950		
38		10	35	200	450			
45			10	80	200	600		
48			10	80	200	600		
60			10	40	100	350		
70			10	40	100	350	700	
80				30	80	300	600	
100				20	60	275	550	
130				10	30	150	325	800
150				10	20	100	250	600

LP Vapor (LPV) 10" to 12" of Water Column

(½" Pressure Drop) (Table values are maximum pipe run in feet.)

LP

LPG: 8.55 ft^3/lb., 4.24 lbs./gal., 2500 btu/ft^3
LPG: 36.3 ft^3 = 1 gal.

Pressure

1 inch mercury = 13.61 inches water column
1 inch Water Column = 0.036 psi
11–14 inches water column = 0.396 psi to 0.50 psi

Note:
- Pipe sizing is based on 0.5" H_2O pressure drop.
- Sizing includes a nominal number of elbows and tees.
- Please verify adequate service and meter sizing.
- Tables based on black pipe.

Note: Size the fuel pipe to the sizing charts or to local codes. When installing other than Sch. 40 black pipe, please refer to the manufactures sizing charts. The air-cooled generator is not a constant flow appliance, the fuel pipe was sized large enough to supply at least 100% of the generator BTU/hr rating.

TABLE 6 LP VAPOR (LPV) TANK SIZING
Vapor Withdrawal

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

TABLE 7 GENERATOR FUEL CONSUMPTION

Generator kW Rating		Fuel Consumption at 100% BTU/HR			Fuel Consumption at 50% BTU/HR		
LP Vapor	Nat. Gas	LP Vapor		Nat. Gas	LP Vapor		Nat. Gas
		BTU/HR	GAL/HR	BTU/HR	BTU/HR	GAL/HR	BTU/HR
7.5	6	115,000	1.26	117,000	90,000	1	85,000
9	8	125,000	1.37	121,000	79,000	0.87	90,000
11	10	179,000	1.97	159,000	107,000	1.18	111,000
15 ECO	15 ECO	261,000	2.87	281,000	120,000	1.32	134,000
16	16	267,000	2.94	309,000	229,000	2.52	218,000
20	18	324,000	3.56	301,000	216,000	2.52	204,000
20 VSCF	18 VSCF	311,000	3.42	285,000	149,000	1.64	174,000
22	19.5	352,000	3.87	310,000	233,000	2.56	216,000
RG22	22	324,000	3.6	324,000	196,500	2.2	207,000
RG25	25	188,000	2.1	221,000	112,500	1.2	140,000
RG27	25	372,500	4.1	396,000	226,000	2.6	233,000
RG30	30	188,000	2.1	221,000	112,500	1.2	140,000
RG32	32	415,000	4.6	381,000	238,000	2.6	219,000
RG36	36	578,000	6.4	626,000	448,000	5	332,000
RG38	38	480,000	5.3	444,000	270,000	3	260,000
RG45	45	774,000	8.6	836,000	445,000	4.9	501,000
RG48	48	780,000	8.6	638,000	378,000	4.2	425,000
RG60	60	1,000,000	11	1,051,000	580,000	6.4	611,000
QT70	67	1,028,000	11.4	1,020,000	496,000	5.46	500,000
QT80	80	1,163,000	12.8	1,253,000	603,000	6.7	785,000
QT100	94	1,268,000	14	1,260,000	718,000	7.9	713,000
QT130	122	1,798,000	19.8	1,786,000	933,000	10.3	927,000
QT150	142	2,080,000	22.9	2,061,000	1,080,000	11.9	1,070,000

Gas Required for Common Appliances

APPLIANCE	Approximate Input BTU / Hr
Warm Air Furnace	
Single Family	60,000–120,000
Multifamily, per unit	40,000–60,000
Hydronic Boiler, Space Heating	
Single Family	80,000–140,000
Multifamily, per unit	50,000–80,000
Hydronic Boiler, Space and Water Heating	
Single Family	100,000–200,000
Multifamily, per unit	50,000–100,000
Range, Free Standing, Domestic	50,000–90,000
Built-In Oven or Broiler Unit, Domestic	14,000–16,000
Built-In Top Unit, Domestic	40,000–85,000
Water Heater, Automatic Storage,	
30 to 40 gal. Tank	25,000–50,000
Water Heater, Automatic Storage,	
50 gal. Tank	30,000–55,000
Water Healer, Automatic Storage,	
Instantaneous	
2.5 GPM	115,000–125,000
3 GPM	125,000–150,000
4 GPM	155,000–200,000
Water Heater, Domestic, Circulating or Side-Arm	
Refrigerator	1,500–2,000
Clothes Dryer, Type 1 (Domestic)	18,000–22,000
Gas Fireplace Direct Vent	20,000–90,000
Gas log	35,000–90,000
Barbecue	40,000–80,000
Gas light	1,400–2,800

Note: Tank BTU capacity and generator run times based upon maintaining a minimum tank fuel level of 20%. Tanks are typically filled to 80% full.

Note: Typical fuel consumption based on a generator 100% loaded.

Operating Cost Per Hour
=
NG Therms/HR x Cost of NG Therm

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. Minuteman UPS input tolerance is closer to 10–36%. 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 0.5 hertz. These units will need to have their frequency tolerance increased to a minimum of 2 hertz. Minuteman UPS products are close to 5 hertz and not 0.5 hertz.

Generator Sizing Recommendation:
Limit the total UPS loading to 15%–20% of the generator capacity.

Double-Conversion (also referenced as on-line)

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%. Minuteman UPS products could have current distortion of 8%. 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.
Single phase Minuteman UPS models: limit the total UPS loading to 50% 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.

UPS Information
2 x kVA rating for a filtered system
3–5 x kVA rating for an unfiltered system

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

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

UPS- GENERATOR COMPATIBILITY SIZING EXAMPLES

- UPS systems create electrical or harmonic noise, and this harmonic noise has to be taken into consideration when sizing a generator.
- The generator alternator has to be sized large enough to accept the Total UPS Load from the connected UPS systems.
- Undersizing the generator can cause damage to the UPS equipment, connected equipment, and/or generator.

The sizing formula for UPS systems is the following:

Number of Systems **X** VA Rating **X** Harmonic Multiplier **X** Generator Multiplier **=** Minimum Alternator Size

Single phase generator backing up 3, 2500 VA Line-Interactive UPS Systems with a Harmonic Multiplier of 3

Number of UPS Systems	3
VA Rating	2500
Harmonic Multiplier	3
Total UPS Load	22,500 VA
Generator Multiplier	4
Minimum Generator Alternator Size	*90,000 VA

(25% of the generator capacity)

**Note: Depending on any voltage and frequency adjustments with the UPS system, generator range is 80-100 kW*

3 Phase generator backing up 4, 10000 VA Double Conversion UPS Systems with a Harmonic Multiplier of 2

Number of UPS Systems	4
VA Rating	10000
Harmonic Multiplier	2
Total UPS Load	80,000 VA
Generator Multiplier	1.25
Minimum Generator Alternator Size	100,000 VA

(80% of the generator capacity)

Sizing Notes:

- Always contact the UPS manufacturer when in doubt of the Harmonic Multiplier for the UPS system.
- Always use the full VA rating of the UPS system for sizing calculations
- Limit Total UPS loading on single phase generators to 25% of the generators capacity
- Limit Total UPS loading on 3 phase generators to 80% of the generators capacity

TYPICAL GENERATOR/TRANSFER SWITCH COMBINATIONS

Current Model - Evolution	Current Switch model #	Description	Prior Models (5/10-3/13)	Prior Switch Model # (*see note)

Evolution models / transfer switches and prior models / transfer switches listed CAN be used together.

		9 kW Air-Cooled Generator - Aluminum		
7029	RTG10EZA1	10 Circuit Pre-wired Switch	**6245**	RTS10EZA1
	RTG16EZA3	100 amp 16 Circuit Switch NEMA 3R		
7030	RTSC100A3	100 amp Normal Smart Switch	**6237**	RTSX100A3
	RTSE100A3CSA	100 amp CSA Service Rated Switch		RTSE100A3CSA

		11 kW Air-Cooled Generator - Aluminum		
	RTG12EZA1	12 Circuit Pre-wired Switch		RTS10EZA1
	RTG16EZA3	100 amp 16 Circuit Switch NEMA 3R		
	RTSC100A3	100 amp Normal Smart Switch	**6439**	RTSX100A3
7031	RTSW100A3	100 amp Service Rated Smart Switch		RTSR100A3
	RTSW150A3	150 amp Service Rated Smart Switch	**6437**	RTSR150A3
7032	RTSC200A3	200 amp Normal Smart Switch		RTSR200A3
	RTSW200A3	200 amp Service Rated Smart Switch	**6438**	RTSR200A3
7033	5449	GenReady Load Center NEMA 1		5449
	5454	GenReady Load Center NEMA 3R		5454
	5448	Basic GenReady Load Center		5448
	RTSE100A3CSA	100 amp CSA Service Rated Switch		RTSE100A3CSA
	RTSE200A3CSA	200 amp CSA Service Rated Switch		RTSE200A3CSA

		15 kW EcoGen Air-Cooled Generator - Aluminum		
7034	RTSB200A3	200 amp Service Rated Smart Switch	**6103**	
	RTSI200A3	200 amp Normal Smart Switch		

		16/16 kW Air-Cooled Generator - Aluminum		
	RTG16EZA1	16 Circuit Pre-wired Switch		RTS16E2A1
	RTG16EZA3	100 amp 16 Circuit Switch NEMA 3R		
7035	RTSC100A3	100 amp Normal Smart Switch	**6459**	RTSX100A3
	RTSW100A3	100 amp Service Rated Smart Switch		RTSR100A3
7036	RTSW150A3	150 amp Service Rated Smart Switch	**6461**	RTSR150A3
	RTSC200A3	200 amp Normal Smart Switch		RTSX200A3
7037	RTSW200A3	200 amp Service Rated Smart Switch	**6462**	RTSR200A3
	5449	GenReady Load Center NEMA 1		5449
	5454	GenReady Load Center NEMA 3R	**6721**	5454
	5448	Basic GenReady Load Center		5448
	RTSE100A3CSA	100 amp CSA Service Rated Switch		RTSE100A3CSA
	RTSE200A3CSA	200 amp CSA Service Rated Switch		RTSE200A3CSA

		20 kW Synergy Air-Cooled Generator - Aluminum		
7040	RTSB200A3	200 amp Service Rated Smart Switch	**6055**	
70241	RTSI200A3	200 amp Normal Smart Switch	**6089**	

		20 kW Air-Cooled Generator - Aluminum		
	RTG16EZA3	100 amp 16 Circuit Switch NEMA 3R		
	RTSC100A3	100 amp Normal Smart Switch		RTSX100A3
	RTSW100A3	100 amp Service Rated Smart Switch		RTSR100A3
	RTSW150A3	150 amp Service Rated Smart Switch		RTSR150A3
7038	RTSC200A3	200 amp Normal Smart Switch	**6729**	RTSX200A3
	RTSW200A3	200 amp Service Rated Smart Switch		RTSR200A3
7039	5449	GenReady Load Center NEMA 1	**6730**	5449
	5454	GenReady Load Center NEMA 3R		5454
	5448	Basic GenReady Load Center		5448
	RTSE100A3CSA	100 amp CSA Service Rated Switch		RTSE100A3CSA
	RTSE200A3CSA	200 amp CSA Service Rated Switch		RTSE200A3CSA

		22 kW Air-Cooled Generator - Aluminum		
	RTG16EZA3	100 amp 16 Circuit Switch NEMA 3R		
	RTSC100A3	100 amp Normal Smart Switch		RTSX100A3
	RTSW100A3	100 amp Service Rated Smart Switch		RTSR100A3
	RTSW150A3	150 amp Service Rated Smart Switch		RTSR150A3
7042	RTSC200A3	200 amp Normal Smart Switch	**6551**	RTSX200A3
	RTSW200A3	200 amp Service Rated Smart Switch		RTSR200A3
7043	5449	GenReady Load Center NEMA 1	**6552**	5449
	5454	GenReady Load Center NEMA 3R		5454
	5448	Basic GenReady Load Center		5448
	RTSE100A3CSA	100 amp CSA Service Rated Switch		RTSE100A3CSA
	RTSE200A3CSA	200 amp CSA Service Rated Switch		RTSE200A3CSA

TYPICAL GENERATOR/TRANSFER SWITCH COMBINATIONS

Current Model - Evolution	Current Switch model #	Description	Prior Models (5/10-3/13)	Prior Switch Model # (*see note)
Evolution models / transfer switches and prior models / transfer switches listed CAN be used together.				
		22 kW Liquid-Cooled Generator, 1phase - Aluminum		
		25 kW Liquid-Cooled Generator, 1phase - Steel		
		27 kW Liquid-Cooled Generator, 1phase - Steel		
		30 kW Liquid-Cooled Generator, 1phase - Steel		
	RTSC100A3	100 amp Normal Smart Switch*		RTSX100A3
RG02224ANAX	RTSW100A3	100 amp Service Rated Smart Switch*	**QT02224ANAN**	RTSR100A3
RG02516ANSX	RTSW150A3	150 amp Service Rated Smart Switch	**QT02516ANSN**	RTSR150A3
RG02724ANAX	RTSC200A3	200 amp Normal Smart Switch	**QT02724ANAN**	RTSX200A3
RG03016ANSX	RTSW200A3	200 amp Service Rated Smart Switch	**QT03016ANSN**	RTSR200A3
	5449	GenReady Load Center NEMA 1		5449
	5454	GenReady Load Center NEMA 3R		5454
	5448	Basic GenReady Load Center		5448
	RTSE100A3CSA	100 amp CSA Service Rated Switch		RTSE100A3CSA
	RTSE200A3CSA	200 amp CSA Service Rated Switch		RTSE200A3CSA
		36 kW Liquid-Cooled Generator - Aluminum		
	RTSC100A3	100 amp Normal Smart Switch*		RTSX100A3
	RTSW100A3	100 amp Service Rated Smart Switch*		RTSR100A3
RG03624ANAX	RTSW150A3	150 amp Service Rated Smart Switch	**QT03624ANAN**	RTSR150A3
	RTSC200A3	200 amp Normal Smart Switch		RTSX200A3
	RTSW200A3	200 amp Service Rated Smart Switch		RTSR200A3
	RTSE100A3CSA	100 amp CSA Service Rated Switch		RTSE100A3CSA
	RTSE200A3CSA	200 amp CSA Service Rated Switch		RTSE200A3CSA
		45 kW Liquid-Cooled Generator - Steel		
RG04524ANSX	RTSC200A3	200 amp Normal Smart Switch	**QT04524ANSN**	RTSX200A3
	RTSW200A3	200 amp Service Rated Smart Switch		RTSR200A3
	RTSE200A3CSA	200 amp CSA Service Rated Switch		RTSE200A3CSA
		48 kW Liquid-Cooled Generator - Aluminum		
	RTSC100A3	100 amp Normal Smart Switch*		RTSX100A3
	RTSW100A3	100 amp Service Rated Smart Switch*		RSSD100A3
RG04842ANAX	RTSC200A3	200 amp Normal Smart Switch	**QT04842ANAN**	RTSX200A3
	RTSW200A3	200 amp Service Rated Smart Switch		RTSR200A3
	RTSE100A3CSA	100 amp CSA Service Rated Switch		RTSE100A3CSA
	RTSE200A3CSA	200 amp CSA Service Rated Switch		RTSE200A3CSA
	RTSC400A3	400 amp Normal Smart Switch		RTSE200A3CSA
		60 kW Liquid-Cooled Generator -		
RG06024ANSX*	RTSC100A3	100 amp Normal Smart Switch*		RTSX100A3
*This model available	RTSW100A3	100 amp Service Rated Smart Switch*	**QT06024ANSN**	RTSR100A3
in Steel or Aluminum;	RTSC200A3	200 amp Normal Smart Switch*		RTSX200A3
Natural Gas or LP	RTSW200A3	200 amp Service Rated Smart Switch*		RTSR200A3
	RTSC400A3	400 amp Normal Smart Switch		RTSX400A3

RTS 100–200 amp*	**22–48 kW Liquid-Cooled Generator - 3Ø service rated**	**100–200 amp***
RTS 100–400 amp*	**22–60 kW Liquid-Cooled Generator - 3Ø options**	**100–400 amp***
RTS 100–800 amp*	**70–150 kW Liquid-Cooled Generator - 1 & 3Ø options**	**100–800 amp***

* See NEC Article 240.21(B)

NEC (700, 701, 702) Comparison

NEC Comparison Table to be used as a general guideline in determining the proper generator for specific applications. Refer to architectural documents for final selection.

		Article 700 - Emergency	Article 701 - Standby	Article 702 - Optional Standby
	Scope	Legally required life safety	Legally required critical support (fire fighting, health hazards, etc)	Protect property & facilities
	Equipment Approval	For Emergency / (UL2200)	For Intended Use / (UL2200)	For Intended Use / (UL2200) / Not in 2008
Testing	Witness Testing (on-sight)	At install & periodically	At install	None
Testing	Periodic Testing	Yes	Yes	None
Testing	Battery Maintenance	Yes	Yes	None
Testing	Maintenance Records	Yes	Yes	None
Testing	Load Testing	Yes	Yes	None
	Capacity	All Loads	All loads intended to operate at one time	All loads intended to operate at one time / Not in 2008
	Other Standby Loads Allowed	Yes with load shedding	Yes with load shedding	2008 – Yes with load shedding
	Peak Shaving Allowed	Yes ??	Yes	Yes
Transfer Switch	Automatic	Yes	Yes	No
Transfer Switch	Equipment Approval	For Emergency / (UL1008)	For Standby / (UL1008)	For Intended Use / (UL1008)
Transfer Switch	Means to Permit Bypass	Yes	No	No
Transfer Switch	Elect. Operated - Mech. Held	Yes	No	No
Transfer Switch	Other loads	No	Yes with load shedding	N/A
Transfer Switch	Max. Fault Current Capable	Yes	Yes	Yes
Signals (Audible & Visual)	Derangement	Yes / Standard common alarm	Yes / Standard common alarm	Yes / Standard common alarm
Signals (Audible & Visual)	Carrying Load	Yes / Displayed at ATS	Yes / Displayed at ATS	Yes / Displayed at ATS
Signals (Audible & Visual)	Battery Charger Failed	Yes	Yes	No
Signals (Audible & Visual)	Ground Fault Indication	Yes (480V & 1000A)	No	No
Signals (Audible & Visual)	NFPA 110 Signaling	Yes / Optional annunciator	Yes / Optional annunciator	No
Signs	At service	Yes / Type & location	Yes / Type & location	Yes / Type & location
Signs	At neutral to ground bonding	Yes (if remote)	Yes (if remote)	Yes (if remote)
	Wiring kept independent	Yes	No	No
	Fire protection (ref 700-9d)	Yes (1000 persons or 75' building)	No	No
	Maximum power outage	10 sec	60 sec	N/A
	Retransfer delay	15 min setting	15 min setting	No
	Automatic starting	Yes	Yes	No
	On-site fuel requirements	2 hours (see NFPA 110)	2 hours	None
	Battery charger	Yes	Yes	No
	Ground Fault	Indication Only	No	No

Electrical Formulas

TO FIND	KNOWN VALUES	1-PHASE	3-PHASE
KILOWATTS (kW)	Volts, Current, Power Factor	$\frac{E \times I}{1000}$	$\frac{E \times I \times 1.73 \times PF}{1000}$
KVA	Volts, Current	$\frac{E \times I}{1000}$	$\frac{E \times I \times 1.73}{1000}$
AMPERES	kW, Volts, Power Factor	$\frac{kW \times 1000}{E}$	$\frac{kW \times 1000}{E \times 1.73 \times PF}$
WATTS	Volts, Amps, Power Factor	Volts x Amps	E x I x 1.73 x PF
NO. OF ROTOR POLES	Frequency, RPM	$\frac{2 \times 60 \times Frequency}{RPM}$	$\frac{2 \times 60 \times frequency}{RPM}$
FREQUENCY	RPM, No. of Rotor Poles	$\frac{RPM \times Poles}{2 \times 60}$	$\frac{RPM \times Poles}{2 \times 60}$
RPM	Frequency, No. of Rotor Poles	$\frac{2 \times 60 \times Frequency}{Rotor\ Poles}$	$\frac{2 \times 60 \times Frequency}{Rotor\ Poles}$
kW (required for Motor)	Motor Horsepower, Efficiency	$\frac{HP \times 0.746}{Efficiency}$	$\frac{HP \times 0.746}{Efficiency}$
RESISTANCE	Volts, Amperes	$\frac{E}{I}$	$\frac{E}{I}$
VOLTS	Ohms, Amperes	I x R	I x R
AMPERES	Ohms, Volts	$\frac{E}{R}$	$\frac{E}{R}$

E = VOLTS I = AMPERES R = RESISTANCE (OHMS) PF = POWER FACTOR

NOTES

U.S. WEIGHTS AND MEASURES

LINEAR MEASURE

			1	INCH	=	2.540 CENTIMETERS
12	INCHES	=	1	FOOT	=	3.048 DECIMETERS
3	FEET	=	1	YARD	=	9.144 DECIMETERS
5.5	YARDS	=	1	ROD	=	5.029 METERS
40	RODS	=	1	FURLONG	=	2.018 HECTOMETERS
8	FURLONGS	=	1	MILE	=	1.609 KILOMETERS

MILE MEASUREMENTS

1	STATUTE MILE	=	5,280	FEET
1	SCOTS MILE	=	5,952	FEET
1	IRISH MILE	=	6,720	FEET
1	RUSSIAN VERST	=	3,504	FEET
1	ITALIAN MILE	=	4,401	FEET
1	SPANISH MILE	=	15,084	FEET

OTHER LINEAR MEASUREMENTS

1	HAND	= 4	INCHES	1	LINK	= 7.92	INCHES
1	SPAN	= 9	INCHES	1	FATHOM	= 6	FEET
1	CHAIN	= 22	YARDS	1	FURLONG	= 10	CHAINS
				1	CABLE	= 608	FEET

SQUARE MEASURE

144	SQUARE INCHES	=	1	SQUARE FOOT
9	SQUARE FEET	=	1	SQUARE YARD
30¼	SQUARE YARDS	=	1	SQUARE ROD
40	RODS	=	1	ROOD
4	ROODS	=	1	ACRE
640	ACRES	=	1	SQUARE MILE
1	SQUARE MILE	=	1	SECTION
36	SECTIONS	=	1	TOWNSHIP

CUBIC OR SOLID MEASURE

1	CU. FOOT	=	1728	CU. INCHES
1	CU. YARD	=	27	CU. FEET
1	CU. FOOT	=	7.48	GALLONS
1	GALLON (WATER)	=	8.34	LBS.
1	GALLON (U.S.)	=	231	CU. INCHES OF WATER
1	GALLON (IMPERIAL)	=	277¼	CU. INCHES OF WATER

METRIC SYSTEM

PREFIXES:

A.	MEGA	=	1,000,000	E.	DECI	=	0.1
B.	KILO	=	1,000	F.	CENTI	=	0.01
C.	HECTO	=	100	G.	MILLI	=	0.001
D.	DEKA	=	10	H.	MICRO	=	0.000001

LINEAR MEASURE:

(THE UNIT IS THE METER = 39.37 INCHES)

1	CENTIMETER	= 10	MILLIMETERS	=	0.3937011	IN.
1	DECIMETER	= 10	CENTIMETERS	=	3.9370113	INS.
1	METER	= 10	DECIMETERS	=	1.0936143	YDS.
				=	3.2808429	FT.
1	DEKAMETER	= 10	METERS	=	10.936143	YDS.
1	HECTOMETER	= 10	DEKAMETERS	=	109.36143	YDS.
1	KILOMETER	= 10	HECTOMETERS	=	0.62137	MILE
1	MYRIAMETER	= 10,000 METERS				

SQUARE MEASURE:

(THE UNIT IS THE SQUARE METER = 1549.9969 SQ. INCHES)

1	SQ. CENTIMETER	= 100	SQ. MILLIMETERS	= 0.1550	SQ. IN.
1	SQ. DECIMETER	= 100	SQ. CENTIMETERS	= 15.550	SQ. INS.
1	SQ. METER	= 100	SQ. DECIMETERS	= 10.7639	SQ. FT.
1	SQ. DEKAMETER	= 100	SQ. METERS	= 119.60	SQ. YDS.
1	SQ. HECTOMETER	= 100	SQ. DEKAMETERS		
1	SQ. KILOMETER	= 100	SQ. HECTOMETERS		

(THE UNIT IS THE "ARE" = 100 SQ. METERS)

1	CENTIARE	= 10	MILLIARES	=	10.7643	SQ. FT.
1	DECIARE	= 10	CENTIARES	=	11.96033	SQ. YDS.
1	ARE	= 10	DECIARES	=	119.6033	SQ. YDS.
1	DEKARE	= 10	ARES	=	0.247110	ACRES
1	HEKTARE	= 10	DEKARES	=	2.471098	ACRES
1	SQ. KILOMETER	= 100	HEKTARES	=	0.38611	SQ. MILE

CUBIC MEASURE:

(THE UNIT IS THE "STERE" = 61,025.38659 CU. INS.)

1	DECISTERE	= 10	CENTISTERES	=	3.531562	CU. FT.
1	STERE	= 10	DECISTERES	=	1.307986	CU. YDS.
1	DEKASTERE	= 10	STERES	=	13.07986	CU. YDS.

METRIC SYSTEM

CUBIC MEASURE:

(THE UNIT IS THE METER = 39.37 INCHES)

1 CU. CENTIMETER	= 1000 CU. MILLIMETERS	=	0.06102 CU. IN.
1 CU. DECIMETER	= 1000 CU. CENTIMETERS	=	61.02374 CU. IN.
1 CU. METER	= 1000 CU. DECIMETERS	=	35.31467 CU. FT.
	= 1 STERE	=	1.30795 CU. YDS.
1 CU. CENTIMETER (WATER)		=	1 GRAM
1000 CU. CENTIMETERS (WATER)	= 1 LITER	=	1 KILOGRAM
1 CU. METER (1000 LITERS)		=	1 METRIC TON

MEASURES OF WEIGHT:

(THE UNIT IS THE GRAM = 0.035274 OUNCES)

1	MILLIGRAM	=		=	0.015432 GRAINS
1	CENTIGRAM	= 10	MILLIGRAMS	=	0.15432 GRAINS
1	DECIGRAM	= 10	CENTIGRAMS	=	1.5432 GRAINS
1	GRAM	= 10	DECIGRAMS	=	15.4323 GRAINS
1	DEKAGRAM	= 10	GRAMS	=	5.6438 DRAMS
1	HECTOGRAM	= 10	DEKAGRAMS	=	3.5274 OUNCES
1	KILOGRAM	= 10	HECTOGRAMS	=	2.2046223 POUNDS
1	MYRIAGRAM	= 10	KILOGRAMS	=	22.046223 POUNDS
1	QUINTAL	= 10	MYRIAGRAMS	=	1.986412 CWT.
1	METRIC TON	= 10	QUINTAL	=	2204.6226 / 21849 POUNDS
1	GRAM	= 0.56438	DRAMS		
1	DRAM	= 1.77186	GRAMS		
		= 27.3438	GRAINS		
1	METRIC TON	= 2,204.6223	POUNDS		

MEASURES OF CAPACITY:

(THE UNIT IS THE LITER = 1.0567 LIQUID QUARTS)

1	CENTILITER	= 10	MILLILITERS	=	0.338	FLUID OUNCES
1	DECILITER	= 10	CENTILITERS	=	3.38	FLUID OUNCES
1	LITER	= 10	DECILITERS	=	33.8	FLUID OUNCES
1	DEKALITER	= 10	LITERS	=	0.284	BUSHEL
1	HECTOLITER	= 10	DEKALITERS	=	2.84	BUSHELS
1	KILOLITER	= 10	HECTOLITERS	=	264.2	GALLONS

NOTE: $\frac{\text{KILOMETERS}}{8} \times 5 = \text{MILES}$ or $\frac{\text{MILES}}{5} \times 8 = \text{KILOMETERS}$

METRIC DESIGNATOR AND TRADE SIZES

METRIC DESIGNATOR												
12	16	21	27	35	41	53	63	78	91	103	129	155
⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6
TRADE SIZE												

U.S. WEIGHTS & MEASURES / METRIC EQUIVALENT CHART

	In.	Ft.	Yd.	Mile	Mm	Cm	M	Km
1 Inch =	1	.0833	.0278	1.578×10^{-5}	25.4	**2.54**	.0254	2.54×10^{-3}
1 Foot =	12	1	.333	1.894×10^{-4}	304.8	**30.48**	.3048	3.048×10^{-4}
1 Yard =	36	3	1	5.6818×10^{-4}	914.4	91.44	**.9144**	9.144×10^{-4}
1 Mile =	63,360	5,280	1,760	1	1,609,344	160,934.4	1,609.344	**1.609344**
1 mm =	**.03937**	.0032808	1.0936×10^{-3}	6.2137×10^{-7}	1	0.1	0.001	0.000001
1 cm =	**.3937**	.0328084	.0109361	6.2137×10^{-6}	10	1	0.01	0.00001
1 m =	39.37	3.28084	**1.09361**	6.2137×10^{-4}	1000	100	1	0.001
1 km =	39,370	3,280.84	1,093.61	**0.62137**	1,000,000	100,000	1,000	1

In. = Inches Ft. = Foot Yd. = Yard Mi. = Mile Mm = Millimeter Cm = Centimeter M = Meter Km = Kilometer

EXPLANATION OF SCIENTIFIC NOTATION:

Scientific Notation is simply a way of expressing very large or very small numbers in a more compact format. Any number can be expressed as a number between 1 & 10, multiplied by a power of 10 (which indicates the correct position of the decimal point in the original number). Numbers greater than 10 have positive powers of 10, and numbers less than 1 have negative powers of 10.

Example: $186{,}000 = 1.86 \times 10^5$ $0.000524 = 5.24 \times 10^{-4}$

USEFUL CONVERSIONS / EQUIVALENTS

1	BTU	Raises 1 LB. of water 1°F
1	GRAM CALORIE	Raises 1 Gram of water 1°C
1	CIRCULAR MIL	Equals 0.7854 sq. mil
1	SQ. MIL	Equals 1.27 cir. mils
1	MIL	Equals 0.001 in.

To determine circular mil of a conductor:

ROUND CONDUCTOR ..... CM = (Diameter in mils)²

BUS BAR ..... $\text{CM} = \frac{\text{Width (mils)} \times \text{Thickness (mils)}}{0.7854}$

NOTES: 1 Millimeter = 39.37 Mils 1 Cir. Millimeter = 1550 Cir. Mils
1 Sq. Millimeter = 1974 Cir. Mils

perferated pages start here

Selected Circuit Load Calculator

Contractor_____ Email _____

Phone_____ Fax _____

Job Name _____

Date_____ Location _____

VOLTAGE ☐ 120/240 1Ø ☐ 120/208 3Ø ☐ 120/240 3Ø ☐ 277/480 3Ø

TYPE ☐ Natural Gas ☐ LP Vapor (LPV)

ELEC. SERVICE ☐ 100 Amp ☐ 150 Amp ☐ 200 Amp ☐ 300 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 8 Motor Load Table (refer to Table 1)

Device	HP	RA	LRA	kW Running (= HP)	Starting kW[1]

[1] See Table 430.7(B) for staring kVA per HP for motor loads.

Applications

The QT Series does not meet the necessary requirements for the following applications:

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 700	Emergency Systems
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
ICC	Fuel Gas Code

To Calculate kW	
120 V 1ø	Amps x 120/1000 = kW
240 V 1ø	Amps x 240/1000 = kW
208 V 3ø	(Amps x 208 x 1.732 x PF) /1000 = kW
240 V 3ø	(Amps x 240 x 1.732 x PF) /1000 = kW
480 V 3ø	(Amps x 480 x 1.732 x PF) /1000 = kW

PF is application power factor (worst case 1.0)
Typical application power factor is 0.95.

TABLE 9 Non-Motor Load Table (refer to Table 2)

Device	Amps	kW

Transfer Switch Availability

RTSW – 100, 150, 200, 300 and 400 Amp service rated

RTSN – 100–800 3ø and 600–800 1ø Amp

RTSC – 100, 200, 400, 600, 800 Amp

GenReady – 200 Amp service panel
RTS and GenReady switches only work with the Evolution or Nexes Controller.

RECOMMENDED GENERATOR SIZE _____ Refer to Generator Sizing Instructions on other side of this sheet.

Install Notes:

1. Consult manual for installation recommendations.
2. Consult local authority having jurisdiction for local requirements.

Selected Circuit Load Calculator

GENERAC

Generator Sizing Instructions:

There is not a single correct sizing solution. Following are several methods that, when mixed with good judgement, should result in an appropriately sized generator. Remember to consider load growth, seasonality, and effects of starting motors.

As municipalities and states adopt the new 2017 NEC Electrical Code, there may be new sizing requirements, spelled out in the code book, which the installation technician must follow. Always check with the local inspection department to confirm which code cycle will affect your install.

Never add Amps when sizing a generator. Convert Amps to kW and add kW to determine the required generator size. Power factors for various motor loads vary widely. Adding Amps without properly accounting for the power factor and/or mixing voltages will result in improperly sizing the generator.

When motors start, they create a current surge that step loads the generator and creates a voltage dip. After selecting a generator, reference the generator's surge capability using **table 3**. Verify that voltage dip is adequate for the application. Most commercial applications should be limited to about 15% voltage dip and residential applications should be limited to a 30% voltage dip.

Some applications utilize an uninterruptible power supply (UPS) to back up critical loads. Please read sizing guide for this load type.

Measurement Method 220.87 Exception NEC 2017

Connect a recording ammeter or power meter that is capable of measuring the maximum peak kW demand continuously over a minimum 30 day period. The maximum kW demand shall be taken while the building is occupied and shall include the larger of the heating or cooling loads. The peak kW demand shall be multiplied by 125%.

Peak kW demand X 125% = Calculated kW demand

Size the generator to the next standard size and verify UPS and motor load compatibility.

Determining Existing Loads/Billing History Method 220.87 NEC 2017

Many customers have a utility rate structure that has a peak demand charge. Using a year's worth of electric bills, size the generator 25% larger than the largest peak demand.

Verify motor and UPS load compatibility. Peak Demand = _____

Load Summation Method

1) Enter running kW for all motor loads (except the largest) expected to run during peak load levels into **table 8**. Refer to **table 1** for typical motor load sizes and electrical requirements.

2) Enter kW for all non-motor loads expected to run during peak load levels into **table 9**. Refer to **table 2** for typical residential loads and rules of thumb.

3) Add the running motor load kW, non-motor load kW, and the starting kW of the largest motor load.

Motor load running total (minus largest motor): _____ kW (ref. table 8)
Non-motor load total: _____ kW (ref. table 9)
Starting load from largest cycling motor: _____ kW (ref. table 8)
Total electrical loads: =_____ kW

Select generator: Commercial (add 20 to 25% to total kW)
Residential (add 10 to 20% to total kW)

4) Confirm that voltage dip is within acceptable limits by comparing motor LRA to generator surge capability (see table #3).

5) Confirm UPS compatibility (see page 11).

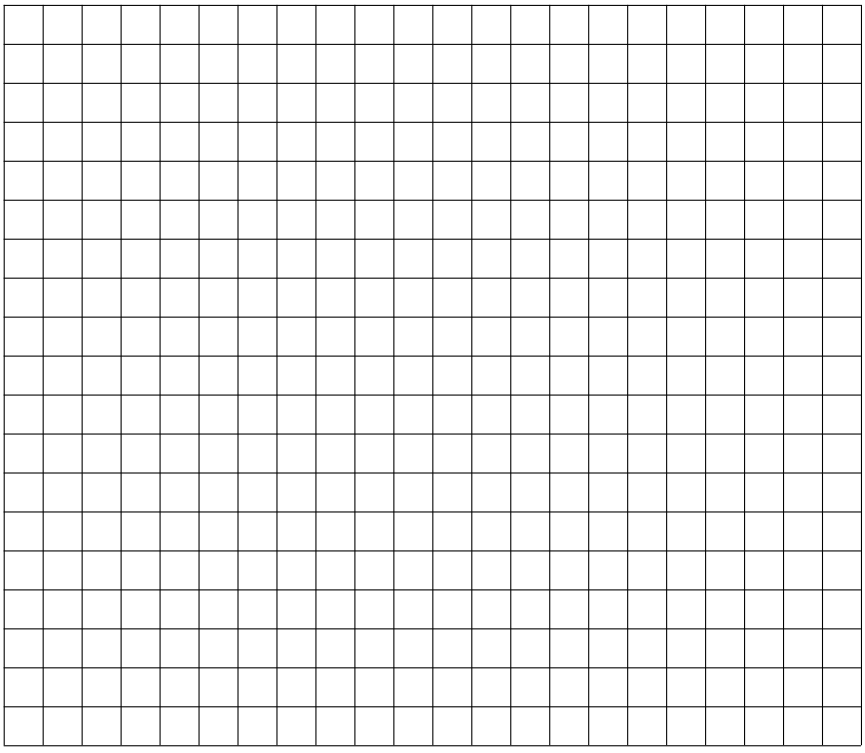
System Capacity – Load Calculation

If the local municipality or state you are in has adopted the 2017 NEC Code, you may be required to use this step. Article 702 of the 2017 NEC includes a new requirement for sizing (702.4). If no other method for sizing is acceptable, sizing of the generator shall be made in accordance with Article 220 of the NEC. The system capacity estimating sheet will guide you through this process.

SMM Load Control Module 702.4 (B) (2) (a) NEC 2017

The SMM Load Control Module is a 50 amp contact housed in a NEMA 3R enclosure for indoor and outdoor installation applications. Through the use of the SMM Modules in conjunction with any of the 100–600 amp Smart Switches, household or business loads can be intelligently managed enabling the use of a smaller, more efficient generator system. Up to four SMM Modules can be used with a single switch.

Project Layout



Ball Park Estimates (Do not use for final sizing)

Estimate based on 60% service size: (commercial)

240 Volts, 1 Ø: _____ Amps x .15 = _____ kW
208 Volts, 3 Ø: _____ Amps x .22 = _____ kW
240 Volts, 3 Ø: _____ Amps x .25 = _____ kW
480 Volts, 3 Ø: _____ Amps x .50 = _____ kW

Estimate based on 40% service size: (residential)

240 Volts, 1 Ø: _____ Amps x .10 = _____ kW
208 Volts, 3 Ø: _____ Amps x .15 = _____ kW
240 Volts, 3 Ø: _____ Amps x .17 = _____ kW
480 Volts, 3 Ø: _____ Amps x .34 = _____ kW

Estimate based on square footage

Fast food, convenience stores, restaurants, grocery stores — kW = 50 kW + 10 watts/sq. ft.

Other commercial applications — kW = 30 kW + 5 watts/sq. ft.

Square footage = _____ Estimated kW = _____

Amps to kW Rule of Thumb (assumes .8 pf)

For 480 volt systems — Amps = kW x 1.5
For 208 volt systems — Amps = kW x 3.5
For 240 volt 3 Ø systems — Amps = kW x 3
For 240 volt 1 Ø systems — Amps = kW x 4

System Capacity – Load Calculator

DIRECTIONS FOR NEC 2017, ARTICLE 220, PART IV 220.80 Optional Feeder and Service Load Calculations (RESIDENTIAL)	NEC REFERENCE
SECTION CAN BE USED FOR DWELLING UNITS	220.82 (A)
• Served by a single feeder conductor (generator)	
• 120/240 volt or 208Y/120 volt service	
• Ampacity of 100 amps or greater	
The calcultated load will be the result of adding	
• 220.82 (B) General Loads, and	220.82 (B)
• 220.82 (C) Heating and Air-Conditioning Load	220.82 (C)
GENERAL LOADS	220.82 (B)
General Lighting and General-Use Receptacles	
• Calculate at 3 VA per square foot	220.82 (B) (1)
• Use exterior dimensions of the home to calculate square footage – do not include open porches, garages, or unused or unfinished spaces not adaptable for future use.	
• Add 20-amp small appliance & laundry circuits @ 1500 VA each	220.82 (B) (2)
Calculate the following loads at 100% of nameplate rating	220.82 (B) (3)
• Appliances fastened in place, permanently connected or located on a specific circuit	220.82 (B) (3) a
• Ranges, wall-mounted ovens, counter-mounted cooking units	220.82 (B) (3) b
• Clothes dryers not connected to the laundry branch circuit	220.82 (B) (3) c
• Water heaters	220.82 (B) (3) d
• Permanently connected motors not included in Heat & Air-Conditioning Load section	220.82 (B) (4)
HEATING & AIR-CONDITIONING LOADS	220.82 (C)
Include the **largest** of the following six selections (kVA load) in calculation	
Air Conditioning and Cooling	220.82 (C) (1)
• 100% of nameplate rating	
Heat Pumps Without Supplemental Electric Heating	220.82 (C) (2)
• 100% of nameplate rating	
Heat Pumps With Supplemental Electric Heating	220.82 (C) (3)
• 100% of nameplate rating of the heat pump compressor*	
• 65% of nameplate rating of supplemental electric heating equipment	
– If compressor & supplemental heat cannot run at the same time do not include the compressor	
Electric Space Heating	
• Less than 4 separately controlled units @ 65% of nameplate rating	220.82 (C) (4)
• 4 or more separately controlled units @ 40% of nameplate rating	220.82 (C) (5)
• 40% of nameplate rating if 4 or more separately controlled units	
Electric Thermal Storage (or system where the load is expected to be continuous at nameplate rating	220.82 (C) (6)
• 100% of nameplate rating	
• Systems of this type cannot be calculated under any other section of 220.82 (C).	

LOAD CALCULATIONS		
General Lighting Load		3 VA x ft²
• Small Appliance & Laundry Circuits	+	1500 VA per circuit
• General Appliances & Motors (100% rated load)	+	Total general appliances
• Sum of all General Loads	=	Total General Load (VA)
APPLY DEMAND FACTORS		
– First 10 kVA @ 100%	=	10,000 VA
– Remainder of General Loads @ 40%		(Total VA - 10,000) x .40
	=	Calculated General Load (VA)
• HEAT / A-C LOAD @ 100%		Largest Heat or A-C Load (VA)
	=	TOTAL CALCULATED LOAD

Converting VA TO kW (Single-phase applications with 1.0 power factor only) 1 kVA = 1 kW

220.54

Worksheet — NEC 2017, 220 Part IV					
Contractor		Email			
Phone		Fax			
Job Name					
Date	Location				
Voltage (Circle)	240V -1Ø				
Fuel		NG	LPV		
Elec. Service	100 Amp	200 Amp	400 Amp	Other	
NET SQUARE FOOTAGE					
GENERAL LOADS	Qty	Rating (Load)	Factor	Loads (VA)	Loads (kW) (VA ÷ 1,000)
General Lighting and General Use Receptacles		3 VA/ft²	100%		
Branch Circuits (1500 VA/ft²)					
Small Appliance Circuits (20 Amp)		1500	100%		
Laundry Circuits		1500	100%		
Fixed Appliances		Full Current Rating			
Well			100%		
Sump Pump			100%		
Freezer			100%		
Microwave (Not counter-top model)			100%		
Disposal			100%		
Dishwasher			100%		
Range			100%		
Wall-Mounted Oven			100%		
Counter-Mounted Cooking Surface			100%		
Water Heater			100%		
Clothes Dryer			100%		
Garage Door Opener			100%		
Septic Grinder			100%		
Other (list)			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
Total General Loads				**VA**	**kW**
HEAT / A-C LOAD					
A-C / Cooling Equipment			100%		
Heat Pump					
• Compressor (if not included as A-C)			100%		
• Supplemental Electric Heat			65%		
Electric Space Heating					
• Less than 4 separately controlled units			65%		
• 4 or more separately controlled units			40%		
System With Continuous Nameplate Load			100%		
Largest Heat / A-C Load (VA) VA kW					
GENERAL LOADS					
• 1st 10 kW of General Loads 100% kW			100%	kW	
• Remaining General Loads (kW) 40% kW			40%	kW	
CALCULATED GENERAL LOAD (kW) kW					kW
LARGEST HEAT / A-C LOAD 100% kW kW					kW
TOTAL CALCULATED LOAD (Net General Loads + Heat/A-C Load)					kW

Selected Circuit Load Calculator

GENERAC®

Contractor_____ Email _____

Phone_____ Fax _____

Job Name _____

Date_____ Location _____

VOLTAGE ☐ 120/240 1Ø ☐ 120/208 3Ø ☐ 120/240 3Ø ☐ 277/480 3Ø

TYPE ☐ Natural Gas ☐ LP Vapor (LPV)

ELEC. SERVICE ☐ 100 Amp ☐ 150 Amp ☐ 200 Amp ☐ 300 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 8 **Motor Load Table (refer to Table 1)**

Device	HP	RA	LRA	kW Running (= HP)	Starting kW[1]

[1] See Table 430.7(B) for staring kVA per HP for motor loads.

Applications

The QT Series does not meet the necessary requirements for the following applications:

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 700	Emergency Systems
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
ICC	Fuel Gas Code

To Calculate kW	
120 V 1ø	Amps x 120/1000 = kW
240 V 1ø	Amps x 240/1000 = kW
208 V 3ø	(Amps x 208 x 1.732 x PF) /1000 = kW
240 V 3ø	(Amps x 240 x 1.732 x PF) /1000 = kW
480 V 3ø	(Amps x 480 x 1.732 x PF) /1000 = kW

PF is application power factor (worst case 1.0)
Typical application power factor is 0.95.

TABLE 9 **Non-Motor Load Table (refer to Table 2)**

Device	Amps	kW

Transfer Switch Availability

RTSW – 100, 150, 200, 300 and 400 Amp service rated

RTSN – 100–800 3ø and 600–800 1ø Amp

RTSC – 100, 200, 400, 600, 800 Amp

GenReady – 200 Amp service panel
RTS and GenReady switches only work with the Evolution or Nexes Controller.

RECOMMENDED GENERATOR SIZE _____ Refer to Generator Sizing Instructions on other side of this sheet.

Install Notes:

1. Consult manual for installation recommendations.
2. Consult local authority having jurisdiction for local requirements.

Selected Circuit Load Calculator

GENERAC

Generator Sizing Instructions:

There is not a single correct sizing solution. Following are several methods that, when mixed with good judgement, should result in an appropriately sized generator. Remember to consider load growth, seasonality, and effects of starting motors.

As municipalities and states adopt the new 2017 NEC Electrical Code, there may be new sizing requirements, spelled out in the code book, which the installation technician must follow. Always check with the local inspection department to confirm which code cycle will affect your install.

Never add Amps when sizing a generator. Convert Amps to kW and add kW to determine the required generator size. Power factors for various motor loads vary widely. Adding Amps without properly accounting for the power factor and/or mixing voltages will result in improperly sizing the generator.

When motors start, they create a current surge that step loads the generator and creates a voltage dip. After selecting a generator, reference the generator's surge capability using **table 3**. Verify that voltage dip is adequate for the application. Most commercial applications should be limited to about 15% voltage dip and residential applications should be limited to a 30% voltage dip.

Some applications utilize an uninterruptible power supply (UPS) to back up critical loads. Please read sizing guide for this load type.

Measurement Method 220.87 Exception NEC 2017

Connect a recording ammeter or power meter that is capable of measuring the maximum peak kW demand continuously over a minimum 30 day period. The maximum kW demand shall be taken while the building is occupied and shall include the larger of the heating or cooling loads. The peak kW demand shall be multiplied by 125%.

Peak kW demand X 125% = Calculated kW demand

Size the generator to the next standard size and verify UPS and motor load compatibility.

Determining Existing Loads/Billing History Method 220.87 NEC 2017

Many customers have a utility rate structure that has a peak demand charge. Using a year's worth of electric bills, size the generator 25% larger than the largest peak demand.

Verify motor and UPS load compatibility. Peak Demand = _____

Load Summation Method

1) Enter running kW for all motor loads (except the largest) expected to run during peak load levels into **table 8**. Refer to **table 1** for typical motor load sizes and electrical requirements.

2) Enter kW for all non-motor loads expected to run during peak load levels into **table 9**. Refer to **table 2** for typical residential loads and rules of thumb.

3) Add the running motor load kW, non-motor load kW, and the starting kW of the largest motor load.

Motor load running total (minus largest motor): _____ kW (ref. table 8)
Non-motor load total: _____ kW (ref. table 9)
Starting load from largest cycling motor: _____ kW (ref. table 8)
Total electrical loads: =_____ kW

Select generator: Commercial (add 20 to 25% to total kW)
Residential (add 10 to 20% to total kW)

4) Confirm that voltage dip is within acceptable limits by comparing motor LRA to generator surge capability (see table #3).

5) Confirm UPS compatibility (see page 11).

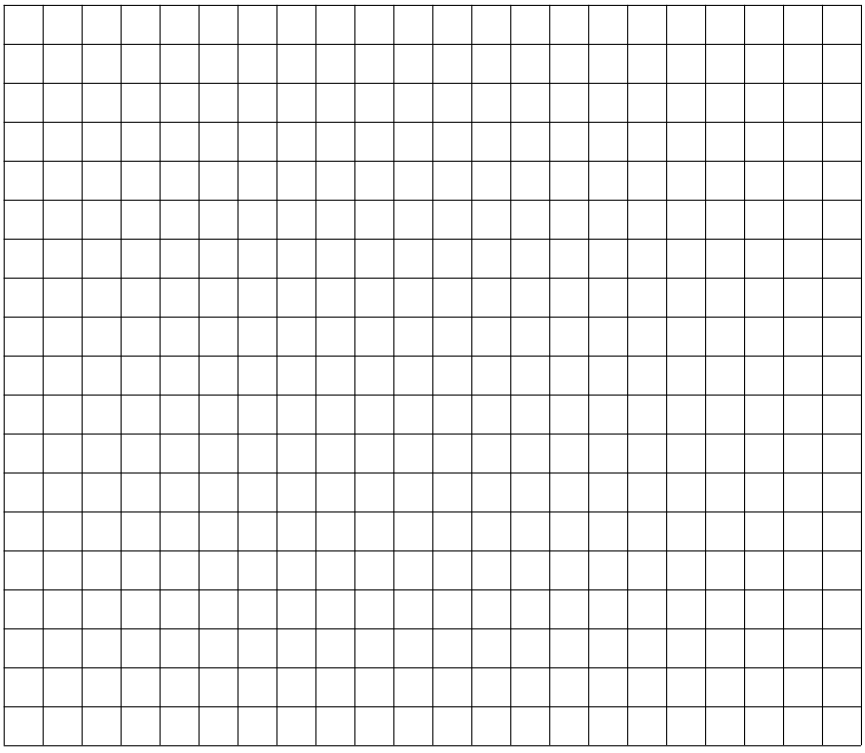
System Capacity – Load Calculation

If the local municipality or state you are in has adopted the 2017 NEC Code, you may be required to use this step. Article 702 of the 2017 NEC includes a new requirement for sizing (702.4). If no other method for sizing is acceptable, sizing of the generator shall be made in accordance with Article 220 of the NEC. The system capacity estimating sheet will guide you through this process.

SMM Load Control Module 702.4 (B) (2) (a) NEC 2017

The SMM Load Control Module is a 50 amp contact housed in a NEMA 3R enclosure for indoor and outdoor installation applications. Through the use of the SMM Modules in conjunction with any of the 100–600 amp Smart Switches, household or business loads can be intelligently managed enabling the use of a smaller, more efficient generator system. Up to four SMM Modules can be used with a single switch.

Project Layout



Ball Park Estimates (Do not use for final sizing)

Estimate based on 60% service size: (commercial)

240 Volts, 1 Ø: _____ Amps x .15 = _____ kW
208 Volts, 3 Ø: _____ Amps x .22 = _____ kW
240 Volts, 3 Ø: _____ Amps x .25 = _____ kW
480 Volts, 3 Ø: _____ Amps x .50 = _____ kW

Estimate based on 40% service size: (residential)

240 Volts, 1 Ø: _____ Amps x .10 = _____ kW
208 Volts, 3 Ø: _____ Amps x .15 = _____ kW
240 Volts, 3 Ø: _____ Amps x .17 = _____ kW
480 Volts, 3 Ø: _____ Amps x .34 = _____ kW

Estimate based on square footage

Fast food, convenience stores, restaurants, grocery stores: kW = 50 kW + 10 watts/sq. ft.

Other commercial applications: kW = 30 kW + 5 watts/sq. ft.

Square footage = _____ Estimated kW = _____

Amps to kW Rule of Thumb (assumes .8 pf)

For 480 volt systems: Amps = kW x 1.5
For 208 volt systems: Amps = kW x 3.5
For 240 volt 3 Ø systems: Amps = kW x 3
For 240 volt 1 Ø systems: Amps = kW x 4

System Capacity – Load Calculator

DIRECTIONS FOR NEC 2017, ARTICLE 220, PART IV 220.80 Optional Feeder and Service Load Calculations (RESIDENTIAL)	NEC REFERENCE
SECTION CAN BE USED FOR DWELLING UNITS	220.82 (A)
• Served by a single feeder conductor (generator)	
• 120/240 volt or 208Y/120 volt service	
• Ampacity of 100 amps or greater	
The calcultated load will be the result of adding	
• 220.82 (B) General Loads, and	220.82 (B)
• 220.82 (C) Heating and Air-Conditioning Load	220.82 (C)
GENERAL LOADS	220.82 (B)
General Lighting and General-Use Receptacles	
• Calculate at 3 VA per square foot	220.82 (B) (1)
• Use exterior dimensions of the home to calculate square footage – do not include open porches, garages, or unused or unfinished spaces not adaptable for future use.	
• Add 20-amp small appliance & laundry circuits @ 1500 VA each	220.82 (B) (2)
Calculate the following loads at 100% of nameplate rating	220.82 (B) (3)
• Appliances fastened in place, permanently connected or located on a specific circuit	220.82 (B) (3) a
• Ranges, wall-mounted ovens, counter-mounted cooking units	220.82 (B) (3) b
• Clothes dryers not connected to the laundry branch circuit	220.82 (B) (3) c
• Water heaters	220.82 (B) (3) d
• Permanently connected motors not included in Heat & Air-Conditioning Load section	220.82 (B) (4)
HEATING & AIR-CONDITIONING LOADS	220.82 (C)
Include the **largest** of the following six selections (kVA load) in calculation	
Air Conditioning and Cooling	220.82 (C) (1)
• 100% of nameplate rating	
Heat Pumps Without Supplemental Electric Heating	220.82 (C) (2)
• 100% of nameplate rating	
Heat Pumps With Supplemental Electric Heating	220.82 (C) (3)
• 100% of nameplate rating of the heat pump compressor*	
• 65% of nameplate rating of supplemental electric heating equipment	
– If compressor & supplemental heat cannot run at the same time do not include the compressor	
Electric Space Heating	
• Less than 4 separately controlled units @ 65% of nameplate rating	220.82 (C) (4)
• 4 or more separately controlled units @ 40% of nameplate rating	220.82 (C) (5)
• 40% of nameplate rating if 4 or more separately controlled units	
Electric Thermal Storage (or system where the load is expected to be continuous at nameplate rating	220.82 (C) (6)
• 100% of nameplate rating	
• Systems of this type cannot be calculated under any other section of 220.82 (C).	

LOAD CALCULATIONS		
General Lighting Load		3 VA x ft²
• Small Appliance & Laundry Circuits	+	1500 VA per circuit
• General Appliances & Motors (100% rated load)	+	Total general appliances
• Sum of all General Loads	=	Total General Load (VA)
APPLY DEMAND FACTORS		
– First 10 kVA @ 100%	=	10,000 VA
– Remainder of General Loads @ 40%		(Total VA - 10,000) x .40
	=	Calculated General Load (VA)
• HEAT / A-C LOAD @ 100%		Largest Heat or A-C Load (VA)
	=	TOTAL CALCULATED LOAD

Converting VA TO kW (Single-phase applications with 1.0 power factor only) 1 kVA = 1 kW 220.54

Worksheet — NEC 2017, 220 Part IV					
Contractor		Email			
Phone		Fax			
Job Name					
Date	Location				
Voltage (Circle)	240V -1Ø				
Fuel		NG	LPV		
Elec. Service	100 Amp	200 Amp	400 Amp	Other	
NET SQUARE FOOTAGE					
GENERAL LOADS	Qty	Rating (Load)	Factor	Loads (VA)	Loads (kW) (VA ÷ 1,000)
General Lighting and General Use Receptacles		3 VA/ft²	100%		
Branch Circuits (1500 VA/ft²)					
Small Appliance Circuits (20 Amp)		1500	100%		
Laundry Circuits		1500	100%		
Fixed Appliances		Full Current Rating			
Well			100%		
Sump Pump			100%		
Freezer			100%		
Microwave (Not counter-top model)			100%		
Disposal			100%		
Dishwasher			100%		
Range			100%		
Wall-Mounted Oven			100%		
Counter-Mounted Cooking Surface			100%		
Water Heater			100%		
Clothes Dryer			100%		
Garage Door Opener			100%		
Septic Grinder			100%		
Other (list)			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
Total General Loads				**VA**	**kW**
HEAT / A-C LOAD					
A-C / Cooling Equipment			100%		
Heat Pump					
• Compressor (if not included as A-C)			100%		
• Supplemental Electric Heat			65%		
Electric Space Heating					
• Less than 4 separately controlled units			65%		
• 4 or more separately controlled units			40%		
System With Continuous Nameplate Load			100%		
Largest Heat / A-C Load (VA) VA kW					
GENERAL LOADS					
• 1st 10 kW of General Loads 100% kW			100%	kW	
• Remaining General Loads (kW) 40% kW			40%	kW	
CALCULATED GENERAL LOAD (kW) kW					kW
LARGEST HEAT / A-C LOAD 100% kW kW					kW
TOTAL CALCULATED LOAD (Net General Loads + Heat/A-C Load)					kW

Selected Circuit Load Calculator

GENERAC®

Contractor_____ Email _____

Phone_____ Fax _____

Job Name _____

Date_____ Location _____

VOLTAGE ☐ 120/240 1Ø ☐ 120/208 3Ø ☐ 120/240 3Ø ☐ 277/480 3Ø

TYPE ☐ Natural Gas ☐ LP Vapor (LPV)

ELEC. SERVICE ☐ 100 Amp ☐ 150 Amp ☐ 200 Amp ☐ 300 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 8 **Motor Load Table (refer to Table 1)**

Device	HP	RA	LRA	kW Running (= HP)	Starting kW[1]

[1] See Table 430.7(B) for staring kVA per HP for motor loads.

Applications

The QT Series does not meet the necessary requirements for the following applications:

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 700	Emergency Systems
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
ICC	Fuel Gas Code

To Calculate kW	
120 V 1ø	Amps x 120/1000 = kW
240 V 1ø	Amps x 240/1000 = kW
208 V 3ø	(Amps x 208 x 1.732 x PF) /1000 = kW
240 V 3ø	(Amps x 240 x 1.732 x PF) /1000 = kW
480 V 3ø	(Amps x 480 x 1.732 x PF) /1000 = kW

PF is application power factor (worst case 1.0)
Typical application power factor is 0.95.

TABLE 9 **Non-Motor Load Table (refer to Table 2)**

Device	Amps	kW

Transfer Switch Availability

RTSW – 100, 150, 200, 300 and 400 Amp service rated

RTSN – 100–800 3ø and 600–800 1ø Amp

RTSC – 100, 200, 400, 600, 800 Amp

GenReady – 200 Amp service panel

RTS and GenReady switches only work with the Evolution or Nexes Controller.

RECOMMENDED GENERATOR SIZE _____ Refer to Generator Sizing Instructions on other side of this sheet.

Install Notes:

1. Consult manual for installation recommendations.
2. Consult local authority having jurisdiction for local requirements.

Selected Circuit Load Calculator

GENERAC

Generator Sizing Instructions:

There is not a single correct sizing solution. Following are several methods that, when mixed with good judgement, should result in an appropriately sized generator. Remember to consider load growth, seasonality, and effects of starting motors.

As municipalities and states adopt the new 2017 NEC Electrical Code, there may be new sizing requirements, spelled out in the code book, which the installation technician must follow. Always check with the local inspection department to confirm which code cycle will affect your install.

Never add Amps when sizing a generator. Convert Amps to kW and add kW to determine the required generator size. Power factors for various motor loads vary widely. Adding Amps without properly accounting for the power factor and/or mixing voltages will result in improperly sizing the generator.

When motors start, they create a current surge that step loads the generator and creates a voltage dip. After selecting a generator, reference the generator's surge capability using **table 3**. Verify that voltage dip is adequate for the application. Most commercial applications should be limited to about 15% voltage dip and residential applications should be limited to a 30% voltage dip.

Some applications utilize an uninterruptible power supply (UPS) to back up critical loads. Please read sizing guide for this load type.

Measurement Method 220.87 Exception NEC 2017

Connect a recording ammeter or power meter that is capable of measuring the maximum peak kW demand continuously over a minimum 30 day period. The maximum kW demand shall be taken while the building is occupied and shall include the larger of the heating or cooling loads. The peak kW demand shall be multiplied by 125%.

Peak kW demand X 125% = Calculated kW demand

Size the generator to the next standard size and verify UPS and motor load compatibility.

Determining Existing Loads/Billing History Method 220.87 NEC 2017

Many customers have a utility rate structure that has a peak demand charge. Using a year's worth of electric bills, size the generator 25% larger than the largest peak demand.

Verify motor and UPS load compatibility. Peak Demand = _____

Load Summation Method

1) Enter running kW for all motor loads (except the largest) expected to run during peak load levels into **table 8**. Refer to **table 1** for typical motor load sizes and electrical requirements.

2) Enter kW for all non-motor loads expected to run during peak load levels into **table 9**. Refer to **table 2** for typical residential loads and rules of thumb.

3) Add the running motor load kW, non-motor load kW, and the starting kW of the largest motor load.

Motor load running total (minus largest motor): _____ kW (ref. table 8)
Non-motor load total: _____ kW (ref. table 9)
Starting load from largest cycling motor: _____ kW (ref. table 8)
Total electrical loads: =_____ kW

Select generator: Commercial (add 20 to 25% to total kW)
Residential (add 10 to 20% to total kW)

4) Confirm that voltage dip is within acceptable limits by comparing motor LRA to generator surge capability (see table #3).

5) Confirm UPS compatibility (see page 11).

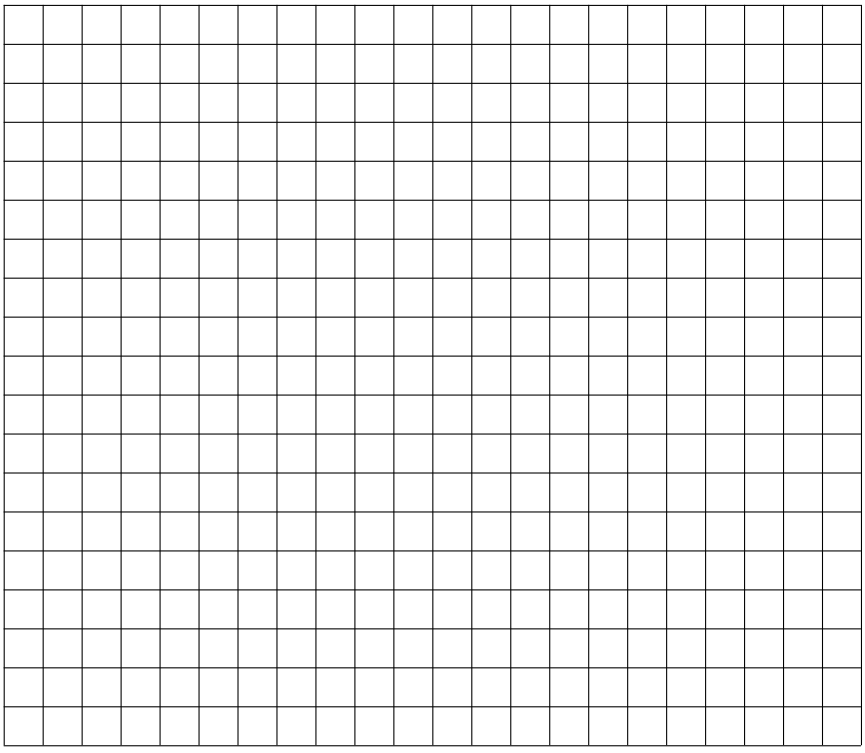
System Capacity – Load Calculation

If the local municipality or state you are in has adopted the 2017 NEC Code, you may be required to use this step. Article 702 of the 2017 NEC includes a new requirement for sizing (702.4). If no other method for sizing is acceptable, sizing of the generator shall be made in accordance with Article 220 of the NEC. The system capacity estimating sheet will guide you through this process.

SMM Load Control Module 702.4 (B) (2) (a) NEC 2017

The SMM Load Control Module is a 50 amp contact housed in a NEMA 3R enclosure for indoor and outdoor installation applications. Through the use of the SMM Modules in conjunction with any of the 100–600 amp Smart Switches, household or business loads can be intelligently managed enabling the use of a smaller, more efficient generator system. Up to four SMM Modules can be used with a single switch.

Project Layout



Ball Park Estimates (Do not use for final sizing)

Estimate based on 60% service size: (commercial)

240 Volts, 1 Ø: _____ Amps x .15 = _____ kW
208 Volts, 3 Ø: _____ Amps x .22 = _____ kW
240 Volts, 3 Ø: _____ Amps x .25 = _____ kW
480 Volts, 3 Ø: _____ Amps x .50 = _____ kW

Estimate based on 40% service size: (residential)

240 Volts, 1 Ø: _____ Amps x .10 = _____ kW
208 Volts, 3 Ø: _____ Amps x .15 = _____ kW
240 Volts, 3 Ø: _____ Amps x .17 = _____ kW
480 Volts, 3 Ø: _____ Amps x .34 = _____ kW

Estimate based on square footage

Fast food, convenience stores, restaurants, grocery stores: kW = 50 kW + 10 watts/sq. ft.

Other commercial applications: kW = 30 kW + 5 watts/sq. ft.

Square footage = _____ Estimated kW = _____

Amps to kW Rule of Thumb (assumes .8 pf)

For 480 volt systems: Amps = kW x 1.5
For 208 volt systems: Amps = kW x 3.5
For 240 volt 3 Ø systems: Amps = kW x 3
For 240 volt 1 Ø systems: Amps = kW x 4

System Capacity – Load Calculator

DIRECTIONS FOR NEC 2017, ARTICLE 220, PART IV 220.80 Optional Feeder and Service Load Calculations (RESIDENTIAL)	NEC REFERENCE
SECTION CAN BE USED FOR DWELLING UNITS	220.82 (A)
• Served by a single feeder conductor (generator)	
• 120/240 volt or 208Y/120 volt service	
• Ampacity of 100 amps or greater	
The calcultated load will be the result of adding	
• 220.82 (B) General Loads, and	220.82 (B)
• 220.82 (C) Heating and Air-Conditioning Load	220.82 (C)
GENERAL LOADS	220.82 (B)
General Lighting and General-Use Receptacles	
• Calculate at 3 VA per square foot	220.82 (B) (1)
• Use exterior dimensions of the home to calculate square footage – do not include open porches, garages, or unused or unfinished spaces not adaptable for future use.	
• Add 20-amp small appliance & laundry circuits @ 1500 VA each	220.82 (B) (2)
Calculate the following loads at 100% of nameplate rating	220.82 (B) (3)
• Appliances fastened in place, permanently connected or located on a specific circuit	220.82 (B) (3) a
• Ranges, wall-mounted ovens, counter-mounted cooking units	220.82 (B) (3) b
• Clothes dryers not connected to the laundry branch circuit	220.82 (B) (3) c
• Water heaters	220.82 (B) (3) d
• Permanently connected motors not included in Heat & Air-Conditioning Load section	220.82 (B) (4)
HEATING & AIR-CONDITIONING LOADS	220.82 (C)
Include the **largest** of the following six selections (kVA load) in calculation	
Air Conditioning and Cooling	220.82 (C) (1)
• 100% of nameplate rating	
Heat Pumps Without Supplemental Electric Heating	220.82 (C) (2)
• 100% of nameplate rating	
Heat Pumps With Supplemental Electric Heating	220.82 (C) (3)
• 100% of nameplate rating of the heat pump compressor*	
• 65% of nameplate rating of supplemental electric heating equipment – If compressor & supplemental heat cannot run at the same time do not include the compressor	
Electric Space Heating	
• Less than 4 separately controlled units @ 65% of nameplate rating	220.82 (C) (4)
• 4 or more separately controlled units @ 40% of nameplate rating	220.82 (C) (5)
• 40% of nameplate rating if 4 or more separately controlled units	
Electric Thermal Storage (or system where the load is expected to be continuous at nameplate rating	220.82 (C) (6)
• 100% of nameplate rating	
• Systems of this type cannot be calculated under any other section of 220.82 (C).	

LOAD CALCULATIONS		
General Lighting Load		3 VA x ft²
• Small Appliance & Laundry Circuits	+	1500 VA per circuit
• General Appliances & Motors (100% rated load)	+	Total general appliances
• Sum of all General Loads	=	Total General Load (VA)
APPLY DEMAND FACTORS		
– First 10 kVA @ 100%	=	10,000 VA
– Remainder of General Loads @ 40%		(Total VA - 10,000) x .40
	=	Calculated General Load (VA)
• HEAT / A-C LOAD @ 100%		Largest Heat or A-C Load (VA)
	=	TOTAL CALCULATED LOAD

Converting VA TO kW (Single-phase applications with 1.0 power factor only) 1 kVA = 1 kW

220.54

Worksheet — NEC 2017, 220 Part IV					
Contractor		Email			
Phone		Fax			
Job Name					
Date	Location				
Voltage (Circle)	240V -1Ø				
Fuel		NG	LPV		
Elec. Service	100 Amp	200 Amp	400 Amp	Other	
NET SQUARE FOOTAGE					
GENERAL LOADS	Qty	Rating (Load)	Factor	Loads (VA)	Loads (kW) (VA ÷ 1,000)
General Lighting and General Use Receptacles		3 VA/ft²	100%		
Branch Circuits (1500 VA/ft²)					
Small Appliance Circuits (20 Amp)		1500	100%		
Laundry Circuits		1500	100%		
Fixed Appliances		Full Current Rating			
Well			100%		
Sump Pump			100%		
Freezer			100%		
Microwave (Not counter-top model)			100%		
Disposal			100%		
Dishwasher			100%		
Range			100%		
Wall-Mounted Oven			100%		
Counter-Mounted Cooking Surface			100%		
Water Heater			100%		
Clothes Dryer			100%		
Garage Door Opener			100%		
Septic Grinder			100%		
Other (list)			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
Total General Loads				**VA**	**kW**
HEAT / A-C LOAD					
A-C / Cooling Equipment			100%		
Heat Pump					
• Compressor (if not included as A-C)			100%		
• Supplemental Electric Heat			65%		
Electric Space Heating					
• Less than 4 separately controlled units			65%		
• 4 or more separately controlled units			40%		
System With Continuous Nameplate Load			100%		
Largest Heat / A-C Load (VA) VA kW					
GENERAL LOADS					
• 1st 10 kW of General Loads 100% kW			100%	kW	
• Remaining General Loads (kW) 40% kW			40%	kW	
CALCULATED GENERAL LOAD (kW) kW					kW
LARGEST HEAT / A-C LOAD 100% kW kW					kW
TOTAL CALCULATED LOAD (Net General Loads + Heat/A-C Load)					kW

Selected Circuit Load Calculator

GENERAC®

Contractor_____ Email _____

Phone_____ Fax _____

Job Name _____

Date_____ Location _____

VOLTAGE ☐ 120/240 1Ø ☐ 120/208 3Ø ☐ 120/240 3Ø ☐ 277/480 3Ø

TYPE ☐ Natural Gas ☐ LP Vapor (LPV)

ELEC. SERVICE ☐ 100 Amp ☐ 150 Amp ☐ 200 Amp ☐ 300 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 8 **Motor Load Table (refer to Table 1)**

Device	HP	RA	LRA	kW Running (= HP)	Starting kW[1]

[1] See Table 430.7(B) for staring kVA per HP for motor loads.

Applications

The QT Series does not meet the necessary requirements for the following applications:

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 700	Emergency Systems
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
ICC	Fuel Gas Code

To Calculate kW	
120 V 1ø	Amps x 120/1000 = kW
240 V 1ø	Amps x 240/1000 = kW
208 V 3ø	(Amps x 208 x 1.732 x PF) /1000 = kW
240 V 3ø	(Amps x 240 x 1.732 x PF) /1000 = kW
480 V 3ø	(Amps x 480 x 1.732 x PF) /1000 = kW

PF is application power factor (worst case 1.0)
Typical application power factor is 0.95.

TABLE 9 **Non-Motor Load Table (refer to Table 2)**

Device	Amps	kW

Transfer Switch Availability

RTSW – 100, 150, 200, 300 and 400 Amp service rated

RTSN – 100–800 3ø and 600–800 1ø Amp

RTSC – 100, 200, 400, 600, 800 Amp

GenReady – 200 Amp service panel

RTS and GenReady switches only work with the Evolution or Nexes Controller.

RECOMMENDED GENERATOR SIZE _____ Refer to Generator Sizing Instructions on other side of this sheet.

Install Notes:

1. Consult manual for installation recommendations.
2. Consult local authority having jurisdiction for local requirements.

Selected Circuit Load Calculator

GENERAC

Generator Sizing Instructions:

There is not a single correct sizing solution. Following are several methods that, when mixed with good judgement, should result in an appropriately sized generator. Remember to consider load growth, seasonality, and effects of starting motors.

As municipalities and states adopt the new 2017 NEC Electrical Code, there may be new sizing requirements, spelled out in the code book, which the installation technician must follow. Always check with the local inspection department to confirm which code cycle will affect your install.

Never add Amps when sizing a generator. Convert Amps to kW and add kW to determine the required generator size. Power factors for various motor loads vary widely. Adding Amps without properly accounting for the power factor and/or mixing voltages will result in improperly sizing the generator.

When motors start, they create a current surge that step loads the generator and creates a voltage dip. After selecting a generator, reference the generator's surge capability using **table 3**. Verify that voltage dip is adequate for the application. Most commercial applications should be limited to about 15% voltage dip and residential applications should be limited to a 30% voltage dip.

Some applications utilize an uninterruptible power supply (UPS) to back up critical loads. Please read sizing guide for this load type.

Measurement Method 220.87 Exception NEC 2017

Connect a recording ammeter or power meter that is capable of measuring the maximum peak kW demand continuously over a minimum 30 day period. The maximum kW demand shall be taken while the building is occupied and shall include the larger of the heating or cooling loads. The peak kW demand shall be multiplied by 125%.

Peak kW demand X 125% = Calculated kW demand

Size the generator to the next standard size and verify UPS and motor load compatibility.

Determining Existing Loads/Billing History Method 220.87 NEC 2017

Many customers have a utility rate structure that has a peak demand charge. Using a year's worth of electric bills, size the generator 25% larger than the largest peak demand.

Verify motor and UPS load compatibility. Peak Demand = _____

Load Summation Method

1) Enter running kW for all motor loads (except the largest) expected to run during peak load levels into **table 8**. Refer to **table 1** for typical motor load sizes and electrical requirements.

2) Enter kW for all non-motor loads expected to run during peak load levels into **table 9**. Refer to **table 2** for typical residential loads and rules of thumb.

3) Add the running motor load kW, non-motor load kW, and the starting kW of the largest motor load.

Motor load running total (minus largest motor): _____ kW (ref. table 8)
Non-motor load total: _____ kW (ref. table 9)
Starting load from largest cycling motor: _____ kW (ref. table 8)
Total electrical loads: =_____ kW

Select generator: Commercial (add 20 to 25% to total kW)
Residential (add 10 to 20% to total kW)

4) Confirm that voltage dip is within acceptable limits by comparing motor LRA to generator surge capability (see table #3).

5) Confirm UPS compatibility (see page 11).

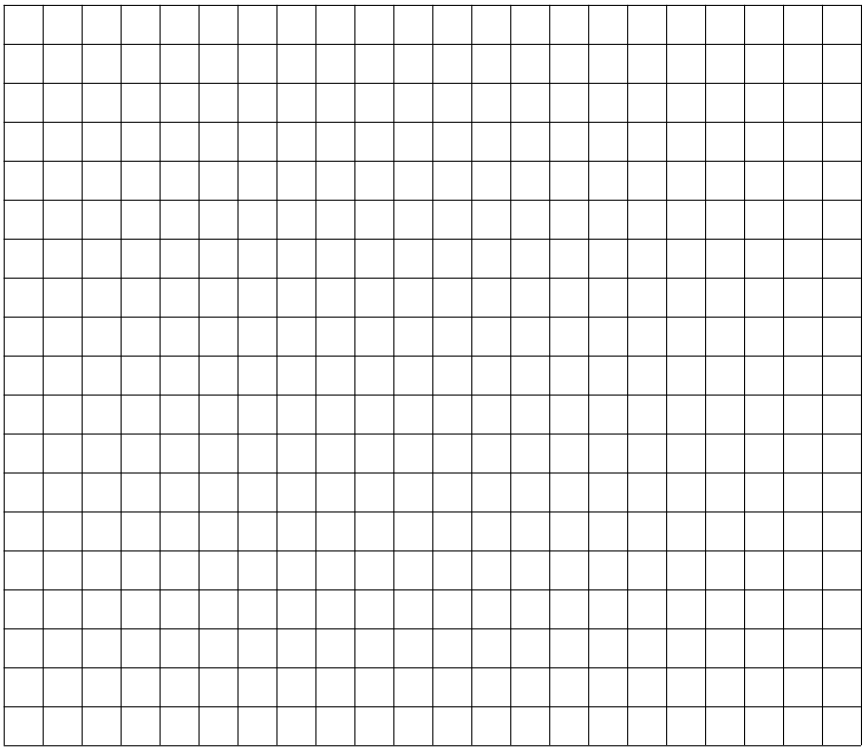
System Capacity – Load Calculation

If the local municipality or state you are in has adopted the 2017 NEC Code, you may be required to use this step. Article 702 of the 2017 NEC includes a new requirement for sizing (702.4). If no other method for sizing is acceptable, sizing of the generator shall be made in accordance with Article 220 of the NEC. The system capacity estimating sheet will guide you through this process.

SMM Load Control Module 702.4 (B) (2) (a) NEC 2017

The SMM Load Control Module is a 50 amp contact housed in a NEMA 3R enclosure for indoor and outdoor installation applications. Through the use of the SMM Modules in conjunction with any of the 100–600 amp Smart Switches, household or business loads can be intelligently managed enabling the use of a smaller, more efficient generator system. Up to four SMM Modules can be used with a single switch.

Project Layout



Ball Park Estimates (Do not use for final sizing)

Estimate based on 60% service size: (commercial)

240 Volts, 1 Ø: _____ Amps x .15 = _____ kW
208 Volts, 3 Ø: _____ Amps x .22 = _____ kW
240 Volts, 3 Ø: _____ Amps x .25 = _____ kW
480 Volts, 3 Ø: _____ Amps x .50 = _____ kW

Estimate based on 40% service size: (residential)

240 Volts, 1 Ø: _____ Amps x .10 = _____ kW
208 Volts, 3 Ø: _____ Amps x .15 = _____ kW
240 Volts, 3 Ø: _____ Amps x .17 = _____ kW
480 Volts, 3 Ø: _____ Amps x .34 = _____ kW

Estimate based on square footage

Fast food, convenience stores, restaurants, grocery stores: kW = 50 kW + 10 watts/sq. ft.

Other commercial applications: kW = 30 kW + 5 watts/sq. ft.

Square footage = _____ Estimated kW = _____

Amps to kW Rule of Thumb (assumes .8 pf)

For 480 volt systems: Amps = kW x 1.5
For 208 volt systems: Amps = kW x 3.5
For 240 volt 3 Ø systems: Amps = kW x 3
For 240 volt 1 Ø systems: Amps = kW x 4

System Capacity – Load Calculator

DIRECTIONS FOR NEC 2017, ARTICLE 220, PART IV 220.80 Optional Feeder and Service Load Calculations (RESIDENTIAL)	NEC REFERENCE
SECTION CAN BE USED FOR DWELLING UNITS	220.82 (A)
• Served by a single feeder conductor (generator)	
• 120/240 volt or 208Y/120 volt service	
• Ampacity of 100 amps or greater	
The calcultated load will be the result of adding	
• 220.82 (B) General Loads, and	220.82 (B)
• 220.82 (C) Heating and Air-Conditioning Load	220.82 (C)
GENERAL LOADS	220.82 (B)
General Lighting and General-Use Receptacles	
• Calculate at 3 VA per square foot	220.82 (B) (1)
• Use exterior dimensions of the home to calculate square footage – do not include open porches, garages, or unused or unfinished spaces not adaptable for future use.	
• Add 20-amp small appliance & laundry circuits @ 1500 VA each	220.82 (B) (2)
Calculate the following loads at 100% of nameplate rating	220.82 (B) (3)
• Appliances fastened in place, permanently connected or located on a specific circuit	220.82 (B) (3) a
• Ranges, wall-mounted ovens, counter-mounted cooking units	220.82 (B) (3) b
• Clothes dryers not connected to the laundry branch circuit	220.82 (B) (3) c
• Water heaters	220.82 (B) (3) d
• Permanently connected motors not included in Heat & Air-Conditioning Load section	220.82 (B) (4)
HEATING & AIR-CONDITIONING LOADS	220.82 (C)
Include the **largest** of the following six selections (kVA load) in calculation	
Air Conditioning and Cooling	220.82 (C) (1)
• 100% of nameplate rating	
Heat Pumps Without Supplemental Electric Heating	220.82 (C) (2)
• 100% of nameplate rating	
Heat Pumps With Supplemental Electric Heating	220.82 (C) (3)
• 100% of nameplate rating of the heat pump compressor*	
• 65% of nameplate rating of supplemental electric heating equipment	
– If compressor & supplemental heat cannot run at the same time do not include the compressor	
Electric Space Heating	
• Less than 4 separately controlled units @ 65% of nameplate rating	220.82 (C) (4)
• 4 or more separately controlled units @ 40% of nameplate rating	220.82 (C) (5)
• 40% of nameplate rating if 4 or more separately controlled units	
Electric Thermal Storage (or system where the load is expected to be continuous at nameplate rating	220.82 (C) (6)
• 100% of nameplate rating	
• Systems of this type cannot be calculated under any other section of 220.82 (C).	

LOAD CALCULATIONS		
General Lighting Load		3 VA x ft²
• Small Appliance & Laundry Circuits	+	1500 VA per circuit
• General Appliances & Motors (100% rated load)	+	Total general appliances
• Sum of all General Loads	=	Total General Load (VA)
APPLY DEMAND FACTORS		
– First 10 kVA @ 100%	=	10,000 VA
– Remainder of General Loads @ 40%		(Total VA - 10,000) x .40
	=	Calculated General Load (VA)
• HEAT / A-C LOAD @ 100%		Largest Heat or A-C Load (VA)
	=	TOTAL CALCULATED LOAD

Converting VA TO kW (Single-phase applications with 1.0 power factor only) 1 kVA = 1 kW

220.54

Worksheet — NEC 2017, 220 Part IV					
Contractor		Email			
Phone		Fax			
Job Name					
Date	Location				
Voltage (Circle)	240V -1Ø				
Fuel		NG	LPV		
Elec. Service	100 Amp	200 Amp	400 Amp	Other	
NET SQUARE FOOTAGE					
GENERAL LOADS	Qty	Rating (Load)	Factor	Loads (VA)	Loads (kW) (VA ÷ 1,000)
General Lighting and General Use Receptacles		3 VA/ft²	100%		
Branch Circuits (1500 VA/ft²)					
Small Appliance Circuits (20 Amp)		1500	100%		
Laundry Circuits		1500	100%		
Fixed Appliances		Full Current Rating			
Well			100%		
Sump Pump			100%		
Freezer			100%		
Microwave (Not counter-top model)			100%		
Disposal			100%		
Dishwasher			100%		
Range			100%		
Wall-Mounted Oven			100%		
Counter-Mounted Cooking Surface			100%		
Water Heater			100%		
Clothes Dryer			100%		
Garage Door Opener			100%		
Septic Grinder			100%		
Other (list)			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
Total General Loads				**VA**	**kW**
HEAT / A-C LOAD					
A-C / Cooling Equipment			100%		
Heat Pump					
• Compressor (if not included as A-C)			100%		
• Supplemental Electric Heat			65%		
Electric Space Heating					
• Less than 4 separately controlled units			65%		
• 4 or more separately controlled units			40%		
System With Continuous Nameplate Load			100%		
Largest Heat / A-C Load (VA) VA kW					
GENERAL LOADS					
• 1st 10 kW of General Loads 100% kW			100%	kW	
• Remaining General Loads (kW) 40% kW			40%	kW	
CALCULATED GENERAL LOAD (kW) kW					kW
LARGEST HEAT / A-C LOAD 100% kW kW					kW
TOTAL CALCULATED LOAD (Net General Loads + Heat/A-C Load)					kW

Selected Circuit Load Calculator

GENERAC®

Contractor_____ Email _____

Phone_____ Fax _____

Job Name _____

Date_____ Location _____

VOLTAGE ☐ 120/240 1Ø ☐ 120/208 3Ø ☐ 120/240 3Ø ☐ 277/480 3Ø

TYPE ☐ Natural Gas ☐ LP Vapor (LPV)

ELEC. SERVICE ☐ 100 Amp ☐ 150 Amp ☐ 200 Amp ☐ 300 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 8 **Motor Load Table (refer to Table 1)**

Device	HP	RA	LRA	kW Running (= HP)	Starting kW[1]

[1] See Table 430.7(B) for staring kVA per HP for motor loads.

Applications

The QT Series does not meet the necessary requirements for the following applications:

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 700	Emergency Systems
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
ICC	Fuel Gas Code

To Calculate kW	
120 V 1ø	Amps x 120/1000 = kW
240 V 1ø	Amps x 240/1000 = kW
208 V 3ø	(Amps x 208 x 1.732 x PF) /1000 = kW
240 V 3ø	(Amps x 240 x 1.732 x PF) /1000 = kW
480 V 3ø	(Amps x 480 x 1.732 x PF) /1000 = kW

PF is application power factor (worst case 1.0)
Typical application power factor is 0.95.

TABLE 9 **Non-Motor Load Table (refer to Table 2)**

Device	Amps	kW

Transfer Switch Availability

RTSW – 100, 150, 200, 300 and 400 Amp service rated

RTSN – 100–800 3ø and 600–800 1ø Amp

RTSC – 100, 200, 400, 600, 800 Amp

GenReady – 200 Amp service panel

RTS and GenReady switches only work with the Evolution or Nexes Controller.

RECOMMENDED GENERATOR SIZE _____ Refer to Generator Sizing Instructions on other side of this sheet.

Install Notes:

1. Consult manual for installation recommendations.
2. Consult local authority having jurisdiction for local requirements.

Selected Circuit Load Calculator

GENERAC

Generator Sizing Instructions:

There is not a single correct sizing solution. Following are several methods that, when mixed with good judgement, should result in an appropriately sized generator. Remember to consider load growth, seasonality, and effects of starting motors.

As municipalities and states adopt the new 2017 NEC Electrical Code, there may be new sizing requirements, spelled out in the code book, which the installation technician must follow. Always check with the local inspection department to confirm which code cycle will affect your install.

Never add Amps when sizing a generator. Convert Amps to kW and add kW to determine the required generator size. Power factors for various motor loads vary widely. Adding Amps without properly accounting for the power factor and/or mixing voltages will result in improperly sizing the generator.

When motors start, they create a current surge that step loads the generator and creates a voltage dip. After selecting a generator, reference the generator's surge capability using **table 3**. Verify that voltage dip is adequate for the application. Most commercial applications should be limited to about 15% voltage dip and residential applications should be limited to a 30% voltage dip.

Some applications utilize an uninterruptible power supply (UPS) to back up critical loads. Please read sizing guide for this load type.

Measurement Method 220.87 Exception NEC 2017

Connect a recording ammeter or power meter that is capable of measuring the maximum peak kW demand continuously over a minimum 30 day period. The maximum kW demand shall be taken while the building is occupied and shall include the larger of the heating or cooling loads. The peak kW demand shall be multiplied by 125%.

Peak kW demand X 125% = Calculated kW demand

Size the generator to the next standard size and verify UPS and motor load compatibility.

Determining Existing Loads/Billing History Method 220.87 NEC 2017

Many customers have a utility rate structure that has a peak demand charge. Using a year's worth of electric bills, size the generator 25% larger than the largest peak demand.

Verify motor and UPS load compatibility. Peak Demand = _____

Load Summation Method

1) Enter running kW for all motor loads (except the largest) expected to run during peak load levels into **table 8**. Refer to **table 1** for typical motor load sizes and electrical requirements.

2) Enter kW for all non-motor loads expected to run during peak load levels into **table 9**. Refer to **table 2** for typical residential loads and rules of thumb.

3) Add the running motor load kW, non-motor load kW, and the starting kW of the largest motor load.

Motor load running total (minus largest motor): _____ kW (ref. table 8)
Non-motor load total: _____ kW (ref. table 9)
Starting load from largest cycling motor: _____ kW (ref. table 8)
Total electrical loads: =_____ kW

Select generator: Commercial (add 20 to 25% to total kW)
Residential (add 10 to 20% to total kW)

4) Confirm that voltage dip is within acceptable limits by comparing motor LRA to generator surge capability (see table #3).

5) Confirm UPS compatibility (see page 11).

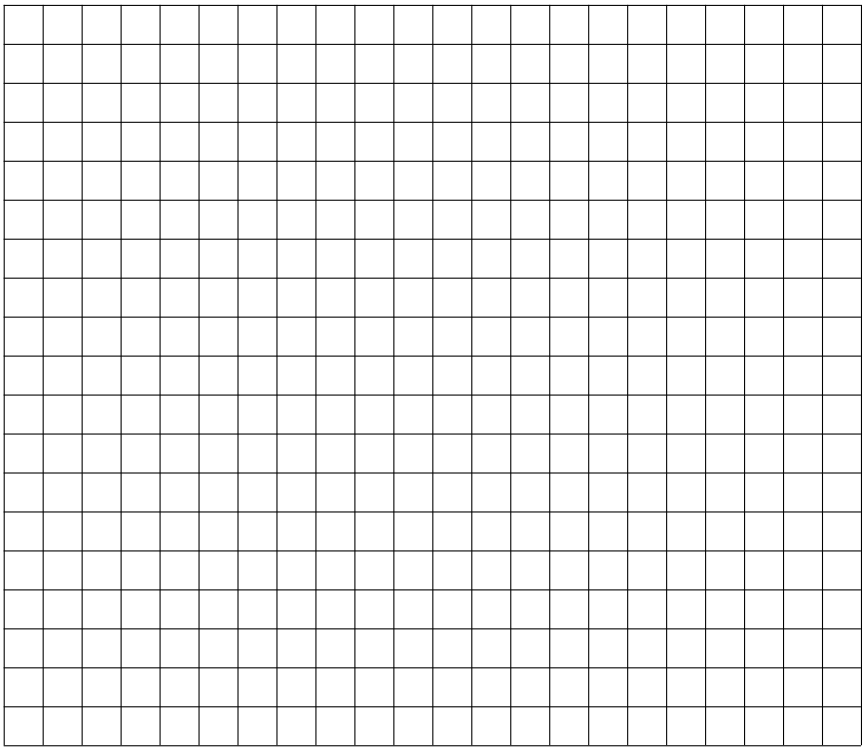
System Capacity – Load Calculation

If the local municipality or state you are in has adopted the 2017 NEC Code, you may be required to use this step. Article 702 of the 2017 NEC includes a new requirement for sizing (702.4). If no other method for sizing is acceptable, sizing of the generator shall be made in accordance with Article 220 of the NEC. The system capacity estimating sheet will guide you through this process.

SMM Load Control Module 702.4 (B) (2) (a) NEC 2017

The SMM Load Control Module is a 50 amp contact housed in a NEMA 3R enclosure for indoor and outdoor installation applications. Through the use of the SMM Modules in conjunction with any of the 100–600 amp Smart Switches, household or business loads can be intelligently managed enabling the use of a smaller, more efficient generator system. Up to four SMM Modules can be used with a single switch.

Project Layout



Ball Park Estimates (Do not use for final sizing)

Estimate based on 60% service size: (commercial)

240 Volts, 1 Ø: _____ Amps x .15 = _____ kW
208 Volts, 3 Ø: _____ Amps x .22 = _____ kW
240 Volts, 3 Ø: _____ Amps x .25 = _____ kW
480 Volts, 3 Ø: _____ Amps x .50 = _____ kW

Estimate based on 40% service size: (residential)

240 Volts, 1 Ø: _____ Amps x .10 = _____ kW
208 Volts, 3 Ø: _____ Amps x .15 = _____ kW
240 Volts, 3 Ø: _____ Amps x .17 = _____ kW
480 Volts, 3 Ø: _____ Amps x .34 = _____ kW

Estimate based on square footage

Fast food, convenience stores, restaurants, grocery stores: kW = 50 kW + 10 watts/sq. ft.

Other commercial applications: kW = 30 kW + 5 watts/sq. ft.

Square footage = _____ Estimated kW = _____

Amps to kW Rule of Thumb (assumes .8 pf)

For 480 volt systems: Amps = kW x 1.5
For 208 volt systems: Amps = kW x 3.5
For 240 volt 3 Ø systems: Amps = kW x 3
For 240 volt 1 Ø systems: Amps = kW x 4

System Capacity – Load Calculator

DIRECTIONS FOR NEC 2017, ARTICLE 220, PART IV 220.80 Optional Feeder and Service Load Calculations (RESIDENTIAL)	NEC REFERENCE
SECTION CAN BE USED FOR DWELLING UNITS	220.82 (A)
• Served by a single feeder conductor (generator)	
• 120/240 volt or 208Y/120 volt service	
• Ampacity of 100 amps or greater	
The calcultated load will be the result of adding	
• 220.82 (B) General Loads, and	220.82 (B)
• 220.82 (C) Heating and Air-Conditioning Load	220.82 (C)
GENERAL LOADS	220.82 (B)
General Lighting and General-Use Receptacles	
• Calculate at 3 VA per square foot	220.82 (B) (1)
• Use exterior dimensions of the home to calculate square footage – do not include open porches, garages, or unused or unfinished spaces not adaptable for future use.	
• Add 20-amp small appliance & laundry circuits @ 1500 VA each	220.82 (B) (2)
Calculate the following loads at 100% of nameplate rating	220.82 (B) (3)
• Appliances fastened in place, permanently connected or located on a specific circuit	220.82 (B) (3) a
• Ranges, wall-mounted ovens, counter-mounted cooking units	220.82 (B) (3) b
• Clothes dryers not connected to the laundry branch circuit	220.82 (B) (3) c
• Water heaters	220.82 (B) (3) d
• Permanently connected motors not included in Heat & Air-Conditioning Load section	220.82 (B) (4)
HEATING & AIR-CONDITIONING LOADS	220.82 (C)
Include the **largest** of the following six selections (kVA load) in calculation	
Air Conditioning and Cooling	220.82 (C) (1)
• 100% of nameplate rating	
Heat Pumps Without Supplemental Electric Heating	220.82 (C) (2)
• 100% of nameplate rating	
Heat Pumps With Supplemental Electric Heating	220.82 (C) (3)
• 100% of nameplate rating of the heat pump compressor*	
• 65% of nameplate rating of supplemental electric heating equipment – If compressor & supplemental heat cannot run at the same time do not include the compressor	
Electric Space Heating	
• Less than 4 separately controlled units @ 65% of nameplate rating	220.82 (C) (4)
• 4 or more separately controlled units @ 40% of nameplate rating	220.82 (C) (5)
• 40% of nameplate rating if 4 or more separately controlled units	
Electric Thermal Storage (or system where the load is expected to be continuous at nameplate rating	220.82 (C) (6)
• 100% of nameplate rating	
• Systems of this type cannot be calculated under any other section of 220.82 (C).	

LOAD CALCULATIONS		
General Lighting Load		3 VA x ft²
• Small Appliance & Laundry Circuits	+	1500 VA per circuit
• General Appliances & Motors (100% rated load)	+	Total general appliances
• Sum of all General Loads	=	Total General Load (VA)
APPLY DEMAND FACTORS		
– First 10 kVA @ 100%	=	10,000 VA
– Remainder of General Loads @ 40%		(Total VA - 10,000) x .40
	=	Calculated General Load (VA)
• HEAT / A-C LOAD @ 100%		Largest Heat or A-C Load (VA)
	=	TOTAL CALCULATED LOAD

Converting VA TO kW (Single-phase applications with 1.0 power factor only) 1 kVA = 1 kW

220.54

Worksheet — NEC 2017, 220 Part IV					
Contractor		Email			
Phone		Fax			
Job Name					
Date	Location				
Voltage (Circle)	240V -1Ø				
Fuel		NG	LPV		
Elec. Service	100 Amp	200 Amp	400 Amp	Other	
NET SQUARE FOOTAGE					
GENERAL LOADS	Qty	Rating (Load)	Factor	Loads (VA)	Loads (kW) (VA ÷ 1,000)
General Lighting and General Use Receptacles		3 VA/ft²	100%		
Branch Circuits (1500 VA/ft²)					
Small Appliance Circuits (20 Amp)		1500	100%		
Laundry Circuits		1500	100%		
Fixed Appliances		Full Current Rating			
Well			100%		
Sump Pump			100%		
Freezer			100%		
Microwave (Not counter-top model)			100%		
Disposal			100%		
Dishwasher			100%		
Range			100%		
Wall-Mounted Oven			100%		
Counter-Mounted Cooking Surface			100%		
Water Heater			100%		
Clothes Dryer			100%		
Garage Door Opener			100%		
Septic Grinder			100%		
Other (list)			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
Total General Loads				**VA**	**kW**
HEAT / A-C LOAD					
A-C / Cooling Equipment			100%		
Heat Pump					
• Compressor (if not included as A-C)			100%		
• Supplemental Electric Heat			65%		
Electric Space Heating					
• Less than 4 separately controlled units			65%		
• 4 or more separately controlled units			40%		
System With Continuous Nameplate Load			100%		
Largest Heat / A-C Load (VA) VA kW					
GENERAL LOADS					
• 1st 10 kW of General Loads 100% kW			100%	kW	
• Remaining General Loads (kW) 40% kW			40%	kW	
CALCULATED GENERAL LOAD (kW) kW					kW
LARGEST HEAT / A-C LOAD 100% kW kW					kW
TOTAL CALCULATED LOAD (Net General Loads + Heat/A-C Load)					kW

Selected Circuit Load Calculator

GENERAC®

Contractor_____ Email _____

Phone_____ Fax _____

Job Name _____

Date_____ Location _____

VOLTAGE ☐ 120/240 1Ø ☐ 120/208 3Ø ☐ 120/240 3Ø ☐ 277/480 3Ø

TYPE ☐ Natural Gas ☐ LP Vapor (LPV)

ELEC. SERVICE ☐ 100 Amp ☐ 150 Amp ☐ 200 Amp ☐ 300 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 8 **Motor Load Table (refer to Table 1)**

Device	HP	RA	LRA	kW Running (= HP)	Starting kW[1]

[1] See Table 430.7(B) for staring kVA per HP for motor loads.

Applications

The QT Series does not meet the necessary requirements for the following applications:

- 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 700 Emergency Systems
- 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
- ICC Fuel Gas Code

To Calculate kW	
120 V 1ø	Amps x 120/1000 = kW
240 V 1ø	Amps x 240/1000 = kW
208 V 3ø	(Amps x 208 x 1.732 x PF) /1000 = kW
240 V 3ø	(Amps x 240 x 1.732 x PF) /1000 = kW
480 V 3ø	(Amps x 480 x 1.732 x PF) /1000 = kW

PF is application power factor (worst case 1.0)
Typical application power factor is 0.95.

TABLE 9 **Non-Motor Load Table (refer to Table 2)**

Device	Amps	kW

Transfer Switch Availability

RTSW – 100, 150, 200, 300 and 400 Amp service rated

RTSN – 100–800 3ø and 600–800 1ø Amp

RTSC – 100, 200, 400, 600, 800 Amp

GenReady – 200 Amp service panel
RTS and GenReady switches only work with the Evolution or Nexes Controller.

RECOMMENDED GENERATOR SIZE _____ Refer to Generator Sizing Instructions on other side of this sheet.

Install Notes:

1. Consult manual for installation recommendations.
2. Consult local authority having jurisdiction for local requirements.

Selected Circuit Load Calculator

GENERAC

Generator Sizing Instructions:

There is not a single correct sizing solution. Following are several methods that, when mixed with good judgement, should result in an appropriately sized generator. Remember to consider load growth, seasonality, and effects of starting motors.

As municipalities and states adopt the new 2017 NEC Electrical Code, there may be new sizing requirements, spelled out in the code book, which the installation technician must follow. Always check with the local inspection department to confirm which code cycle will affect your install.

Never add Amps when sizing a generator. Convert Amps to kW and add kW to determine the required generator size. Power factors for various motor loads vary widely. Adding Amps without properly accounting for the power factor and/or mixing voltages will result in improperly sizing the generator.

When motors start, they create a current surge that step loads the generator and creates a voltage dip. After selecting a generator, reference the generator's surge capability using **table 3**. Verify that voltage dip is adequate for the application. Most commercial applications should be limited to about 15% voltage dip and residential applications should be limited to a 30% voltage dip.

Some applications utilize an uninterruptible power supply (UPS) to back up critical loads. Please read sizing guide for this load type.

Measurement Method 220.87 Exception NEC 2017

Connect a recording ammeter or power meter that is capable of measuring the maximum peak kW demand continuously over a minimum 30 day period. The maximum kW demand shall be taken while the building is occupied and shall include the larger of the heating or cooling loads. The peak kW demand shall be multiplied by 125%.

Peak kW demand X 125% = Calculated kW demand

Size the generator to the next standard size and verify UPS and motor load compatibility.

Determining Existing Loads/Billing History Method 220.87 NEC 2017

Many customers have a utility rate structure that has a peak demand charge. Using a year's worth of electric bills, size the generator 25% larger than the largest peak demand.

Verify motor and UPS load compatibility. Peak Demand = _____

Load Summation Method

1) Enter running kW for all motor loads (except the largest) expected to run during peak load levels into **table 8**. Refer to **table 1** for typical motor load sizes and electrical requirements.

2) Enter kW for all non-motor loads expected to run during peak load levels into **table 9**. Refer to **table 2** for typical residential loads and rules of thumb.

3) Add the running motor load kW, non-motor load kW, and the starting kW of the largest motor load.

Motor load running total (minus largest motor): _____ kW (ref. table 8)
Non-motor load total: _____ kW (ref. table 9)
Starting load from largest cycling motor: _____ kW (ref. table 8)
Total electrical loads: =_____ kW

Select generator: Commercial (add 20 to 25% to total kW)
Residential (add 10 to 20% to total kW)

4) Confirm that voltage dip is within acceptable limits by comparing motor LRA to generator surge capability (see table #3).

5) Confirm UPS compatibility (see page 11).

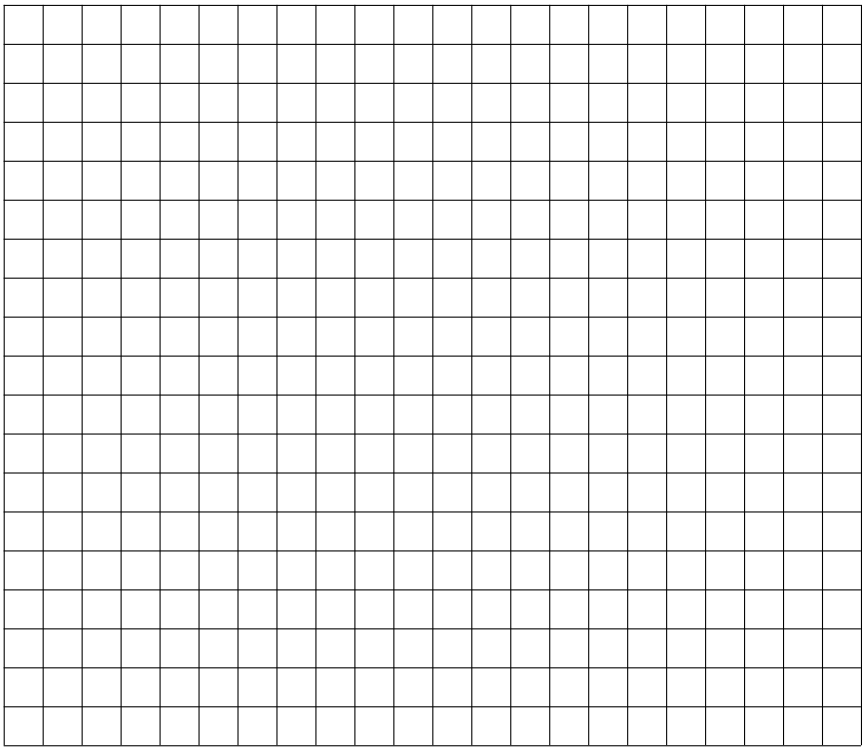
System Capacity – Load Calculation

If the local municipality or state you are in has adopted the 2017 NEC Code, you may be required to use this step. Article 702 of the 2017 NEC includes a new requirement for sizing (702.4). If no other method for sizing is acceptable, sizing of the generator shall be made in accordance with Article 220 of the NEC. The system capacity estimating sheet will guide you through this process.

SMM Load Control Module 702.4 (B) (2) (a) NEC 2017

The SMM Load Control Module is a 50 amp contact housed in a NEMA 3R enclosure for indoor and outdoor installation applications. Through the use of the SMM Modules in conjunction with any of the 100–600 amp Smart Switches, household or business loads can be intelligently managed enabling the use of a smaller, more efficient generator system. Up to four SMM Modules can be used with a single switch.

Project Layout



Ball Park Estimates (Do not use for final sizing)

Estimate based on 60% service size: (commercial)

240 Volts, 1 Ø: _____ Amps x .15 = _____ kW
208 Volts, 3 Ø: _____ Amps x .22 = _____ kW
240 Volts, 3 Ø: _____ Amps x .25 = _____ kW
480 Volts, 3 Ø: _____ Amps x .50 = _____ kW

Estimate based on 40% service size: (residential)

240 Volts, 1 Ø: _____ Amps x .10 = _____ kW
208 Volts, 3 Ø: _____ Amps x .15 = _____ kW
240 Volts, 3 Ø: _____ Amps x .17 = _____ kW
480 Volts, 3 Ø: _____ Amps x .34 = _____ kW

Estimate based on square footage

Fast food, convenience stores, restaurants, grocery stores: kW = 50 kW + 10 watts/sq. ft.

Other commercial applications: kW = 30 kW + 5 watts/sq. ft.

Square footage = _____ Estimated kW = _____

Amps to kW Rule of Thumb (assumes .8 pf)

For 480 volt systems: Amps = kW x 1.5
For 208 volt systems: Amps = kW x 3.5
For 240 volt 3 Ø systems: Amps = kW x 3
For 240 volt 1 Ø systems: Amps = kW x 4

System Capacity – Load Calculator

GENERAC

DIRECTIONS FOR NEC 2017, ARTICLE 220, PART IV 220.80 Optional Feeder and Service Load Calculations (RESIDENTIAL)	NEC REFERENCE
SECTION CAN BE USED FOR DWELLING UNITS	220.82 (A)
• Served by a single feeder conductor (generator)	
• 120/240 volt or 208Y/120 volt service	
• Ampacity of 100 amps or greater	
The calcultated load will be the result of adding	
• 220.82 (B) General Loads, and	220.82 (B)
• 220.82 (C) Heating and Air-Conditioning Load	220.82 (C)
GENERAL LOADS	220.82 (B)
General Lighting and General-Use Receptacles	
• Calculate at 3 VA per square foot	220.82 (B) (1)
• Use exterior dimensions of the home to calculate square footage – do not include open porches, garages, or unused or unfinished spaces not adaptable for future use.	
• Add 20-amp small appliance & laundry circuits @ 1500 VA each	220.82 (B) (2)
Calculate the following loads at 100% of nameplate rating	220.82 (B) (3)
• Appliances fastened in place, permanently connected or located on a specific circuit	220.82 (B) (3) a
• Ranges, wall-mounted ovens, counter-mounted cooking units	220.82 (B) (3) b
• Clothes dryers not connected to the laundry branch circuit	220.82 (B) (3) c
• Water heaters	220.82 (B) (3) d
• Permanently connected motors not included in Heat & Air-Conditioning Load section	220.82 (B) (4)
HEATING & AIR-CONDITIONING LOADS	220.82 (C)
Include the **largest** of the following six selections (kVA load) in calculation	
Air Conditioning and Cooling	220.82 (C) (1)
• 100% of nameplate rating	
Heat Pumps Without Supplemental Electric Heating	220.82 (C) (2)
• 100% of nameplate rating	
Heat Pumps With Supplemental Electric Heating	220.82 (C) (3)
• 100% of nameplate rating of the heat pump compressor*	
• 65% of nameplate rating of supplemental electric heating equipment	
– If compressor & supplemental heat cannot run at the same time do not include the compressor	
Electric Space Heating	
• Less than 4 separately controlled units @ 65% of nameplate rating	220.82 (C) (4)
• 4 or more separately controlled units @ 40% of nameplate rating	220.82 (C) (5)
• 40% of nameplate rating if 4 or more separately controlled units	
Electric Thermal Storage (or system where the load is expected to be continuous at nameplate rating	220.82 (C) (6)
• 100% of nameplate rating	
• Systems of this type cannot be calculated under any other section of 220.82 (C).	

LOAD CALCULATIONS		
General Lighting Load		3 VA x ft²
• Small Appliance & Laundry Circuits	+	1500 VA per circuit
• General Appliances & Motors (100% rated load)	+	Total general appliances
• Sum of all General Loads	=	Total General Load (VA)
APPLY DEMAND FACTORS		
– First 10 kVA @ 100%	=	10,000 VA
– Remainder of General Loads @ 40%		(Total VA - 10,000) x .40
	=	Calculated General Load (VA)
• HEAT / A-C LOAD @ 100%		Largest Heat or A-C Load (VA)
	=	TOTAL CALCULATED LOAD

Converting VA TO kW (Single-phase applications with 1.0 power factor only) 1 kVA = 1 kW

220.54

Worksheet — NEC 2017, 220 Part IV					
Contractor		Email			
Phone		Fax			
Job Name					
Date	Location				
Voltage (Circle)	240V -1Ø				
Fuel		NG	LPV		
Elec. Service	100 Amp	200 Amp	400 Amp	Other	
NET SQUARE FOOTAGE					
GENERAL LOADS	Qty	Rating (Load)	Factor	Loads (VA)	Loads (kW) (VA ÷ 1,000)
General Lighting and General Use Receptacles		3 VA/ft²	100%		
Branch Circuits (1500 VA/ft²)					
Small Appliance Circuits (20 Amp)		1500	100%		
Laundry Circuits		1500	100%		
Fixed Appliances		Full Current Rating			
Well			100%		
Sump Pump			100%		
Freezer			100%		
Microwave (Not counter-top model)			100%		
Disposal			100%		
Dishwasher			100%		
Range			100%		
Wall-Mounted Oven			100%		
Counter-Mounted Cooking Surface			100%		
Water Heater			100%		
Clothes Dryer			100%		
Garage Door Opener			100%		
Septic Grinder			100%		
Other (list)			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
Total General Loads				**VA**	**kW**
HEAT / A-C LOAD					
A-C / Cooling Equipment			100%		
Heat Pump					
• Compressor (if not included as A-C)			100%		
• Supplemental Electric Heat			65%		
Electric Space Heating					
• Less than 4 separately controlled units			65%		
• 4 or more separately controlled units			40%		
System With Continuous Nameplate Load			100%		
Largest Heat / A-C Load (VA) VA kW					
GENERAL LOADS					
• 1st 10 kW of General Loads 100% kW			100%	kW	
• Remaining General Loads (kW) 40% kW			40%	kW	
CALCULATED GENERAL LOAD (kW) kW					kW
LARGEST HEAT / A-C LOAD 100% kW kW					kW
TOTAL CALCULATED LOAD (Net General Loads + Heat/A-C Load)					kW

Selected Circuit Load Calculator

GENERAC®

Contractor_____ Email _____

Phone_____ Fax _____

Job Name _____

Date_____ Location _____

VOLTAGE ☐ 120/240 1Ø ☐ 120/208 3Ø ☐ 120/240 3Ø ☐ 277/480 3Ø

TYPE ☐ Natural Gas ☐ LP Vapor (LPV)

ELEC. SERVICE ☐ 100 Amp ☐ 150 Amp ☐ 200 Amp ☐ 300 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.

Applications

The QT Series does not meet the necessary requirements for the following applications:

- 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 700 Emergency Systems
- 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
- ICC Fuel Gas Code

TABLE 8 Motor Load Table (refer to Table 1)

Device	HP	RA	LRA	kW Running (= HP)	Starting kW[1]

[1] See Table 430.7(B) for staring kVA per HP for motor loads.

To Calculate kW	
120 V 1ø	Amps x 120/1000 = kW
240 V 1ø	Amps x 240/1000 = kW
208 V 3ø	(Amps x 208 x 1.732 x PF) /1000 = kW
240 V 3ø	(Amps x 240 x 1.732 x PF) /1000 = kW
480 V 3ø	(Amps x 480 x 1.732 x PF) /1000 = kW

PF is application power factor (worst case 1.0)
Typical application power factor is 0.95.

TABLE 9 Non-Motor Load Table (refer to Table 2)

Device	Amps	kW

Transfer Switch Availability

RTSW – 100, 150, 200, 300 and 400 Amp service rated

RTSN – 100–800 3ø and 600–800 1ø Amp

RTSC – 100, 200, 400, 600, 800 Amp

GenReady – 200 Amp service panel

RTS and GenReady switches only work with the Evolution or Nexes Controller.

RECOMMENDED GENERATOR SIZE _____ Refer to Generator Sizing Instructions on other side of this sheet.

Install Notes:

1. Consult manual for installation recommendations.
2. Consult local authority having jurisdiction for local requirements.

Selected Circuit Load Calculator

GENERAC

Generator Sizing Instructions:

There is not a single correct sizing solution. Following are several methods that, when mixed with good judgement, should result in an appropriately sized generator. Remember to consider load growth, seasonality, and effects of starting motors.

As municipalities and states adopt the new 2017 NEC Electrical Code, there may be new sizing requirements, spelled out in the code book, which the installation technician must follow. Always check with the local inspection department to confirm which code cycle will affect your install.

Never add Amps when sizing a generator. Convert Amps to kW and add kW to determine the required generator size. Power factors for various motor loads vary widely. Adding Amps without properly accounting for the power factor and/or mixing voltages will result in improperly sizing the generator.

When motors start, they create a current surge that step loads the generator and creates a voltage dip. After selecting a generator, reference the generator's surge capability using **table 3**. Verify that voltage dip is adequate for the application. Most commercial applications should be limited to about 15% voltage dip and residential applications should be limited to a 30% voltage dip.

Some applications utilize an uninterruptible power supply (UPS) to back up critical loads. Please read sizing guide for this load type.

Measurement Method 220.87 Exception NEC 2017

Connect a recording ammeter or power meter that is capable of measuring the maximum peak kW demand continuously over a minimum 30 day period. The maximum kW demand shall be taken while the building is occupied and shall include the larger of the heating or cooling loads. The peak kW demand shall be multiplied by 125%.

Peak kW demand X 125% = Calculated kW demand

Size the generator to the next standard size and verify UPS and motor load compatibility.

Determining Existing Loads/Billing History Method 220.87 NEC 2017

Many customers have a utility rate structure that has a peak demand charge. Using a year's worth of electric bills, size the generator 25% larger than the largest peak demand.

Verify motor and UPS load compatibility. Peak Demand = _____

Load Summation Method

1) Enter running kW for all motor loads (except the largest) expected to run during peak load levels into **table 8**. Refer to **table 1** for typical motor load sizes and electrical requirements.

2) Enter kW for all non-motor loads expected to run during peak load levels into **table 9**. Refer to **table 2** for typical residential loads and rules of thumb.

3) Add the running motor load kW, non-motor load kW, and the starting kW of the largest motor load.

Motor load running total (minus largest motor): _____ kW (ref. table 8)
Non-motor load total: _____ kW (ref. table 9)
Starting load from largest cycling motor: _____ kW (ref. table 8)
Total electrical loads: =_____ kW

Select generator: Commercial (add 20 to 25% to total kW)
Residential (add 10 to 20% to total kW)

4) Confirm that voltage dip is within acceptable limits by comparing motor LRA to generator surge capability (see table #3).

5) Confirm UPS compatibility (see page 11).

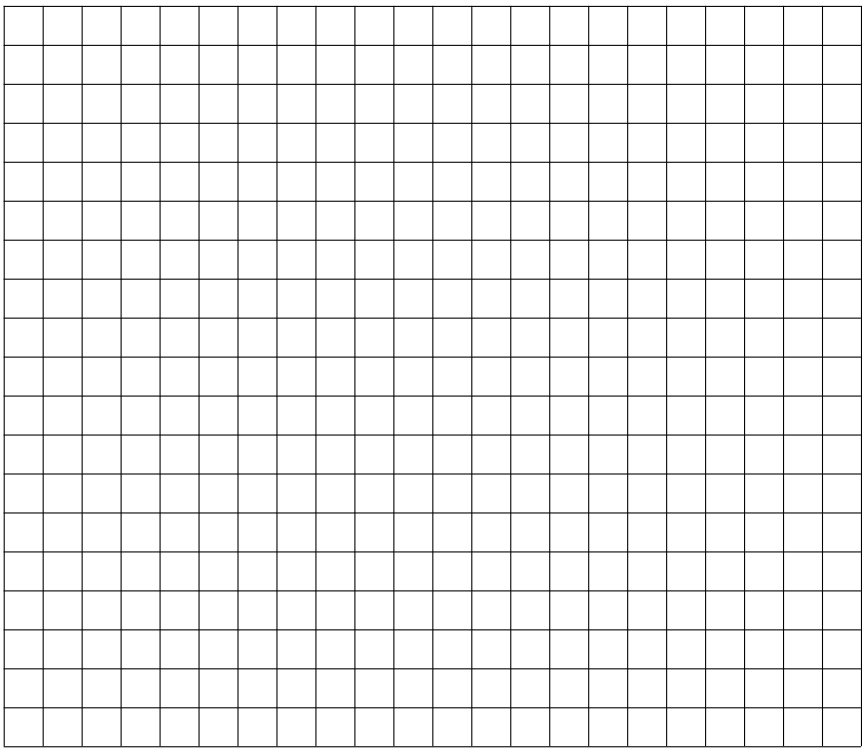
System Capacity – Load Calculation

If the local municipality or state you are in has adopted the 2017 NEC Code, you may be required to use this step. Article 702 of the 2017 NEC includes a new requirement for sizing (702.4). If no other method for sizing is acceptable, sizing of the generator shall be made in accordance with Article 220 of the NEC. The system capacity estimating sheet will guide you through this process.

SMM Load Control Module 702.4 (B) (2) (a) NEC 2017

The SMM Load Control Module is a 50 amp contact housed in a NEMA 3R enclosure for indoor and outdoor installation applications. Through the use of the SMM Modules in conjunction with any of the 100–600 amp Smart Switches, household or business loads can be intelligently managed enabling the use of a smaller, more efficient generator system. Up to four SMM Modules can be used with a single switch.

Project Layout



Ball Park Estimates (Do not use for final sizing)

Estimate based on 60% service size: (commercial)

240 Volts, 1 Ø: _____ Amps x .15 = _____ kW
208 Volts, 3 Ø: _____ Amps x .22 = _____ kW
240 Volts, 3 Ø: _____ Amps x .25 = _____ kW
480 Volts, 3 Ø: _____ Amps x .50 = _____ kW

Estimate based on 40% service size: (residential)

240 Volts, 1 Ø: _____ Amps x .10 = _____ kW
208 Volts, 3 Ø: _____ Amps x .15 = _____ kW
240 Volts, 3 Ø: _____ Amps x .17 = _____ kW
480 Volts, 3 Ø: _____ Amps x .34 = _____ kW

Estimate based on square footage

Fast food, convenience stores, restaurants, grocery stores: kW = 50 kW + 10 watts/sq. ft.

Other commercial applications: kW = 30 kW + 5 watts/sq. ft.

Square footage = _____ Estimated kW = _____

Amps to kW Rule of Thumb (assumes .8 pf)

For 480 volt systems: Amps = kW x 1.5
For 208 volt systems: Amps = kW x 3.5
For 240 volt 3 Ø systems: Amps = kW x 3
For 240 volt 1 Ø systems: Amps = kW x 4

System Capacity – Load Calculator

DIRECTIONS FOR NEC 2017, ARTICLE 220, PART IV 220.80 Optional Feeder and Service Load Calculations (RESIDENTIAL)	NEC REFERENCE
SECTION CAN BE USED FOR DWELLING UNITS	220.82 (A)
• Served by a single feeder conductor (generator)	
• 120/240 volt or 208Y/120 volt service	
• Ampacity of 100 amps or greater	
The calcultated load will be the result of adding	
• 220.82 (B) General Loads, and	220.82 (B)
• 220.82 (C) Heating and Air-Conditioning Load	220.82 (C)
GENERAL LOADS	220.82 (B)
General Lighting and General-Use Receptacles	
• Calculate at 3 VA per square foot	220.82 (B) (1)
• Use exterior dimensions of the home to calculate square footage – do not include open porches, garages, or unused or unfinished spaces not adaptable for future use.	
• Add 20-amp small appliance & laundry circuits @ 1500 VA each	220.82 (B) (2)
Calculate the following loads at 100% of nameplate rating	220.82 (B) (3)
• Appliances fastened in place, permanently connected or located on a specific circuit	220.82 (B) (3) a
• Ranges, wall-mounted ovens, counter-mounted cooking units	220.82 (B) (3) b
• Clothes dryers not connected to the laundry branch circuit	220.82 (B) (3) c
• Water heaters	220.82 (B) (3) d
• Permanently connected motors not included in Heat & Air-Conditioning Load section	220.82 (B) (4)
HEATING & AIR-CONDITIONING LOADS	220.82 (C)
Include the **largest** of the following six selections (kVA load) in calculation	
Air Conditioning and Cooling	220.82 (C) (1)
• 100% of nameplate rating	
Heat Pumps Without Supplemental Electric Heating	220.82 (C) (2)
• 100% of nameplate rating	
Heat Pumps With Supplemental Electric Heating	220.82 (C) (3)
• 100% of nameplate rating of the heat pump compressor*	
• 65% of nameplate rating of supplemental electric heating equipment	
– If compressor & supplemental heat cannot run at the same time do not include the compressor	
Electric Space Heating	
• Less than 4 separately controlled units @ 65% of nameplate rating	220.82 (C) (4)
• 4 or more separately controlled units @ 40% of nameplate rating	220.82 (C) (5)
• 40% of nameplate rating if 4 or more separately controlled units	
Electric Thermal Storage (or system where the load is expected to be continuous at nameplate rating	220.82 (C) (6)
• 100% of nameplate rating	
• Systems of this type cannot be calculated under any other section of 220.82 (C).	

LOAD CALCULATIONS		
General Lighting Load		3 VA x ft²
• Small Appliance & Laundry Circuits	+	1500 VA per circuit
• General Appliances & Motors (100% rated load)	+	Total general appliances
• Sum of all General Loads	=	Total General Load (VA)
APPLY DEMAND FACTORS		
– First 10 kVA @ 100%	=	10,000 VA
– Remainder of General Loads @ 40%		(Total VA - 10,000) x .40
	=	Calculated General Load (VA)
• HEAT / A-C LOAD @ 100%		Largest Heat or A-C Load (VA)
	=	TOTAL CALCULATED LOAD

Converting VA TO kW (Single-phase applications with 1.0 power factor only) 1 kVA = 1 kW 220.54

Worksheet — NEC 2017, 220 Part IV					
Contractor		Email			
Phone		Fax			
Job Name					
Date	Location				
Voltage (Circle)	240V -1Ø				
Fuel		NG	LPV		
Elec. Service	100 Amp	200 Amp	400 Amp	Other	
NET SQUARE FOOTAGE					
GENERAL LOADS	Qty	Rating (Load)	Factor	Loads (VA)	Loads (kW) (VA ÷ 1,000)
General Lighting and General Use Receptacles		3 VA/ft²	100%		
Branch Circuits (1500 VA/ft²)					
Small Appliance Circuits (20 Amp)		1500	100%		
Laundry Circuits		1500	100%		
Fixed Appliances		Full Current Rating			
Well			100%		
Sump Pump			100%		
Freezer			100%		
Microwave (Not counter-top model)			100%		
Disposal			100%		
Dishwasher			100%		
Range			100%		
Wall-Mounted Oven			100%		
Counter-Mounted Cooking Surface			100%		
Water Heater			100%		
Clothes Dryer			100%		
Garage Door Opener			100%		
Septic Grinder			100%		
Other (list)			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
			100%		
Total General Loads				**VA**	**kW**
HEAT / A-C LOAD					
A-C / Cooling Equipment			100%		
Heat Pump					
• Compressor (if not included as A-C)			100%		
• Supplemental Electric Heat			65%		
Electric Space Heating					
• Less than 4 separately controlled units			65%		
• 4 or more separately controlled units			40%		
System With Continuous Nameplate Load			100%		
Largest Heat / A-C Load (VA) VA kW					
GENERAL LOADS					
• 1st 10 kW of General Loads 100% kW			100%	kW	
• Remaining General Loads (kW) 40% kW			40%	kW	
CALCULATED GENERAL LOAD (kW) kW					kW
LARGEST HEAT / A-C LOAD 100% kW kW					kW
TOTAL CALCULATED LOAD (Net General Loads + Heat/A-C Load)					kW

NOTES

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