

# **ALL PURPOSE CNC/HEAVY DUTY**

## **ROTARY PHASE CONVERTERS**

**240 VOLT SERIES W/ BUILT-IN STARTER**

**MODELS: PCDR-WS-HP  
PCDR-NS-HP  
PCBR-WS-HP  
PCBR-NS-HP**

## **OPERATION & INSTALLATION MANUAL**

**American Rotary, LLC**  
[www.AmericanRotary.com](http://www.AmericanRotary.com)

## ***DANGER: HIGH VOLTAGE***

**Electric shock could result in death or injury. Please consult qualified personnel for installation.**

## ***DANGER: Risk of Electric Shock***

**Please wait 30 minutes before servicing**

## **WARNING! READ BEFORE STARING CONVERTER!**

If this phase converter does not start in less than 2 seconds, **TURN IT OFF!**

1. Make sure the wire size meets our minimum recommended size.
2. All loads **INCLUDING TRANSFORMERS** must be **DISCONNECTED** before starting the phase converter each time. This includes small control transformers that run controls inside your equipment. If you need an economical 3-phase disconnect switch, please visit [www.AmericanRotary.com](http://www.AmericanRotary.com) or call 1-888-743-6832 for assistance.

If your converter still takes more than 2 seconds to start, call our Toll-Free Technical support line 1-888-743-6832. You will be asked to verify conditions 1 and 2 above are met. Failing to meet these two condition account for 99% of starting problems and can result in damage to the starting capacitors.

This converter is quiet. If it does not sound quiet and smooth, **TURN IT OFF!**

3. Make sure the idler motor is mounted on rubber. **DO NOT BOLT THE IDLER MOTOR DOWN!** This can cause bearing failure.
4. Make sure the idler motor is wired properly.

For the American Rotary/Baldor soft-start idler motor

240 Volts Input (1,7,T1), (2,8,T2), (3,9,T3), (4,5,6 bolted together and insulated)

**For a stock three-phase motor** that uses our Stock Motor Panel, wire the motor according to the diagram for that motor, **NOT** according to our wiring diagram.

\* Make sure the Phase Converter Panel, the Idler Motor, and your equipment is grounded!

\* If this phase converter does not start in less than 2 seconds, **TURN IT OFF!**



## OVERVIEW

Congratulations on your purchase of a state of the art American Rotary rotary phase converter. American Rotary along with Baldor Electric have created the ultimate Idler / Generator to provide balanced voltage and a voltage boost for extra starting torque. Our super quiet idler reduces its in-rush starting current by about 75%. The American Rotary / Baldor Idler is the ultimate in flexibility and smooth true sine-wave power.

All American Rotary rotary phase converters provide the voltage balance and true sinusoidal 3-phase AC output that many of today's modern machines require. Our control panel had been engineered to exceed UL, CSA, & NEMA standards. They offer the easiest installation in the industry with straight line runs, bus bar connections, built-in starter, power guard restart protection, and no stress capacitor mountings. Rotary phase converters can be operated from almost any single phase 240 VAC power source that has adequate current carrying capacity. They can operate any type of equipment that requires 3-phase 240 VAC.

### KEY FEATURES AND CONSIDERATIONS

- Current limiting soft starting idler / generator made exclusively by Baldor
- Built-in starter with power guard restart protection
- Pushbutton start with raised safety OFF button
- Virtually zero harmonic content
- Balanced voltages for voltage sensitive equipment
- Straight in Bus Bar connections, no messy terminal blocks
- Remote start ready so it can be switched on and off by a pressure switch, remote timer etc.
- Separate control panel and Idler / generator for optimum space saving installation
- Built in power factor correction
- Loads can be located a large distance from the converter.
- American Rotary rotary phase converters should be wired by an experienced and qualified electrician into a 208V – 250V AC single phase circuit with proper breaker protection.
- American Rotary rotary phase converters can run any type of load, resistive, inductive, multiple motor, and in any combination and or number.
- Best warranty in the industry 5yr/lifetime.



# American Rotary

2 / 5 / LIFETIME  
**LIMITED WARRANTY**  
**Rotary Phase Converters**

All American Rotary rotary phase converter control panels are warranted against defects in material and workmanship for a period of 5 years. This warranty covers both control panel parts and labor for 2 years, after 2 years, only parts are warranted. The American Rotary Baldor Idler / Generator is covered by Baldor's 2 year warranty. The rotor is warranted for lifetime against defects in material and workmanship to the original owner. Warranty is from the date of purchase by the original owner. American Rotary will repair or replace (at our option), at no charge, any part(s) found to be faulty during the warranty period specified. The control panel warranty repairs must be performed by/at American Rotary's facility. Baldor Idler repairs or replacements must be performed by/at American Rotary's facility, or at a Baldor Authorized Service Center. Baldor Idler repairs or replacements must also be pre-authorized in writing by American Rotary.

## Obligations of the Original Owner

1. The original Bill of Sale must be present in order to obtain "in-warranty" service
2. Transportation of control panels to American Rotary is the responsibility of the original purchaser. Return transportation is provided by American Rotary when the control panel is "in-warranty"
3. Repair or replacement control panels "out of warranty" will not be returned without pre-payment. Shipping to and from American Rotary is the responsibility of the customer.
4. American Rotary will not accept Baldor Idler returns or repairs sent to American Rotary. All Baldor issues are handled by Baldor Authorized Service Centers.

## Exclusions of the Warranty

This warranty does not cover any of the following: accident, misuse, fire, flood, and other acts of God, acts of terrorism, nor any contingencies beyond the control of American Rotary, including water damage, incorrect line voltage, improper installation, installation where this unit will not meet local electrical codes, missing or altered serial numbers, and service performed by an unauthorized facility. American Rotary's liability for any damages caused in association with the use of American Rotary's equipment shall be limited to the repair or replacement only of the American Rotary's equipment. No person, agent, distributor, dealer, or company is authorized to modify, alter, or change the design of this merchandise without express written approval of American Rotary.

Liability Limitation: In no event shall American Rotary be liable or responsible for consequential, incidental or special damages resulting from or related in any manner to any American Rotary product, third party installation(s), manufactured or distributed, or parts thereof. A licensed electrician must perform all installations. Not all American Rotary phase converters are UL listed, this is an option the customer must specify and additional charges will apply. American Rotary is not responsible for meeting, complying with or insuring installation inspections. American Rotary does not accept returns on units that have been installed or energized.

**INSTALLATIONS MUST COMPLY WITH ALL NATIONAL AND LOCAL ELECTRICAL CODE REQUIREMENTS AND MUST BE INSTALLED BY A QUALIFIED LICENSED ELECTRICIAN. CUSTOMER IS RESPONSIBLE FOR MAKING SURE THIS PHASE CONVERTER CAN PASS INSPECTION WHERE INSTALLED.**

## American Rotary Converter™

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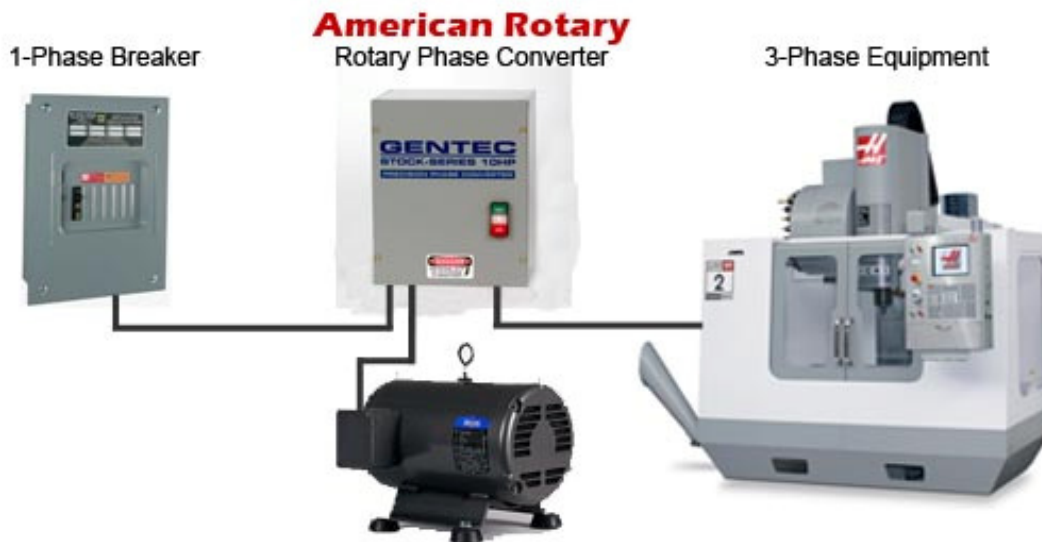


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## 1. INTRODUCTION

American Rotary specializes in converting Single Phase electrical power to Three Phase electrical power. The diagram below provides a very simple view of the layout.



An additional 3-phase breaker panel may be installed on the line between the converter control panel and the 3-phase equipment. This is recommended to protect each piece of equipment and the wire that feeds that equipment.

The two single phase lines pass through the phase converter and are used to manufacture the 3<sup>rd</sup> line that completes the three phases. The output voltage will always be close to the input voltage. If a completely different voltage is needed then a transformer installed in front of the phase converter will be necessary.

The three-phase output is delta configured. Phase to phase voltages are similar to the input voltage, but phase to ground voltages are not all equal. When the two pass through lines measured to ground measure 120v, the third manufactured line will measure approximately 208v to ground. This voltage may vary widely depending upon load conditions. Most machinery requires a delta three phase voltage and this third line voltage to ground should not affect operation. If a piece of equipment requires a wye voltage and requires a neutral connection, the output of the phase converter must be run through a delta-wye transformer to create the neutral. The phase converter must be started before the transformer is connected electrically. This is done with a safety disconnect switch. American Rotary supplies these transformers and disconnect switches.

The American Rotary rotary phase converters have built in starters and are remote ready. This allows them to be configured to almost any automatic start stop scenario.

## 2.0 INSTALLATION

### 2.1 PHYSICAL INSTALLATION

All American Rotary rotary phase converters come standard in NEMA 1 indoor rated enclosures. NEMA Type 3R rainproof enclosures are available. The control panels should be mounted securely on a vertical surface. The Idler / Generators should be mounted on a clean flat surface.

## 2.1.1 PHYSICAL INSTALLATION ENVIRONMENTAL CONSIDERATIONS

The unit should be installed in a location free from the following:

- Dirt
- Corrosive gases or liquids
- Excessive vibration
- Airborne particles (particularly metal particles)
- Ambient temperatures exceeding 50 degrees C
- High humidity

Mount the control panel separate from the idler / generator to minimize heat and vibration in the control panel. The Idler can be mounted in an elevated position to help reduce the introduction of dust and foreign contaminants into the windings. TEFC idlers need to be protected from dust buildup on the outside of the motor. This can lead to overheating.

## 2.1.2 INSTALLATION PICTURES (CONTROL PANEL & IDLER)



Mount enclosure on secure wall or machine. Attach conduit fittings for 1-phase input line, 3-phase line to idler and 3-phase line to load.



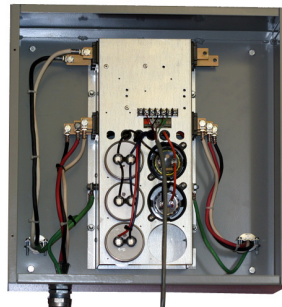
Pull electrical lines into the enclosure. Run the ground lines with each circuit. Make sure to leave enough wire to reach the bus bars.



After cleaning out the enclosure, reinstall the controls using the 4 lock nuts provided.



Using the Bolts and Lock Nuts provided, secure the ring lugged wires to the proper bus bars. Torque the bolts to 25 in-lbs.



A complete installation should be neat and clean with plenty of wiring space.



*(clear cover used for clarity)* Firmly snap in the green, yellow & red switch terminals into the pushbutton switch body.

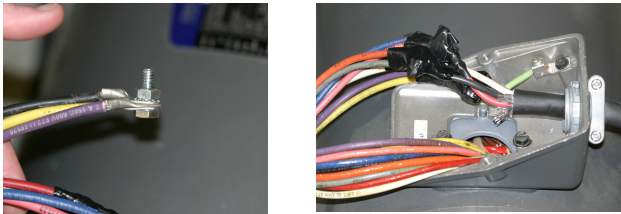
Hook Bus Bar T1 to Idler terminals (1 & 7)

Hook Bus Bar T2 to Idler terminals (2 & 8)

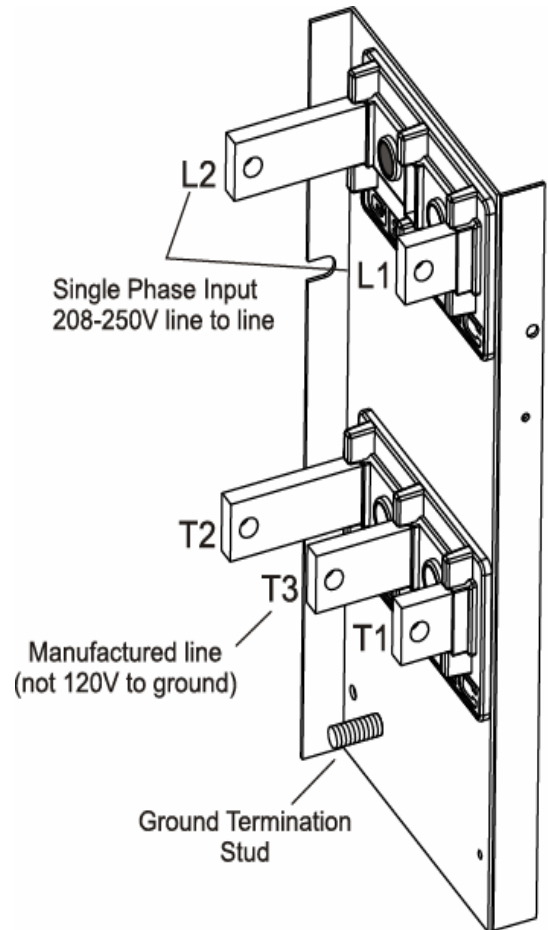
Hook Bus Bar T3 to Idler terminals (3 & 9)

The same terminals (T1, T2 & T3) provide the 3-phase power to your equipment. The picture on the right shows the left side of the controls, the right side is a mirror image and provides additional bus bar connection points.

## IDLER WIRING



Bolt motor leads 4,5,6 together. Insulate this connection with electrical tape or heat shrink tubing. Connect the ground line to the ground screw inside the motor conduit box. Connect T1 to (1,7), T2 to (2,8), T3 to (3,9). Insulate these connections separately.



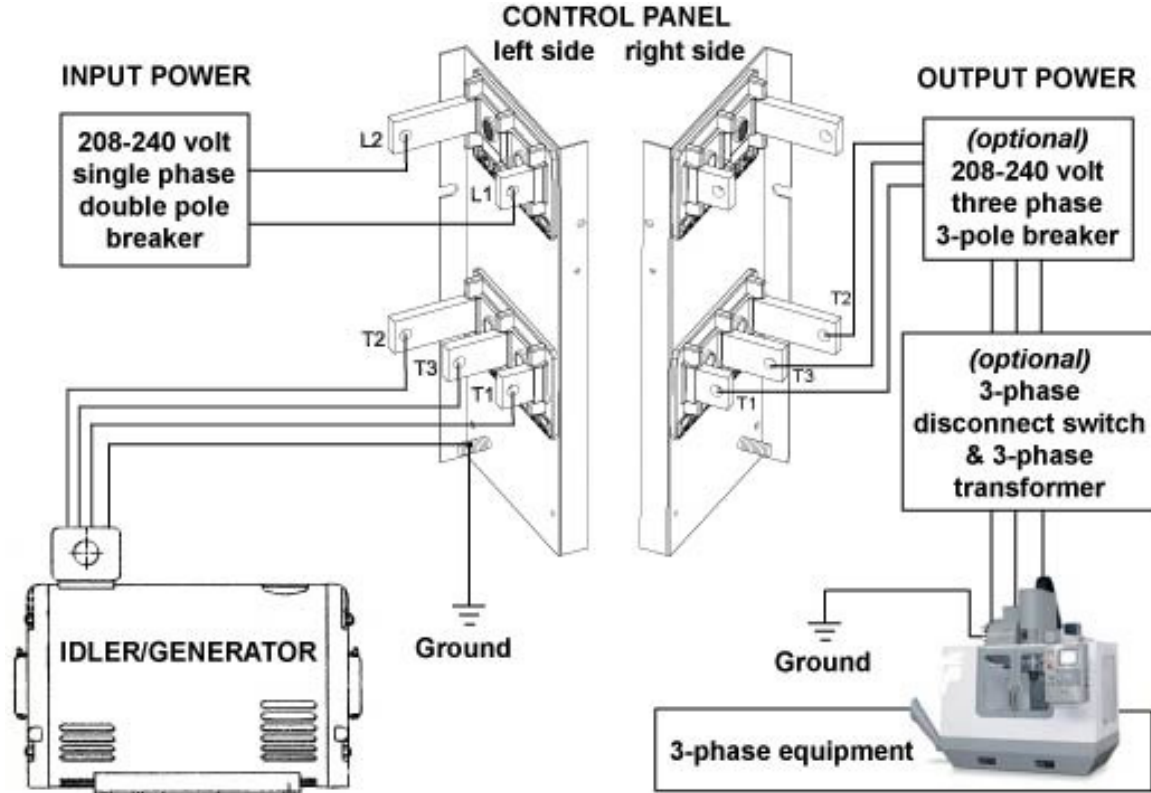
The picture above shows the left side of the converter as installed. The right side is a mirror image. Both sides are live and can be used

## 2.1.3 GENERAL WIRING CONSIDERATIONS

- Follow all local, state and national electric codes (NEC)
- T3 is the manufactured line; DO NOT use T3 for any single phase loads
- Protect all wire and machinery with proper size breakers
- Always make sure rotary phase converter starts before external load(s)
- Current is limited by the full load current rating of the phase converter. If the internal starter is bypassed, and single phase is switched directly into T1 and T2, more current can be run through the converter; however, this does not make the converter larger in size or have more starting potential.
- A qualified electrician should do all wiring.
- DO NOT assume that a breaker box neutral is a ground! Be sure to ground all equipment including breaker boxes, phase converter control panel & Idler, disconnect switches, transformers, loads etc.
- T1 & T2 measured to ground will produce half the single phase input voltage, but T3 to ground will NOT.
- Run all controls from lines T1 and T2.
- See Wire Sizing Recommendations (section 2.1.5) for wire sizes. This is VERY IMPORTANT, as under sizing the wire may lead to a phase converter that does not start or work properly.



## 2.1.4 HOOKUP DIAGRAM



## 2.1.5 WIRE SIZING RECOMMENDATIONS

It is important to have adequate single-phase electrical service. The actual single phase current that will flow through the converter is 1.73 times the three-phase current. The National Electric Code requires 2.5 times the three-phase current to allow for starting current and a margin of safety. This is a good conservative calculation to determine your single phase branch circuit wire size and breaker size.

This means that with a 240 volt supply, a 10 hp machine that runs near full load (28 amps) will need approximately 44 amps of single phase current. N.E.C. requires (28 amps x 2.5 = 70 amps) of single phase. Therefore wire should be used that can handle at least 70 amps and the breaker should protect that wire. Multiply this current by the voltage (in this case 240 volts) to get the kW or kilowatts of 16.8 kW. The transformer that supplies your power must be at least this big.

The power required to run the phase converter is very small and is negligible in figuring out the power required. The power required is calculated based on the load only.

Motor loads can be estimated at approximately  
2.6 amps per horsepower at 230 volts.  
2.5 amps per horsepower at 240 volts  
2.9 amps per horsepower at 208 volts

HP	1-Phase Breaker Range	Input Copper Wire (AWG)	3-Phase Current (Max)	Output Copper Wire (AWG)
3	10-20	12	9.5	12
5	10-30	10	15	12
7.5	15-40	8	22	10
10	20-50	6	28	10
15	20-80	4	42	8
20	30-100	2	54	6
25	40-125	1/0	68	4
30	50-160	2/0	80	3
40	60-200	4/0	104	2
50	75-250	300MCM	130	1/0
60	100-300	350MCM	154	2/0
75	120-380	500MCM	192	3/0

**This table does not replace or supersede any requirements of local, state or national electric codes.**

Size the wire going to a load for the Converter's maximum 3-phase current if the converter is sized to run and start that particular load. Example: a 10 hp lathe would normally need a 20 hp converter to start and run it. Size the wire going to the 10 hp lathe to 54 amps (the max current for a 20 hp converter). This will aid in the starting of the converter and insure that a power reducing voltage drop will not occur.

Wire can never be sized to large, but too small of wire can impede performance and even keep the converter from starting properly.

All wires to be connected to bus bars should either be terminated with a crimp style ring lug or a single pole terminal lug.

Increase wire size one size for every 50 feet of run and round up.

### 3.0 OPERATION & MAINTENANCE

#### 3.1 STARTING & STOPPING

Every American Rotary rotary phase converter is started by pushing the momentary start push button. The starting sequence is automatic and the button needs only to be pushed in and released, it does not need to be held in. Stopping the phase converter is done in a similar manner, by pushing the stop push button. These start and stop buttons run a series of contactor(s), which bring the power from the input bus bars L1, and L2 to T1 and T2. These contactors can be bypassed by switching power directly into T1 and T2 if an external motor starter is to be used.

#### 3.2 REMOTE STARTING

Remote starting refers to a means of starting other than the pushbutton switch provided.

A single pole contact must be used that is rated for 240 volts and can handle ½ amp. This can be wired directly into the terminal strip in the control panel. By closing the Red and Black (positions 1 & 3) terminals, and removing the white (position 2) wire, the internal contactors will engage and the converter will start. The converter can be wired to start from a pressure switch, thermostat etc. Many thermostats have a 24 volt output. This means that the thermostat will actually need to control a 24 volt contactor that will then close the red and black terminals.



### 3.3 CHECKING VOLTAGES

Measuring Voltage is the easiest way to test to see if the phase converter is working properly. When voltages are balanced on the three 3-phase lines, currents are balanced. Measuring current is more difficult as there are different types of current present in the running phase converter.

#### Voltage Measurements:

**Note:** voltage balance is calculated by first averaging the three 3-phase voltages. This is done by adding the three voltages and dividing by 3. Then take the lowest of the 3 voltages and divide it by the average voltage and multiply by 100.

**Note:** voltage measurements from a 3-phase line to ground IS NOT a meaningful measurement. If your equipment is grounded, T1 and T2 to ground will be approximately 120 volts, but T3 to ground can read any voltage.

**Example:** (T1-T2 = 242)            (T1-T3 = 253)            (T2-T3 = 251)

**The average is**  $(242+253+251)/3 = 248.6$  volts

**The imbalance on T1-T2** is  $100 - (242/248.6) \times 100 = 2.7\%$

Note: the single phase line is considered to be imbalanced as well. In other words, don't use the single phase line as the benchmark for balance; use the average as shown above.

**The imbalance on T1-T3** is  $100 - (253/248.6) \times 100 = 1.7\%$

**The imbalance on T2-T3** is  $100 - (251/248.6) \times 100 = 1\%$

**3 and 5 hp models are balanced @10%, 7.5 hp and larger models are balanced @5%**

Measure L1 to L2            This is your single phase voltage as supplied from the utility. The converter does not have to be running to measure this voltage.

Measure T1 to T2            This voltage should only be present when the converter is running. It should be very close to the L1 and L2 voltages, within a volt or two. It is also your single phase voltage; all control should be run from these lines.

Measure T1 to T3            This is the voltage between the manufactured line (T3) and one of the single phase lines. This voltage should be up to 13 volts higher than the T1 to T2 single-phase voltage. 13 volts is about 5%.

Measure T2 to T3            This voltage is the least important. It should also be within 5% or about 13 volts. This voltage will drop when a load is applied.

When the load is applied, this voltage will drop. Ideally it will only drop to 5% below the average of the 3-phase voltages. If needed, adding motor run capacitors across the T1-T3 or T2-T3 lines can increase these voltages.

If your load motor runs backwards, reverse the two single-phase carry through lines T1 and T2 at the motor that needs reversing. If these lines are switched going to the idler, then the direction of all equipment will be reversed.



### 3.4 GENERAL MAINTENANCE

The rotary phase converter may operate continuously with or without a load. The converter will run cool and quiet in the no load condition because the voltages are well balanced.

1. Never start the converter with a load applied (including transformers)
2. The converter should start within a second or two. Wait to start loads (including transformers) until the converter reaches full speed. A timer circuit can be used to automatically start loads after the converter reaches full speed.

#### 3.4.1 MAINTENANCE

Keep dust and moisture from the control panel and the idler. Keep dust from accumulating in the motor. Dust can be blown out using compressed air. Keep dust from accumulating on the surface of a TEFC model as this prohibits proper cooling.

#### 3.4.2 LUBRICATION

American Rotary rotary phase converter idler/generators are custom made and come with pre-packed lubricant specifically designed for the bearings. Exxon Polyrex EM high temperature bearing grease or equivalent polyurea lubricant is recommended for the Baldor Idlers.

**DO NOT use Lithium based lubricants.** These may cause premature bearing failure and will void any warranty.

Be careful not to force so much grease into the bearings that the excess finds its way into the windings of the idler. Some idlers have sealed bearings and will never require greasing. If the idler has grease fittings located on the end bells of the idler, use the chart below for a greasing schedule.

Frame	HP Range	Hours running	Grease Type
Up to 210	3-5	12,000	Polyrex EM
210-280	7.5-20	9,500	Polyrex EM
280-360	25-50	7,400	Polyrex EM
>360	60 & 75	3,500	Polyrex EM

### 4.0 TROUBLE SHOOTING

<b>Questions/Problems</b>	<b>Answer</b>
1. Machine does not seem to have enough power to start	A, B, C, K, M,
2. Converter does not start. It makes a growling sound	B, C, D, E, N, M
3. Converter does not start. Absolutely nothing happens.	C, D
4. Converter does not have a smooth quiet sound	D, F
5. My machine runs backwards	E, H
6. I blew a start capacitor on start-up	O, N
7. The idler has a squealing noise	F, G
8. The idler is very hot	G
9. My machine has contactors that are clicking or lights that are flickering	H
10. My CNC machine kicks out when I start the spindle	H, I
11. My voltage is too high	J
12. My voltage is too low	K
13. My voltage balance is not as good as I want	E, J, K
14. I measure 120 volts from T1 and T2 to ground, but not from T3 to ground	L
15. My Idler generator motor makes a ringing noise	P



- Answer A: Check to make sure your converter is big enough. If not, a second converter of equal size can be installed in parallel to your converter to double its size. Ask us about our Autolink.
- Answer B: Make sure your wire is big enough. Use the minimum wire size on the front of this page. Go up at least one size for every 50 feet of run. Wire may need to be upsized for hard loads.
- Answer C: Check the connections. L1 and L2 are the single phase input and should measure 240 volts from line to line. These lines measure 120 volts line to ground.
- Answer D: Check to make sure the idler is hooked up for low voltage (208-240 volts). Make sure lines 4, 5 & 6 are electronically tied together and then insulated.
- Answer E: By switching any two of the three output lines to the idler, the direction can be reversed. Trying different combinations of T1, T2 and T3 will result in a slightly varying voltage balance.
- Answer F: Although small, the vibrations caused by the idler can resonate depending on how it is mounted. Never bolt the motor to a rigid structure. Visit [www.AmericanRotary.com](http://www.AmericanRotary.com)
- Answer G: The GENTEC/BALDOR idlers are rated up to 150°C. It may be normal for them to run hot. High current on one or more lines may also cause them to run hot. A good voltage balance means a good current balance.
- Answer H: All controls should be run from T1 and T2 (the single phase lines). These lines do not fluctuate voltage as much as T1 to T3 or T2 to T3. If your machine does not have these clearly marked, try different combinations of T1, T2 and T3
- Answer I: You are probably getting a low voltage error. Slow the acceleration down on the spindle in order to reduce the inrush current.
- Answer J: First check your single phase input voltage. The phase converter output voltage is based on the single phase input voltage. To lower your voltage, remove run capacitors from across T1 to T3 and or T2 to T3. Call American Rotary for assistance.
- Answer K: First check your single phase input voltage. The phase converter output voltage is based on the single phase input voltage. To raise your voltage, extra capacitors can be added across T1 to T3 and or T2 to T3. Call American Rotary for assistance.
- Answer L: T3, the manufactured line references a floating ground. Voltage from T3 to ground usually is between 190 and 220 volts. This is correct. The output of a phase converter is a Delta three phase voltage. If a neutral or 120 volts to ground is needed from all three lines, a Delta-Wye transformer is needed. American Rotary stocks the correct transformers for this.
- Answer M: You may need bigger service. Everything may be big enough on your end, but sometimes the power company's transformer is not big enough. Call your power company for service.
- Answer N: Adding start capacitors can help get a motor started. Please contact American Rotary for help.
- Answer O: Blowing a start capacitor is a result of too frequent starts, or having a load on when starting. Make sure all loads are disconnected when starting including transformers.
- Answer P: Check and tighten the bolts on the conduit box and all 4 through bolts on both end bells.