COMPRESSOR SOFT STARTER - THREE PHASE SERIES

PREMIER BENEFITS:

- Most Compact Soft Starter in the Market
- Compatible with all Modern Scroll Technologies
- Reduces In-Rush Current by 30-50%
- Lowers Start-Up Torque by 50-70%
- Greatly Reduces Compressor and Refrigerant Piping Stress
- Reduces Start-Up Noise and Vibration
- Eliminates Light Flicker at System Start-Up
- Reverse Motor Protection
- Integrated Reverse Phase Protection
- Under Voltage and Over Voltage Protection
- Compatible with Major Utility Regulations
- Easy Retrofit

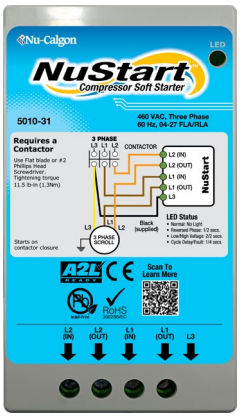
FURTHER ADVANTAGES:

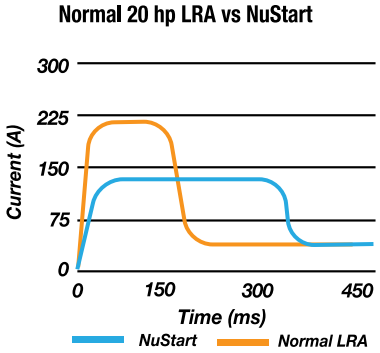
- OEM Approved Technology – Time Proven
- Efficient Start-Up on Back-Up Power Sources
- Prevents Generator Stalls/Solar Inverter Shutdown
- Eliminates Motor Stalling During Brownouts
- Automatic Optimization of Motor Start-Up Current
- Protects Compressor from Rapid Cycling
- Reduces Contactor Arcing Damage
- Easy-To-Use LED Fault Diagnostics

Specialty Products

NuStart

Compressor Soft Starter





Description:

NuStart is both a soft starter and protection device for scroll compressors in HVAC/R systems. NuStart uses current-based motor control to optimize motor start-up of the scroll compressor. In doing so, significant reductions inrush current and motor torque result. End-user benefits include: reduction in start-up noise and vibration, eliminates light flicker and nuisance circuit breaker trips at start-up, reduction in contactor arcing, and significant reduction in mechanical stress on the compressor, compressor mounts, and connected refrigerant piping at start-up. Lowering the inrush current of the compressor allows for more efficient start-up with off-grid solutions such as solar/battery systems or other back-up power sources – allows the use of a smaller generator.

NuStart provides another level of protection for the scroll compressor in the HVAC/R system. NuStart offers reverse motor (scroll) protection, plus under voltage protection to prevent motor stalling at start-up or during operation in low voltage (brownout) events, over voltage and reverse phase protections. The device is tolerant to “dirty power” conditions. NuStart provides additional compressor protection– it is NOT a replacement for any primary circuit breaker or an overload protection device, nor is it a surge protector.

Application:

NuStart is the premier solution to start and protect scroll compressors in the HVAC/R market. The OEM approved technology is the most trusted in the HVAC/R market – with years of global installations.

NuStart is the most compact device available allowing for the easiest installation inside the condensing unit. In addition, the device provides many advantages that other competing products don’t offer including: reverse scroll protection technology, hard start time out feature, and best market line-up with single and three phase options for residential and commercial systems.

NuStart is designed for modern scroll compressor technologies in the HVAC/R market – single stage, dual stage, and digital type scroll compressors. Do NOT use NuStart for inverter type scroll compressors. For other compressor types, contact Nu-Calgon.

NuStart must be selected on proper electrical phase, RLA, and LRA of the compressor stated on the nameplate of the condensing unit. Use NuStart for the following systems equipped with scroll compressors:

- Air Conditioning
- Heat Pumps
- Chillers
- Refrigeration

NuStart models 5010-30 and 5010-31 cover commercial air conditioning, heat pump, chiller, and refrigeration systems systems that operate on 230 VAC or 460 VAC three phase power. They are an excellent accessory to offer with new HVAC/R installs or systems already in service to optimize starting scroll compressors up to 20 horsepower.

Commercial compressors exhibit a significant amount of torque at start-up, typically generate significant noise and mechanical shock to the refrigerant piping often requiring vibration eliminators to protect the piping. NuStart reduces start-up torque by 50-70% thereby greatly reducing mechanical stress to the compressor,

compressor mounts, and refrigerant piping. If the piping is not properly protected, ongoing stress to refrigerant piping could lead to a potential refrigerant leak and expensive repair. NuStart provides more latitude to operate the system off-grid or battery back-up power options with more efficient HVAC/R system start-up

Packaging:

NuStart, 230 VAC Three Phase 4-28 RLA **5010-30**
NuStart, 460 VAC Three Phase 4-27 RLA **5010-31**

Specifications:

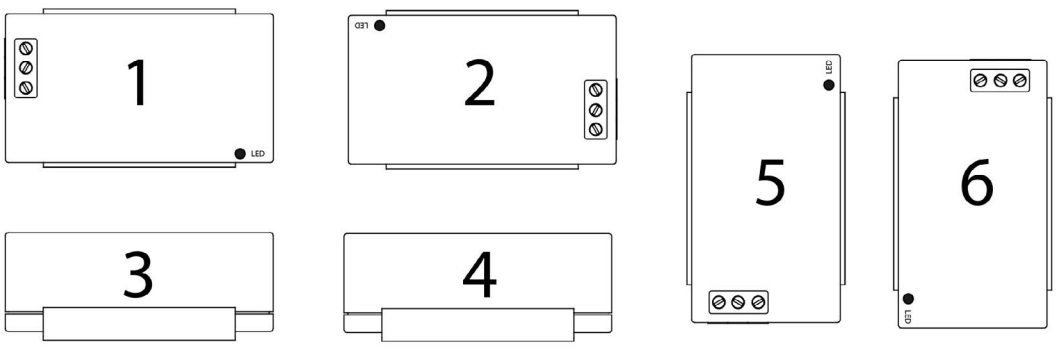
Attributes	Nu-Calgon Three Phase Models	
	5010-30	**5010-31**
Nominal Voltage Rating	208-230 VAC	460 VAC
Rated Phase	Three	Three
Rated Frequency, Hz	50/60	60
Motor Current, Max. RLA/FLA Range	4-28A	4-27A
LRA, Max.	210A	210A
Start Current Reduction*	30-50% of LRA	30-50% of LRA
Startup Torque Reduction	50-70%	50-70%
Degree of Protection – Housing	IP20	IP20
Operating Temperature	-4° to 140°F	-4° to 140°F
Storage Temperature	-40°F to 185°F	-40°F to 185°F
Maximum I2t for Fusing, A2s	1060	1060
Maximum Number of Starts per Hour	15	15
Minimum Startup Voltage	176V	414V
Maximum Permissible High Voltage	253V	510V
Shutdown on Low Voltage	176V	391V
Dimensions	5.30”x 1.96”x 2.94”	5.30”x 1.96”x 2.94”
Weight	1.1 lb.	1.1 lb.
Life Expectancy	Minimum 100,000 Cycles	Minimum 100,000 Cycles
Limited Warranty	One Year from Install	One Year from Install

Cautions:

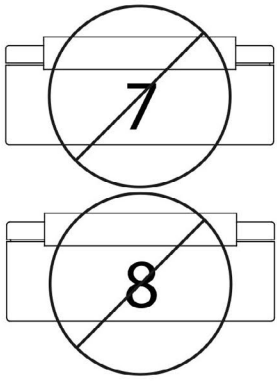
1. NuStart is designed for install in the electrical compartment of the condensing unit, confirm dry fit location before installation. If NuStart must be installed outside the condensing unit, contact Nu-Calgon.
2. NuStart must not be used in conjunction with inverter drives or other soft start devices.
3. For use with single/dual stage scroll compressors, plus digital type scroll compressors. For other compressor designs, contact Nu-Calgon.
4. This soft starter is NOT designed for motor loads which require a starting time greater than 0.5s upon direct on-line supply at nominal voltage.
5. NuStart must be installed in a location that ensures that the external heat from a hot gas line, compressor discharge piping, or similar heat source will not cause damage. Minimum 3” (76 mm) clearance is recommended.
6. This device is not intended for use as motor overload protection. Must be supported with a suitably rated overload relay and Short Circuit Protective Device.
7. This device has been certified for use with hermetic refrigerant scroll compressors ONLY.
8. Device does not require grounding. Motor chassis must be earthed, and all applicable codes adhered to.
9. **Opening of the starter or attempting to run the unit on motor loads beyond stated capacity will void the warranty!**

POSITIONING:

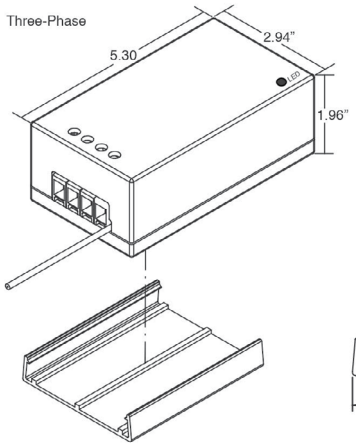
Approved Mounting:



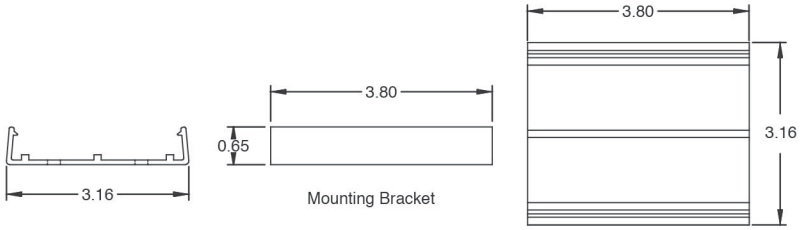
Not Approved



Dimensions:



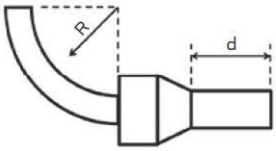
Note: Install mounting bracket to interior metal cabinet wall with two self-tapping screws (field supplied).



Field Wiring Specifications:

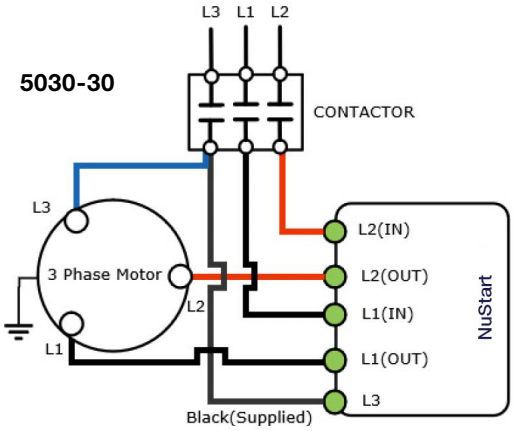
ENSURE ALL POWER IS ISOLATED BEFORE WORKING ON THE EQUIPMENT.

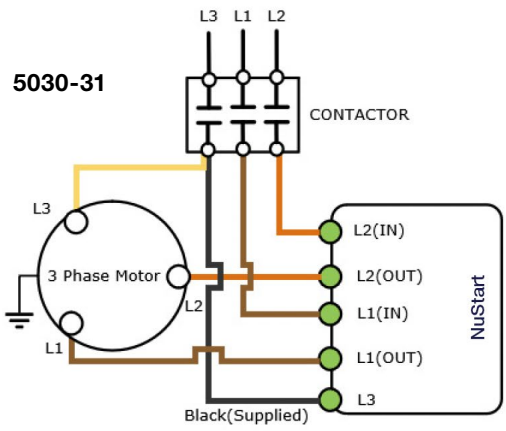
1. Ensure all wire sizing used are compliant with compressor full load current requirements as stated below.
2. Increase conductor sizing to next higher rated cross-section if ambient temperatures above 50°C (122°F) are expected.
3. Use TINNED stranded copper wire ONLY.
4. Ensure minimum conductor length of 20 in. (50cm).
5. All main connector terminations must be tightened to 10.5 lb-in (1.2 Nm).
6. Minimum end use enclosure size: 10″ x 8″ x 6″
7. Insertion length of ferrule “d”: 12 mm (0.47”)
8. Cable bend radius “R” > 38mm (1.5”) minimum
9. Improper or loose termination can lead to heating and subsequent damage to the soft starter.



I < 20A	20A ≤ I < 30 A	I ≥ 30A
AWG 12 /2.5-4 mm²	AWG 10 / 4-6 mm²	AWG 8/ 6-10 mm²

General Wiring Schematic:





Installation:

NuStart must be installed by qualified/licensed technician. Record date of installation on device.

STEP 1: Phase Rotation Identification

FIRST ESTABLISH THAT THE SUPPLY PHASE ROTATION OF THE CONNECTED MOTOR IS CORRECT WITHOUT THE NUSTART INSTALLED. Incorrect phase rotation may have damaging effects on the motor and its connected load.

Note: Correct phase rotation for the application must be established by the installer.

Identifying the correct phase rotation for the motor is crucial for each installation. This is to align the internal phase detection of the soft starter with the application. Once correctly installed, NuStart has a phase rotation lock-out feature. This feature will prevent the motor from starting if the phase rotation is reversed and the LED will flash to indicate this.

STEP 2: NuStart Wiring

ENSURE ALL POWER IS ISOLATED BEFORE WORKING ON THE EQUIPMENT. Remove any start assist devices if they already exist.

L1-L2-L3 is assumed as the standard phase rotation input available at contactor input terminals.
L2-L1-L3 is assumed as the desired phase rotation required for the application.

1. Ensure STEP 1 is verified.
2. Disconnect the L1 motor lead from the load side L1 of the contactor.
3. Add a wire link from open L1 load terminal of the contactor and the NuStart connection L1 (IN).
4. Connect the loose L1 motor lead to the next NuStart connection L1 (OUT).
5. Next, disconnect the L2 motor lead from the load side L2 of the contactor.
6. Add a wire link from open L2 load terminal of the contactor and the NuStart connection L2 (IN).
7. Connect the loose L2 motor lead to the next NuStart connection L2 (OUT).
8. The L3 connection of the contactor remains directly connected to the motor L3 termination.
9. The additional black wire (L3) from NuStart device must be connected to the load side of the contactor on the L3 phase.

STEP 3: Phase Confirmation Test

Upon First Power up, the installation is complete if the motor starts running OR NuStart will flash a ‘Reverse Phase’ fault code if the supply phase sequence is incorrectly aligned with its built-in phase detection setup.

To correct the phase alignment:

1. REMOVE POWER TO THE UNIT

2. Swap the connections at load side of contactor terminals L2 and L1.
3. Also, swap the motor leads at the soft starter L1 (OUT) and L2 (OUT).

(Note that this double swap keeps the phase sequence to the motor unchanged but reverses the phase sequence for NuStart only).

After re-wiring, verify that the installation is complete if the motor starts running on second Power Up.

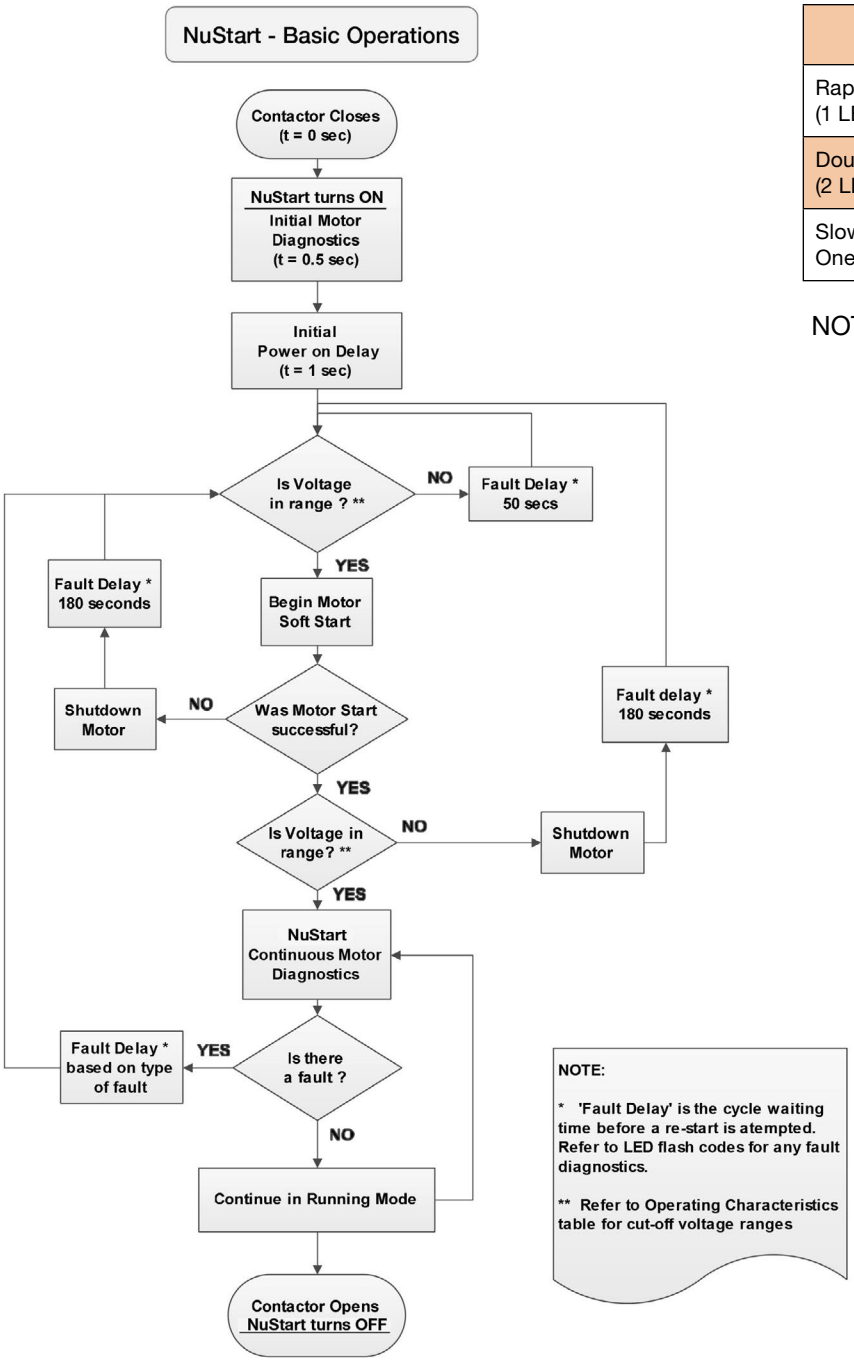
Ensure that connections on NuStart terminals are re-tightened to required torque specifications.

NuStart Operation

Device does not require any auxiliary control voltage input for its operation.

1. Line contactor must first operate. After the contactor pulls in, NuStart will initiate a start sequence after one second delay or the LED fault indicator will be flashing. The compressor stops when the contactor opens or if the NuStart observes any fault condition.
2. If the supply voltage is less than Start-up Voltage (90% of Vrated), no start will be attempted. The LED will flash for “Low Voltage/ Over Voltage”. NuStart will attempt a restart after three minutes.
3. Allow up to 6-7 starts to obtain an optimized soft start performance.
4. Maximum programmed NuStart time is less than 600ms.
5. In case of an intermittent power interruption longer than 100ms or a failure to start-up the compressor, the NuStart enters a 3-minute cycle delay after which it will attempt a restart provided all supply conditions are favorable again.
6. NuStart does not offer any soft stop feature.

Mode of Operation:



LED Flash Codes

Flash Code	Definition	Time to Re-start Attempt
Rapid Flash (1 LED flash every 2 seconds)	Reverse Phase Rotation	3 minutes
Double Flash (2 LED flashes every 2 seconds)	Low Voltage / Over Voltage	3 minutes
Slow Flash One LED flash every 4 seconds)	Fault Mode / Cycle Delay	3 minutes

NOTE: LED fault indicator remains off in normal running mode.

Flash Code - Reverse Phase Rotation:
(1 LED flash every 2 secs.)

- Displayed if the supply “phase sequence” gets reversed before or after a start.
- Re-start is attempted after 3 minutes.

Flash Code - Low Voltage / Over Voltage:
(Double LED flash every two seconds)

- Displayed for “low supply voltage” or “high supply voltage” before or after a soft start.
- If voltage is out of range before a start, a re-start is attempted after 50 seconds.
- If voltage is out of range after a start, a re-start is attempted after 3 minutes

Flash Code - Fault Mode / Cycle Delay:
(1 LED flash every 4 secs.)

- Displayed for “cycle delay” between two consecutive soft starts or other faults mentioned below.
- Re-start is attempted after a default period of 3 minutes.
- Other possible reasons for this fault mode indicator can be due to:
  - *a failed soft start attempt,*
  - *intermittent power loss (duration longer than 100ms)*
  - *frequency out of range*

Certifications:

NuStart products are complaint to RoHS, REACH, 3TG and SCIP regulations. UL compliance as per UL IEC60947-4-2 Compliant under ETL file 5008 865 CE compliance as per IEC60947-4-2 and IEC61000 series EMI/EMC standards

Limited Warranty: NuStart offers a limited one-year warranty from the date of installation. The warranty does not cover labor, return shipping charges, damages caused by normal wear and tear, field modifications within the housing, inadequate maintenance or faulty repair, failure to observe the operating instructions, overloading, use of any unsuitable material, effect of chemical or electrolytic action, building or resulting from other reasons beyond Nu-Calgon’s control. Contact Nu-Calgon with further questions.

1. What is different between a hard start kit and NuStart?

Hard start kits are more preferred in applications where the system design requires high starting torque. In small sized applications reciprocating and rotary compressors that must start against a pressure head and may require a device to increase the starting torque. If the HVAC unit utilizes a scroll compressor, hard start kits are not normally required.

NuStart is a sophisticated and intelligent device designed to reduce the starting current of the compressor by actively controlling the current in both the run and start windings. They actively (phase control) limit the current through run winding while a balanced value of start capacitor is connected in situ to provide the optimal torque required to start a compressor at any operating voltage. Along with soft starting, electronic soft starters also provide a substantial number of built-in features to pre-emptively protect the compressor under abnormal circumstances.

2. How do I select a NuStart?

Determine voltage input, phase type (single or three), compressor RLA and LRA to make sure it falls between specified range of appliable NuStart model.

3. What compressors is NuStart suitable for?

Single stage, dual stage, and digital scroll type compressors. Do not use NuStart on inverter type scroll compressors.

4. Why can't I use NuStart on a reciprocating compressor?

It is extremely important that NuStart starts a compressor when system pressures are equalized so not to shorten NuStart's service life. By design scroll compressors equalize very quickly at shut-off. Reciprocating and other compressors don't necessarily equalize quickly at system shut-down and NuStarts is not to be used with non-scroll compressor designs without some system design provision to allow quick pressure equalization at shut-down.

5. Do I need to do anything different with a condensing fan using a ECM motor?

No, NuStart is wired independently of the condensing fan motor.

6. What is unique with NuStart vs. other market options?

Most compact soft starter in the market for easiest installation inside the condensing unit. NuStart is available in single and three phase models and provides a suite of protection features for the scroll compressor: reverse scroll protection, low voltage, hard start lock-out feature, plus overcurrent protection (single phase types) and over voltage/integrated phase protection (three phase types).

7. What is reverse scroll protection?

If there is a brief interruption in power, it is possible for a scroll compressor to suddenly operate in reverse direction caused by pressure differential in the system – this is very detrimental to the compressor. NuStart will de-energize the compressor and restart the compressor after a few minutes.

8. What is low voltage protection?

During a low voltage (brownout) event, if the voltage is below the specified minimum voltage input during start-up or during running, NuStart will de-energize the compressor and try a restart three minutes later. Low voltage conditions can cause compressor stall resulting in LRA current draw which is damaging to the compressor after an extended period of time.

9. How does NuStart protect the compressor from rapid cycling damage?

After three failed attempts, the NuStart will go automatically into a 50 minute lockout before attempting another start. This prevents the compressor from overheating due to rapid cycling which leads to a bigger issue versus what is preventing the compressor from starting successfully.

10. Is NuStart transferable to another system?

Yes, as long as it is for another single, dual or digital scroll compressor system. Not to be to be used in an inverter type scroll compressor equipped system.

11. What is automatic optimization of motor start-up?

NuStart requires 6 to 8 starts to learn what is required to optimize the start-up of the compressor. NuStart continues to automatically optimize the compressor start-up during its service life.

12. Do I need a circuit breaker with installing NuStart?

Yes, a circuit breaker is electrical circuit protection is required with installation of NuStart.

13. Is NuStart a surge protection from electrical storms?

No. NuStart does not provide this level of protection to protect the refrigerant system. This requires a standalone protection device for the system.

14. Do the capacitor(s) stay in the system with the installation of NuStart?

For a single phase scroll compressor systems equipped with a run capacitor, this device remains in the system with NuStart installation. If there is a hard start kit installed in a single phase system, this must be removed before installing NuStart. Start and run capacitors are not applicable with three phase NuStart installations.