

Basic Electrical Troubleshooting Course

[BELTS]



Course Overview

Length: 3-days (24 hrs)

Hands-On: 75%

Target Audience: Beginners and those who may need a refresher to solidify electrical concepts (Operators, Managers, New Technicians)

Summary Description: This course first develops and solidifies the student's understanding of electrical concepts as a foundation to build upon. Students will then apply and reinforce these concepts as they construct, test, and then troubleshoot a variety of increasingly complex electrical circuits and systems, and will learn how to utilize a logical methodology in troubleshooting.

Course Agenda:

Day 1

- Introduction to Electricity (Thinking in terms of FLOW):
 - Impacts of voltage, current, and resistance on one another in typical circuits
 - Series and Parallel circuit concepts
- Resistance Concepts
 - Components (wattage ratings and intro to power concepts; potentiometers, rheostats)
 - Impacts of resistance (heat / wattage, human body, water & liquids, etc.)
 - Measuring resistance (concepts, precautions, tips, tricks, & mistakes)
 - Resistance calculation concepts
- Basic Electrical components
 - Lamps
 - Switches
 - Resistors & resistive wire
 - Magnetism & Electromagnetism
 - DC Motor Basics
 - Diodes and LED's
- Introduction to Metric prefixes as used in electrical field
- Relationship between Voltage, Current, Resistance, and Power (Ohm's Law)
- Behavior of voltage drops and current flows in simple circuits
- Introduction to common electrical faults and basic analysis impact of faults on simple circuits (open circuits, short circuits, etc.)

DAY 2

- Typical electrical control circuits
- Introduction to LOGICAL troubleshooting
 - Discussion of common mistakes made during troubleshooting
 - Discussion of problems of "part-swapping" or "Easter-egging"
 - Importance of logic
 - Systematic approaches to troubleshooting
 - The 7-Step troubleshooting methodology
 - Importance of root cause failure analysis (RCFA)
 - Importance of full and proper retest
- Understanding electrical prints and other references
 - Common schematics and symbols
 - Ladder Diagrams
 - Wiring Diagrams
- Basic electrical troubleshooting practice

DAY 3

- Troubleshooting short circuits (including tips and tricks)
- Troubleshooting intermittent faults (including tips & tricks)

- Advanced interpretation of Ladder and Wiring diagrams
 - Investigative problem-solving vs troubleshooting
 - Analysis of common electrical control circuits
 - Intermediate level electrical troubleshooting practice (numerous sessions)
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Hands-On Exercises (only major items or group titles listed):

This course is over 75% hands-on training. The course is designed so that the lab exercises steer and propel the learning process by producing real-world questions and queries, which the instructor will then explain, and which students will directly test and observe. The hands-on exercises are designed to be challenging and thought-provoking, but are also fun and engaging.

Our strategic, hands-on teaching style aligns very well with how most technical people learn and does a fantastic job of associating the concepts learned to real world applications. Because of the practical, real-world approach, our training produces a more observable boost in practical skills and long-term abilities than typical slide-show or lecture oriented courses.

Some of the hands-on exercises for this course include:

- Basic circuit concepts (simple - lamps, batteries)
 - Series and Parallel circuits (simple - lamps, batteries, switches)
 - Practical Ohm's Law visualizations
 - Intro to reading schematics
 - Intro to Shorts and open-circuits
 - Resistance labs (several)
 - Conductivity of water (in reference to impacts on electrical safety and troubleshooting faults)
 - Understanding electrical shock (thinking beyond the rules and assumptions)
 - Electrical Power and Heat
 - Resistance approximations (and intro to calculations)
 - Troubleshooting practice (numerous levels from zero to hero)
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Student Outcomes (Course Objectives)

- Students will understand electrical concepts and be able to use that knowledge to better perform preventative and corrective maintenance tasks.
- Students will learn to troubleshoot more logically and methodically (and will be able to troubleshoot more successfully, and more quickly).
- Students will better understand the impact of liquid (water) on electrical circuits, including partial shorts, and other challenging faults.
- Students will better understand electrical safety concepts that are often misunderstood and that often lead to potential risks and dangerous mistakes.
- Students will be able to better read and understand electrical prints, including wiring diagrams, ladder diagrams, and schematics.

- Students will become familiar with basic electrical devices, terminology, components.
 - Students will learn to test common components.
 - Students will better recognize common failure modes of various devices and equipment.
 - Students will become better at performing Root-Cause-of-Failure Analysis (RCFA) and determining likely causes of problems and faults.
 - Students will learn tips and tricks to aid troubleshooting and problem solving efforts.
 - Students will learn to 'Divide and Conquer' when analyzing electrical circuits and systems.
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Team / Organizational Benefits:

- Improved troubleshooting effectiveness and efficiency - more methodical and logical troubleshooting has a dramatic impact on up-time due to quicker resolution of problems, but also due to better identification of root-causes of failures and more effective retest procedures.
 - Better recognition of potential problems with maintenance procedures, and systems – A solid understanding of the fundamentals is nearly always a major underlying cause of mistakes; yet personnel with strong fundamentals are able to understand details and identify potential problems 'before' they cause problems.
 - Improved safety performance due to better understanding and application of the underlying principles that are often misunderstood and/or misapplied in work - When personnel actually understand the underlying fundamentals of electricity, they are able to understand the basis, and the reasons & intentions behind electrical safety program rules and policies, resulting in tighter compliance, and better reduced risks.
 - Reduced downtime – Plant performance and run-time will increase due to improved maintenance performance with fewer mistakes, and by faster, more accurate troubleshooting efforts to get systems running properly again.
 - Enhanced team cohesion – Lesser skilled individuals sometimes hide their weaknesses and use other means to establish a position in the team hierarchy (vs performance). When they develop the fundamentals, they are able to learn; able to better communicate with team-mates; and can succeed based on merit and skills vs other approaches. Developing the underlying fundamentals often leads lower performers to shift their energy and efforts into improvement instead of other behaviors that can damage the team.
 - Increased job satisfaction and team morale – Technical personnel derive great satisfaction from 'being good' at their jobs. Giving them the skills to troubleshoot and to continue growing boosts job performance and ultimately boosts retention.
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Why Choose Orion Technical Solutions?

Training with Purpose

Orion Technical Solutions was founded by Mike Glass in 2000 in order to provide top quality, hands-on instruction in the I&E fields.

Management with Connection to the Field and Industry

Unlike most of our competitors, who are directed by layers of corporate executives focused on profits, Orion Technical Solutions courses and programs are designed and operated by professionals with:

- Credentialed, expert-level knowledge in the specific craft areas we teach
- Decades of real-world industry experience in applicable crafts
- Extensive teaching, assessment, and curriculum development experience
- A genuine passion for helping people learn and grow

Honest, Values-Based Service

As a family-owned business, we take great pride in delivering what we promise and providing maximum value to our customers and students. We believe in old-fashioned business approaches of honesty, integrity, and quality.

The Competition: What Sets Us Apart

Many of today's industrial training organizations are large, profit-driven corporations with outdated equipment, taught by under-skilled or burned-out instructors with antiquated sales-focused course designs that fail to deliver expected outcomes.

We don't sell any industrial equipment, and we have no affiliations, contracts, or agreements with any vendors or equipment manufacturers - so you get honest information with no sales pitches or hidden agendas.

Recently, many organizations who specialize in online training system software or packages are now listing "hands-on training" on their websites and sales literature - but be cautious, because many of them don't actually have the instructors on staff (and/or equipment) to provide legitimate hands-on training. Beware of the "bait and switch" strategies when it comes to technical training.

While online training can be a helpful component in some overall developmental programs as a means to help reinforce and refresh specific details and topics, or to provide short, focused tutorial modules on very specific details such as a task, procedure, or a complex piece of equipment. But online training is way less successful at establishing foundational knowledge and developing general skills. Hands-on training is by far the best option for developing a strong foundation, improving general skills.

Tip - Always ask to speak to the designated Course Instructor for any proposed courses and discuss course agendas, labs, and deliverables in some detail. This helps ensure that the person actually teaching a proposed course can/will deliver what you need, and it puts them personally on the hook (so they can't just blame an overly optimistic salesperson for overcommitting). Be extremely cautious of any training organizations that will not allow you to speak directly with the actual course instructors.

Our Commitment to Hands-On, In-Person Training

At Orion Technical Solutions, our entire focus is hands-on, in-person, instructor-led training. While it may not be the cheapest or most profitable option, it is still the most effective way to develop strong and lasting foundations and real-world skills - and that is our mission.

Purpose-Built Courses for Real Results

We don't offer the short, superficial bullet-list type courses that promise unrealistic results or that don't deliver specific improvements across the entire breadth of the field. Our courses are designed by true industry experts with decades of experience assessing, teaching, and performing the applicable work and are designed to achieve real and lasting outcomes.

Our course coverage is extremely well targeted to hit the topics people need help with, and the areas that are causing the biggest problems in the applicable fields.

We spend the necessary class and lab time on each key topic to ensure each student truly learns, understands, and can apply the material covered.

High-Quality Instructors with Top Level Technical Credentials and Outstanding Teaching Skills

Our instructors are highly knowledgeable with decades of experience and have top level certifications and credentials in their fields. They are also screened to ensure they possess all the important human characteristics and teaching skills needed to produce desired results in the classroom.

Satisfaction Guarantee:

In addition to the many reasons above, another advantage of using Orion Technical Solutions for your training needs is that we back up our training with a 100%, money-back, no-questions-asked satisfaction guarantee on ALL of our training services - because we know we will consistently exceed our customer's expectations.

Some of our Satisfied Customers:

- **Georgia Pacific**
- **Idaho National Laboratory**
- **Bechtel**
- **Newmont Mining**
- **Peabody Energy**
- **Southern Energy**
- **PacifiCorp**
- **Enbridge Energy**
- **BP**
- **US Dept of Defense**
- **NASA**
- **US Navy**
- **Basic American Foods**
- **National Oilwell Varco (NOV)**
- **FMC**
- **Bridger Coal**
- **Chevron**
- **Nestle - Purina**