



# OPERATION & INSTALLATION MANUAL

## ROTARY PHASE CONVERTERS (MODELS PL, UL & CP)

240 VOLTS

**WARNING:** To reduce the risk of injury, the user must read and understand the operator's manual before using this product.

# TABLE OF CONTENTS

**Section 1** Introduction and Installation Notes

**Section 2** Installation

2.1 Typical Line Diagram

2.2 Branch Circuit (Circuit Breaker & Fuse) and Wire Sizing

2.3 Control Panel Connection

2.4 Idler Generator Connection

2.5 Switch Assembly

**Section 3** Checking the Converter

3.1 Checking single phase power

**Section 4** Operation & Maintenance

4.1 Operation

4.2 Maintenance

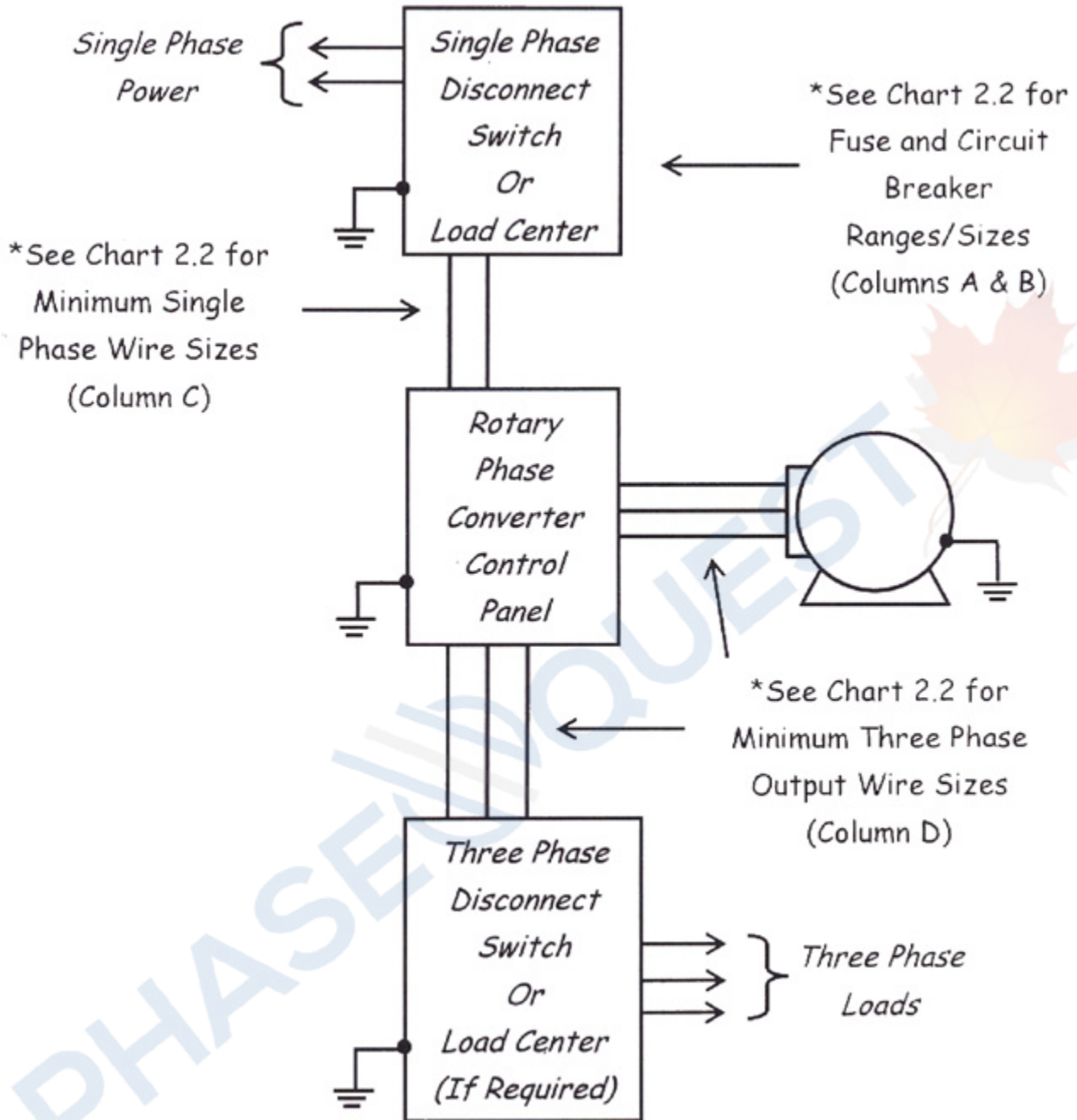
**Section 5** Trouble Shooting

**HIGH VOLTAGE - Risk of electric shock.** This equipment is connected to line voltage that can create a potentially hazardous situation.

Your rotary phase converter has been engineered and manufactured to our standards for dependability, ease of operation, and operator safety. When properly cared for, it will give you years of rugged, trouble-free performance.

- Installation of this equipment must comply with all national, state and local electrical codes.
- Installation must be performed by qualified personnel and should have experience working with this line voltage.
- Always make certain power is off before servicing this equipment.
- The input wire gauge must be sized to furnish the single-phase input current (amperage); this wire is larger than the three phase output current to the load.
- Make sure the input voltage is 208-240 before connecting.
- Do not connect control circuits to T3.
- Do not connect a ground or neutral to T3.
- All loads (including transformers) must be turned off before starting phase converter.
- Do not bolt idler generator down solid. This can cause diminished generator life.
- Make sure phase converter control panel, generator and equipment are properly grounded.
- Wire recommendations are minimums. Voltage drop is dependent on wire length and gauge. Increase wire one (1) additional size for every fifty (50) feet of wire run.
- Wire recommendation is based on the use of copper wire. If using aluminum wire, use the copper equivalent for current amount.
- Single phase loads must always be energized by lines T1 and T2.

**SAVE THIS MANUAL FOR FUTURE REFERENCE**



1. Installation must comply with all National, Provincial and Local Electrical Codes.
2. Installation must be performed by a licensed electrician.
3. Rotary phase converter must start first before loads are started.
4. T3 is the generated leg, do not use for single phase loads or control circuits.
5. Do not bolt generator down solid.
6. Rotary phase converter should reach full speed within 2 to 3 seconds.

Column	A	B	C	D
Generator Horse Power	Minimum Circuit Breaker & Fuse Size	Maximum Circuit Breaker & Fuse Size	MIN   MAX Single phase wire size	MIN   MAX Three Phase Wire Size
3	10 amps	20 amps	14   10	14   12
5	15 amps	30 amps	14   8	14   10
7.5	15 amps	40 amps	12   8	12   8
10	20 amps	50 amps	12   6	12   8
15	20 amps	80 amps	10   4	12   6
20	30 amps	100 amps	10   3	10   4
25	40 amps	125 amps	8   1	10   4
30	50 amps	150 amps	8   1/0	8   3
40	60 amps	200 amps	6   3/0	8   1/0
50	75 amps	250 amps	4   300mcm	6   2/0
60	100 amps	300 amps	3   350mcm	4   3/0
75	175 amp	310amp	2/0   350mcm	2/0   4/0mcm

## BRANCH CIRCUIT (CIRCUIT BREAKER & FUSE) SIZING:

Your PHASE QUEST rotary phase converter has a minimum and a maximum circuit range/size. Your circuit protection can be sized at the minimum, maximum or anywhere between the two amounts.

To determine your single phase branch circuit required to feed your converter and load:

- Add your total 3 phase loads together and multiply by 1.73. This is the amount of single phase current you will draw at full load. This is the minimum single phase service needed to run your phase converter and loads. However, the National Electric Code (N.E.C.) Article 455 recommends multiplying your total phase loads by 2.5.

## EXAMPLES

Total 3 phase load(s) amperage X 1.73 = Single Phase Current Draw

Total 3 phase load(s) amperage X 2.5 = **Minimum** Circuit Protection Size

**Wire / Conductor Sizing: Wire sizing is extremely important in order that proper voltage may be maintained during motor start-up.**

The N.E.C. Article 455.6 governs the wire size of phase converters. Article 455.6 states that the input wire size shall not be less than 125% of the phase converter nameplate input full-load amperes (for variable loads) and/or not less than 250% of the sum of the full-load 3-phase current rating (for variable and fixed loads).

Minimum wire size recommendations are listed in the chart from previous page. These wire recommendations are for wire runs of fifty (50) feet or less. Increase the wire size one (1) size for every additional fifty (50) foot run.

**NOTE-** Wire recommendations are for copper wire. If using aluminium wire, use the copper equivalent current amount.

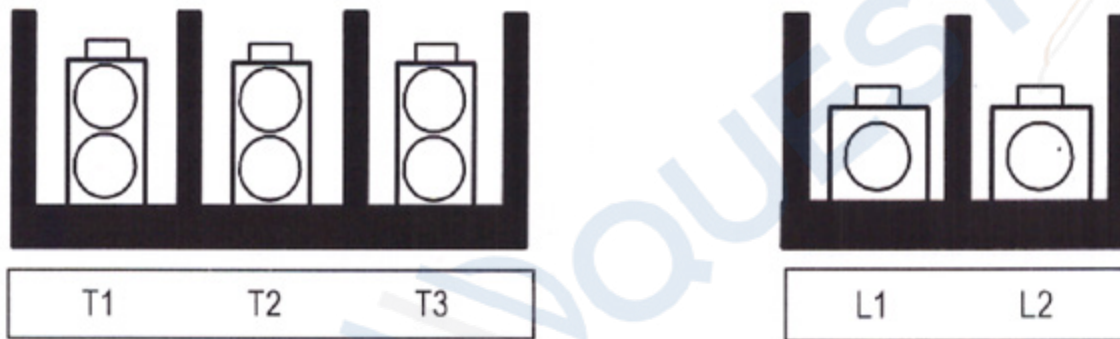
All PHASE QUEST rotary phase converters are equipped with power distribution blocks for wire terminations.

Single phase **input** power connections are labeled **L1** and **L2**.

**Output** idler generator and load power connections are labeled **T1**, **T2** and **T3**.

**T3** is the manufactured leg of power.

Here is an illustration of the wiring connections:



\*Front view of power distribution blocks

Recommend Tightening Torque	
10 - 14 AWG	35 Lb.-in
8 AWG	40 Lb.-in
6 - 2/0 AWG	120 Lb.-in
1/0 - 400 MCM	275 Lb.-in

### For 9 Lead Wire Idler Generators (Motors) - ODF - All Sizes and TECF - 3HP, 5HP, 7.5HP and 10HP

Connect the idler generator according to the nameplate wiring diagram. Your 9 wire lead connection is most commonly referred to as a wye connection.

Connect wire leads 4, 5 and 6 together. Insulate this connection with electrical tape or heat shrink tubing. These 3 leads are connected to each other and NOT to any other wires.

Now, connect wire leads 1 & 7 to T1 in the control panel, wire leads 2 & 8 to T2 in the control panel and wire leads 3 & 9 to T3 in the control panel.

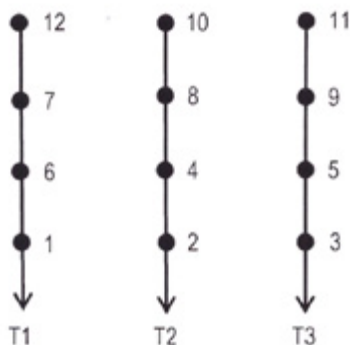
### For 12 Lead Wire Idler Generators (Motors) - TEFC - 15HP, 20HP, 25HP, 30HP, 40HP and 50HP.

Connect the idler generator according to the nameplate wiring diagram. This 12 wire lead connection is most commonly referred to as a delta connection run.

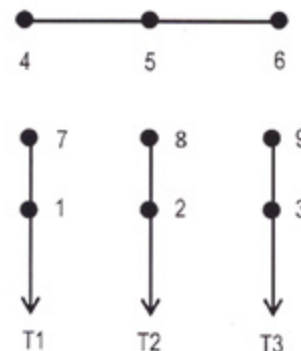
Connect wire leads 1, 6, 7 & 12 to T1 in the control panel, wire leads 2, 4, 8 & 10 to T2 in the control panel and wire leads 3, 5, 9 & 11 to T3 in the control panel.

Here is a line diagram for reference:

#### 9 Lead Wire Idler Generators



#### 12 Lead Wire Idler Generators



Finally, properly ground idler generator to earth ground.

\*Note - this is a low voltage. Low voltage is 208 - 240 volts



On the front cover of the control panel, press the “red” stop button. While doing this, look at the back side of the panel cover and note on which side the “red” tab pushed forward.

Securely push the terminal blocks into the back of the switch. The “red” terminal block matches the “red” tab.

Lastly, slide the tab on top of the terminal blocks to the right (when looking at the back of the switch) to lock the switch terminal blocks into place.



Measure the single phase utility input supply voltage between L1 and L2 with a voltmeter and record. It should measure between 220 and 245 on a standard single phase system.

**NOTE: if your input voltage is too high, you may need to install a buck-boost transformer to decrease the voltage.** Please contact PHASE QUEST; we carry a complete line of buck-boost transformers.

Input Voltage L1-L2 \_\_\_\_\_

Start the rotary phase converter. Press the "Green" Start push button. A light between the start and stop buttons will illuminate. The phase converter should reach full speed within 2-3 seconds.

**NOTE: if the phase converter does not start in 5 seconds, turn it off.**

Measure the output line-to-line voltages at the phase converter and record. This is done by measuring between the three (3) combinations of output terminals. (T1-T2, T1-T3 and T2-T3)

Output Voltages T1-T2 \_\_\_\_\_ T1-T3 \_\_\_\_\_ T2-T3 \_\_\_\_\_

T1-T2's voltage should be the same or within 1-2 volts of L1-L2. T1-T3 and T2-T3 should measure 5-15 volts higher than T1-T2 without a load running. Once a load is applied, these voltages will drop down closer together.

**NOTE: If voltage is too high, capacitors can be removed. If voltage is too low, capacitors can be added.**

**NOTE: Line-to-ground voltage are not relevant.** However, T1 and T2 should measure @120 to ground T3 should measure between 190 and 250 when measuring to ground.

You can now start your loads. **NOTE: if a load motor rotates backwards, switch any two (2) connections at the load.**

## 1.1 OPERATION

1. A rotary phase converter may operate continuously with or without a load.
2. DO NOT start the phase converter under load.
3. Wait until phase converter reaches full speed before starting loads.
4. If possible, avoid starting more than on load at the same time.
5. Turn rotary converter off if excessive noise or vibration occurs.

## 1.2 MAINTENANCE

Your rotary phase converter requires very little maintenance. We recommend periodic lubrication, cleaning and inspection.

### LUBRICATION

All rotary phase converters generator bearings are pre-greased by the factory. This initial greasing generally will last the lifetime of the generators, however, a quirt of grease , may be needed from time to time.

### Recommend grease- Exxon Polyrex EM Bearing Grease

#### Cleaning and Inspection

1. Inspect the rotary converter from time to time.
2. Make sure all vents are clear and clean.
3. Clean off dust, dirt and any debris buildup on the generator. This can insulate the generator and cause overheating.
4. Open control panel and inspect power and control components.
5. Check all wires for loose connections, cuts/nicks or damage. Clean, tighten or replace if necessary.

Condition	What to look for / Actions
Converter does not start, no noise.	<ul style="list-style-type: none"> <li>-Check (L1-L2) input power source for voltage.</li> <li>-Check circuit breaker or fuses.</li> <li>-Check for loose connection.</li> <li>-Make sure switch terminal blocks are securely attached.</li> </ul>
Converter is trying to start, but does not.	<ul style="list-style-type: none"> <li>-Check (L1-L2) input power for correct voltage.</li> <li>-Make sure loads are off downstream of converter.</li> <li>-Check generator motor for correct wiring.</li> <li>-Make sure input wire is the correct size.</li> <li>-Check kVA size of transformer, it may be too small.</li> </ul>
Converter is vibrating, runs loud or has bearing noise (squealing).	<ul style="list-style-type: none"> <li>-Make sure converter is not bolted down solid.</li> <li>-Check (L1-L2) input power for correct voltage.</li> <li>-Check generator motor for correct wiring.</li> <li>-New converters may need break in period, let run 25 – 50 hours.</li> </ul>
Load does not start or run.	<ul style="list-style-type: none"> <li>-Check (L1-L2) input power for correct voltage.</li> <li>-Rotary phase converter may be too small.</li> <li>-Make sure input wire is the correct size.</li> <li>-Check kVA size of transformer, it may be too small.</li> <li>-Measure voltage when load is starting and running, additional capacitors may need to be added.</li> <li>-Check load motor wired for low voltage.</li> </ul>
Load motor is running backwards.	<ul style="list-style-type: none"> <li>-Switch any two (2) connections at the load.</li> </ul>
Chatter noise from my load relay.	<ul style="list-style-type: none"> <li>-Check (L1-L2) input power for correct voltage.</li> <li>-Check if T3 is connected to motor starting relay (coil).</li> </ul>
Output voltage is high.	<ul style="list-style-type: none"> <li>-Check (L1-L2) input power for correct voltage.</li> <li>-Capacitors may need to be removed. Consult PHASE QUEST.</li> <li>-A buck-boost transformer may be needed if single phase input is too high.</li> </ul>
Output voltage is low.	<ul style="list-style-type: none"> <li>-Check (L1-L2) input power for correct voltage.</li> <li>-Capacitors may need to be added. Consult PHASE QUEST.</li> <li>-A buck-boost transformer may be needed if single phase input is too low.</li> </ul>
Generator feels hot.	<ul style="list-style-type: none"> <li>-Generator will feel warm to the touch. This is a normal condition.</li> </ul>