

Safety, Calibration, and Testing

Course 280: Safety, Calibration, and Testing

Covers the responsibilities of employer, employee, and regulatory agencies in maintaining safety. Discusses ways of identifying and handling chemical, electrical, biological, radiation, and mechanical hazards. Discusses importance of maintenance (including calibration) and proper record keeping. Describes use of common electrical and electronic test instruments. Offers guidelines for handling heavy equipment, decontaminating and servicing pneumatic and hydraulic equipment, and troubleshooting. Discusses specification details, conversion between English and SI units, calibration methods, and the maintenance of records.

TPC Training is accredited by IACET to offer **0.6 CEU** for this program.



Lesson 1: Safety Standards and Practices

Topics

Identifying Hazards; Safety Regulations; Employer Responsibility; Your Responsibilities; Government Safety Regulations; Compressed Gases; Chemical Hazards; Electrical Hazards; Biological Hazards; Radiation Hazards; Mechanical Hazards; Noise Pollution; General Precautions

Objectives

- Discuss kinds of hazards and compare employer and employee responsibilities relating to safe job practices.
- Describe safe procedures for working with compressed gases, acids, flammable solvents, and other hazardous chemicals.
- Describe ways to minimize the possibilities of hazardous or lethal electric shock, including safe lockout procedures.
- Explain the use of dosimeters.
- Identify potential safety hazards in the instrument shop and along the process control network and describe the use of appropriate safety equipment for each hazard.

Lesson 2: Servicing Fundamentals

Topics

Why Is Instrument Servicing Necessary?; Repair Modes; Repair Records; Failure Mode Analysis; Maintenance Modes; Maintenance Records; Calibration Modes; Calibration Records; Calibration Seals; Care of Tools and Equipment; Shop Layout and Operations

Objectives

- Compare methods of on-site and shop repair of malfunctioning instruments.
- Describe the differences between repairing, maintaining, and calibrating instruments.
- Describe the contents of an equipment history file and a process loop file.
- Discuss the benefits of failure mode analysis.
- Describe proper calibration procedures, including use of calibration seals, and explain what NIST-traceable means.
- Describe the typical main sections of an industrial instrument shop.

Lesson 3: Electrical and Electronic Stations

Topics

Test Station Requirements; Electrical Station; Electronic Station; Electrical Test Equipment; Electronic Test Equipment; Pneumatic and Hydraulic Test Equipment; Test Stands; On-Site Operations; Calibration; Maintenance Records and Files

Objectives

- Describe the differences between electrical and electronic test areas.
- Describe how the ammeter, megohmmeter, wattmeter, and dynamometer are used in electrical work.
- Describe how the multimeter, signal/waveform generator, oscilloscope, voltage and current source, and frequency counter are used in electronics.
- Discuss the benefits of accurate calibration and thorough equipment maintenance records.
- Explain how test stands are used and name three kinds of operations that are typically conducted on site.

Lesson 4: Pneumatic and Hydraulic Stations

Topics

Purpose of Pneumatic/Hydraulic Stations; Power Requirements; Handling Heavy Equipment; Cleaning and Decontamination; Safety in Cleaning; Testing and Evaluation; Disassembling the Equipment; Reassembling the Equipment; Calibration; Test Stands; On-Site Servicing

Objectives

- Describe the layout and power requirements of a typical pneumatic/hydraulic station.
- Describe safe and efficient methods of cleaning pneumatic and hydraulic instruments and controls.
- Discuss procedures for testing and evaluating a faulty component, using the calibration of a pressure-to-current (P/I) transmitter as an example.
- Describe proper procedures for disassembling and reassembling pneumatic and hydraulic components.
- Name the steps in preparing to service instruments on site.

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Lesson 5: Instrument Troubleshooting

Topics

Troubleshooting Requirements; Knowledge of the Equipment; Manufacturer's Literature; Maintenance and Repair Records; Tools and Test Instruments; Calibration Standards; Troubleshooting Techniques; Gathering Information; Checking the Records; Returning the Loop to Operation; Inspecting the Instrument; In-Shop Troubleshooting; Recording the Repair

Objectives

- Explain how an understanding of the process and its instrumentation reduces troubleshooting time.
- List at least four kinds of information typically included in a manufacturer's manual or instruction book.
- Describe the contents of an instrument history file and explain its usefulness in troubleshooting.
- Discuss the kinds of tools, including calibration standards, you are apt to use in troubleshooting.
- Describe the steps in a typical troubleshooting procedure and explain how to use a branching troubleshooting chart.
- Describe cascading failure.

Lesson 6: Systems Specifications and Instrument Calibration

Topics

Interpreting Specifications; Error; Accuracy; Precision; Resolution; Transfer Function and Sensitivity; Hysteresis; Response Time; Time Constant; Units of Measurement; SI Units; English Units; Calibration; Standards; Calibration Laboratory; Field Calibration

Objectives

- Discuss the specifications of a typical measurement system.
- Explain how to read a graph showing a linear or nonlinear transfer function, hysteresis, or the time constant.
- Discuss SI and English systems of units and explain how to convert from one to the other.
- Describe the elements of instrument calibration.
- Discuss the standards commonly used in instrument calibration.