**lab 7 wiring 3 phase motor starters.**

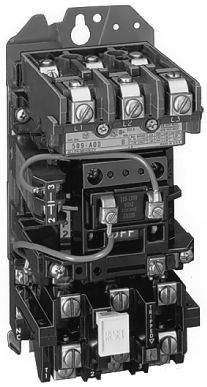
MIKE HASSELL | Emech 1250 |

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| STUDENT NAMES: |  |

Before doing any wiring on the trainer, you need to verify that the trainer is not energized, ie…not connected to a power source. Perform the following 4 steps to confirm the trainer is not energized.

1. **PPE (personal protective equipment)**: Required for all live voltage work.
   1. Blue arc flash rated lab coat.
   2. Hard hat with arc flash shield. Should have shield down while doing all live voltage checks and trouble shooting.
   3. Rubber insulated gloves and leather glove protectors. Remove any watches or rings from hands. Gloves can be damaged by these items.
   4. Standard ANSI safety glasses.
2. **Trust but Verify:** Get Digital Multi-Meter and set the meter to measure Voltage AC.
   1. While standing on the rubber insulation mat at the front of the classroom, test the meter operation to a known source. In our case, the power strip plugged into the 120 VAC outlet.
   2. **Measured Value\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_VAC**.
3. **Seven Check System (SCS):** Perform the 7 voltage checks that were shown to you the first week of class.
   1. **(#1-3) Measure voltage Phase to Phase.** ***If any voltages higher than mV are present, Stop and notify the class instructor! Do not attempt to wire or touch anything on the trainer.***
   2. **A to B\_\_\_\_\_\_\_\_\_\_\_\_Volts A to C\_\_\_\_\_\_\_\_\_\_\_\_Volts B to C\_\_\_\_\_\_\_\_\_\_\_\_Volts**
   3. **(#4-6) Measure voltage Phase to Ground.** ***If any voltages higher than mV are present, Stop and notify the class instructor! Do not attempt to wire or touch anything on the trainer.***
   4. **A to Gnd\_\_\_\_\_\_\_\_\_\_Volts B to Gnd\_\_\_\_\_\_\_\_\_\_\_Volts C to Gnd\_\_\_\_\_\_\_\_\_\_\_Volts**
   5. **(#7) Verify Meter Operation:** Confirm meter to same known source as done in step 2. **Measured Value** \_\_\_\_\_\_\_\_\_\_\_\_**VAC**

**Practice wiring a 3 phase motor using an Allen Bradley Bulletin 509 NEMA starter and start/stop pushbuttons with memory lock-in.**

The image is of the NEMA motor start we will use.

Thermal Overload normally closed contacts. This will be White wire back to neutral.

Incoming 3 phase power to L1, L2, L3.

Thermal Overload heaters shown in the power circuit of the wire diagram.

Reset Pushbutton. Used to reset thermal overloads. Remember, it will not reset the until overloads have cooled down.

Trip indicator. Shows there has been a thermal overload with the motor.

Output 3 phase power to motor from T1, T2, T3.

Memory Lock-in. Current flows into 2 and out of 3 to the coil terminal. This will be Red wire from Memory Lock-in circuit.

Notice the image shows pre-existing wires for Memory lock-in through the N.O. contact numbered 2 and 3 and N.C. thermal overload contacts. These would be wired new out of the box.

Examine the 3 phase motor nameplate. Notice the wiring diagram on the nameplate that shows the motor being used at our voltage, 208-230 VAC.

T4, T5, T6 all should be tied together**. We will not be removing the cover to do this**. Understand the inside of the conduit box is where these connections would be changed for High/Low voltage based on the available supply.

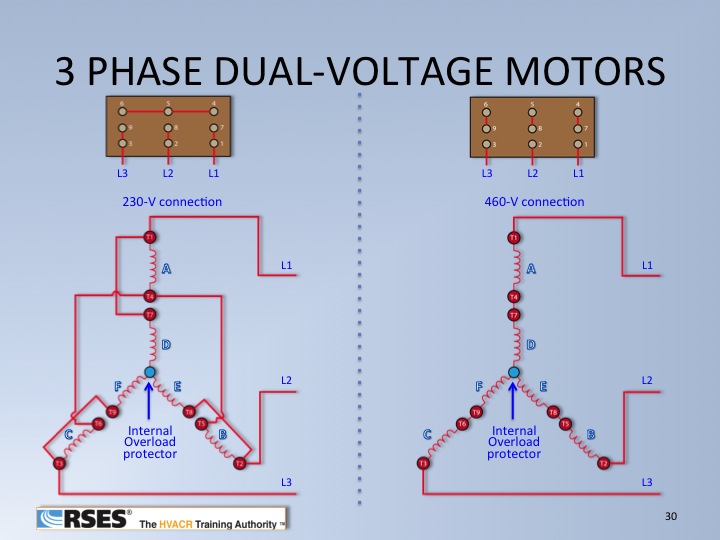
The nameplate should indicate (for low voltage 208-230 VAC) the following…

L1 from the power source should be connected to T1 and T7.

L2 from the power source should be connected to T2 and T8.

L3 from the power source should be connected to T3 and T9.

Again, all these connections have already been made. We need to use the cord from the motor with the following connected to a terminal strip at the bottom of the trainer.

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L1, L2, L3 are at the top of the trainer on the far right.

From the fuses, run 3 wires to the NEMA motor starter L1, L2, L3. This will be the left side of the “M” normally open contacts.

**Wires should be all black, but we can use red for this lab only!**

NEMA motor starter terminal strip connections to the 3 phase motor cord…

T1 on the terminal strip with the black wire of the 4 wire cord.

T2 on the terminal strip with the white wire of the 4 wire cord.

T3 on the terminal strip with the red wire of the 4 wire cord.

Green wire of the cord to Ground.

**The control circuit is on the last page of this packet.**

Follow the image of the NEMA motor starter for the location of the N.O. auxiliary contacts for memory lock-in and the location of the N.C. contacts for the thermal overloads.

Note, the wires in the image that would have been pre-existing in new condition may or may not be installed. If they are not, obviously you will need to add them to make the correct connections.

***Do not energize until reviewed with your instructor.***

Run the motor and notice the difference in sound compared to the single phase motor. Most 3 phase motors run much smoother than the single phase motors.

**Record the direction of the motor shaft rotation. Caution, do not touch the motor shaft as there can be sharp edges that can be dangerous!**

**CW or CCW**

Measure current the motor draws on each leg (T1, T2, T3). Using the clamp part of the multimeter, clamp around the leg at the terminal strip where the motor cord is connected. Current measurements are best if done as close to the motor as safely possible!

T1 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

T2 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

T3 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Reverse the direction of the motor…**

Recall that a 3 phase motor can be reversed by switching any of the 3 legs (T1, T2, T3). Switch the leads at the terminal strip and run the motor in the reverse direction.

**Record the direction of the motor shaft rotation. Caution, do not touch the motor shaft as there can be sharp edges that can be dangerous!**

**CW or CCW**

Measure current the motor draws on each leg (T1, T2, T3). Using the clamp part of the multimeter, clamp around the leg at the terminal strip where the motor cord is connected. Current measurements are best if done as close to the motor as safely possible!

T1 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

T2 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

T3 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Note that the motor draws the same current regardless of direction.**

**Practice wiring the Allen Bradley IEC motor starter and start/stop pushbuttons with memory lock-in.**

Leave the cord for the motor connected to the terminal strip at the bottom of the trainer.

Disconnect the wires from the NEMA motor starter and switch them over to the IEC motor starter. This should include the 3 phase power wires as well as the control wiring from the pushbuttons.

***[](https://www.reynoldsonline.com/125981/Category/IEC-Contactors-&-Starters)***

***[](http://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0CAcQjRxqFQoTCMT_ron-8MgCFUNAJgodvZgM3g&url=http://www.vwmin.org/welcome-to-rockwell-automation.html&psig=AFQjCNF_oOHYP2HSL46YMd1g7zs8Io12Kg&ust=1446527713833572)***

***Do not energize until reviewed with your instructor.***

Run the motor With the IEC contactor

**Record the direction of the motor shaft rotation. Caution, do not touch the motor shaft as there can be sharp edges that can be dangerous!**

**CW or CCW**

Measure current the motor draws on each leg (T1, T2, T3). Using the clamp part of the multimeter, clamp around the leg at the terminal strip where the motor cord is connected. Current measurements are best if done as close to the motor as safely possible!

T1 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

T2 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

T3 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Reverse the direction of the motor…**

Recall that a 3 phase motor can be reversed by switching any of the 3 legs (T1, T2, T3). Switch the leads at the terminal strip and run the motor in the reverse direction.

Switch the leads at the terminal strip and run the motor in the reverse direction.

**Record the direction of the motor shaft rotation. Caution, do not touch the motor shaft as there can be sharp edges that can be dangerous!**

**CW or CCW**

Measure current the motor draws on each leg (T1, T2, T3). Using the clamp part of the multimeter, clamp around the leg at the terminal strip where the motor cord is connected. Current measurements are best if done as close to the motor as safely possible!

T1 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

T2 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

T3 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Practice wiring the Allen Bradley IEC manual motor starter.**

Leave the cord for the motor connected to the terminal strip at the bottom of the trainer.

The manual starter does not use pushbuttons or memory lock-in. Disconnect the wires from the IEC electromechanical motor starter and switch them over to the IEC manual motor starter. This should include the 3 phase power wires, but not the control wiring from the pushbuttons. **Be sure to place the manual motor starter in the OFF position.**

[](https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0CAcQjRxqFQoTCOHOz8D98MgCFUJKJgodYuQCoQ&url=https://www.codale.com/index.jsp?path=product&part=391599&psig=AFQjCNFMl5RR8lraXUa0ZNQ_-5l4yQQDXA&ust=1446527620963972)

***Do not energize until reviewed with your instructor.***

Run the motor with the IEC manual motor starter.

**Record the direction of the motor shaft rotation. Caution, do not touch the motor shaft as there can be sharp edges that can be dangerous!**

**CW or CCW**

Measure current the motor draws on each leg (T1, T2, T3). Using the clamp part of the multimeter, clamp around the leg at the terminal strip where the motor cord is connected. Current measurements are best if done as close to the motor as safely possible!

T1 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

T2 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

T3 Amps=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Reverse the direction of the motor…**

Recall that a 3 phase motor can be reversed by switching any of the 3 legs (T1, T2, T3). Switch the leads at the terminal strip and run the motor in the reverse direction.

Switch the leads at the terminal strip and run the motor in the reverse directions.

**Record the direction of the motor shaft rotation. Caution, do not touch the motor shaft as there can be sharp edges that can be dangerous!**

**CW or CCW**

**De-energize and proceed to tear down. Lab Complete.**