

Training Manual for 3 phase training skid – hands-on practical.

Mode 1 – 120VAC only, no three phase supply connected.

1. Plug in independent 120VAC control power. The breaker should close
2. Check thermostat setting. It has been turned to below ambient. Increase the setting
3. You should hear the three phase contactor engage.
4. Press the push-button to trip the three phase breaker. You should hear the breaker trip. These two interlocks are your safeties to prevent three phase supply to load.
5. Reset the breaker and reclose.
6. Wear PPE and setup Safe Work Zone
7. Open control cabinet and measure 370VAC as known reference
8. Open Power cabinet Perform live dead live on the breaker in 7 steps.

Mode 2 – Lockout/Tagout Training.

1. Refer LOTO schematic provided and determine all sources of energy.
2. Write a procedure for complex Lockout/Tagout.
3. Perform a risk assessment for this system in inclement weather with trip hazards.
4. Start a hasp or lockbox and lead authorized person to initiate lockout.
5. Ascertain positions where locks have to be attached.
6. Notify affected party
7. De-energize switch connect using correct body position and PPE.
8. Challenge and verify the LOTO
9. Open the 208VAC fuse disconnect and test for absence of voltage.
10. Use proving unit as known voltage source.
11. Perform work (replace fuse if blown).
12. Perform return to normal.

Mode 3 – Three Phase normal operating condition.

1. MegOhm check phase to phase and phase to ground of circuit for no shorts.
2. DLRO check phase to phase for loose connections or anomalies.
3. Before connecting three phase source make sure B1 is tripped via PB.
4. Also open B2, B3 and B4 for no loads connected to three phase incoming.
5. Fill the tank with water. Check the temperature gauge, it should be ambient approx. 23 deg C/73 deg F.
6. Reset and close breaker B1. This is where everyone stands back except technician.
7. Wear PPE as required. You shall be evaluated for this decision.
8. Plug in 120VAC control power. Turn thermostat high to engage contactor C1.
9. Close three phase 40 Amp breaker B2. At this point you should start to see temperature gauge reflect rise due to heating of water by elements 1, 2 & 3.
10. This is where the technician takes Infrared or amp clamp readings for normal operating condition of a three-phase balanced load.
11. There is about a 35-45 minute window where the water heats up to disengage the contactor. If your normal operating readings have not been established by then, we have a problem with your performance or speed of execution
12. De-energize and cool system down.

Mode 4 – Three Phase imbalanced load.

1. MegOhm check phase to phase and phase to ground of circuit for no shorts.
2. DLRO check phase to phase for loose connections or anomalies.
3. Before connecting three phase source make sure B1 is tripped via PB.
4. Also open B2, B3 and B4 for no loads connected to three phase incoming.
5. Fill the tank with water. Check the temperature gauge, it should be ambient approx. 23 deg C/73 deg F.
6. Reset and close breaker B1. This is where everyone stands back except technician.
7. Wear PPE as required. You shall be evaluated for this decision.
8. Plug in 120VAC control power. Turn thermostat high to engage contactor C1.
9. Close three phase 40 Amp breaker B2. At this point you should start to see temperature gauge reflect rise due to heating of water by elements 1, 2 & 3.
10. Close breaker B3. You have now introduced an imbalanced three phase load.
11. Take amp clamp or IR readings to compare against normal operating condition.
12. Report the differences, you shall be judged on your observations.
13. De-energize and cool system down.

Mode 5 – Partial ground fault.

1. MegOhm check phase to phase and phase to ground of circuit for no shorts.
2. DLRO check phase to phase for loose connections or anomalies.
3. Before connecting three phase source make sure B1 is tripped via PB.
4. Also open B2, B3 and B4 for no loads connected to three phase incoming.
5. Fill the tank with water. Check the temperature gauge, it should be ambient approx. 23 deg C/73 deg F.
6. Reset and close breaker B1. This is where everyone stands back except technician.
7. Wear PPE as required. You shall be evaluated for this decision.
8. Plug in 120VAC control power. Turn thermostat high to engage contactor C1.
9. Close three phase 40 Amp breaker B2. At this point you should start to see temperature gauge reflect rise due to heating of water by elements 1, 2 & 3.
10. Close breaker B4. You have now a 2 Amp simulated partial ground fault.
11. Take amp clamp or IR readings to compare against normal operating condition.
12. Report the differences, you shall be judged on your observations.
13. De-energize and cool system down.

Mode 6 – general electrical safety observation questions and tasks.

1. Demonstrate Setup of a Safe Work Zone.
2. What is an Electrically Safe Work Condition?
3. Do you have to wear PPE while operating an energized three phase system in normal operating condition?
4. How do you define abnormal operation? What are signs you could observe?
5. What does finger safety do for you?
6. Judge the technician on insulated tools, conductive articles, barricades and signage.