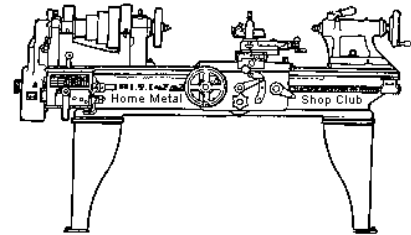




**May 2014**  
Newsletter

Volume 19 - Number 5



<http://www.homemetalshopclub.org/>

The Home Metal Shop Club has brought together metal workers from all over the Southeast Texas area since its founding by John Korman in 1996.

Our members' interests include Model Engineering, Casting, Blacksmithing, Gunsmithing, Sheet Metal Fabrication, Robotics, CNC, Welding, Metal Art, and others. Members enjoy getting together and talking about their craft and shops. Shops range from full machine shops to those limited to a bench vise and hacksaw.

If you like to make things, run metal working machines, or just talk about tools, this is your place. Meetings generally consist of **general announcements**, an **extended presentation** with Q&A, a **safety moment**, **show and tell** where attendees share their work and experiences, and **problems and solutions** where attendees can get answers to their questions or describe how they approached a problem. The meeting ends with **free discussion** and a **novice group** activity, where metal working techniques are demonstrated on a small lathe, grinders, and other metal shop equipment.

President <i>Vance Burns</i>	Vice President <i>Norm Berls</i>	Secretary <i>Joe Sybille</i>	Treasurer <i>Emmett Carstens</i>	Librarian <i>Dan Harper</i>
Webmaster/Editor <i>Dick Kostelnicek</i>	Photographer <i>Jan Rowland</i>	CNC SIG <i>Dennis Cranston</i>	Casting SIG <i>Tom Moore</i>	Novice SIG <i>Rich Pichler</i>

This newsletter is available as an electronic subscription from the front page of our [website](#). We currently have over 642 subscribers located all over the world.

## About the Upcoming 14 June Meeting

The next general meeting will be held on 14 June at noon at the [Fairbanks Branch Library](#) in northwest Houston TX.

Visit our [website](#) for up-to-the-minute details, date, location, and presentation topic for the next meeting.

## General Announcements

[Videos of recent meetings](#) can be viewed on the HMSC website.

The HMSC has a large library of metal shop related books and videos available for members to check out at each meeting. The library is maintained by the [club librarian, Dan Harper](#). These books can be quite expensive, and are not usually available at local public libraries. Access to the library is one of the many benefits of club membership.

We need more articles for the monthly newsletter! If you would like to write an article, or would like to discuss writing an article, please contact the [Webmaster Dick Kostelnicek](#). Think about your last project. Was it a success, with perhaps a few 'ugh ohs' along the way? If so, others would like to read about it. At the September, 2012 HMSC board meeting, the board elected to waive membership fees during the next membership renewal cycle for those providing newsletter articles.

Ideas for programs at our monthly meeting are always welcome. If you have an idea for a meeting topic, or if you know someone that could make a presentation, please contact [Vice President Norm Berls](#).

The club has funds to purchase new books for the library. If you have suggestions, contact the [Librarian, Dan Harper](#).

## Recap of the 10 May General Meeting

By Joe Sybille, with photos by Jan Rowland

Club president Vance Burns led the meeting. Vance requested volunteers to serve on the novice SIG committee. Twenty three (23) members attended the noon meeting at the Spring Branch Memorial Library, 903 Corbindale Road, Houston, Texas 77024. There were three guests present, Harold Gilmer, Gilbert Groendyke, and Walter Potter.



Rich Pichler led his last Novice SIG meeting today. The members of the club thanked Rich for fifteen years of dedicated service as novice SIG leader.

## Presentation

Club member Tom Moore gave a talk on 'Sharpening Lathe Cutters'. By way of a 'hands-on' demonstration, he began by passing around large scale models of cutters that he fashioned from wood. The cutters had either three (3) or four (4) faces. Several of the models are shown below.



The faces were designated as plan, clearance, top rake, and side rake. A large rake angle is used for light cuts requiring a fine finish. For deep roughing cuts a small rake angle is preferable. Cutters for brass demand no rake angle in order to prevent the bit from pulling itself into the work.

The cutting edge must be aligned with the center of rotation of the work piece. If the edge is higher than the center, it will rub the work; if lower, it will dig into the work. Tom then displayed jigs for presetting cutting angles and for setting cutter height in the lathe (right photo).

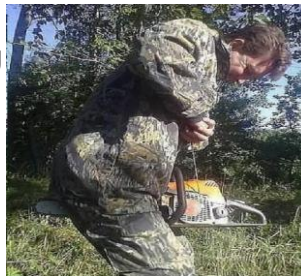


Cutters are typically classed by the job they are expected to do. For example, some are used for making rough cuts, finishing the work, serving as a cut-off tool, and for threading. Tom displayed an assortment of cutting tools that he uses to cut crankshafts, for internal threading, for cutting snap ring grooves, and for rounding the ends of shafts, among other tasks (above and left photos)..

Moving on to sharpening, he explained how he sharpens his cutter bits without removing them from their tool holder. Conventional sharpening methods require removal of the cutter from the holder. An abrasive belt sander may be used to sharpen a cutter bit without removing it from the holder. However, one must ensure the rotation of the belt is away from the cutting edge. He recommended using a zirconia oxide grinding wheel for sharpening steel lathe cutters, and a diamond wheel for brazed carbide bits.

## Safety Moment

*Vance Burns* showed two pictures of unsafe practices. The first depicted a person attempting to start a chain saw while supporting the saw blade between his legs. The second depicted a person sawing a board that is supported by the back of another person positioned on hands and knees (right photos).



*Norm Berls* demonstrated the radioactivity of a souvenir piece of trinitite glass from the plutonium based nuclear bomb testing at Alamogordo, New Mexico in July 1945. Using a Geiger counter, he showed the radioactivity of thoriated welding rods containing 2% thorium. These rods are used in TIG welding. Lastly, Norm passed around a sample of uranium ore.

*Dan Harper* cautioned members to avoid the hazards of breathing dust while cutting cadmium based metals.

## Show and Tell

*Alan May* displayed a model of an alcohol lamp he built for a Sterling engine (right photo).



*Joe Williams* showed a whimsical bottle opener, aka 'church key', mounted in a lathe tool and, ostensibly, serving double duty as a bottle cap remover and a cutting tool (left photo).



*Dick Kostelnicek* brought in an inexpensive \$8.50 digital ohm meter (DOM) for the members to see. His experience with the meter reveals it works as well as DOMs costing hundreds of dollars.

*Norm Berls* showed some of the cutting tools he has made and sharpened (right photo). He sharpened them first on an aluminum oxide wheel and then on a belt sander. Norm then displayed a purchased set of angle gages and a tool height setting jig he made. He passed around a backing plate that he made for a 4-jaw chuck.



*Dan Harper* reminded everyone that when using a file to remove nicks and burrs the particles lodged in the file teeth should be removed with a file card or stiff wire brush. Otherwise the file may scratch the work rather than smoothly cut it.

*Jan Rowland* showed pictures of his well organized shop.

*Tom Darragh* displayed a boring bar he fashioned. He also showed an improved version of a bullet seat setting die used for reloading spent cartridges. He then showed a set of large micrometers, among other items, that he purchased at an estate sale.

## **Problems and Solutions - Ask the Blacksmith**

A member has a granite surface plate that had dropped to the floor as a result of a fire. He wanted to know how to tell if the plate is still perfectly flat. One suggestion offered was to take the plate to a testing laboratory.

One member recommended the website [www.weldingtipsandtricks.com](http://www.weldingtipsandtricks.com) for excellent advice on welding.

Another member wanted to know the best way to repair an errant hole in the lower receiver of a rifle. Suggestions ranged from leaving the hole as is to plugging it with JB-Weld.

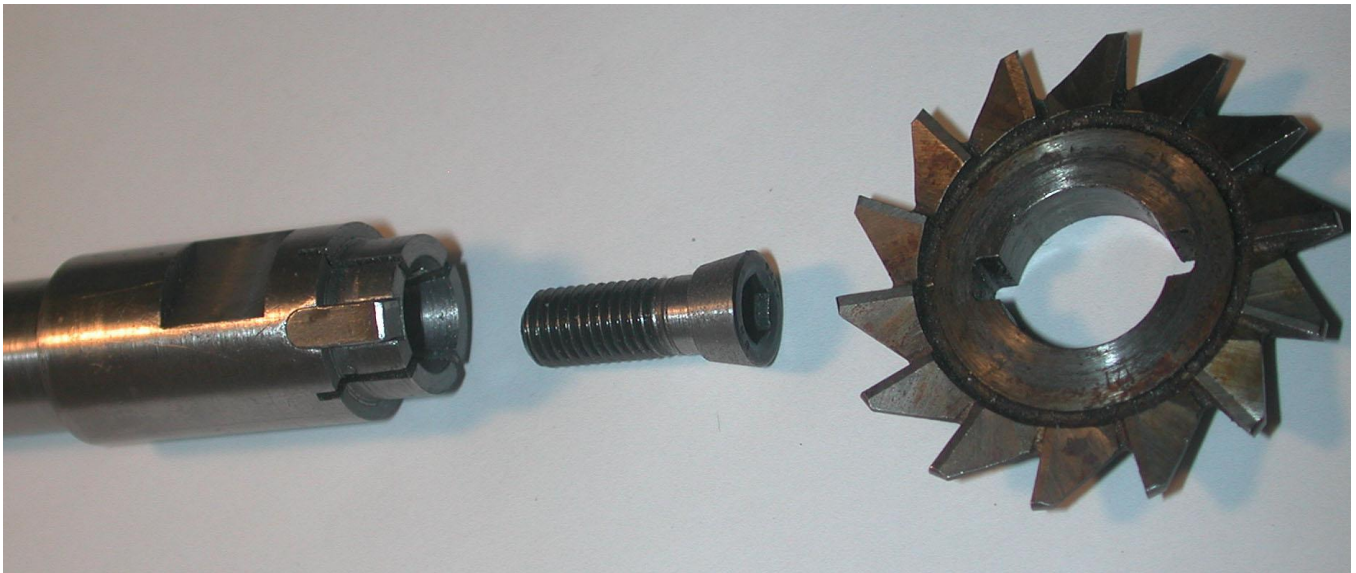
## **Novice SIG Activities**

Rich Pichler concluded the session on marking the center for drilling holes. He then used a center drill bit to start the hole and a twist drill bit to finish it. Lastly, he demonstrated the use of a tap to make internal threads in the hole.

## Articles

### Small Cutter Arbor

By J. R. Williams



My original cutter arbor used a large washer and screw to hold the cutter in place. A 1/8-inch key prevented the cutter from slipping on the arbor. Recently I needed the same cutter to clean out the bottom of a dovetail; however, the screw and washer were in the way of a flush cut. I drilled the arbor and tapped the end for a 1/4-28 thread. The opening of the threaded hole was then bored with a 10 degree taper. A head of a socket head cap screw was turned down with the same taper as the tapered hole in the arbor. The cavity in the end of the arbor and taper on the screw were cut with the same setting of the lathe's compound to insure that the tapers matched. The arbor was then held in a square collet block and a 0.030 slitting saw was used to cut two kerfs at 90 deg to one another in the end of the arbor. The slit depths are about 1/8-inch deeper than the cutter's hub thickness. As the screw is tightened, the end of the end arbor expands and firmly grasps the cutter. The above photo shows the arbor, tapered screw head, and the cutter. This technique can be scaled up to work with larger cutters.

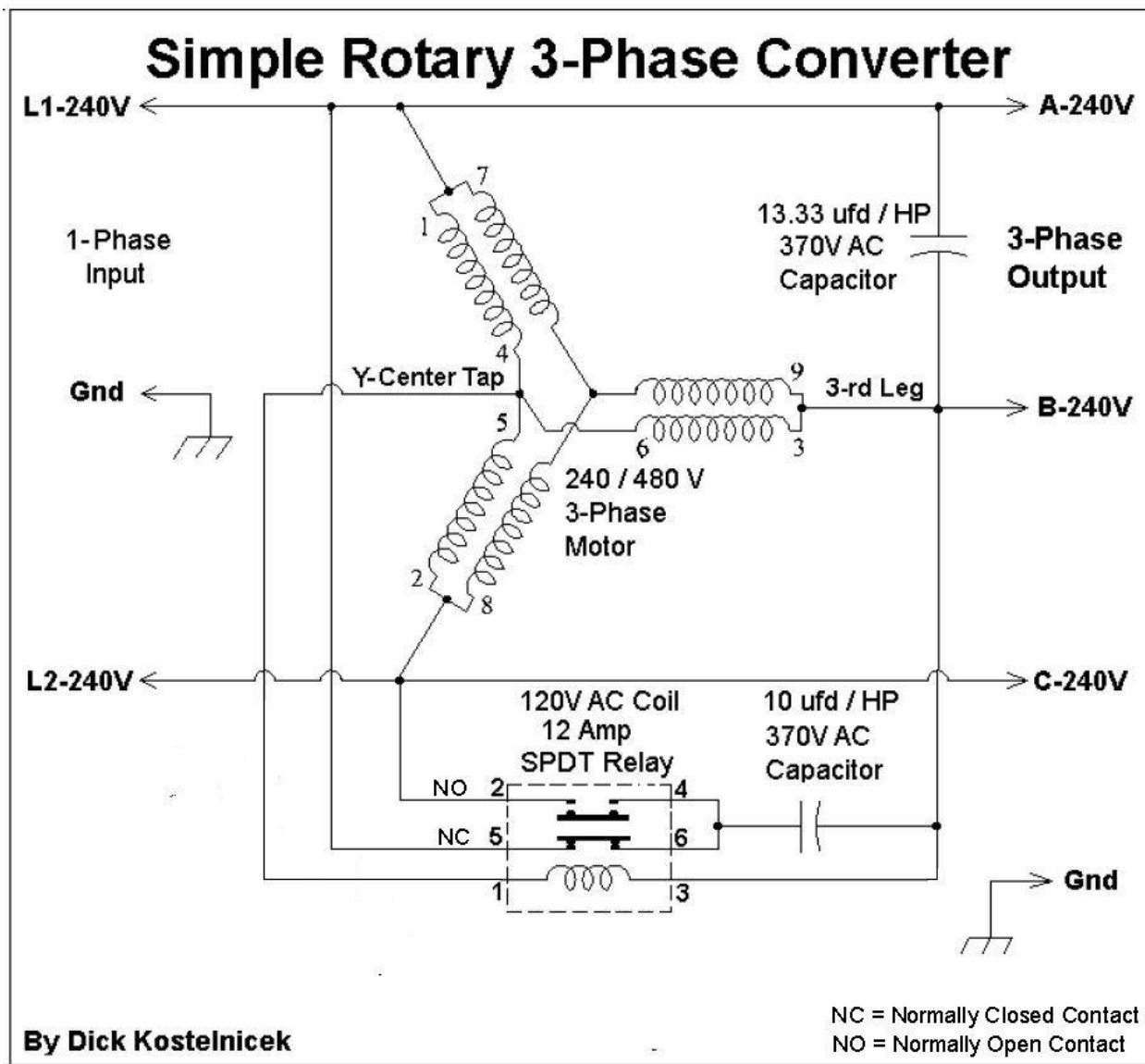
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The difference between *arbors and mandrels*: The arbor supports a rotating cutting tool, abrasive wheel, gear, or pulley. A mandrel holds the work being rotated.

## Simple Rotary 3-Phase Converter

By Dick Kostelnicek

What is a *rotary 3-phase converter*? It's a stand alone, 3-phase motor that runs from ordinary single phase 240V electrical power (L1 - L2 in the diagram). When idling (rotating without a mechanical load), the converter's motor generates the so called *3rd leg* voltage (B in the diagram). Then, another 3-phase motor can be operated at its full HP (Horse Power) when connected to the converter (see the connection diagram at the middle of this article). Hence, you can run any machine tool's 3-phase motor when all you have in your shop is single phase power. As we'll see later, this is a practical albeit inefficient use of an auxiliary electric motor running as a motorized alternator. Here is a web link to a classic HMSC article about [Phase Converters and Starting Circuits](#) from the HMSC website.



My converter uses a 7.5 HP, 1725 RPM, 240/480V, Y-connected, 3-phase motor. It is hooked-up with the electrical windings connected in parallel to accommodate 240V. Either a 1725 or 3750 RPM motor would work equally well. The only difference: a 1725 RPM motor will be a bit larger, more costly, and heavier in weight. I also sawed off the motor's shaft to prevent my tripping over it.

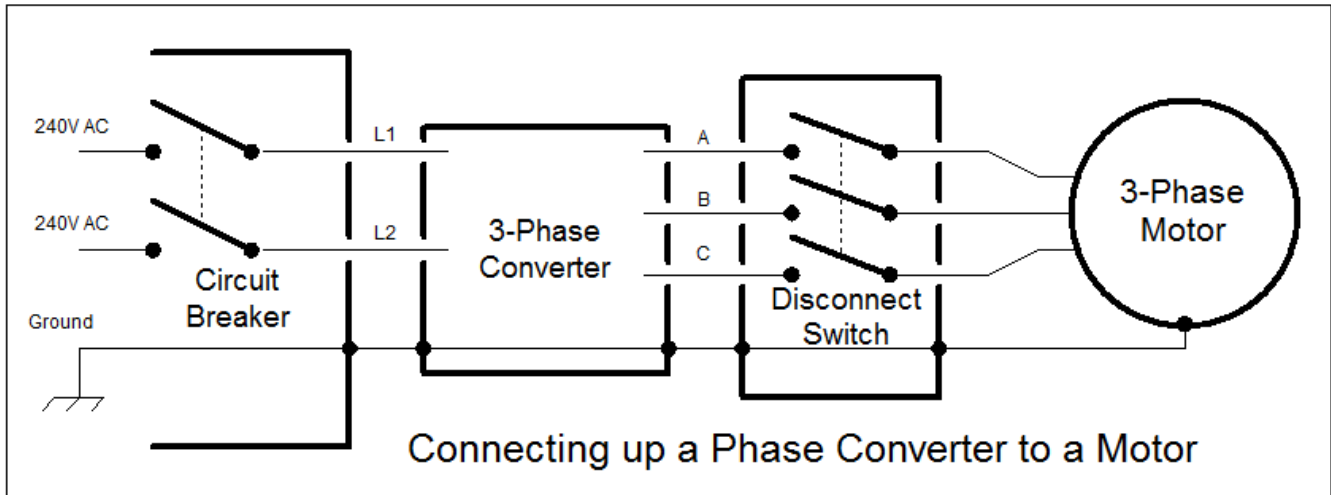
Usually, a rotary phase converter employs 3 capacitors, 2 while running and a separate large one for start-up. Run capacitors are meant to operate continuously on AC voltage. Start capacitors often have a much larger micro-Farad or  $\mu\text{fd}$  value and are meant to be energized for just a few seconds at a time. This converter uses two run capacitors without a dedicated start capacitor. On startup, both run capacitors are connected in parallel and perform the task of a single large start capacitor. As the converter picks up speed, a SPDT relay switches one of the capacitors from its start to its run connection. The other capacitor's connection remains unaltered. As long as the converter is rotating near rated speed, the relay remains pulled-in, and the two run capacitors help generate a balanced set of 3-phase of voltages. Some phase converters don't use run capacitors. As a consequence, their A-B, B-C, and C-A output voltages will be unbalanced, especially under load. This unbalance is of little consequence unless you are trying to run a machine's 3-phase motor near its full HP rating and in that case, one of the motor windings could overheat.

The relay's coil is connected between the motor's Y-center tap (wires 4-5-6) and the 3rd leg or B output. The center tap is at the neutral 3-phase voltage, however on delta connected motors, a center tap is not available. Neither center tapped transformers nor capacitor dividers are used here to synthesize a neutral voltage, as is often done with other phase converters. As the motor speeds up, the voltage between the center tap and the 3-rd leg increases from 0V to 138V. The relay coil is specified for use at 120V AC, but I have encountered no problems running it at 138V, only 15% above its rated value. If the converter is slow to start, increase both capacitors by the same ratio, say 20% or so. Now remember, it's just a converter, *so it doesn't have to come up to speed in a millisecond.*

A rotary phase converter will allow you to operate another 3-phase motor whose HP rating is less than about 2/3 or 67% of the converter's nameplate HP. For example, a 7.5 HP converter will power another 5 HP 3-phase motor ( $67\% \times 7.5 = 5$ ). However, the converter may have difficulty starting that 5 HP motor, especially if it is under severe mechanical load. This is because a motor's starting currents typically are much larger than its full load run amperage. Here's what happens. As the 5 HP motor starts rotating, the high starting current drags down the converter's speed. The converter generates less 3rd leg voltage and drops into its starting mode by tripping out the start relay. The converter sits there and makes a loud growling sound while turning at low speed. Possibly, the electrical supply circuit breaker trips. What you eventually determine is that your 7.5 HP rotary phase converter will only reliably start and run a 3 to 4 HP motor or about 50% of the converter's nameplate HP rating.

There is, however, a trick to get around this 50% HP, hard to start, limitation. Suppose you have several motors driving machine tools that run on 3-phase power. Start the smallest one, say 1 HP, and let its machine sit at idle. Then, start the next bigger machine, say 2 HP, and keep it at idle. When you add up the horse power ratings of the rotary converter and the two idling motors, you obtain  $7.5 + 1 + 2 = 10.5$  HP. Now, you can easily start and run that 5 HP motor which will require about 50% of the combined

10.5 HP rating at start up. Here, the 1 and 2 HP idling machine motors have also become rotary converters. Although the idling motors are operating without run capacitors, they are still contributing additional 3rd leg power in conjunction with your main 7.5 HP rotary converter.



You can electrically connect multiple phase converters in parallel to increase the amount of delivered 3-phase power. They need not have the same nameplate HP nor speed rating. Make sure that the motor windings are similarly connected to the L1–L2 electrical supply and that the A-B-C output phases are in the same order. You should start and run each additional converter with its output disconnected from the converters already *on-line*. Measure the AC voltage between each pair of like phases (A-to-A, B-to-B, and C-to-C) before connecting the two converters together. If these voltages are all near zero volts AC, the converters are in phase and it's ok to connect their outputs to one another.

Here's another way to join two converters together. Connect the two 3-phase motors having similar HP and speed by mounting them face to face and direct coupling their shafts. Since these motors will turn in opposite directions, their windings must be connected in reversed phase. Refer to the above drawings and connect the motors as follows:

- Motor 1 (terminals 1, 7) to Motor 2 (terminals 2, 8)
- Motor 1 (terminals 2, 8) to Motor 2 (terminals 1, 7)
- Motor 1 (terminals 9, 3) to Motor 2 (terminals 9, 3)
- Double the values of each run capacitor
- You'll still need just one starting relay

After much testing, I determined the size of the capacitors for my 7.5 HP converter (see capacitor values in the drawing near the beginning of this article). I assume that scaling them according to your converter's nameplate HP is a reasonable thing to do. For example: my 7.5 HP use 75  $\mu$ fd =  $(7.5 * 10$



$\mu\text{fd} / \text{HP}$ ) and  $100 \mu\text{fd} = (7.5 * 13.33 \mu\text{fd} / \text{HP})$  capacitors. You can make up the 75  $\mu\text{fd}$  value by wiring a 50 and a 25  $\mu\text{fd}$  capacitor in parallel. Use only continuous duty 370V AC rated run capacitors.

You can optimize the performance of your phase converter by balancing the three output voltages. While idling and with no motors connected to the converter, add or subtract small amounts of capacitance, say 5 or 10  $\mu\text{fd}$  to each of the two run capacitors in turn. Your goal is to make the voltages between A-B and B-C both as close to the A-C or L1-L2 voltage as possible. After balancing the voltages, connect the largest machine motor that you have to the converter, hopefully under full mechanical load. Use a clamp-on ammeter and again vary the values of the two run capacitors till the A, B, and C output currents are all about equal. By equal I mean within 10%. Now you can't do both, i.e. make the three output voltages all equal and make the three output currents all equal. If you typically run small motors and don't tax the full output of the converter, then make the voltages all equal. Otherwise, make the full load currents as equal as possible.

Surprisingly, the above diagram of a rotary 3-phase converter is the same as that for a static 3-phase converter connected to a 3-phase motor. Here, the driven motor and the rotary converter's motor are one in the same. Think of it as generating and using its own 3-phase power. Be aware that it can't have a heavy mechanical load on startup, such as an air compressor. Also, you'll get no more than 67% of the nameplate HP from the machine's motor. What is happening here is that you are running a 3-phase motor as an inefficient capacitor start single phase motor. To reverse the motor's rotation, exchange the 2-8 and 1-7 motor windings. For light duty machine tools, such as a 3-phase surface grinder, a self contained rotary or what is often called a static 3-phase converter is a good option. When you buy a commercially built static phase converter, what you get is a rotary converter's electrical components without the motor; i.e., a box full of capacitors and a relay.

Notes: Read this web article if you want to [Check Out a Junk 3-Phase Motor](#) for use in your rotary converter. I obtained a 7.5 HP 3-phase motor from my local scrap metal dealer. *Sometimes they just throw out the good with the bad!*



The relay is a Supco 90382 General Purpose Fan Relay, 18 A Load Current, 120 V AC Coil Voltage, Normally Open and Normally Closed Contacts. It's available from Amazon, Ebay, or at a HVAC supply.



The capacitors are 370V AC run capacitors and can be made up by paralleling smaller capacitance values. If you get within 10% of the required capacitance, *that's good enough*. They're available from Amazon, Ebay, or at a HVAC supply.