

NORTH AMERICA PHASE CONVERTER CO.

northamericaphaseconverters.com



OPERATION AND INSTALLATION MANUAL

Rotary Phase Converters

Model SB – Smart Boost™ | 240 Volts | Delta

WARNING

To reduce the risk of injury or death, the installer must read and understand this manual in full before installing or operating this equipment.

Installation must be performed by a qualified, licensed electrician familiar with phase converter installations. This equipment operates at high voltage. Electrical shock can cause serious injury or death.

SAVE THIS MANUAL FOR FUTURE REFERENCE

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Section 1: Introduction and Safety Notes

Your North America Phase Converter Co. Smart Boost™ rotary phase converter is built in the United States to our highest standards for reliability, long service life, and operator safety. When installed correctly and properly maintained, it will provide years of dependable three-phase power from your single-phase service.

1.1 How It Works

The SB Smart Boost™ rotary phase converter takes your existing single-phase utility power and manufactures a true third leg of three-phase power. The two single-phase lines pass through the control panel, and the idler generator (motor) produces the third leg. On the SB model, T2 is the manufactured (generated) leg. Three-phase output is available at T1, T2, and T3.

The output voltage will always be close to your input voltage. If you need a different output voltage, a step-up or step-down transformer will be required in addition to the phase converter.

1.2 Safety Rules — Read Before You Begin

DANGER: HIGH VOLTAGE

This equipment is connected to line voltage that can cause serious injury or death.

Always confirm power is OFF at the breaker before working on this equipment.

After disconnecting power, wait at least 1 minute before opening the control panel. Capacitors retain a charge.

Installation Requirements:

- Installation must comply with all national, state, and local electrical codes.
- Installation must be performed by a qualified, licensed electrician.
- Input voltage must be between 208 and 250 volts single-phase before connecting. Do not install it if your voltage is outside this range.
- All loads, including transformers, must be turned off and disconnected before starting the phase converter each time.
- Do not connect control circuits or single-phase loads to T2. T2 is the manufactured (generated) leg only.
- Do not connect a ground or neutral wire to T2.
- Single-phase loads must always be energized by lines T1 and T3 only.
- Do not bolt the idler generator down solid. Mount it on the rubber isolation mounting feet or a rubber pad.
- Make sure the control panel, idler generator, and all connected equipment are properly grounded.
- Wire size recommendations in this manual are minimums based on copper wire. Increase wire size by one gauge for every additional 50 feet of wire run beyond the first 50 feet.
- The input wire must be sized for the full single-phase input current. This current amount is larger than the three-phase output current to the load.
- If using aluminum wire instead of copper, use the copper equivalent rating for the current amount.
- For floor-mount all-in-one enclosures, maintain a minimum of 12 inches of clearance around the unit for airflow.

Section 2: Important Notice – Inductive Coil

Do NOT Remove or Un-Spool the Wire Coil!

This spool of wire supplied with your Smart Boost™ phase converter is an inductive coil. It is required for the protection of the phase converter's controller.

Removing, unwinding, or changing the size or shape of the coil will leave the controller unprotected and void the warranty.

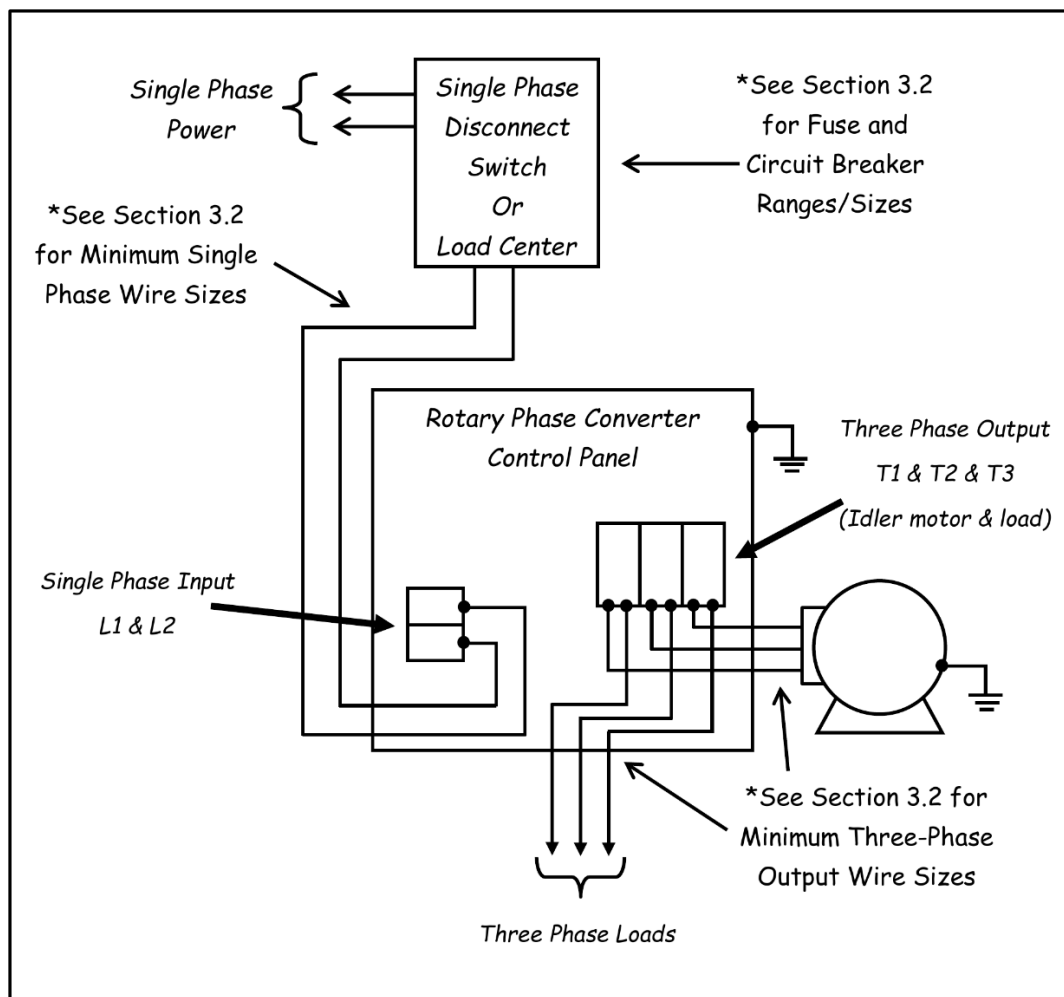
Do not alter this coil in any way. If you have questions about the function of the inductive coil, please contact us before proceeding.



Section 3: Installation

3.1 Typical Line Diagram

The diagram below shows the standard installation layout for the Smart Boost™ rotary phase converter. Your installation may vary depending on your facility and load configuration. Confirm all details with your licensed electrician.



Key rules shown in the diagram:

1. Installation must comply with all national, state, and local electrical codes.
2. Installation must be performed by a licensed electrician.
3. The rotary phase converter must be fully started and up to speed before any loads are energized, including transformers.
4. **T2** is the generated leg. Do not connect it to single-phase loads or control circuits.
5. Single-phase loads must always be energized by lines T1 and T3.
6. Do not bolt the idler generator down solid.
7. The phase converter should reach full speed within 2 to 3 seconds of pressing the start button.
8. Properly ground the control panel, idler generator, and all connected equipment.
9. For floor-mount all-in-one enclosures, maintain at least 12 inches of clearance around the unit for proper airflow.

3.2 Branch Circuit and Wire Sizing

Breaker Sizing

Your NAPCco rotary phase converter has a minimum and maximum circuit breaker range. Your circuit protection can be sized anywhere within that range. Use the table below to determine the correct breaker size for your unit.

To calculate the single-phase branch circuit, you need to:

- Add the full-load amperage (FLA) of all three-phase loads together, then multiply by 1.732. This gives you the minimum single-phase current draw at full load.
- For proper circuit protection per NEC Article 455, multiply your total three-phase load amperage by 2.5. This is the recommended minimum circuit protection size.

Formula: Total 3-phase load amperage $\times$ 1.732 = Single-phase current draw

Formula: Total 3-phase load amperage $\times$ 2.5 = Minimum circuit protection size (NEC Article 455)

Converter HP	Min. Breaker / Fuse	Max. Breaker / Fuse	Min. Single-Phase Wire Size	Min. Three-Phase Wire Size (Idler and Load)
3 HP	10 amps	20 amps	#12 AWG or 125% of breaker size	#12 AWG or based on load
5 HP	20 amps	30 amps	#10 AWG or 125% of breaker size	#12 AWG or based on load
7.5 HP	20 amps	40 amps	#8 AWG or 125% of breaker size	#10 AWG or based on load
10 HP	30 amps	50 amps	#6 AWG or 125% of breaker size	#10 AWG or based on load
15 HP	40 amps	80 amps	#4 AWG or 125% of breaker size	#8 AWG or based on load
20 HP	50 amps	100 amps	#2 AWG or 125% of breaker size	#6 AWG or based on load
25 HP	60 amps	125 amps	#1/0 AWG or 125% of breaker size	#4 AWG or based on load
30 HP	70 amps	150 amps	#2/0 AWG or 125% of breaker size	#2 AWG or based on load
40 HP	100 amps	200 amps	#4/0 AWG or 125% of breaker size	#1 AWG or based on load
50 HP	125 amps	250 amps	250 MCM or 125% of breaker size	#2/0 AWG or based on load
60 HP	150 amps	300 amps	300 MCM or 125% of breaker size	#3/0 AWG or based on load

Wire Size Notes

All wire size recommendations in this table are minimums based on copper wire and wire runs of 50 feet or less.

Increase wire size by one gauge for every additional 50 feet of wire run beyond 50 feet.

If using aluminum wire, use the copper equivalent rating for the same current amount.

Voltage drop depends on wire length and gauge. When in doubt, go one size larger.

3.3 Suggested Wire Size by Breaker Size (NEC 310.16)

Use the table below to match your circuit breaker size to the correct minimum wire gauge. Columns 2 and 3 are based on NEC Table 310.16 using copper wire rated at 90°C (194°F). These recommendations apply to both your single-phase input wiring and your three-phase output wiring to the idler motor and load.

Note:

Wire can never be too large, but undersized wire is one of the most common causes of starting problems and poor performance.

Always confirm your wire selection with your licensed electrician and verify it meets all local code requirements.

Breaker Size (Amps)	Minimum Wire Size (AWG / MCM)	Ampacity Rating at 90°C
15 amps	#14 AWG copper	25 amps
20 amps	#12 AWG copper	30 amps
30 amps	#10 AWG copper	40 amps
40 amps	#8 AWG copper	55 amps
50 amps	#6 AWG copper	75 amps
60 amps	#4 AWG copper	95 amps
70 amps	#3 AWG copper	115 amps
80 amps	#3 AWG copper	115 amps
90 amps	#2 AWG copper	130 amps
100 amps	#1 AWG copper	145 amps
110 amps	#1/0 AWG copper	170 amps
125 amps	#1/0 AWG copper	170 amps
150 amps	#2/0 AWG copper	195 amps
175 amps	#3/0 AWG copper	225 amps
200 amps	#4/0 AWG copper	260 amps
225 amps	250 MCM copper	290 amps
250 amps	250 MCM copper	290 amps
300 amps	350 MCM copper	350 amps

*Reference: NEC Table 310.16, 2020 edition. Copper conductors with a 90°C insulation rating (THWN-2 or equivalent). Based on not more than three current-carrying conductors in a raceway, cable, or earth (directly buried), with an ambient temperature of 86°F (30°C).

Disclaimer:

Code Compliance Notice: This manual may include information about the National Electrical Code (NEC) and local electrical codes. That information is provided for general guidance only. It does not replace the NEC or local code requirements and should not be used as proof of code compliance.

3.4 Mounting the Control Panel

The control panel should be mounted to a solid, non-vibrating wall surface as close to your single-phase power source as practical. Keeping the single-phase supply run short reduces voltage drop and improves converter performance.

- 1. Choose a location that is clean, dry, and protected from excessive dust, moisture, and corrosive fumes. The unit is rated for indoor installation by default. If the installation environment requires an outdoor or washdown-rated enclosure, contact us before proceeding.
- 2. Remove the panel cover by removing the screws on the front and sides of the panel.
- 3. To make the enclosure lighter and easier to mount, you may remove the converter's backplate by unscrewing the 4 bolts in each corner.
- 4. Remove the conduit knockouts (available on NEMA 1 enclosures) that you will use for your wire entry points. The panel can be mounted with knockouts accessible from the side or bottom.
- 5. Mark your mounting hole locations on the wall. Mounting hardware is not included.
- 6. Secure the panel to the wall and reinstall the backplate (if removed).

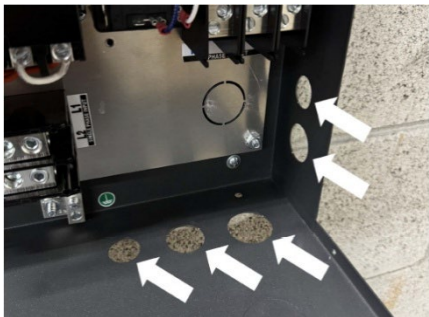
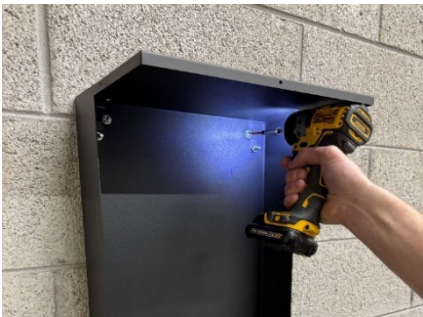


Image Descriptions

Image 1: The removable backplate lets you reduce the enclosure's weight before mounting. Remove the 4 bolts in each corner to detach the backplate.

Image 2: The lightweight enclosure mounts easily to the wall. Secure it using the mounting hole locations you marked in step 5.

Image 3: The NEMA 1 enclosure has 5 conduit-entry knockouts: 3 on the bottom and 2 on the right-hand side. Remove only the knockouts you need for your wiring.

Enclosure Knockout Fitting Sizes

The table below lists the pre-punched conduit-entry knockout sizes for each available enclosure. Use these to select the appropriate conduit fittings for your installation.

Enclosure Size	Right Side Knockouts	Bottom Knockouts
18" × 12" × 8"	3/4" and 1"	3/4", 1", and 1-1/4"
18" × 18" × 8"	1" and 1-1/4"	1", 1-1/4", and 1-1/2"
26" × 18" × 8-1/2"	1-1/2" and 2"	1-1/2", 2", and 2-1/2"

Note: Additional holes can be drilled or punched if needed.

Note: Each enclosure also includes a 6th pre-punched knockout for an optional twist-lock outlet.

Note:

The floor mounting kit includes its own installation instructions. Please refer to those instructions for proper floor-mount assembly and installation.

3.5 Control Panel Wiring Connections

All North America Phase Converter Co. Smart Boost™ rotary phase converters are equipped with clearly labeled power distribution blocks for all wire terminations. You will find two separate blocks inside the control panel. Properly ground the control panel using the designated ground lug.

L1 and L2

Single-phase input power connections. Connect your two hot conductors from your single-phase panel here.

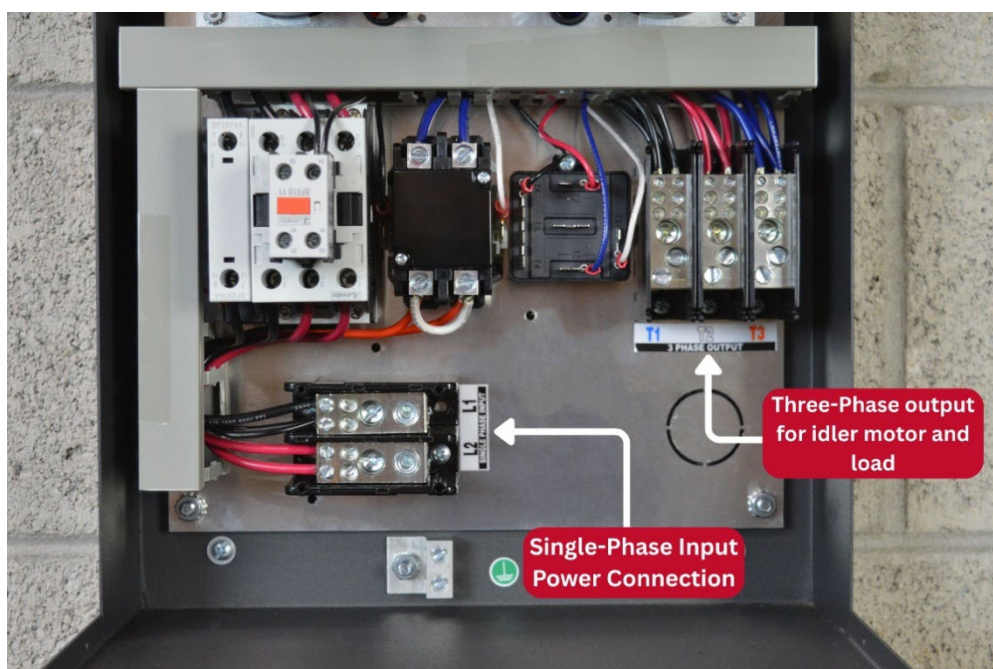
T1, T2, T3

Three-phase output connections to the idler generator and your load. **T2** is the manufactured (generated) leg.

Note:

The output power block labeled T1, T2, and T3 has double lugs. Both the idler generator and the load connect to this same output power block.

Do not connect any single-phase loads or control circuits to T2. Single-phase loads must run from T1 and T3 only.



Recommended Tightening Torque

Use the torque values below when tightening all lug connections. Under-tightened connections are a leading cause of heat buildup and equipment failure.

Wire Size	Torque
#10 AWG – #14 AWG	35 lb.-in
#8 AWG	40 lb.-in
#6 AWG – #2/0 AWG	120 lb.-in
#3/0 AWG – 400 MCM	275 lb.-in

Note:

Use a calibrated torque wrench or torque screwdriver for all connections.
Recheck all connections after the first 50 hours of operation. New wire tends to compress and settle under the lugs.

3.6 Idler Generator Connection

The idler generator is the rotating motor that produces the manufactured leg (T2) of three-phase power. It must be wired correctly for the converter to start and run properly. Most North America Phase Converter Co. idler generators use a 9-lead (delta) configuration. If your idler generator has only 3 leads, follow the 3-lead instructions on page 11.

Important

Do NOT use wire nuts anywhere on the idler generator. Use only mechanical terminations such as lugs, pressure connectors, or terminal blocks.

Do NOT ground any of the idler lead connections at the junction box. Ground only the motor frame at the designated ground terminal.

Failure to wire the idler correctly will prevent the converter from starting and may damage the unit.

Mounting the Idler Generator

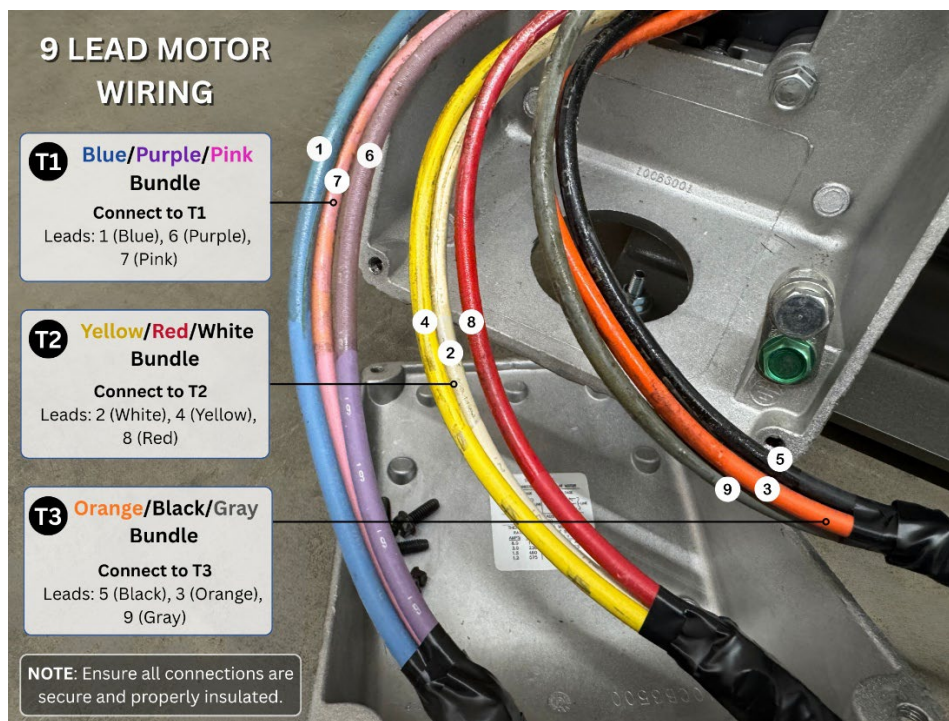
1. Place the idler generator on a clean, flat surface in a location with good airflow and away from excessive dust, moisture, and corrosive fumes.
2. Mount the generator on rubber isolation mounting feet. Do not bolt it down solid to the floor or wall. The isolation feet absorb vibration and extend bearing life.
3. Keep the junction box accessible for future inspection.

9-Lead (Delta) Idler Generator Wiring (ODP 25 HP – 60 HP and all TEFC Idler Generators)

Connect the leads as follows inside the idler junction box using mechanical terminations such as lugs, pressure connectors, or terminal blocks. Insulate each connection with electrical tape or heat-shrink tubing after making the connection.

Control Panel Terminal	Idler Leads to Connect
T1	Leads 1, 6, and 7 (Blue, Purple, Pink)
T2	Leads 2, 4, and 8 (White, Yellow, Red)
T3	Leads 3, 5, and 9 (Orange, Black, Gray)

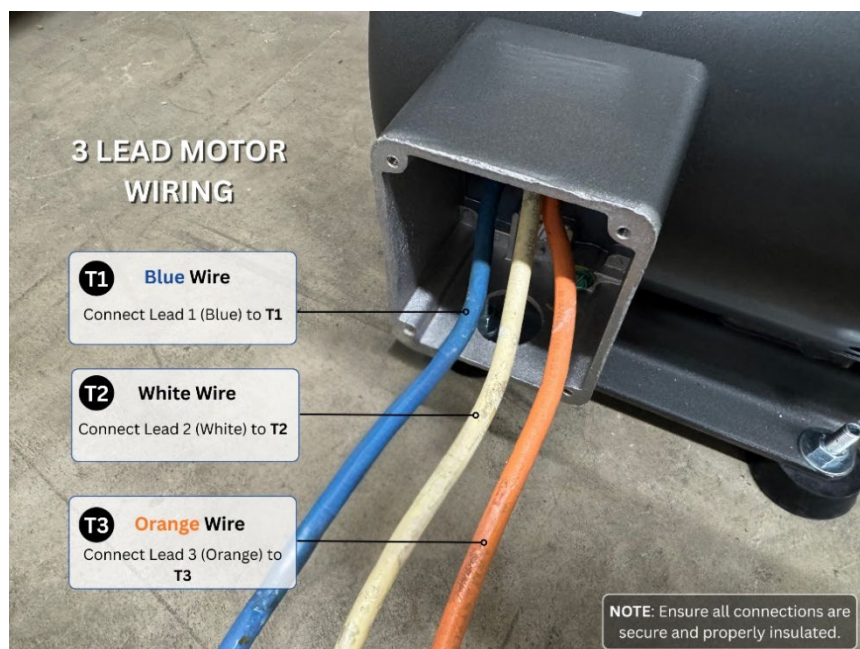
After making all three connections, insulate each connection group thoroughly and confirm that none of the idler leads are grounded. Ground only the motor frame itself to earth ground.



3-Lead Idler Generator Wiring (ODP 3 HP – 20 HP)

If your idler generator has only 3 leads, connect them as follows:

Control Panel Terminal	Idler Lead
T1	Lead 1 (Blue)
T2	Lead 2 (White)
T3	Lead 3 (Orange)



Note:

This is a low-voltage (208 to 250 volt) installation.

After wiring, ground the idler generator frame to earth ground using the designated ground terminal.

3.7 Switch Assembly

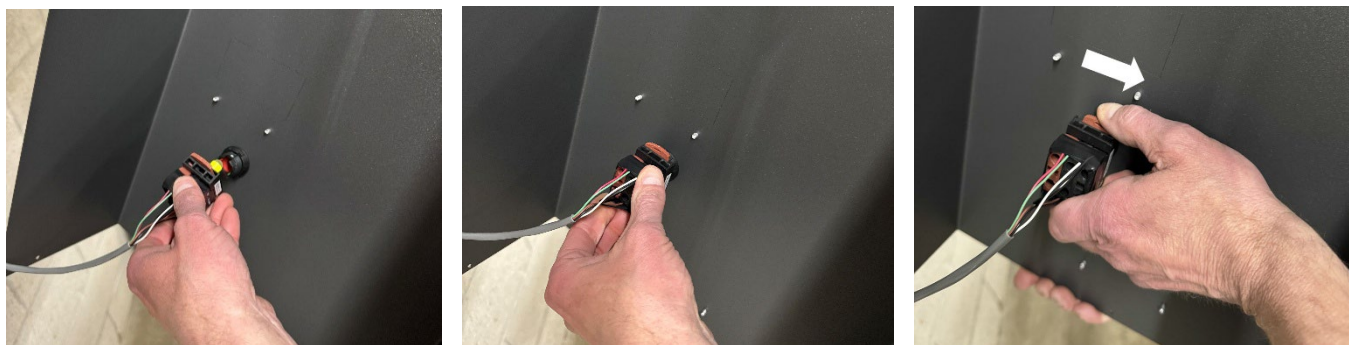
The start/stop switch assembly is pre-wired into the control panel. Follow these steps to install it correctly in the panel cover.

Caution

The switch can only be installed in one direction. Installing it in the wrong direction will break the switch.

Read all four steps before beginning.

1. Press the red OFF button on the front of the panel cover. While pressing it, look at the back of the cover and note which side the red tab pushes forward. This tells you the correct orientation.
2. Securely push the terminal blocks into the back of the switch. The red terminal block matches the red tab.
3. Slide the locking tab on top of the terminal blocks to the right (when looking at the back of the switch) to lock the terminal blocks in place.
4. Give the assembly a firm tug to confirm it is fully locked before closing the panel.



Section 4: Checking the Converter

Before connecting any loads, verify that the converter is wired correctly and producing the correct output voltage. This step protects both the phase converter and your connected equipment.

4.1 Checking Single-Phase Input Voltage

With the single-phase power on and the converter off, use a voltmeter to measure the input voltage between L1 and L2. Record the reading below.

Input Voltage L1 to L2: _____ volts

The reading should be between 208 and 250 volts on a standard single-phase utility service. If the input voltage is too high, a buck-boost transformer may be needed to bring it into range. Contact us for assistance. We carry a full line of buck-boost transformers.

Note:

If your input voltage is below 208 volts, do not start the converter. Contact your power company or us before proceeding.

Low input voltage is one of the most common causes of starting problems.

4.2 Checking Three-Phase Output Voltage

Start the converter by pressing the green ON button on the panel cover. The indicator light will illuminate, and the converter should reach full speed within 2 to 3 seconds.

Important

If the converter does not start within 5 seconds, press the red OFF button immediately. Do not attempt to restart until you have identified and corrected the problem. Refer to Section 6 for troubleshooting guidance.

With the phase converter running and no loads connected, measure the output voltage across each of the three combinations of output terminals and record the readings below.

T1 to T2: _____ volts

T1 to T3: _____ volts

T2 to T3: _____ volts

What you should see on the Smart Boost™:

- T1 to T3 should be the same as your L1 to L2 input voltage, or within 1 to 2 volts. T1 to T3 is the reference leg on this model.
- T1 to T2 and T2 to T3 will read 15 to 30 volts higher than T1 to T3 when no load is connected. This is completely normal. These voltages will drop and balance once a load is running.
- Do not measure line-to-ground voltages. Line-to-ground readings are not meaningful on a delta system.
- For reference only: T1 and T3 should measure approximately 120 volts to ground. T2 (the generated leg) should measure between 190 and 250 volts when measuring to ground.

Tip:

Record your no-load voltage readings above and keep this manual with the unit. Having a baseline reading on file makes future troubleshooting much easier.

If a load motor runs backward when you first start it, switch any two of the three output connections at the motor to reverse rotation.

Section 5: Operation and Maintenance

5.1 Operation Guidelines

1. Always start the phase converter first and allow it to reach full speed before energizing any connected loads or transformers.
2. Do not start the converter with a load already energized. **This includes transformers.**
3. The converter may run continuously with or without a load. Running at idle is normal and does not harm the unit.
4. Avoid starting multiple loads at the same time whenever possible. Starting loads one at a time reduces strain on the converter and your electrical service.
5. If you hear excessive noise or feel unusual vibration from the control panel or idler generator, shut the unit down immediately and contact us before restarting.
6. Frequent start and stop cycles are harder on the converter than continuous operation. If your application requires frequent cycling, contact us about our time delay relay option.

5.2 Routine Maintenance

Your North America Phase Converter Co. Smart Boost™ rotary phase converter requires very little routine maintenance. The following checks, performed periodically, will keep the unit running reliably for years.

Every 6 Months

1. Inspect all vents on the control panel and idler generator. Clear any dust, dirt, or debris that may block airflow. Restricted airflow leads to overheating.
2. Wipe down the exterior of the idler generator. Dust buildup on the motor housing acts as insulation and can cause the motor to run hot.
3. Inspect the rubber isolation mounting feet under the idler generator. Replace them if they show signs of cracking, hardening, or deterioration.
4. Inspect the inductive coil. Confirm it remains intact, coiled, and unchanged. Do not alter it.

Annually

1. Open the control panel and visually inspect all internal components. Look for any signs of heat damage, discoloration, or corrosion.
2. Check all wire connections and confirm they are tight. Check all lug nuts and re-torque to the values in Section 3.5 if needed.
3. Inspect all wires for cuts, nicks, or damaged insulation. Replace any damaged wire before restarting the unit.
4. Test the capacitors with a capacitor meter and replace any that are out of spec. Contact us for replacement capacitors.
5. Confirm the switch assembly is secure and operating correctly.

Safety Reminder

Always disconnect power at the breaker and wait at least 1 minute before opening the control panel or working on any part of this equipment.

Capacitors inside the control panel retain a charge even after power is disconnected.

5.3 Lubrication

All North America Phase Converter Co. idler generator bearings are pre-greased at the factory. In most cases, this initial grease will last the lifetime of the generator. A small amount of grease added every few years under normal operating conditions is all that is required.

Recommended Grease: Exxon Polyrex EM Bearing Grease or equivalent polyurea-based bearing grease.

Lubrication Caution

Do not over-grease. Excess grease can find its way into the motor windings and cause damage. Do not use lithium-based greases. These are not compatible with the factory grease and may cause premature bearing failure.

Some idler generators are equipped with sealed bearings and will never require greasing. If your unit has no grease fittings (zerks), the bearings are sealed and maintenance-free.

Section 6: Troubleshooting

Use the table below to identify and resolve the most common issues. If you are unable to resolve a problem after working through the relevant steps, contact our technical support team.

Symptom	What to Check
The converter does not start; no sound or movement.	Check the input voltage between L1 and L2. Check the circuit breaker and fuses. Check for loose wire connections. Confirm switch terminal blocks are fully seated and locked.
The converter tries to start but will not reach full speed.	Verify that input voltage (L1-L2) is within the correct range (208 to 250 V). Confirm that all loads are off and disconnected downstream. Check idler generator wiring. Verify that the input wire size is correct. Check the kVA rating of any transformer in the circuit.
The idler generator vibrates excessively or runs louder than expected.	Confirm the idler generator is NOT bolted down solid — it must float on the rubber isolation feet. Check the input voltage (L1-L2). Check idler generator wiring. New units may have a break-in period of 25 to 50 hours.
Load will not start or run.	Check input voltage (L1-L2). Verify the converter is sized correctly for the load. Check input and output wire sizes. Verify transformer kVA if one is used. Measure voltage at the load while starting — additional capacitors may be needed. Check that the load motor is wired for the correct voltage.
Load motor runs backward.	Switch any two of the three output connections at the load motor. Do not change anything at the converter.
Control relays chatter or lights flicker on the load equipment.	Check input voltage (L1-L2). Confirm T2 is not connected to any control circuit. All control circuits must run from T1 and T3 only.
Output voltage is too high.	Check input voltage (L1-L2). Capacitors may need to be removed. Contact us for assistance. A buck-boost transformer may be needed if the single-phase input voltage is too high.
Output voltage is too low.	Check input voltage (L1-L2). Confirm wire sizes are adequate. Capacitors may need to be added. Contact us for assistance. A buck-boost transformer may be needed if the single-phase input is too low.
Idler generator feels hot to the touch.	The idler generator will normally run warm. Verify airflow around the unit is not restricted. Check that the rubber isolation feet are in place and the generator is not bolted down solid.
Breaker keeps tripping.	Check for improper wiring; a ground connected where it should not be is a common cause. Confirm the breaker is correctly sized per Section 3.2. Verify wire sizes are adequate. Check that no idler lead connections are grounded.

Note:

If you have 480V incoming power or any voltage other than 208 to 250 volts, do not install or operate this unit. Contact us before proceeding.

For technical support, contact North America Phase Converter Co. Our team is available to help with sizing, installation questions, and troubleshooting.

Section 7: Warranty

Rotary Phase Converter Limited Lifetime Warranty

North America Phase Converter Co. warrants that all rotary phase converter control panels are free from defects in material and workmanship. If any component is found to be defective upon examination, inspection, and testing by North America Phase Converter Co. or an authorized service center, we will, at our option, repair or replace the defective part at no charge.

Warranty Period

- Control panel parts: 10 years from the date of purchase for the original purchaser.
- Capacitors: 1 year from the date of purchase for the original purchaser.
- Control panel labor: Lifetime. North America Phase Converter Co. will maintain the control panel and perform repairs caused by normal use at no charge for the useful life of the panel.
- Idler generator: Covered separately by the motor manufacturer and subject to their terms and conditions.

Warranty Conditions

- Warranty is valid for the original purchaser only and is non-transferable.
- All transportation costs to return the unit to the factory are the responsibility of the purchaser. Shipping back to the purchaser is provided by North America Phase Converter Co. when the repair is covered under warranty.
- A licensed electrician must perform all installations. The customer is responsible for ensuring the installation complies with all applicable codes and passes any required inspections.
- Not all North America Phase Converter Co. rotary phase converters are UL-listed. UL-listing is an option and must be specified at the time of order.

Warranty Exclusions

This warranty is exclusive and is in lieu of any other warranty, expressed or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose. This warranty does not cover: damage or failure caused by improper installation, unauthorized modifications or repairs, misuse, accident, vandalism, excessive wear, abnormal operating conditions, lack of maintenance, or any cause outside the control of North America Phase Converter Co. North America Phase Converter Co. is not liable, under any circumstances, for consequential or incidental damages, including but not limited to lost profits resulting from the use or inability to use the unit, or lost profits or labor costs for removal and reinstallation of the unit.

Returns

North America Phase Converter Co. will not accept the return of any goods without prior written approval. Contact us before returning any equipment. Returns must be initiated within 30 days of purchase.

North America Electrical Sales LLC
DBA North America Phase Converter Co.

northamericaphaseconverters.com
New Berlin, Wisconsin