

# AR

## GENERAL DUTY

Rotary Phase Converters  
240 VOLT SERIES



## PRO SERIES

# Operation & Installation Manual

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**AmericanRotary.com**

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## TABLE OF CONTENTS

-	<b>Warning before starting</b>	.....	2
-	<b>Overview</b>	.....	3
-	<b>Warranty</b>	.....	4
-	<b>Return Policy</b>	.....	5
1.	<b>Introduction</b>	.....	6
2.	<b>Installation</b>	.....	7
	<b>2.1. Physical Installation</b>	.....	7
	<b>2.1.1. Physical Installation Environmental Considerations</b>	.....	7
	<b>2.1.2. Installation Guidelines</b>	.....	7
	<b>2.1.3. General Wiring Considerations</b>	.....	9
	<b>2.1.4. Wire Sizing Recommendation</b>	.....	9
3.	<b>Operation &amp; Maintenance</b>	.....	10
	<b>3.1. Starting / Stopping</b>	.....	10
	<b>3.2. Checking Voltages</b>	.....	10
	<b>3.3. General Maintenance</b>	.....	11
	<b>3.3.1. Maintenance</b>	.....	11
	<b>3.3.2. Lubrication</b>	.....	11
4.	<b>Trouble Shooting</b>	.....	12

**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

This manual is to serve the purpose of providing recommendations for proper performance but is not to supersede or replace local or national electric codes. Installation should be done by a licensed electrician who is familiar with phase converter installations.

## **WARNING! READ BEFORE STARTING 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 conditions 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, A), (2, 8, B), (3, 9, C), (4, 5, 6 bolted together and insulated)  
480 Volts Input (1, A), (2, B), (3, C). The following bolted together and insulated: (4, 7), (5, 8), (6, 9)  
Do not use wire nuts or ground any of these connections. Use the supplied bolts and make all connections insulated.

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

5. This phase converter does NOT disconnect the single phase power as it passes through the unit, so the single phase legs remain energized even when the rotary phase converter is off. In addition to installing a single phase breaker in front of the phase converter, you need to be aware that the single phase power DOES flow through the phase converter whether the unit is on or off.
6. Before connecting load, verify proper function of phase converter. This will ensure the protection of the phase converter and your equipment.

**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.

## 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. The idler is the phase converter motor which has no shaft and comes as part of the unit. 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 has been engineered to exceed UL, CSA, & NEMA standards. We offer the easiest installation in the industry with straight line runs, terminal block connections, built-in starter, power guard restart protection, and no stress capacitor mountings. Rotary phase converters can be operated from almost any single phase 240/480 VAC power source that has adequate current carrying capacity. They can operate any type of equipment that requires 3-phase 240/480 VAC.

### KEY FEATURES AND CONSIDERATIONS

- Current limiting soft starting idler / generator made exclusively by Baldor
- Built-in starter with power guard restart protection
- Virtually zero harmonic content
- Industrial Control Circuit - the single phase power remains on even when the rotary phase converter is in the off position, allowing you to activate any single phase control circuits, DRO's or other single phase features on your three phase equipment
- Balanced voltages for voltage sensitive equipment
- Convenient terminal blocks for easy connections
- 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 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

## **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.**

## PRODUCT RETURN POLICY

This policy covers the return of GENTEC/American Rotary products (excluding Warranty returns, which are covered by a separate policy). Under this policy, original Purchaser may return product to GENTEC LLC with its **PRIOR APPROVAL\***, for credit under the following terms and conditions:

**Product MUST BE in its original UNOPENED, UNMARKED carton.**

Any product whose carton has been opened (seal broken), installed, or has been marked on in any way is not considered suitable for resale, and will not be accepted for credit.

Customers must return the product to the GENTEC/American Rotary warehouse, freight prepaid. The product carton should be packed in the same condition as it was shipped, with adequate protection from damage. Upon receipt, the product will be inspected, tested, and evaluated. If the package is found not to be in “as-new” resalable condition, the customer will be notified, and will be offered the option of having the product returned to them, freight collect.

Valid returns will be credited the original purchase price **minus a restocking charge of 25%. In addition, the price of any replacement parts will be subtracted. Modified Stock will be subject to a 50% restocking charge plus the price of any replacement parts. These products are defined as items that have been upgraded from our standard product line such as, but not limited to, NEMA 3R, TEFC, UL, 480V. Custom products are not returnable.**

### Valid Returns

The unit must have been purchased within thirty (30) days of the date it is received by GENTEC/American Rotary. Only products sold by GENTEC/American Rotary through its North American sales network are eligible for this program.

\*PRIOR APPROVAL: Contact a GENTEC/American Rotary representative with pertinent details to obtain an RMA number and shipping instructions.

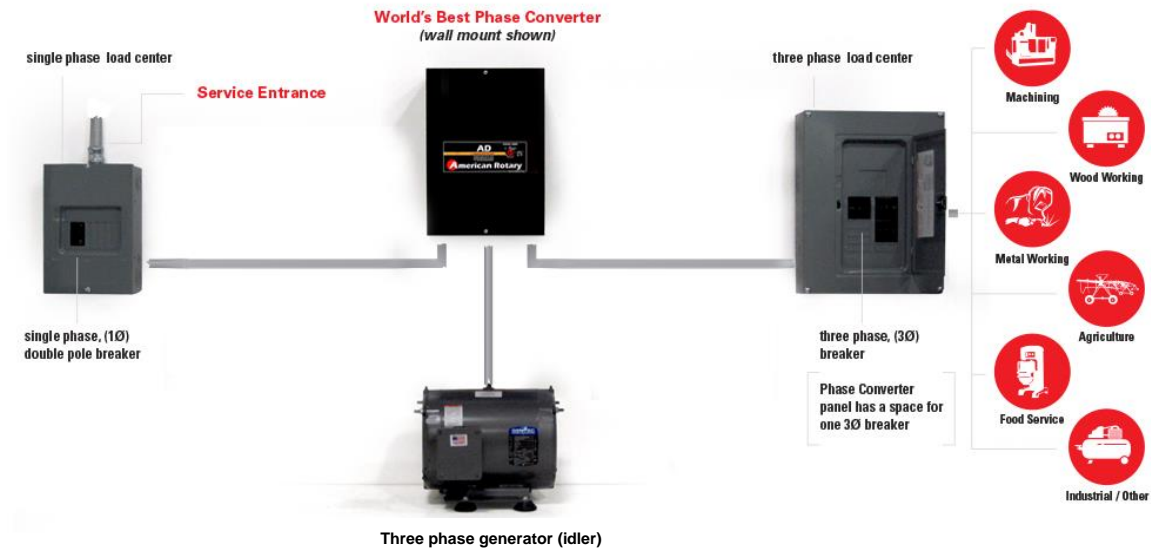
This form must be signed, dated, and faxed to our company headquarters before credit is issued. FAX (262) 402-6438

I have read and agree to all of the terms of the above mentioned product return policy:

**Signed** \_\_\_\_\_ **Date** \_\_\_\_\_

## 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. This means that voltage measurements between phases will be similar to input voltages. **Voltages should only be measured line to line. Do not measure voltages line to ground.** 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 wye voltage and 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 can provide these transformers and disconnect switches.



## 2.0 INSTALLATION

*\*Note: Each phase converter comes standard with spare fuses for the ones already installed in the unit.*

### 2.1 PHYSICAL INSTALLATION

All American Rotary AR, AD, ADX rotary phase converter units come standard in NEMA 1 indoor rated enclosures. NEMA Type 3R rainproof enclosures are available with the AI series converters. If the idler/generator is to be located outdoors, you should consider the American Rotary AI series or special order TEFC idler/generator as an option. 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

American Rotary offers both wall mount and idler mount control panel locations. In either case, to minimize heat and vibration in the control panel be sure to use proper isolation mounts on the idler/generator. 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.

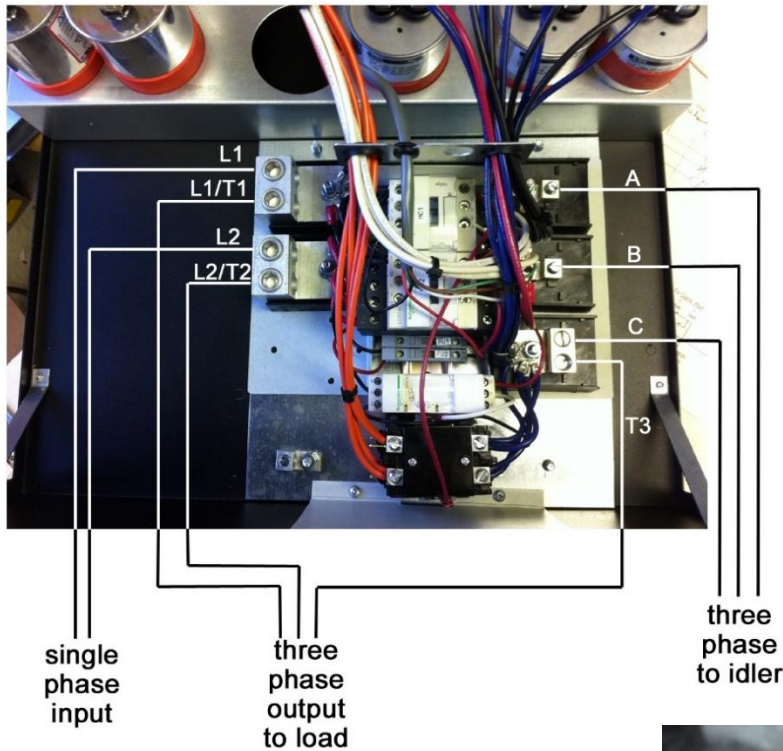
#### 2.1.2 INSTALLATION GUIDELINES (CONTROL PANEL & IDLER)

##### ***Steps to install the control panel and idler:***

- a. Mount enclosure on a secure wall or on the idler (idler mount models only.) Attach conduit fittings for single phase input line, 3-phase line to idler and 3-phase line to load.
- b. Pull electrical lines into the enclosure. Be sure to pull enough wire for your load to reach the two terminals on the left side (L1 & L2) plus the terminal on the right side (T3) of the phase converter controls. Run the ground lines with each circuit.
- c. Connect the lines to the idler/generator to the terminals marked A, B and C.
- d. Connect the three phase output lines to the terminals marked L1/T1, L2/T2, and T3.
- e. Connect the single phase input lines to the terminals marked L1 and L2.



The following diagram shows the electrical schematic for the rotary phase converter:



Firmly snap in the green, yellow/white and red switch terminals into the pushbutton switch body. (In the image at right, a clear enclosure cover is used for clarity.)



f. Wire the idler:

240V:

Bolt idler leads 4, 5 & 6 together. **DO NOT ground 4, 5, and 6!** Insulate this connection with electrical tape, ceramic electrical tape, or heat shrink tubing. Connect the ground line to the ground screw inside the motor conduit box. Inside the phase converter panel box, connect terminal A to (1,7), terminal B to (2,8) and terminal C to (3,9). Insulate these connections separately. Hardware for these connections is provided. **DO NOT use wire nuts for ANY idler connections!**



### 2.1.3 GENERAL WIRING CONSIDERATIONS

- **Follow all local, state and national electric codes (NEC) which may supersede American Rotary recommendations.**
- **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) are applied.
- 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.
- Run all control voltage and equipment controls from lines L1/T1 and L2/T2. Terminals A and B are for the idler only.
- See Wire Sizing Recommendations (section 2.1.4) 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.
- To minimize voltage drop, American Rotary recommends increasing wire size one size for every 50 feet of run and rounding up.

### 2.1.4 WIRE SIZING RECOMMENDATIONS

**FOR 240V:**

Converter Selection & Load Chart (208-240V)						
Model	KVA Rating	Largest Load for Optimal Performance - HP(Amps)	Max Total Load Running - HP(Amps)	Min. 1-Phase Breaker Size (Amps)	Min. Recommended Wire Size	
					1-Phase Input	3-Phase Output (Idler & Load)
AR 5	2.5	2.5 (7)	5 (14)	20	10	12
AR 7	3.75	3.5 (9.8)	7 (19.6)	30	8	12
AR 10	5	5 (14)	10 (28)	40	8	12
AR 15	7.5	7.5 (21)	15 (42)	50	6	10
AR 20	10	10 (28)	20 (56)	60	3	8

\*For all voltages: Conductors listed are minimum recommended based on largest hard starting & CNC amps. For combined HP's greater than 50% of maximum total HP listed in the tables above, consult NEC & local codes for conductor sizing. The above charts do not replace or supersede any requirements by local, state, or national electric codes.

#### ADDITIONAL NOTES ON WIRING:

It is important to have adequate single-phase electrical service. The actual single phase current that will flow through the converter is approximately 1.73 times the three-phase current. The National Electric Code requires 2.5 times the three-phase load 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.

The power needed 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.

Wire can never be sized too large, but too small of wire can impede performance and even keep the converter from starting properly. 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 AR 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. As with most electrical equipment, frequent stops and starts are harder on the rotary phase converter than steady operation. The rotary phase converter is extremely low cost to operate at idle (with no three-phase load), and this is preferable to a high level of stopping and starting. If your load situation dictates that the rotary phase converter must be started and stopped frequently, call us about our On Demand with Delay Off kit for optimum product operation.

### 3.2 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 such as regenerative current.**

#### Voltage Measurements:

Measure L1 to L2 (T1 to T2)	This is your single phase voltage as supplied from the utility. To get the most accurate voltage measurements, make sure that the converter is on And the load is applied.
Measure L1/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 5% higher than the T1 to T2 single-phase voltage.
Measure L2/T2 to T3	This voltage is the least important. It should also be within 5%. <b>This voltage will drop when a load is applied.</b>

**Do not measure line to ground. Voltages will vary widely when doing this.**

**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 your load motor runs backwards, the single-phase connections to the load will need to be reversed. Reverse only the load motor connections at T1 and T2. If lines A and B going to the idler are reversed, then the direction of all equipment will be reversed.

### 3.3 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.

#### 3.3.1 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.

Annually check the wires and connections on the phase converter. No connections or wires should be loose. Also inspect for damaged or missing insulation. Be sure that power is disconnected when doing so!

#### 3.3.2 LUBRICATION

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

**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 following rule of thumb for scheduled maintenance:

For use of the phase converter that is less frequent, add grease to the idler bearings approximately every 6 months. For more frequent use, add grease to the idler bearings about every 3 months. When adding grease, one or two pumps for each fitting should be enough.

## 4.0 TROUBLE SHOOTING

<u>Questions/Problems</u>	<u>Answer</u>
1. Machine does not seem to have enough power to start	A, B, C, L
2. Converter does not start. It makes a growling sound	B, C, D, E, L
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	M
7. The idler has a squealing noise	F
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	J
13. My voltage balance is not as good as I want	E, J
14. I measure 120 volts from T1 and T2 to ground, but not from T3 to ground	K
15. My Idler generator motor makes a ringing noise	N
16. My breaker is popping	D, O, B, 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 suggested on pages 9 or 10. 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 about the same voltage from line to line as the incoming.
- Answer D: Check to make sure the idler is hooked up for its rated voltage. If it is 208-240 volts, make sure lines 4, 5 & 6 are electrically tied together, insulated, and not grounded. If it is for higher voltages (480 volts), make sure lines (4,7), (5,8), and (6,9) are electrically tied together, insulated, and not grounded.
- Answer E: By switching any two of the three output lines to the idler, the direction can be reversed. Trying different combinations of A, B and C 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: The voltage that the phase converter will produce is based off the incoming single phase voltage. The phase converter will use your voltage measured leg to leg on single phase as a baseline for balancing the voltage. Leg to leg, voltage may vary by about 5% while under load. The phase converter does not transform the voltage up or down. If you need to raise or lower your voltage, a transformer may need to be added. Please contact American Rotary for assistance.
- Answer K: Do not measure line to ground. T3, the manufactured line references a floating ground. 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 L: 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 M: 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 N: Check and tighten the bolts on the conduit box and all 4 through bolts on both end bells.
- Answer O: Popping or blowing breakers might mean that there is a short from improper wiring installation. There may also be grounding connected somewhere that should not be. Check the phase converter and the idler for both of these potential problems.
- Answer P: Your breaker may be undersized. Check sizing requirements for your current setup. If further assistance is needed in sizing, contact American Rotary.