

ESTIMATING THE ELECTRIC LOAD  
ELECTRIC MOTOR INFORMATION

The table #1 is based on average motors used under average load conditions. An electric motor requires more current in starting than when running. Also, the power factor (magnetizing current requirement) is very low during starting. Therefore, the starting current of the motor will be several times that of the running current. This applies particularly where the motors are started across the line. The amount that the starting current exceeds the running current varies greatly, depending on the type, make of motor, motor horsepower and speed. Allow at least 25% extra for difficult starting conditions such as compressors, deep well pumps, air-conditioning, etc.

TABLE #1  
WATTS REQUIRED TO START

Motor H.P. Rating	Approx. "Running" Watts	Split Phase Motors	Capacitor Start Motors	Repulsion Induction Motors
1/6	275	2050	850	600
1/4	400	2400	1050	850
1/3	450	2700	1350	975
1/2	600	3600	1800	1300
3/4	850	-	2600	1900
1	1100	-	3300	2500

Extra starting current for universal motors, such as used in saws, drills and electrical appliances, can be disregarded and only the "running" watts figured.

Starting current of AC motors can be found from Technical Bulletin #9. Full load current of single-phase and three-phase motors can be determined from Technical Bulletin #10. Table #2 lists estimated average watts or horsepower for Farm/Home appliances and electrical equipment.

TABLE #2  
ESTIMATED AVERAGE KW/HP OF  
FARM/HOME APPLIANCES AND ELECTRICAL EQUIPMENT

Application	Watts/HP	Ampere
<u>GENERAL FARM</u>		
Feed Grinding	1-10 HP	
Feed Mixing	1-7½ HP	
Grain Cleaning	¼-½ HP	
Grain Drying (heated air)	3-10 HP	
Grain Drying (unheated air)	3-10 HP	
Grain Elevating	¼-5 HP	
Gutter Cleaner (40 cows)	1½-3 HP	
Hay Curing, Barn Type (unheated air)	3-7½ HP	
(heated air)	3-7½ HP	
Hay Hoisting	½-1 HP	
Milker (portable)	¼-½ HP	
Milker (pipeline)	½-3 HP	
Pig Brooding	100-300 W	
Pump House Heater	500-2000 W	
Silo Unloading	1/3-½ HP	
Stock Tank Heater	200-1500 W	
Yard Light(s) (nonautomatic)	100-500 W	
Yard Light(s) (dust-to-dawn)	275 W	
<u>POULTRY</u>		
Brooder (infrared type)	125-1000 W	
Egg Cooler	200-300 W	
Incubator		
Poultry-House Ventilation	¼ HP Per 500 Birds	
<u>MILKHOUSE</u>		
Bottle Washer	1/8-¼ HP	
Dairy Utensil Sterilizer (25 Cows)	1000-6000 W	
Dairy Water Heater	1000-3000 W	
Milk Cooler	¼-5 HP	
Milk Cooler Pump	¼ HP	
Milkhouse Heater	660-2500 W	
<u>FARM SHOP</u>		
Heater (portable)	1000-2000 W	
Heater (engine)	100-300 W	
Saw (circular, 8-10 inch)	1/3-½ HP	
Saw (jig)	¼-1/3 HP	

Application	Watts/HP	Ampere
<u>HOME</u>		
Attic Fan	1/6-3/4 HP	
Air Conditioner	1/2-1 1/2 HP	
Blanket (automatic)	100-200 W	
Bottle Sterilizer	550 W	
Cleaner, Vacuum (floor)	200-1000 W	
Clock	1-10 W	
Clothes Drier	1600-5000 W	
Coffee Maker	500-1000 W	
Dishwasher	500-1000 W	
Fan (16-inch)	210 W	
Floor Polisher	220-400 W	
Food Freezer	300-800 W	
Furnace (oil Burner)	100-300 W	
Furnace Fan (blower)	500-700 W	
Garbage Disposal	1/2-1/3 HP	
Hair Drier	200-1200 W	
Heater (portable)	660-1620 W	
Heating Pad	25-100 W	
House Heating (5 Rooms insulated)	10000-15000 W	
Iron (hand)	400-1100 W	
Lighting (farm and home)	Varies Widely	
Mixer (food)	50-200 W	
Pasteurizer (1/2 gal.)	1500 W	
Radio (console)	100-300 W	
Radio (table)	40-100 W	
Range	8500-16500 W	
Razor	15 W	
Record Player	100 W	
Refrigerator (conventional)	200-300 W	
Refrigerator (freezer-comb.)	250-600 W	
Sewing Machine	30-100 W	
Sump Pump	250-500 W	
Television	200-315 W	
Toaster (automatic)	550-1170 W	
Washing Machine (automatic)	250-640 W	
Washing Machine (nonautomatic)	100-400 W	
Water Heater (automatic)		
(family of 4)	1200-7000 W	
Water Pump (shallow well)	250-1000 W	
Water Pump (deep well)	300-5000 W	

## HOW TO DETERMINE THE GENERATOR CAPACITY REQUIRED

1. List in detail the wattage of all lights, heaters, appliances, etc. Take figures from nameplate data where possible, otherwise, use tables.
2. Pay special attention to motor loads. List the "starting" watts for all automatic appliances such as refrigerators, freezers and furnaces.
3. Estimate the approximate "Load Factor". It may not be necessary to have a generator large enough to handle the total connected load at one time. For example, arrangements can be made to stagger the load by manually controlling such items as water pumps and air-conditioning during an emergency. Be sure that the power demand does not exceed total capacity of plant. Determine the critical load, i.e. the load that must be turned on during a power outage.
4. Now list the non critical load. Could the non critical load be turned off completely? Or could it be staggered during the operation of critical load.
5. Critical load is a minimum for continuous operation. Any non critical load that has to be operated should be added to critical load to determine the continuous rating of an alternator.
6. Is the alternator selector in number 5 capable of starting largest motor along with motors on critical load.
7. Allowances should be made for future expansion.

### EXAMPLE #1

A suburban home has the following minimum standby service requirements: A 3/4 H.P. deep well pump which will be turned on manually during the emergency, a freezer (1/3 H.P. capacitor start), refrigerator (1/4 H.P. capacitor start) and furnace blower (1/4 H.P. capacitor start) which operates automatically, 500 watts living room lights, 100 watts bathroom lights, 200 watts kitchen lights and 150 watts miscellaneous lights.

Pump (3/4 H.P. Running)	----- 850
Freezer (1/3 H.P. Starting)	-----1350
Refrigerator (1/4 H.P. Starting)	-----1050
Furnace (1/4 H.P. Starting)	-----1050
Living Room Lights	----- 500
Bathroom Lights	----- 100
Kitchen Lights	----- 200
Misc. Lights	----- 150
TOTAL	<u>5250</u>

A 6,000 Watt WINPOWER Alternator would have adequate capacity even if the freezer, refrigerator and furnace motors were to start simultaneously (which could occur at any time the unit is started). Under average emergency operation, assuming that the pump motor did not start at the same time as any other motor, the pump motor could remain on "Automatic" operation. Other appliances could also be used safely, provided the plant capacity is not exceeded.

EXAMPLE #2

Load requirements are:

30 HP code D motor while carrying two 15 HP code F motors and one 7.5 HP motor at full load and a lighting and miscellaneous load of 30KW without exceeding 25% voltage dip.

The unit shall carry the indicated load w/o exceeding the standby rating of any component of the assembly. Normal power supply is 480/277 volts, 3 phase, 4 wire, Wye connected, 60 HZ. Recommend the size of diesel gen-set.

Assuming that no allowance is made for future expansion answer to the above example is DR100A4-L. Model DR125E4-L would provide 25% expansion possibilities.

EXAMPLE #3

A farmer has the following equipment. Please make recommendation for a proper size and type of generator that will operate the load in the event of a power outage.

	<u>WATTS</u>	<u>CRITICAL LOAD WATTS</u>	<u>CRITICAL LOAD WATTS</u>
1. 16 light bulbs			
2. Milking machine ( $\frac{1}{2}$ to 5HP)			
3. Bulk milk cooler (1 to 12 KW)			
4. Water pump ( $\frac{1}{3}$ to 2 HP)			
5. Water heater (1 KW - 10KW)			
6. Milking parlor heat (2 KW to 10 KW)			
7. Space heater (1 KW - 5 KW)			
8. Ventilation fan (4) ( $\frac{1}{6}$ to $\frac{1}{2}$ HP)			
9. Silo unloader ( $7\frac{1}{2}$ hp)			
10. Electric fence			
11. Six Infrared lamp ( $\frac{1}{4}$ KW)			
12. Yard light			
13. Shop tools (drill press, circular saw)			

Critical + Non critical load (w/o staggering) =

Critical + Non critical load (with staggering) =

Answer to above exanples is 45/25 PT2.