



Pressure Measurement

Course 273: Pressure Measurement

Covers units of pressure and discusses Boyle's and Charles' laws to explain relationships among pressure, volume, and temperature. Describes sensor operation of manometers, bourdon tubes, diaphragms, and bellows. Explains the operation of potentiometric, capacitive, relative, servo, strain-gauge, and piezoelectric transducers. Describes devices used in low-pressure control. Discusses proper and safe methods for installing and servicing pressure instruments.

TPC Training is accredited by IACET to offer **0.5 CEU** for this program.



Lesson 1: Principles of Pressure in Liquids and Gases

Topics

Properties of Matter; Principles of Liquid Pressure; Units of Pressure; Conditions Affecting Liquid Pressure; Density and Relative Density; Gauge Pressure and Absolute Pressure; Using Liquid Pressure Measurements; Gas Pressure and Volume; Gas Volume and Temperature; Gas Pressure and Temperature; Pressure, Temperature, and Volume Related; Atmospheric Pressure; Pressure and Flow

Objectives

- Compare the three forms of matter.
- Define pressure and explain the difference between gauge pressure and absolute pressure.
- Discuss the conditions that affect the pressure of a liquid.
- Describe how changes in volume affect the pressure of a gas at a constant temperature.
- Describe how changes in temperature affect the volume of a gas at constant pressure, and the pressure of a gas with a constant volume.
- Discuss the two causes of pressure drop in a pipe carrying liquid from a tank.

Lesson 2: Pressure Sensors

Topics

Functions of Measuring Instruments; Manometers; Bourdon Tube Sensors; C-Shape Bourdon Tube; Other Bourdon Tube Shapes; Bourdon Tube Metals; Diaphragm Pressure Sensors; Diaphragm Construction; Diaphragm Capsule Elements; Bellows Pressure Sensors; Sensor Application Comparisons; Maintaining Accuracy; Calibration; Pressure Switches

Objectives

- Explain how a manometer works.
- Describe four kinds of bourdon-tube sensors.
- Discuss construction details of bourdon tubes, diaphragms, and bellows.
- Explain how bellows pressure sensors work.
- Describe how calibration may be accomplished and list the steps in calibrating a pressure gauge.
- Explain how normally open and normally closed pressure switches work.

Lesson 3: Pressure Transducers

Topics

Pressure Conversion; Potentiometric Pressure Transducers; Pressure-to-Current (P/I) and Pressure-to-Pressure (P/P) Transducers; Capacitive Pressure Transducers; Reluctance; Relative Pressure Transducers; Servo Pressure Transducers; Strain Gauge Pressure Transducers; Piezoelectric Pressure Transducers; Response Comparisons; Environmental Considerations

Objectives

- Discuss the advantages and disadvantages of the potentiometric pressure transducer.
- Explain how a P/I transducer works.
- Describe the operation of capacitive, relative, and servo pressure transducers.
- Compare the three kinds of strain gauge pressure transducers.
- Describe the operation and advantages of the piezoelectric pressure transducer.
- Discuss three environmental conditions that can affect transducer operation.

Lesson 4: Low-Pressure Measurement

Topics

Vacuum; Low Pressure; Units of Low-Pressure Measurement; Methods of Conversion; DP Transmitters; Pressure Gauges; Slack-Diaphragm Gauge; Ionization; McLeod Gauge; Capacitance Manometer; Thermal Conductivity Gauges; Pirani Gauge; Thermocouple Gauge

Objectives

- Define the pressure unit torr and calculate pressure in specified units when given the pressure in other units.
- Explain the operation of a differential-pressure transmitter and a slack-diaphragm gauge.
- Name two kinds of ionization gauges and describe how they work.
- Explain how the McLeod gauge works.
- Describe the capacitance manometer.
- Compare the operation of the Pirani gauge and the thermocouple gauge.

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Lesson 5: Installation and Service

Topics

Components of Pressure Transmitters; Pressure Tap, Diaphragm Seal, and Pulsation Dampener; Isolation Valve, Instrument Valve, and Blowdown Valve; Instrument Piping, Connections, and Fittings; Locating and Mounting the Instrument; Piping; Electrical Wiring; Placing the Instrument into Service; Guidelines for Periodic Maintenance; Calibration; Troubleshooting and Repair; Instrument Shop; Safety

Objectives

- List the components of a pressure-transmitter installation.
- Compare methods of joining pipes and other instrumentation components.
- Describe the procedure for placing a pressure instrument into service.
- Discuss the elements of periodic maintenance.
- Explain how to calibrate pressure instruments with electrical and pneumatic outputs.
- Describe three important techniques used in troubleshooting and repair.
- List five important safety rules.