Industrial Electrical Technology for Injection Molding Service Technicians

COURSE DESCRIPTION: This course covers the fundamentals and principles of industrial electrical systems utilized on Milacron Equipment with an emphasis on safety. Basic Electrical Technology will be the focus of the class. The theoretical discussions will be solidified utilizing hands-on exercises. Basic electrical history and principles first sets a foundation. Students will be given instruction regarding the hazards associated with work on live electrical circuits and testing energized parts with Meters. The use of individual Equipment specific electrical components and sub-systems will be studied in detail.

Prerequisites: None

Textbook: Milacron Custom Manual, Ugly's Reference Guide, Schematics plus handouts & cut sheets

Course Time Allocation: 3 days; 50% Hands-on, 50% Power Point presentation and animations

Equipment: Breadboard Trainers, Basic Control Circuits Test Boards, Custom Back-panels with working Components, Multi-Meters, Hand tools, Wire, Cords and Connectors

Learning Objectives:

- Understand the History of Electrics and the Basic Electrical Laws
- Understand the physics of Electron Transfer, Magnetism and Conductance
- Understand the Laws of Energy Conservation, Light, Heat, Mechanical and Sound
- Compare AC vs. DC Power and why different energy transfer methods are used
- Demonstrate the ability to use a Multimeter to test Voltage, Current and Resistance
- Demonstrate the ability to safely test DC, 110/230/440 single and 3-phase AC voltages
- Understand Power Distribution, Transformers, Power Supplies and Circuit Protection
- Gain Familiarity with Conductor Sizes and Modern Interconnection Technology
- Demonstrate the ability to make quality electrical interconnections
- Understand the operation of Relays, Contactors and basic Relay Logic Circuits
- Demonstrate the ability to troubleshoot common circuit failures
- Understand Regulations, Codes and Industry Terminology; NEC, NEMA, IEC, OSHA & SIL
- Compare Discrete vs. Analog signals and circuits
- Understand Modern Sensing Technologies; Inductive, Capacitive, Photo's and Lasers
- Gain Familiarity with Motor Technologies, Motor Control and Feedback Devices
- Gain Familiarity with Heaters and Thermocouples
- Demonstrate the ability to read and understand Milacron schematics
- Gain Familiarity with modern PLC's, PAC's and distributed Control System Architecture

Day 1, Full Day

Introduction to Electrical Theory
- Pre-Test
- Early discoveries; Watts, Edison, Faraday, Tesla
- Basic Electrical Physics
- Ohm's, Watts, Kirchhoff Laws
- Magnetism, Electro-Magnetism and Superconductors
- Labs: Intro to Meters and Test Instruments, Breadboard Labs with Basic Circuit Measurements

Day2, Full Day

Power and Control
- AC vs. DC
- Batteries
- Single and Three Phase Power – Voltage, Current and Power
- Frequency, Frequency Control, Power Factor and Noise
- Power Distribution and Transformers
- Ground vs. Neutral
- Lighting, LED's
- Circuit Protection; Fuses, Breakers, Thermal Overloads, Surge/Arc Suppression and RC Circuits
- Relays, Relay Logic, Motors & Starters and Arc Flash
- Safety when approaching High Power Circuits with PPE and LTT
- Labs: Breadboard Circuits & Measurements, Troubleshooting Components/Testing Methods with Meter

Day3, Full Day

Milacron Electrical Systems and Circuits
- Pressure/Temp/Flow/Position Sensing
- Discrete/Analogue signals, circuits and Microprocessor Based Control
- Heaters, Thermocouples and I/O
- Communication Networks; Multiplexing, RS232/422, Ethernet, CAN-bus,
- Discrete Valve and Induction Motor Technology
- Wiring to Print
- Wire Proportional Valve Amplifier Card to Print, Tune and Troubleshoot
- Wire Custom Panel to Print, connect to Discrete Valve, Troubleshoot
- Post-Test