

Course 437: Control Systems

Introduces the need for control, control methods, and system basics. Includes information on self-powered, pneumatic, hydraulic, electric, and electronic systems. Covers various sensors and controlled devices. Covers basics of two-position, floating, and proportional control systems and their maintenance and troubleshooting. Discusses processes requiring control in a refrigeration or air-conditioning system.

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



Lesson 1: Introduction to Control Systems

Topics

The Need for Controls; Automatic Control; Control System Basics; Control Methods; Two-Position Control; Floating Control; Proportional Control; Open- and Closed-Loop Control; Control System Operating Power; Self-Powered Control System; Pneumatic and Hydraulic Control Systems; Electric and Electronic Control Systems

Objectives

- Explain why control systems are needed and name devices used to control environmental conditions.
- Define the terms used to describe control systems—controlled variable, controller, controlled device, setpoint, control point, and controlled medium—and name the basic elements of a control system.
- Describe the action of two-position, floating, and proportional control.
- Explain how anticipators work.
- Compare open-loop and closed-loop control.
- Compare the basic requirements of pneumatic/hydraulic control systems to those of electric/electronic control systems.

Lesson 2: Sensors and Controlled Devices

Topics

Sensors; Temperature Sensors; Humidity Sensors; Pressure Sensors; Controlled Devices; Dampers; Valves; Variable-Speed Drives

Objectives

- Explain the need for a sensor in a control system.
- Name and explain the operation of three kinds of temperature sensors.
- Define relative humidity, state the range required for human comfort, and describe common humidity sensors.
- Name three common pressure sensors and explain their operation.
- Explain the operation of two-position dampers and valves in shutoff and throttling applications.
- List the advantages of variable-speed drives over older methods of speed control.

Lesson 3: Automatic Control Systems

Topics

Two-Position Electric Control; Floating Electric Control; Proportional Electric Control; Pneumatic Control Systems; Pneumatic Controllers; Pneumatic Actuators; Pneumatic Relays and Switches; Electronic Control Systems; Proportional Band and Gain; PID Control

Objectives

- Describe the operation of two-position, floating, and proportional electric controllers.
- List the equipment needed for a pneumatic control system.
- Name several pneumatic relays and switches, and explain why each is used.
- Discuss the advantages and basic operation of electronic controls.
- Define resolution, sensitivity, proportional band, and gain, and explain how they are related.
- Distinguish between integral and derivative action, and explain how each can improve system performance.

Lesson 4: Control of Refrigeration and Air-Conditioning Processes

Topics

Primary Control; Low-Pressure Control; High-Pressure Control; High-Temperature Cutout Control; Low-Water-Temperature Cutout Control; Anti-Recycle Timers; Condenser Pressure Regulators; Oil-Pressure Controls; Oil-Level Float Controls; Motor Overload Protection; Capacity Controls; System Interlock; Control of Air-Conditioning Systems; Flow Control in Hydronic Systems; Space-Temperature Control; Seasonal Changeover; Pressure Regulation; Flow Switches; Control of a Complex Air-Handling System

Objectives

- Explain how pumpdown control operates and why pumpdown is often preferred over other methods of primary control.
- Describe the location, function, and operation of a high-pressure control.
- Name three ways to control condenser pressure and at least three ways to control system capacity.
- Explain how a differential oil pressure safety control works.
- Compare the two methods of modulating the flow of water to hydronic terminals.

Control Systems**Lesson 5: Maintaining and Troubleshooting Controls***Topics*

Establishing a PM Program; Maintaining Pressure Controls; Maintaining Thermostats; Maintaining Float Switches and Valves; Maintaining Oil-Pressure Controls; Maintaining Timers; Maintaining Condenser Controls; Maintaining Compressor Capacity Controls; Maintaining Valves and Accessories; Maintaining Instrument Air; Maintaining Pneumatic Controllers; Maintaining Pneumatically Controlled Devices; Maintaining Pressure Switches and Pneumatic Relays; Maintaining Electric/Electronic Power Sources; Maintaining Electric Controllers; Maintaining Electronic Controllers; Maintaining Electrically Controlled Actuators; Maintaining Electric and Electronic Switches; Troubleshooting a Control System; Following Up

Objectives

- List the four basic steps involved in setting up a PM program.
- Explain the importance of high-pressure controls as safety devices and explain their testing procedures.
- Explain how oil pressure is maintained in various kinds of compressors.
- Describe the testing and maintenance required for condenser water regulating valves and compressor capacity controls.
- Explain how to check for oil and water contamination in control air and what measures to take to minimize them.
- Explain the major maintenance requirements of a pneumatic control system.
- Describe the maintenance required by electric and electronic controllers.
- Explain how to use a troubleshooting chart.