

# KAY INDUSTRIES ANSWERS THE MOST FREQUENTLY ASKED QUESTIONS ABOUT PHASE CONVERTERS

FAQ'S

## *The World Leader in Single to Three-Phase Electric Power Conversion*

### **Is there *any* type of 3-phase equipment that cannot be operated on a phase converter?**

In a word, NO! Any machine can be operated at its full capacity and specified performance on a rotary phase converter. A properly sized converter can run motors, heaters, and rectifiers, separately or simultaneously.

### **What is the efficiency of the phase converter?**

Phase converter installations are *extremely* efficient. At full load, over 95% of all the power consumed is turned into useful work by the load equipment. The actual losses are *insignificant*. But the true difference between *efficiency* and the *capability* of running a load at full power is widely misunderstood. See the next question for a further explanation.

### **Do I “lose” power when running on a phase converter?**

With a **rotary** converter, the answer is a resounding **NO!** You *do not* “lose” anything. The motor or any other load develops its *full* rated nameplate capacity. The same cannot be said for a **static** converter, which is essentially an “electric rope starter.” A static converter simply starts a motor and then switches off. It is not able to balance the motor currents, which means that one phase carries all the load. As soon as that winding reaches its full capacity, the motor can't be loaded further without stalling, tripping an overload, or burning up. This occurs at 60-75% of the rated motor horsepower and is commonly, though **incorrectly**, referred to as a “power loss.” It's not a true loss because you got all the power that that you could possibly consume without causing a motor failure. But it *is* a loss of running load *capability* that occurs with a **static** converter. If this distinction were understood, this question would never be asked.

### **How much power does the converter draw?**

A more meaningful question is how much does the *load* draw. Since the converter is actually a transformer, it merely passes through whatever current is called for by the load. If the load calls for 25 amps, that's what gets pulled through the converter. As long as the converter is large enough, anything the load wants, it gets. A small amount of current on the order of a few amps is consumed by the converter, but it's a fraction of the power delivered to the load.

### **How will the converter affect my power bill?**

In most cases, it will have little or no effect on your bill. The load consumes *exactly the same number* of kilowatt-hours of electricity regardless of whether it is being registered on a 3-phase or 1-phase meter. Any change in your power bill will be caused by the difference between the utility rate structure for single vs. 3-phase. Most 3-phase rates include a demand charge. 1-phase rates rarely include a demand charge. The result is that quite often it actually costs *significantly less* to operate from a 1-phase supply with a phase converter rather than to install utility 3-phase.

### **How reliable is a phase converter? What can go wrong?**

There is very little to go wrong with a rotary phase converter. It has no external shaft and only two moving parts. Radio stations run them on transmitters around the clock for years without shutdown. All rotary converters are extraordinarily reliable, particularly when compared to generators, pumps and other mechanical equipment.

### **What maintenance is required on a phase converter?**

Converters need minimal ongoing maintenance. Small converters use pre-greased sealed bearings which do not require regular greasing. Large converters require only annual lubrication. We also recommend routine periodic inspection for signs of unusual wear, corrosion or obstructed ventilation.

### **If my two utility wires are 1-phase, how can *one* extra wire from the converter give me 3-phase?**

Your two utility lines A and B have *one* voltage between them,  $V_a - V_b$ . When line C from the converter is introduced, it creates *two* new voltage relationships,  $V_a - V_c$  and  $V_b - V_c$ . These three voltages are not in-step with each other. Each voltage follows its own AC sine wave corresponding to a complete revolution of the converter. Each voltage reaches its peak value at a different time, 120 degrees apart to be specific, much like the piston position in a 3-cylinder engine.

### **Can I operate a motor with a variable speed (variable frequency) drive?**

Absolutely. And don't believe anyone who says otherwise. Just be sure to make it clear that you will be powering a VFD because it may change the size recommendation.



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**What size service do I need to supply the converter?**

We must first know the total connected load. To size the service, add together the full load amps of all loads that operate simultaneously. The National Electric Code requires the service to be at least 250% of that total. A 10 HP and 5 HP motor pulling 26 and 14 amps respectively require a minimum 1-phase service of 40A times 2.5 or 100 amps.

**Can I run the converter continuously even when there is no load connected?**

Absolutely. The Phasemaster converter is designed to operate continuously without overheating regardless of whether load is connected. The converter operates at a somewhat higher temperature without load but will cool down as soon as load is applied. Converter brands which use extra capacitor panels tend to run particularly hot.

**How much noise does the converter make?**

Phasemaster converters have been carefully designed for quiet operation at their running speed of 1800 RPM. The normal sound level will be 72 db or less at no-load, quieter when loaded. Many converters are designed for 3600 RPM to reduce cost and, as such, are much louder. Noise conscious buyers should insist on 1800 RPM converter speed.

**Where is the converter normally installed? Can it be installed outdoors?**

The most common location is next to the incoming single-phase service panel. It may also be placed near the load equipment. The converter may be installed outdoors in a sheltered area. Kay Industries offers an outdoor fiberglass enclosure or a totally enclosed converter for the most severe environments.

**How does a converter compare to the cost of replacing the 3-phase motors with 1-phase motors?**

It may be economical to replace motors under 3HP, but you must also figure in the cost to rewire the machines for 1-phase controls. However at 5HP and above, 1-phase motors are difficult to find and VERY expensive. Since one converter can operate many motors, it is almost always less costly to use a converter than to change motors. Aside from higher cost, 1-phase motors are far more maintenance-prone and less efficient than 3-phase motors.

**What type of controls are necessary ahead of the converter?**

A two or three-pole safety switch is all that is required to provide on-off control for the converter. For most attended loads, that's all that is necessary. Some loads such as elevators or pumps are often unattended. For maximum economy of operation, these applications require the converter to be equipped with magnetic controls that turn the converter on and off as required by the load.

**Can I put in 240V single-phase and get 480V three-phase output?**

The phase converter will produce a three-phase version of any input voltage. Put in 240 volts, 1-phase and you will get 240 volts, 3-phase out. In order to get 480 volts, it will require a 240 to 480 volt single-phase step-up transformer ahead of the converter. Operating the converter at 480V will then produce the necessary 480V, 3-phase output.

**Does the converter require any adjustments when operating?**

If the converter is properly sized, the voltages and currents will usually balance without further adjustment.

**Is a phase converter like an Motor-Generator set?**

No, a phase converter is nothing like an M-G set. After all if you think about it, in the absence of 3-phase power an M-G set requires a single-phase drive motor...expensive and not easy to find. Instead, the converter is a single rotating machine with three windings that starts from a single-phase line. The spinning rotor replicates the applied 1-phase voltage by induction into the other two windings thus producing a true 3-phase output that looks almost exactly like utility 3-phase with each line shifted by 120°. This single frame construction is much more efficient than an M-G set.

**How do you size a converter? How many motors can operate on a single converter?**

It is generally adequate to size a converter for the largest horsepower motor which will start alone or the sum of all motors that start simultaneously. A rotary converter can operate many motors at the same time provided they do not all start together. This capability makes the converter an ideal way to run a shop with many different machines. A rotary phase converter carries two ratings, the maximum starting horsepower and the maximum running horsepower. Any combination of motors that fits within these ratings will normally operate successfully.

**Are converters approved by the utility company?**

Most utilities will not object to using a phase converter. In fact many even recommend them. It is generally not necessary to consult the utility prior to installing a converter unless you are planning are going to need a larger service.

**Can the converter output be wired into a three-phase panel?**

Yes. Just keep track of the phasing so that the manufactured phase from the converter is not used in the control circuit of the loads connected to the panel.