

SIZING A PORTABLE GENERATOR FOR JOB-SITE WORK

CHART 1 : UNIVERSAL, STANDARD AND HEAVY DUTY ELECTRIC MOTORS

TOOLS & STANDARD DUTY MOTORS	RUN WATTS
3/8" DRILL	500
1/2" DRILL	900
DEMOLITION HAMMER	1300
PORTABLE ROTARY HAMMER	1200
7" DISC GRINOR	2000
8" CIRCULAR SAW	1500
SCREW GUN	600
MITER SAW	1600
JIG SAW	700
RECIPROCATING SAW	900
CUT-OFF SAW (CODE G)	2500
8" TABLE SAW (CODE G)	1800
1/2" IMPACT WRENCH	700
BELT SANDER (CODE G)	800
ROUTER	1000

These electric hand tools with universal type motors, require (2) times run watts for start watts. Code G, standard motors require 3.5 times run watts.

HEAVY DUTY INDUCTION MOTORS	RUN WATTS
3/4 HP BRICK SAW **	900
3/4 HP SUBMERSIBLE PUMP **	900
1 HP SUBMERSIBLE PUMP **	1200
1 TON AIR CONDITIONER **	1200
2 TON AIR CONDITIONER **	2500
3/4 HP AIR COMPRESSOR **	900
1 1/2" HP AIR COMPRESSOR **	1800
3 HP AIR COMPRESSOR **	3500

** These hard starting code L motors are used on large contractor type equipment and are always used on air conditioners, air compressors, and submersible water pumps.

CHART 2 : APPROXIMATE STARTING WATTS

MOTOR HP	APPROX. RUN WATTS	SPLIT PHASE MOTOR	CODE G MOTOR	CODE L MOTOR
1/3	500	2000	1500	3000
1/2	750	2800	2000	5000
3/4	900	—	3000	6000
1	1200	—	3500	7500
1 1/2	1700	—	6000	12500
2	2200	—	7500	15000
3	3100	—	10000	20000
5	4000	—	15000	28000

Capcitor start motors with code G design will require (3) times run watts for starting watts. Code L design motors (as shown in chart 1 with ** symbol) require(6) times the run watts for starting watts.

CHART 3 : EXAMPLES OF CALCULATING THE LOAD

TOOL OR EQUIPMENT	MOTOR TYPE	APPROX. RUN WATTS	APPROX. START WATTS
3/8" DRILL	UNIVERSAL	500	1000
SCREW GUN	UNIVERSAL	600	1200
3/4 HP AIR COMP.	CAP. START	900	6000
TOTAL ELECTRICAL LOAD		2000	8200

There are four different types of electrical loads with which you should be familiar, as they are very common in construction work. These four loads are as follows:

RESISTIVE LOADS: Lights, electric heaters or blow dryers are examples of resistive loads. Their total nameplate watts will be the same as what is required by the generator output with no concern for additional starting power. Example: A 2000 watt heater can be run with a 2000 watt generator.

UNIVERSAL MOTORS: Small brush type motors or permanent magnet motors are universal in design and are used in portable hand tools, such as drills and saws. Chart 1 shows a variety of such tools and their running watts. Two times run watts are required for starting.

It is important to know that all motors have a starting winding to achieve operating speed within 1-1½ seconds before it is automatically disconnected from the circuit. This auxiliary winding causes increased power usage or starting watts within this 1-1½ second time period. When it is disconnected at operating speed, the motor consumes a much lower running watts. Typically, universal motors demand two times the tool's running watts for starting watts. Example: A Rotary hammer yields 2400 watts starting power for three seconds; then reduces to 1200 run watts.

INDUCTION MOTORS: Larger, stationary equipment such as brick saws, floor scrubbers or cement mixers have induction motors with much larger horsepower sizes than universal motors; but, they have the same starting winding design.

A Code G induction motor is used on a variety of construction equipment. This design is used where the equipment can start unloaded and have the load gradually applied after the motor is in the run watts condition. This common type Code G motor requires 3½ times the running watts for 1-1½ seconds of starting power. Example: a 1-1/2 HP Code G motor requires 5400 watts starting power before it drops to 1800 run watts.

CAUTION: The design of construction equipment that must start under full load is on the increase. Motors for this equipment have a name plate Code L or M and requires six times the running watts for 1-1½ seconds of heavy duty starting power. Three common equipment examples are air compressors, air conditioners, and submersible water pumps. It is important to know that generator must be sized so that there is no more than 25% voltage drop during motor starting.

ELECTRONIC LOADS: More construction equipment is being designed with microprocessor based controllers. New, high speed "chips" are being used in these microprocessors, which require less than 10% harmonic distortion of the generated power wave form. Normal power generates 3-4% harmonic distortions. Almost all portable generators produce 20% to 40% harmful harmonic distortions. It is most important to use a generator set that yields less than 10% harmonic distortions for your rental or re-sell business.

Chart 2 shows motor horsepower with calculated starting watts. The generator rated wattage output must equal or be within 25% of the motor starting watts in order to start the motor.

Chart 3 shows an example of calculating the load. The two universal motors have run watts times (2) while code L motor has run watts times (6). If the 3/4 hp motor is started first, then the hand tools are used, a 6500 watt generator will do the job.

A RENTAL/CONTRACTOR'S GUIDE TO SIZING A PORTABLE GENERATOR SET FOR JOB-SITE APPLICATION

It is very important to rent or sell a portable generator set to your customers that is easy to operate, safe to use, and large enough to power the intended electrical load. The best way to do this is to fully understand the function of a generator set and its various features and benefits. The following is a checklist of important gen-set features for job-site use:

✓ Two choices of engine designs are available. The side valve engine (SV) is an older design offering a less efficient operation, and in our opinion should never be used on heavy duty equipment. In contrast to the SV design, recent innovations have led to the overhead valve (OHV) design, which allows a very compact engine, lighter weight, fuel and oil consumption reduced up to 30%, low noise, and longer lasting than the SV design. Also, a more efficient combustion produces less carbon, less exhaust pollutions, and allows the OHV to conform to clean air standards of California Clean Air Regulations (C.A.R.B) and the 1997 EPA emission standards. Our choice is to use the OHV engine allowing up to 3000 hours of service life, over the SV design, yielding approximately 1000 hours of life between major overall repairs.

✓ Engine features are many, and sometimes these heavy duty items are considered optional equipment. Following are engine features that should be considered mandatory for job-site users.

1. **Low Oil Shutdown:** An oil sensor is located inside engine crankcase area, and upon sensing a low oil level, it will automatically shut down the engine and will not allow engine restart until oil level is restored, thus saving costly repairs.

2. **Electric Start:** A portable generator size of 9000 watts (16 HP) and larger, plus all diesel engines should be equipped with electric start. In these sizes, it becomes difficult to start these engines with the manual rope start method. Be sure to specify an automatic battery charging system with all electric start engines.

3. **Automatic Decompression:** Most engines now have this feature, and it greatly facilitates engine starting by automatically opening the exhaust valve to relieve pressure created by the compression stroke when engine cranking occurs. Be sure to specify this feature, because without it, the starting battery size must be increased, and manual starting becomes extremely difficult.

4. **Automatic Idle:** This device automatically lets the engine run at 3/4 speed without usable electric power output. When power is demanded, the engine runs at full speed producing full power. The concept is to save fuel and engine life when gen-set must be continually running. However, in this Manufacturer's view, the efficiencies of the OHV engine make this device less important, and it remains whether EPA regulations will permit any engine to run idle for long periods of time without performing a work function.

5. **Dual Air Filter:** The ability of the engine air intake filter to trap dirt before it can enter the engine is the single most important function to longer engine life. A two element air cleaner, changed regularly, reduces costly repairs over the single element filters. Also, on full pressure oil lubricated engines, specify a spin-on oil filter.

✓ There are many generator designs available. Following are the most asked for and required features:

1. **Brushless Design:** This design allows a virtual maintenance-free operation as there are no brushes to replace every 600-800 hours of operation.

2. **Volts, Frequency, Phase and Harmonics:** Voltage regulation should be plus or minus 5% from name plate rating; frequency should be 5% (3 hertz) from no load to full load; phase should be 1 or single as up to 95% of construction equipment is powered by single phase components; harmonic distortion of the generator power wave form should be less than 10%. If the generator can meet these maximum criterion, it is considered safe to use with any type electric load.

✓ **COMPLETE GENERATOR SET:** New, larger horsepower engines are being developed that allow larger KW generator sets. Built-in two wheel dollies with large, full pneumatic tires should be specified for ease of transportation of these larger, heavier sets over rough job-site terrain by one person. Large, extended run fuel tanks should be selected for uninterrupted power supply and the safety of less tank fill-ups during the work period. Special GFCI (Ground Fault Circuit Interrupter) receptacles should be used on all 120 volt circuits up to 20 amps for an electric shock protection for workers on the job-site as legislated by OSHA.