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# TROUBLESHOOTING OF ELECTRICAL EQUIPMENT AND CONTROL CIRCUITS



## **YOU WILL LEARN HOW TO:**

- Diagnose problems "right-first-time"
- Eliminate expensive trial and error approach
- Reduce unexpected downtime on electrical motors and other equipment
- Improve plant safety
- Learn specific techniques to troubleshoot equipment and control circuits
- Analyse equipment problems
- Determine causes of equipment failure

## The Workshop

There is a chasm between the theory of electron flow, magnetic fields and troubleshooting electrical equipment and control circuits in the plant. This workshop shows delegates how to troubleshoot electrical equipment and control circuits.

The course helps individuals and employers. It does this by increasing all delegates knowledge and skills in improving equipment productivity whilst reducing maintenance costs.

Attendance on this course will help all delegates identify, prevent and fix common electrical equipment and control circuits. The focus is "outside the box". The emphasis is on practical issues that go beyond typical electrical theory and focus on providing those that attend with the necessary tool-kit of skills in solving electrical problems, ranging from control circuits to motors and variable speed drives.

This workshop focuses on the main issues of troubleshooting electrical equipment and control circuits of today to enable you to walk onto your plant or facility to troubleshoot and fix problems as quickly as possible.

**This is not an advanced workshop but one aimed at the fundamentals of troubleshooting systems. The workshop is very practical in its approach to troubleshooting and the examples you will be shown are applicable to any facility.**

## Practical Sessions

You will work in teams on simulation software running on PC's on electrical equipment to simulate real problems for at least 40% of the course proceeding through ten practical sessions ranging from the elementary to the more advanced. These will be very close in structure to the motor control circuits in your plant. In addition we will give three case study wiring diagrams with potential problems and expect you to uncover faults when given the symptoms.

## The Program

### INTRODUCTION

#### COURSE DESCRIPTION

##### BASIC PRINCIPLES

- Industrial electricity
- Single and three phase power systems
- Meters used in troubleshooting
- Clamp on ammeter/megohmmeter

##### DEVICES, SYMBOLS AND CIRCUITS

- Devices and symbols
- Language of control circuits
- Reading and understanding electrical drawings
- Reading and understanding ladderlogic
- Wire and terminal numbering

##### BASIC PRINCIPLES IN TROUBLESHOOTING

##### BASIC PRINCIPLES IN USING A DRAWING AND METER IN TROUBLESHOOTING CIRCUITS

- Circuits
- Equipment

##### TROUBLESHOOTING AC MOTORS AND MOTOR STARTERS

- Fundamentals of AC motors
- Types of AC and DC motors used
- Motor terminal identification and connection diagrams
- Identification and construction
- Connecting up a multiple speed motor
- Connection of dual voltage motor
- Motor name plate information
- Operating a motor for forward and reverse operation
- Motor braking methods
- Test equipment to check motor operation
- Why motors fail and how to extend life
- Troubleshooting of motors

##### MOTOR CIRCUIT BREAKERS AND SWITCHBOARDS

- Purpose and duty
- Clearance times
- Types

##### TROUBLESHOOTING VARIABLE SPEED DRIVES

- Fundamentals of variable speed drives
- Problems associated with variable speed drives
- Terminology used
- Manufacturer's literature - what they don't tell you
- Minimisation of equipment failure
- Troubleshooting Tricks

##### TROUBLESHOOTING CONTROL CIRCUITS

- Basic control circuits
- Ladderlogic circuits
- Troubleshooting strategies
- Two-wire control and hands-off/auto
- Overload protection
- Three-wire control - start/stop
- Jog/inch circuits
- Sequence start and stop
- Automatic sequence starting
- Reversing circuits
- Plug stop and anti-plug circuits
- Two speed motor control
- Reduced voltage Starting circuits

##### TROUBLESHOOTING MORE COMPLEX CONTROL CIRCUITS

- Tank fill control
- Duplex Pump control

##### SUMMARY & OPEN FORUM

##### COMPLETE FEEDBACK SHEETS

##### CLOSING