NORTHERN LIGHTS®

Generator Set Application Guide

for Prime and Stand-By Power Generator Sets

MODEL SELECTION

Northern Lights generators provide continuous or standby power for homes, schools, government facilities, farms, campsites and businesses. This guide will help you select the appropriate model for your application. Remember, if you have any questions regarding a particular application, call your local Alaska Diesel Electric representative or Northern Lights dealer.

1. Use this Northern Lights Generator application questionnaire for a worksheet. Include all motors, lights, appliances, and electrically powered devices to be powered by the generator. If the generator is to be used for standby operation, list only essential lights and appliances needed during a power failure.
2. Continuous operation puts many hours on an engine. Diesel engines are more durable and should be considered for long term operation. Also, diesel fuel is safer than gasoline or propane and more energy efficient. Compare fuel costs over a one month time span.

ESTIMATING ELECTRICAL LOAD

It is important that the correct size Northern Lights generator be selected. The size generator required is determined by the total wattage of all the equipment and appliances which will be operated at the same time.

Wattage required for any given piece of equipment or appliance is usually printed on the name plate. If only the amps required are listed on the name plate, then use the following formula to figure the watts needed.

A. Single Phase - Amps x Voltage = Watts
B. Three Phase - Amps x Voltage x 1.73 = Watts

If there is no data plate, or if the information is not supplied on the data plate, see the following charts for typical wattage requirements of some motors and appliances. Starting a motor requires several times more power than is needed to run it. If the motor starting load is large, a voltage dip may cause the lights to dim or relays to chatter. Selecting a generator which is inadequate for the peak load may make it difficult to start motors in air conditioners or freezers, for example.

Selecting a generator that is too large causes the engine to operate in an overcool condition. This results in injector carboning, carboning of valves, raw fuel being pumped into the exhaust, etc.

A good rule of thumb is that the continuous load should be at least 50% of the generator capacity.

BALANCING LOADS

It is recommended that all loads which will be in use at any one time be divided up equally among the generator's output legs. For example, do not put heating loads on one leg, and air conditioning loads on the other leg. If the loads are not balanced properly, it may cause a loss in voltage on the loaded leg and excessive voltage on the unloaded leg as well as low output. Normally, the engine will not be affected by an unbalanced load.

MOTOR LOADS

Electric motors and appliances containing electric motors usually require up to ten times the running wattage during starting. A good rule of thumb when working with motor loads is to take running wattage of the largest motor and multiply that by ten. Then add the running wattage of all the smaller motors, as well as the wattage of all the other loads. This will add up to your total load.

Then determine how much of the total load would be operating at any one time. If a motor can be wired up at several voltages, for example 120 volt or 240 volt, it is usually more efficient to wire it at the higher voltage. The following charts give some typical power requirements.

MOTOR WATTAGES

Starting wattages of motors vary by its class which is designated as a NEMA Code Letter. Try to choose equipment with lower motor starting wattage requirements. These motors are more expensive but allow you to use a smaller generator.

Motor Starting Wattage

NEMA Code Letter	Starting Wattage* per H.P.
A	3100
B	3500
C	4000
D	4500
E	5000
F	5600
G	6300
H	7100
J	8000
K	9000
L	10,000
M	11,200

Motor Running Wattage

Size (H.P.)	Approximate Running Watts
1/6	275
1/4	400
1/3	450
1/2	600
3/4	850
1	1108

Typical Example:

NEMA Code	Starting Watts/H.P.		H.P.		Starting Watts*	Running Watts
A	3100	x	1/2	=	1550	600

Determine starting wattage of largest electric motor by taking NEMA Code Letter on nameplate multiplied by horsepower.
For example: NEMA "A" Coded frame, 1/2 H.P. motor requires 1550 watts for starting (3100 x 1/2 = 1550).
Add running wattages of all other motors to this figure for total motor wattages.

**Starting watts required are determined by NEMA Code Rating on motor nameplate.*

TYPICAL LOAD CALCULATIONS

The following is an example of one method for load calculation to determine the minimum size of panel boards and their main conductors as well as the size of the power source(s) supplying these devices.

A. Lighting Fixtures and Receptacles

Length times width of living space (excluding spaces only for machinery and open deck areas) times 2 watts per square foot.

Formula: _____ (LENGTH) x _____ (WIDTH) x 2 = _____ lighting watts.

B. Small Appliances

Number of circuits times 1,500 watts for each 20 ampere appliance receptacle.

Formula: _____ (NUMBER OF CIRCUITS) x 1500 = _____ appliance watts.

Sub-total: _____ (A. LIGHTING FIXTURE WATTS) + _____ (B. SMALL APPLIANCE WATTS) = _____ total wattage required.

C. Load Factor

First 2,000 total watts at 100% ..... _____
Remaining total watts times 35% ..... _____
Total watts divided by system voltage ..... _____

D. Amperes

If power system is to operate on 240 volts, split and balance loads into Leg A and Leg B. If power is to operate on 120 volts, use Leg A only.

	Leg A	Leg B
Total Amperes (from "C")	_____	_____

E. Add name plate amperes for motor & heater loads.

	Leg A	Leg B
Exhaust & supply fans	_____	_____
Air Conditioners* / **	_____	_____
Electric, gas, oil heater*	_____	_____
Other loads (winch, etc.)	_____	_____
Largest motor	_____	_____
Sub-total***	_____	_____

NOTE:
**Omit the smaller of these two, but include any motor common to both functions.*
***If system consists of 3 or more independent units, adjust the total by multiplying by 75% diversity factor.*
****Or, ten times the running amperage of the largest motor, whichever is largest.*

F. Add name plate amperes at indicated use factor percentage for:

	Leg A	Leg B
Disposal / 10%	_____	_____
Water heater / 100%	_____	_____
Wall mount oven / 75%	_____	_____
Cooking units / 75%	_____	_____
Refrigerator / 100%	_____	_____
Freezer / 100%	_____	_____
Ice maker / 50%	_____	_____
Dishwasher / 25%	_____	_____
Washing machine / 25%	_____	_____
Dryer / 25%	_____	_____
Trash compactor / 10%	_____	_____
Air compressor / 10%	_____	_____
Battery chargers / 100%	_____	_____
Vacuum system / 10%	_____	_____
Other fixed appliances	_____	_____
	_____	_____
Sub-total	_____	_____

NOTE: *If four or more appliances are installed, adjust the total by multiplying by a 60% diversity factor.*

Adjusted Sub Total	_____	_____

G. Add amps for free-standing range, distinguished from separate oven and cooking units in "F".
Derive from following table by dividing watts by 120 volts or 240 volts depending on which unit is installed.

Sub-total	_____	_____

	Leg A	Leg B
I. Lighting and small appliances	_____	_____
Motors	_____	_____
Fixed appliances	_____	_____
Free standing range	_____	_____
Total	_____	_____

NOTE: *If the total for Legs A and B are unequal, use the larger value to determine the total power required.*

TYPICAL RUNNING LOADS

(See data plate for exact wattage)

Kitchen

Dishwasher	1000-2500 watts
Garbage Disposal	300-400 watts
Microwave Oven	650-1600 watts
Range (per element)	500-1500 watts
Water Heater	3500-5000 watts

Laundry

Dryer	4000-5000 watts
Iron	500-1300 watts
Washer	250-1200 watts

Food Storage

Freezer*	350-850 watts (see motors)
Refrigerator*	350-850 watts (see motors)

Entertainment

Stereo	100-300 watts
Radio	50 watts
TV	300-400 watts

Comfort and Health

Air Conditioner (12,000 BTU)*	3200 watts (see motors)
Electric Blanket	70-225 watts
Furnace Fan (1/4 HP)*	800 watts
(1/2 HP)*	1200 watts
Oil Burner on Furnace	300 watts
Fan	50-100 watts
Heat Lamp	250 watts
Heater	1000-2000 watts
Oil-Fired Space Heater (30,000 BTU)	150 watts
Sun Lamp	400 watts

Personal Grooming

Curling Iron	600 watts
Hair Dryer	750-1000 watts

Portables

Coffee maker	500-800 watts
Frying Pan	1000-1400 watts
Fryer	1300 watts
Kettle	1500 watts
Mixer	150-300 watts
Toaster Oven	1000-1500 watts
Toaster	800-1200 watts
Waffle Iron	600-1300 watts

Other

Clock	4-10 watts
Sewing Machine	1000 watts
Vacuum Cleaner	400-1000 watts
Milk Cooler*	1100 watts
Coffee Maker	1000 watts
Jet Pump*	800 watts

Lawn/Garden Uses

Chain Saw	1200 watts
Lawn Mower	1200 watts
Hand Drill (3/8")	500 watts
Edger Trimmer	500 watts
Weed Trimmer	500 watts
Hedge Trimmer	450 watts
Hand Drill (1/4")	250 watts

Construction/Tools

Radial Arm Saw	2600 watts
Concrete Vibrator	2500 watts
Compressor (1 HP)*	2000 watts
Electric Nail Gun	1200 watts
Disc Sander (9")	1200 watts
Belt Sander (3")	1000 watts
Submersible Pump (1 1/2 HP)*	4000 watts
Circular Saw (6-1/2")	1000 watts
Battery Charger (20 amp)	500 watts
Hand Drill (3/8")	500 watts
Airless Paint Sprayer (1/3 HP)*	600 watts
Hand Drill (1/4")	250 watts
Impact Wrench	500 watts
Oil-Fired Space Heater (140,000 BTU)	400 watts
Hand Drill (1/4")	250 watts
Oil-Fired Space Heater (85,000 BTU)	225 watts

**Don't forget to calculate motor starting requirements for these items.*

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L151 11/14/07