

Generator Sizing Guide



Residential and commercial

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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, Siemens recommends that the backup power system be installed, serviced and repaired by a Siemens 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.

Table of Contents

Table 1 – Motor Load Reference	5
Table 2 – Non-Motor Load Reference	6
Table 3 – Surge Capability	7
Table 4 – Fuel Pipe Sizing	8
Table 5 – LP Vapor (LPV) Tank Sizing	9
UPS – Generator Compatibility	10
Typical Generator/Transfer Switch Combinations	11
NEC 700, 701, 702 Comparison.....	12
Electrical Formulas, Weights and Measures	13, 14
Onsite Estimating Sheet.....	15-16
System Capacity – Load Calculator	17-18

TABLE 1 MOTOR LOAD REFERENCE

Caution:
DO NOT size the generator based on starting kW alone.
YOU MUST compare LR Amps to generator surge capability (table #3).
SIZE the generator by following the sizing instructions.

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	Starting kW
1 Ton (12,000 BTU)	1	1	5	3	3	1	33	22	19	10	2.5
2 Ton (24,000 BTU)	2	2	10	7	6	3	67	44	38	19	5
3 Ton (36,000 BTU)	3	3	15	10	8	4	100	67	58	29	7.5
4 Ton (48,000 BTU)	4	4	20	13	11	6	117	78	67	34	10
5 Ton (60,000 BTU)	5	5	25	16	14	7	145	97	84	42	12.5
7.5 Ton (85,000 BTU)	7.5	7.5	37	24	21	11	219	146	126	63	17
10 Ton* (120,000 BTU)	5 Hp (x2)	10	49	33	28	14	145	97	84	42	12.5
10 Ton (120,000 BTU)	10 Hp	10	49	33	28	14	250	167	144	72	20
15 Ton* (180,000 BTU)	7.5 Hp (x2)	15	74	49	42	21	219	146	126	63	17
15 Ton (180,000 BTU)	15 Hp	15	74	49	42	21	375	250	217	108	30
20 Ton* (240,000 BTU)	10 Hp (x2)	20	98	65	57	28	250	167	144	72	20
20 Ton (240,000 BTU)	20 Hp	20	n/a	65	57	28	500	333	289	144	40
25 Ton (300,000 BTU)	25	25	n/a	82	71	35	625	416	361	180	50
30 Ton* (360,000 BTU)	15 Hp (x2)	30	n/a	98	85	42	375	250	217	108	30
30 Ton (360,000 BTU)	30 Hp	30	n/a	98	85	42	750	500	433	217	60
40 Ton* (480,000 BTU)	20 Hp (x2)	40	n/a	131	113	57	500	333	289	144	40
40 Ton (480,000 BTU)	40 Hp	40	n/a	131	113	57	1000	666	577	289	80
50 Ton* (480,000 BTU)	25 Hp (x2)	50	n/a	163	142	71	625	416	361	180	50
50 Ton (480,000 BTU)	50 Hp	50	n/a	163	142	71	1250	833	722	361	100

* 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 at 120V 1Ø	Amps at 240V 1Ø
Electric heat per 1000 ft ²	12	n/a	50
Heat pump elements per 1000 ft ²	7	n/a	29
Dryer	5.5	n/a	23
Hot tub	10	n/a	50
Range oven/Stove top per burner	8	n/a	30
Hot water	4.5	n/a	19
General lighting and receptacles per 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

Siemens Generators (Operating at less than 3600 RPM)

Size (kW)	Rated Output (Running Amps)				Commercial Surge Capability (LR Amps @ 15% Voltage Dip)				Residential Surge Capability (LR Amps @ 30% Voltage Dip)			
	240V 1Ø	208V 3Ø	240V 3Ø	480V 3Ø	240V 1Ø	208V 3Ø	240V 3Ø	480V 3Ø	240V 1Ø	208V 3Ø	240V 3Ø	480V 3Ø
22	92	76	n/a	n/a	71	48	n/a	n/a	134	92	n/a	n/a
27	113	94	81	41	100	67	58	33	153	137	118	64
36	150	125	108	54	113	75	65	44	225	151	131	87
48	200	167	144	72	163	109	94	57	321	214	185	112
70	292	243	210	105	275	164	159	95	550	330	318	190
100	417	347	300	150	369	222	214	128	738	441	426	255
130	542	451	390	195	546	364	315	209	1088	724	628	419

Siemens Generators (Operating at 3600 RPM)

Size (kW)	Rated Output (Running Amps)				Commercial Surge Capability (LR Amps @ 15% Voltage Dip)				Residential Surge Capability (LR Amps @ 30% Voltage Dip)			
	240V 1Ø	208V 3Ø	240V 3Ø	480V 3Ø	240V 1Ø	208V 3Ø	240V 3Ø	480V 3Ø	240V 1Ø	208V 3Ø	240V 3Ø	480V 3Ø
8	33	n/a	n/a	n/a	26	n/a	n/a	n/a	51	n/a	n/a	n/a
10	42	n/a	n/a	n/a	31	n/a	n/a	n/a	63	n/a	n/a	n/a
14	58	n/a	n/a	n/a	52	n/a	n/a	n/a	102	n/a	n/a	n/a
17	71	n/a	n/a	n/a	63	n/a	n/a	n/a	125	n/a	n/a	n/a
20	83	n/a	n/a	n/a	73	n/a	n/a	n/a	145	n/a	n/a	n/a
25	104	87	75	38	71	48	46	30	138	92	91	60
30	125	104	90	45	100	67	60	43	205	137	130	87
45	188	156	135	68	146	98	94	57	292	195	168	112
60	250	208	180	90	179	120	103	69	350	234	204	136
70	292	243	210	105	275	164	142	95	550	330	286	190
80	333	278	240	120	275	183	158	106	550	366	318	212
100	417	347	300	150	369	222	214	128	738	441	426	255
150	625	520	451	226	558	372	322	215	1121	747	647	431

Note: All nominal ratings based upon LP fuel. Refer to specification sheet for NG ratings and deration adjustments for ambient temperature and altitude.

TABLE 4 FUEL PIPE SIZING

Natural Gas (Table values are maximum pipe run in feet.)

kW	Pipe Size (in)						
	0.75"	1"	1.25"	1.5"	2"	2.5"	3"
8	55	200	820				
10	20	85	370	800			
14	10	50	245	545			
17		40	190	425			
20		20	130	305	945		
22		15	115	260	799		
25		10	95	220	739		
27			85	203	552		
30			60	147	565		
36			35	95	370	915	
45			15	60	260	650	
48				50	230	585	
60				25	145	390	1185
70				5	75	225	710
80					65	195	630
100					40	140	460
130						50	215
150						30	150

LP

LPG: 8.55 ft³/lb., 4.24 lbs./gal., 2500 btu/ft³

LPG: 36.3 ft³ = 1 gal.

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

5-14 inches water column = 0.18 psi to 0.50 psi

LP Vapor (LPV) (Table values are maximum pipe run in feet.)

kW	Pipe Size (in)						
	0.75"	1"	1.25"	1.5"	2"	2.5"	3"
8	165	570					
10	70	255	1000				
14	45	170	690				
17	25	130	540				
20	15	115	480				
22		85	365				
25		60	275	605			
27		55	260	575			
30		40	195	435			
36		20	125	290	1030		
45			82	195	725		
48			70	165	620		
60			45	115	445	1095	
70			20	60	260	660	
80			15	50	230	590	
100				30	165	430	1305
130					70	205	660
150					45	150	490

Note:

- Pipe sizing is based on 0.5" H₂O pressure drop.
- Sizing includes a nominal number of elbows and tees.
- Please verify adequate service and meter sizing.

TABLE 5 LP VAPOR (LPV) TANK SIZING

Vapor Withdrawal

Tank Capacity Total (Gal.)	Tank Capacity Useable (Gal.)	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

Load (kW)	BTU / Hr	LP Gal / Hr	NG Ft ³ / Hr	NG Therms/ HR
5	110,000	1.2	110	1.1
10	156,000	2	156	1.6
15	231,800	2.5	220	2.2
20	294,000	2.9	294	2.6
25	345,000	3.8	345	3.2
30	418,300	4.5	417	4.2
35	485,000	5.1	485	4.8
40	550,000	6.1	550	5.5
50	655,000	7.5	655	6.7
60	836,600	9	862	8.6
70	1,035,700	11	1,020	10.2
80	1,170,000	12.7	1,154	11.5
90	1,200,000	13	1,200	12
100	1,280,000	13.8	1,260	12.6
110	1,550,000	17.1	1,550	15.5
120	1,675,000	18.5	1,675	16.7
130	1,800,000	19.5	1,786	17.8
140	1,925,000	21.3	1,925	19.2
150	2,050,000	22.7	2,050	20.5
200	2,800,000	30.9	2,800	28.0
300	4,100,000	45.3	4,100	49.0

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

Gas Required For Common Appliances	
Appliance	Approximate Input BTU / Hr
Warm Air Furnace Single Family Multifamily, per unit	100,000 60,000
Hydronic Boiler, Space Heating Single Family Multifamily, per unit	100,000 60,000
Hydronic Boiler, Space and Water Heating Single Family Multifamily, per unit	120,000 75,000
Range, Free Standing, Domestic Built-In Oven or Broiler Unit, Domestic Built-In Top Unit, Domestic	65,000 25,000 40,000
Water Heater, Automatic Storage, 30 to 40 gal. Tank Water Heater, Automatic Storage, 50 gal. Tank Water Heater, Automatic Storage, Instantaneous 2 GPM 4 GPM 6 GPM Water Heater, Domestic, Circulating or Side-Arm	35,000 50,000 142,800 285,000 428,000 35,000
Refrigerator Clothes Dryer, Type 1 (Domestic) Gas Fireplace Direct Vent Gas log Barbecue Gas light Incinerator, Domestic	3,000 35,000 40,000 80,000 40,000 2,500 35,000

Table Reprinted From Table 5.4.2.1, NFPA 54, 2002 ed.

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.

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

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.

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

TYPICAL GENERATOR/TRANSFER SWITCH COMBINATIONS

Current Model - NEXUS	Current Switch model #	Description
Nexus models / transfer switches and prior models / transfer switches listed CAN be used together. See notes below for details		
ASGN008RBS		8 kW Air-Cooled Generator - Steel
	ST100R10C	10 Circuit Load Distribution Panel
	SL100R	100 amp Normal Nexus Smart Switch
	SL100RCSA	100 amp CSA Service Rated Switch
ASGN010RBS		10 kW Air-Cooled Generator - Steel
	ST100R10C	10 Circuit Load Distribution Panel
	SL100R	100 amp Normal Nexus Smart Switch
	SL100RD	100 amp Service Entrance Rated Nexus Smart Switch
	SL150RD	150 amp Service Entrance Rated Nexus Smart Switch
	SL200R	200 amp Normal Nexus Smart Switch
	SL200RD	200 amp Service Entrance Rated Nexus Smart Switch
	SL200J	LTS Load Shedding 200 amp Nexus Smart Switch
		GenReady Load Center NEMA 1
		GenReady Load Center NEMA 3R
	SL100RCSA	100 amp CSA Service Rated Switch
SL200RCSA	200 amp CSA Service Rated Switch	
ASGN014RBS		14 kW Air-Cooled Generator - Steel
	ST100R12C	12 Circuit Load Distribution Panel
	ST100R14C	14 Circuit Load Distribution Panel
	SL100R	100 amp Normal Nexus Smart Switch
	SL100RD	100 amp Service Entrance Rated Nexus Smart Switch
	SL150RD	150 amp Service Entrance Rated Nexus Smart Switch
	SL200R	200 amp Normal Nexus Smart Switch
	SL200RD	200 amp Service Entrance Rated Nexus Smart Switch
	SL200J	LTS Load Shedding 200 amp Nexus Smart Switch
		GenReady Load Center NEMA 1
		GenReady Load Center NEMA 3R
SL100RCSA	100 amp CSA Service Rated Switch	
SL200RCSA	200 amp CSA Service Rated Switch	
ASGN017RBS ASGN017RBA		17 kW Air-Cooled Generator - Steel 17 kW Air-Cooled Generator - Aluminum
	ST100R16C	16 Circuit Load Distribution Panel
	SL100R	100 amp Normal Nexus Smart Switch
	SL100RD	100 amp Service Entrance Rated Nexus Smart Switch
	SL150RD	150 amp Service Entrance Rated Nexus Smart Switch
	SL200R	200 amp Normal Nexus Smart Switch
	SL200RD	200 amp Service Entrance Rated Nexus Smart Switch
	SL200J	LTS Load Shedding 200 amp Nexus Smart Switch
		GenReady Load Center NEMA 1
		GenReady Load Center NEMA 3R
	SL100RCSA	100 amp CSA Service Rated Switch
SL200RCSA	200 amp CSA Service Rated Switch	
ASGN020RBA		20 kW Air-Cooled Generator - Aluminum
	SL100R	100 amp Normal
	SL100RD	100 amp Service Entrance Rated
	SL150RD	150 amp Service Entrance Rated Nexus Smart Switch
	SL200R	200 amp Normal Nexus Smart Switch
	SL200RD	200 amp Service Entrance Rated Nexus Smart Switch
		GenReady Load Center NEMA 1
		GenReady Load Center NEMA 3R
	SL200J	LTS Load Shedding 200 amp Nexus Smart Switch
	SL100RCSA	100 amp CSA Service Rated Switch
SL200RCSA	200 amp CSA Service Rated Switch	

*NOTE 1: Combining a previous model transfer switch with a current Nexus model generator requires kit #0H930305RV to be installed to complete the battery charging circuit.
NOTE 2: Installing a previous model series generator with any of the listed transfer switch will require the installation of the battery charger included with the generator
Centurion generator models are not displayed.

TYPICAL GENERATOR/TRANSFER SWITCH COMBINATIONS

Current Model - NEXUS	Current Switch model #	Description
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Nexus models / transfer switches and prior models / transfer switches listed CAN be used together. See notes below for details

SGN022RBAL SGN025RBS SGN027RBAL SGN030RBS		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
	SL100R	100 amp Normal Nexus Smart Switch
	SL100RD	100 amp Service Entrance Rated Nexus Smart Switch
	SL150RD	150 amp Service Entrance Rated Nexus Smart Switch
	SL200R	200 amp Normal Nexus Smart Switch
	SL200RD	200 amp Service Entrance Rated Nexus Smart Switch
	SL200J	LTS Load Shedding 200 amp switch
		GenReady Load Center NEMA 1
	GenReady Load Center NEMA 3R	
SL100RCSA	100 amp CSA Service Rated Switch	
SL200RCSA	200 amp CSA Service Rated Switch	

SGN036RBAL		36 kW Liquid-Cooled Generator - Aluminum
	SL100R	100 amp Normal Nexus Smart Switch
	SL100RD	100 amp Service Entrance Rated Nexus Smart Switch
	SL150RD	150 amp Service Entrance Rated Nexus Smart Switch
	SL200R	200 amp Normal Nexus Smart Switch
	SL200RD	200 amp Service Entrance Rated Nexus Smart Switch
	SL200J	LTS Load Shedding 200 amp switch
	SL100RCSA	100 amp CSA Service Rated Switch
SL200RCSA	200 amp CSA Service Rated Switch	

SGN045RBS		45 kW Liquid-Cooled Generator - Steel
	SL100R	100 amp Normal Nexus Smart Switch
	SL100RD	100 amp Service Entrance Rated Nexus Smart Switch
	SL200R	200 amp Normal Nexus Smart Switch
	SL200RD	200 amp Service Entrance Rated Nexus Smart Switch
	SL200J	LTS Load Shedding 200 amp switch
	SL100RCSA	100 amp CSA Service Rated Switch
SL200RCSA	200 amp CSA Service Rated Switch	

SGN048RBAL		48 kW Liquid-Cooled Generator - Aluminum
	SL100R	100 amp Normal Nexus Smart Switch
	SL100RD	100 amp Service Entrance Rated Nexus Smart Switch
	SL200R	200 amp Normal Nexus Smart Switch
	SL200RD	200 amp Service Entrance Rated Nexus Smart Switch
	SL200J	LTS Load Shedding 200 amp switch
	SL100RCSA	100 amp CSA Service Rated Switch
	SL200RCSA	200 amp CSA Service Rated Switch
SL400R	400 amp Normal Nexus Smart Switch	

SL 100 - 400 amp*	22-60 kW Liquid-Cooled Generator - 3Ø options	100 - 400 amp*
SL 100 - 800 amp*	70-150 kW Liquid-Cooled Generator - 1 & 3Ø options	100 -800 amp*

*(all NON service entrance rated)

NOTE: Combining a previous model transfer switch with a current Nexus model generator requires a kit #0H93030SRV to be installed to complete the battery charging circuit.

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
Testing	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
	Witness Testing (on-sight)	At install & periodically	At install	None
	Periodic Testing	Yes	Yes	None
	Battery Maintenance	Yes	Yes	None
	Maintenance Records	Yes	Yes	None
	Load Testing	Yes	Yes	None
Transfer Switch	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
	Automatic	Yes	Yes	No
	Equipment Approval	For Emergency / (UL1008)	For Standby / (UL1008)	For Intended Use / (UL1008)
	Means to Permitt Bypass	Yes	No	No
	Elect. Operated - Mech. Held	Yes	No	No
Signals (Audible & Visual)	Other loads	No	Yes with load shedding	N/A
	Max. Fault Current Capable	Yes	Yes	Yes
	Derangement	Yes / Standard common alarm	Yes / Standard common alarm	Yes / Standard common alarm
	Carrying Load	Yes / Displayed at ATS	Yes / Displayed at ATS	Yes / Displayed at ATS
	Battery Charger Failed	Yes	Yes	No
	Ground Fault Indication	Yes (480V & 1000A)	No	No
	NFPA 110 Signaling	Yes / Optional annunciator	Yes / Optional annunciator	No
Signs	At service	Yes / Type & location	Yes / Type & location	Yes / Type & location
	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	$E \times I \times 1.73 \times PF$
NO. OF ROTOR POLES	Frequency, RPM	$\frac{2 \times 60 \times \text{Frequency}}{\text{RPM}}$	$\frac{2 \times 60 \times \text{frequency}}{\text{RPM}}$
FREQUENCY	RPM, No. of Rotor Poles	$\frac{\text{RPM} \times \text{Poles}}{2 \times 60}$	$\frac{\text{RPM} \times \text{Poles}}{2 \times 60}$
RPM	Frequency, No. of Rotor Poles	$\frac{2 \times 60 \times \text{Frequency}}{\text{Rotor Poles}}$	$\frac{2 \times 60 \times \text{Frequency}}{\text{Rotor Poles}}$
kW (required for Motor)	Motor Horsepower, Efficiency	$\frac{HP \times 0.746}{\text{Efficiency}}$	$\frac{HP \times 0.746}{\text{Efficiency}}$
RESISTANCE	Volts, Amperes	$\frac{E}{I}$	$\frac{E}{I}$
VOLTS	Ohms, Amperes	$I \times R$	$I \times R$
AMPERES	Ohms, Volts	$\frac{E}{R}$	$\frac{E}{R}$

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

U.S. WEIGHTS AND MEASURES

LINEAR MEASURE

12 INCHES	= 1 FOOT	= 2.540 CENTIMETERS
3 FEET	= 1 YARD	= 3.048 DECIMETERS
5.5 YARDS	= 1 ROD	= 9.144 DECIMETERS
40 RODS	= 1 FURLONG	= 5.029 METERS
8 FURLONGS	= 1 MILE	= 2.018 HECTOMETERS
		= 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
30 3/4 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)	= 277 1/4 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 = 0.00001

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 = 2,2045.622 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
3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	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	1.578x10 ⁻⁵	25.4	2.54	.0254	2.54x10 ⁻³
1 Foot =	12	1	.333	1.894x10 ⁻⁴	304.8	30.48	.3048	3.048x10 ⁻¹
1 Yard =	36	3	1	5.6818 x10 ⁻⁴	914.4	91.44	91.44	9.144x10 ⁻¹
1 Mile =	63,360	5,280	1,760	1	1,609,344	160,934.4	1,609,344	1.609344
1 mm =	.03937	.0032808	1.0936x10 ⁻³	6.2137x10 ⁻⁷	1	0.1	0.001	0.000001
1 cm =	.3937	.0328084	.0109361	6.2137x10 ⁻⁴	10	1	0.01	0.00001
1 m =	39.37	3.28084	1.09361	6.2137x10 ⁻¹	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 x 10⁵ 0.000524 = 5.24 x 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 CONDUCTORCM = (Diameter in mils)²

BUS BARCM = $\frac{\text{Width (mils)} \times \text{Thickness (mils)}}{0.7854}$

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

SYSTEM CAPACITY – LOAD CALCULATOR

DIRECTIONS FOR NEC 2008, ARTICLE 220, PART IV DIRECTIONS FOR NEC 2011, ARTICLE 220, PART IV		NEC REFERENCE
220.80 Optional Feeder and Service Load Calculations (RESIDENTIAL)		
SECTION CAN BE USED FOR DWELLING UNITS		220.82 (A)
<ul style="list-style-type: none"> • Served by a single feeder conductor (generator) • 120/240 volt or 208Y/120 volt service • Ampacity of 100 amps or greater The calculated load will be the result of adding <ul style="list-style-type: none"> • 220.82 (B) General Loads, and 220.82 (B) • 220.82 (C) Heating and Air-Conditioning Load 220.82 (C) • Calculated neutral load determined by 220.61. (Additional 70% demand factor can be taken for cooking appliances and dryers when tables 220.54 and/or 220.55 are used)		
GENERAL LOADS		220.82 (B)
General Lighting and General-Use Receptacles <ul style="list-style-type: none"> • 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) <ul style="list-style-type: none"> • 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 (Tables 220.54 & 220.55) 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 <ul style="list-style-type: none"> Air Conditioning and Cooling 220.82 (C) (1) <ul style="list-style-type: none"> • 100% of nameplate rating Heat Pumps Without Supplemental Electric Heating 220.82 (C) (2) <ul style="list-style-type: none"> • 100% of nameplate rating Heat Pumps With Supplemental Electric Heating 220.82 (C) (3) <ul style="list-style-type: none"> • 100% of nameplate rating of the heat pump compressor* • 65% of nameplate rating of supplemental electric heating equipment <ul style="list-style-type: none"> – If compressor & supplemental heat cannot run at the same time do not include the compressor Electric Space Heating <ul style="list-style-type: none"> • 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) <ul style="list-style-type: none"> • 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 ft ²	
• Small Appliance & Laundry Circuits	+ 1500 VA per circuit	
• General Appliances & Motors (100% rated load)	+ <u>Total general appliances</u>	
• Sum of all General Loads	= Total General Load (VA)	
APPLY DEMAND FACTORS		
– First 10 kVA @ 100%	= 10,000 VA	
– Remainder of General Loads @ 40%	= <u>(Total VA - 10,000) x .40</u>	
• HEAT / A-C LOAD @ 100%	= <u>Largest Heat or A-C Load (VA)</u>	
	= TOTAL CALCULATED LOAD	

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

220.54

ONSITE ESTIMATING SHEET

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 200 Amp 400 Amp 600 Amp Other _____

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

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

Use the following for sizing and determining generator kW.

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

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

- 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

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

UPS Information
1.5 x kVA rating for a filtered system
3 – 5 x kVA rating for an unfiltered system
Siemens recommends you refer to the Siemens UPS Generator Compatibility sheet and contact the manufacturer of the UPS system to assist in your installation.

Transfer Switch Availability
SLD Type – 100, 150, 200 and 400 Amp service rated
SL Type – 100-800 3Ø and 600-800 1Ø Amp
SL Type – 100, 200, 400 Amp
PowerManager – 200 Amp service rated load shed switch
GenReady – 200 Amp service panel

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

- INSTALL NOTES:**
- Suggested concrete pad minimum thickness of 4" with 6" overhang on all sides. Composite pad included with air-cooled products.
 - Consult manual for installation recommendations.
 - Consult local authority having jurisdiction for local requirements.

SYSTEM CAPACITY – LOAD CALCULATOR

DIRECTIONS FOR NEC 2011, ARTICLE 220, PART IV		NEC REFERENCE
220.80 Optional Feeder and Service Load Calculations (RESIDENTIAL)		
SECTION CAN BE USED FOR DWELLING UNITS		220.82 (A)
<ul style="list-style-type: none"> • Served by a single feeder conductor (generator) • 120/240 volt or 208Y/120 volt service • Ampacity of 100 amps or greater <p>The calculated load will be the result of adding</p> <ul style="list-style-type: none"> • 220.82 (B) General Loads, and 220.82 (B) • 220.82 (C) Heating and Air-Conditioning Load 220.82 (C) <p>• Calculated neutral load determined by 220.61. (Additional 70% demand factor can be taken for cooking appliances and dryers when tables 220.54 and/or 220.55 are used)</p>		
GENERAL LOADS		220.82 (B)
<p>General Lighting and General-Use Receptacles</p> <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • Add 20-amp small appliance & laundry circuits @ 1500 VA each 220.82 (B) (2) <p>Calculate the following loads at 100% of nameplate rating 220.82 (B) (3)</p> <ul style="list-style-type: none"> • 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 (Tables 220.54 & 220.55) 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)
<p>Include the largest of the following six selections (kVA load) in calculation</p> <p>Air Conditioning and Cooling 220.82 (C) (1)</p> <ul style="list-style-type: none"> • 100% of nameplate rating <p>Heat Pumps Without Supplemental Electric Heating 220.82 (C) (2)</p> <ul style="list-style-type: none"> • 100% of nameplate rating <p>Heat Pumps With Supplemental Electric Heating 220.82 (C) (3)</p> <ul style="list-style-type: none"> • 100% of nameplate rating of the heat pump compressor* • 65% of nameplate rating of supplemental electric heating equipment <ul style="list-style-type: none"> – If compressor & supplemental heat cannot run at the same time do not include the compressor <p>Electric Space Heating</p> <ul style="list-style-type: none"> • 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 <p>Electric Thermal Storage (or system where the load is expected to be continuous at nameplate rating 220.82 (C) (6)</p> <ul style="list-style-type: none"> • 100% of nameplate rating <p>• Systems of this type cannot be calculated under any other section of 220.82 (C).</p>		
LOAD CALCULATIONS		
<p>General Lighting Load 3 VA x ft²</p> <ul style="list-style-type: none"> • Small Appliance & Laundry Circuits + 1500 VA per circuit • General Appliances & Motors (100% rated load) + <u>Total general appliances</u> <p>• Sum of all General Loads = Total General Load (VA)</p> <p>APPLY DEMAND FACTORS</p> <ul style="list-style-type: none"> – First 10 kVA @ 100% = 10,000 VA – Remainder of General Loads @ 40% = <u>(Total VA - 10,000) x .40</u> <p>• HEAT / A-C LOAD @ 100% = <u>Calculated General Load (VA)</u></p> <p>= <u>Largest Heat or A-C Load (VA)</u></p> <p>= <u>TOTAL CALCULATED LOAD</u></p>		

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

220.54

SYSTEM CAPACITY – LOAD CALCULATOR

DIRECTIONS FOR NEC 2011, ARTICLE 220, PART IV		NEC REFERENCE
220.80 Optional Feeder and Service Load Calculations (RESIDENTIAL)		
SECTION CAN BE USED FOR DWELLING UNITS		220.82 (A)
<ul style="list-style-type: none"> • Served by a single feeder conductor (generator) • 120/240 volt or 208Y/120 volt service • Ampacity of 100 amps or greater The calculated load will be the result of adding		
<ul style="list-style-type: none"> • 220.82 (B) General Loads, and • 220.82 (C) Heating and Air-Conditioning Load 		220.82 (B) 220.82 (C)
<ul style="list-style-type: none"> • Calculated neutral load determined by 220.61. (Additional 70% demand factor can be taken for cooking appliances and dryers when tables 220.54 and/or 220.55 are used) 		
GENERAL LOADS		220.82 (B)
General Lighting and General-Use Receptacles		
<ul style="list-style-type: none"> • Calculate at 3 VA per square foot • 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. 		220.82 (B) (1)
<ul style="list-style-type: none"> • 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)
<ul style="list-style-type: none"> • Appliances fastened in place, permanently connected or located on a specific circuit • Ranges, wall-mounted ovens, counter-mounted cooking units (Tables 220.54 & 220.55) • Clothes dryers not connected to the laundry branch circuit • Water heaters • Permanently connected motors not included in Heat & Air-Conditioning Load section 		220.82 (B) (3) a 220.82 (B) (3) b 220.82 (B) (3) c 220.82 (B) (3) d 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)
<ul style="list-style-type: none"> • 100% of nameplate rating 		
Heat Pumps Without Supplemental Electric Heating		220.82 (C) (2)
<ul style="list-style-type: none"> • 100% of nameplate rating 		
Heat Pumps With Supplemental Electric Heating		220.82 (C) (3)
<ul style="list-style-type: none"> • 100% of nameplate rating of the heat pump compressor* • 65% of nameplate rating of supplemental electric heating equipment <ul style="list-style-type: none"> – If compressor & supplemental heat cannot run at the same time do not include the compressor 		
Electric Space Heating		
<ul style="list-style-type: none"> • Less than 4 separately controlled units @ 65% of nameplate rating • 4 or more separately controlled units @ 40% of nameplate rating • 40% of nameplate rating if 4 or more separately controlled units 		220.82 (C) (4) 220.82 (C) (5)
Electric Thermal Storage (or system where the load is expected to be continuous at nameplate rating)		220.82 (C) (6)
<ul style="list-style-type: none"> • 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 ft ²
• Small Appliance & Laundry Circuits	+	1500 VA per circuit
• General Appliances & Motors (100% rated load)	+	<u>Total general appliances</u>
• Sum of all General Loads	=	Total General Load (VA)
APPLY DEMAND FACTORS		
– First 10 kVA @ 100%	=	10,000 VA
– Remainder of General Loads @ 40%	=	<u>(Total VA - 10,000) x .40</u>
	=	Calculated General Load (VA)
• HEAT / A-C LOAD @ 100%	=	<u>Largest Heat or A-C Load (VA)</u>
	=	TOTAL CALCULATED LOAD

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

220.54

SYSTEM CAPACITY – LOAD CALCULATOR

DIRECTIONS FOR NEC 2011, ARTICLE 220, PART IV ART IV		NEC REFERENCE
220.80 Optional Feeder and Service Load Calculations (RESIDENTIAL)		
SECTION CAN BE USED FOR DWELLING UNITS		220.82 (A)
<ul style="list-style-type: none"> • Served by a single feeder conductor (generator) • 120/240 volt or 208Y/120 volt service • Ampacity of 100 amps or greater <p>The calculated load will be the result of adding</p> <ul style="list-style-type: none"> • 220.82 (B) General Loads, and 220.82 (B) • 220.82 (C) Heating and Air-Conditioning Load 220.82 (C) <p>• Calculated neutral load determined by 220.61. (Additional 70% demand factor can be taken for cooking appliances and dryers when tables 220.54 and/or 220.55 are used)</p>		
GENERAL LOADS		220.82 (B)
<p>General Lighting and General-Use Receptacles</p> <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • Add 20-amp small appliance & laundry circuits @ 1500 VA each 220.82 (B) (2) <p>Calculate the following loads at 100% of nameplate rating</p> <ul style="list-style-type: none"> • Appliances fastened in place, permanently connected or located on a specific circuit 220.82 (B) (3) • Ranges, wall-mounted ovens, counter-mounted cooking units (Tables 220.54 & 220.55) 220.82 (B) (3) a • Clothes dryers not connected to the laundry branch circuit 220.82 (B) (3) b • Water heaters 220.82 (B) (3) c • Permanently connected motors not included in Heat & Air-Conditioning Load section 220.82 (B) (3) d 		
HEATING & AIR-CONDITIONING LOADS		220.82 (C)
<p>Include the largest of the following six selections (kVA load) in calculation</p> <p>Air Conditioning and Cooling 220.82 (C) (1)</p> <ul style="list-style-type: none"> • 100% of nameplate rating <p>Heat Pumps Without Supplemental Electric Heating 220.82 (C) (2)</p> <ul style="list-style-type: none"> • 100% of nameplate rating <p>Heat Pumps With Supplemental Electric Heating 220.82 (C) (3)</p> <ul style="list-style-type: none"> • 100% of nameplate rating of the heat pump compressor* • 65% of nameplate rating of supplemental electric heating equipment <ul style="list-style-type: none"> – If compressor & supplemental heat cannot run at the same time do not include the compressor <p>Electric Space Heating</p> <ul style="list-style-type: none"> • 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 <p>Electric Thermal Storage (or system where the load is expected to be continuous at nameplate rating 220.82 (C) (6)</p> <ul style="list-style-type: none"> • 100% of nameplate rating <p>• Systems of this type cannot be calculated under any other section of 220.82 (C).</p>		
LOAD CALCULATIONS		
<p>General Lighting Load 3 VA x ft²</p> <ul style="list-style-type: none"> • Small Appliance & Laundry Circuits + 1500 VA per circuit • General Appliances & Motors (100% rated load) + <u>Total general appliances</u> • Sum of all General Loads = Total General Load (VA) <p>APPLY DEMAND FACTORS</p> <ul style="list-style-type: none"> – First 10 kVA @ 100% = 10,000 VA – Remainder of General Loads @ 40% = <u>(Total VA - 10,000) x .40</u> <p>• HEAT / A-C LOAD @ 100% = <u>Largest Heat or A-C Load (VA)</u></p> <p style="text-align: right;">= TOTAL CALCULATED LOAD</p>		

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

220.54

Worksheet — NEC 2011, 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 (See Table 220.55 for multiple cooking appliances)								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%	<u> </u>	kW			
• Remaining General Loads (kW) 40% kW								40%	<u> </u>	kW			
CALCULATED GENERAL LOAD (kW) kW										<u> </u> kW			
LARGEST HEAT / A-C LOAD 100% kW kW										<u> </u> kW			
TOTAL CALCULATED LOAD (Net General Loads + Heat/A-C Load)										<u> </u> kW			

Siemens Industry, Inc.
Building Technologies Division
5400 Triangle Parkway
Norcross, GA 30092
1-800-964-4114

info.us@siemens.com

www.usa.siemens.com/generators

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