



Western Technical College

10601142 HVACR Temperature Controls

Course Outcome Summary

Course Information

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| Description | This course will assist the student in developing the skills required to design, analyze, modify and calibrate HVAC (Heating, Ventilating and Air Conditioning) control systems. The fundamentals of control systems will be studied and applied to common control strategies most often found in commercial HVAC systems. HVACR is a common reference to Heating, Ventilation, Air Conditioning and Refrigeration. |
| Career Cluster | Architecture and Construction |
| Instructional Level | Associate Degree Courses |
| Total Credits | 3 |
| Total Hours | 72 |

Pre/Corequisites

Prerequisite 10601116 HVACR Electric Motors and Controls

Textbooks

No textbook required.

Learner Supplies

Safety glasses with side eye protection that meet Z87 OSHA guidelines. **Vendor:** Campus Shop. Required.

Program Outcomes

1. Install HVACR systems.
2. Service HVACR systems.
3. Troubleshoot HVACR systems.
4. Evaluate HVACR system designs.
5. Repair HVACR equipment.
6. Analyze HVACR systems.

7. Design HVACR systems.

Course Competencies

1. Apply control terminology to HVAC control systems

Assessment Strategies

- 1.1. Written Objective Test

Criteria

You will know you are successful when

- 1.1. learner describes control systems and processes using current control terminology.
- 1.2. learner describes the characteristics of automatic control systems.
- 1.3. learner identifies types of control systems.

Learning Objectives

- 1.a. Define control terms.
- 1.b. Describe the characteristics of automatic control systems.
- 1.c. Use correct terminology to describe basic processes.
- 1.d. Identify power supplies and their components.

2. Diagram a simple control loop including the flow of information.

Assessment Strategies

- 2.1. Written Objective Test

Criteria

You will know you are successful when

- 2.1. learner diagrams a simple control loop.
- 2.2. learner identifies the components in a control loop.
- 2.3. learner describes the flow of information in a control loop.
- 2.4. learner identifies the fail-safe condition of control loop components.
- 2.5. learner identifies the control loop control agent.

Learning Objectives

- 2.a. Identify the components required in a basic control loop.
- 2.b. Describe the flow of information through the control loop.
- 2.c. Draw a block diagram of a simple control loop.
- 2.d. Identify basic control loop components, power supplies and control agents.
- 2.e. Identify control loop and component fail-safe conditions.
- 2.f. Summarize the design and operational characteristics of microprocessor-based control systems.

3. Apply formulas and graphing to determine system unknowns.

Assessment Strategies

- 3.1. Written Product
- 3.2. Project

Criteria

You will know you are successful when

- 3.1. you tune a PID control.
- 3.2. you explain the effect of proportional control, integral control, and derivative control.
- 3.3. you describe the difference between open loop and closed loop tuning.

Learning Objectives

- 3.a. Explore proportional, integral, and derivative control.
- 3.b. Describe the effect of proportional control.
- 3.c. Describe the effect of integral control.
- 3.d. Describe the effect of derivative control.
- 3.e. Explain what the interval is in a computerized control and how it is related to the gains.
- 3.f. Define "hunting".

- 3.g. Tune a PID controller.
- 3.h. Explore the difference between open loop and closed loop tuning.

4. Diagnose basic control loop problems.

Assessment Strategies

- 4.1. Skill Demonstration

Criteria

You will know you are successful when

- 4.1. learner properly connects control devices.
- 4.2. learner locates control devices for a specified control loop.
- 4.3. learner identifies the control agent for a specified control loop.
- 4.4. learner tests sensors to determine if the sensor is accurate to within + or - 2 degrees f of its operating range.
- 4.5. learner calibrates a controller to maintain a specified throttling range at a given temperature.
- 4.6. learner identifies fail-safe conditions of final controlled devices.
- 4.7. learner diagnoses basic control loop problems using appropriate test instruments.

Learning Objectives

- 4.a. Test and calibrate sensors.
- 4.b. Test and calibrate controlled devices.
- 4.c. Test and calibrate controllers.
- 4.d. Test and calibrate sensor/controllers.
- 4.e. Diagnose simple control loops.

5. Evaluate sensors.

Assessment Strategies

- 5.1. Skill Demonstration

Criteria

You will know you are successful when

- 5.1. learner describes the construction and operational characteristics of a sensor.

Learning Objectives

- 5.a. List the purpose of a sensor.
- 5.b. Define the operational characteristics used to select a sensor.
- 5.c. Describe the proper location requirements for HVAC sensors.
- 5.d. List the design and the operational characteristics of various HVAC sensors.

6. Evaluate controllers.

Assessment Strategies

- 6.1. Skill Demonstration

Criteria

You will know you are successful when

- 6.1. learner describes the construction and operational characteristics of a controller.

Learning Objectives

- 6.a. List the purpose of a controller.
- 6.b. Define the primary characteristics of the different controller modes.
- 6.c. Describe the characteristics of the different gains used in modulating controller transfer functions.
- 6.d. Associate basic HVAC applications response criteria with the proper controller mode.

7. Evaluate controlled devices.

Assessment Strategies

- 7.1. Skill Demonstration

Criteria

You will know you are successful when

7.1. learner describes the construction and operational characteristics of a controlled device.

Learning Objectives

- 7.a. Describe the construction and operational characteristics of valves and dampers.
- 7.b. Explain how pressure drop effects the response of a flow control device.
- 7.c. Describe the adverse affects of improperly sized devices on loop operation.

8. Select control devices.

Assessment Strategies

- 8.1. Skill Demonstration

Criteria

You will know you are successful when

- 8.1. learner sizes and selects control valves.
- 8.2. learner sizes and selects control dampers.
- 8.3. learner selects sensors for given applications.
- 8.4. learner selects controllers for given applications.
- 8.5. learner selects controller modes based on the process characteristics.
- 8.6. learner determines controller action, ratio, reset schedule and reset adjustment for given applications.

Learning Objectives

- 8.a. Correctly size a control valve.
- 8.b. Correctly size a damper.
- 8.c. Select the proper valve for a given application.
- 8.d. Select the proper damper for a given application.
- 8.e. Select sensors and controllers for a given application.
- 8.f. Select a controller mode based upon the process characteristics.
- 8.g. Determine controller action, ratio, reset schedules and reset adjustment.

9. Analyze common control strategies.

Assessment Strategies

- 9.1. Drawing/Illustration

Criteria

You will know you are successful when

- 9.1. learner identifies HVAC systems.
- 9.2. learner diagrams control strategies used in HVAC systems.

Learning Objectives

- 9.a. Identify the control loop components.
- 9.b. Describe individual zone controls.
- 9.c. Compare typical control strategies.
- 9.d. Diagram control strategies.

10. Develop graphic function blocks.

Assessment Strategies

- 10.1. Project

Criteria

You will know you are successful when

- 10.1. learner analyzes control programming.
- 10.2. learner writes control programming using manufacturers software.

Learning Objectives

- 10.a. Define a graphic function block.
- 10.b. Analyze a graphic function block.
- 10.c. Revise a graphic function block.
- 10.d. Design a graphic function block.

11. Document control processes.

Assessment Strategies

11.1. Project

Criteria

You will know you are successful when

- 11.1. learner diagrams a control loop and the associated HVAC system components.
- 11.2. learner writes a sequence of operation for a control loop.
- 11.3. learner develops a flow chart for a control loop.

Learning Objectives

- 11.a. Describe the characteristics and uses of a system drawing.
- 11.b. Describe the characteristics and uses of a sequence of operation.
- 11.c. Describe the characteristics, symbols and uses of a flow chart.
- 11.d. Write a sequence of operation.
- 11.e. Draw a single line drawing of a simple control loop.
- 11.f. Draw a flow chart of a simple control loop.

12. Analyze system diagrams and written descriptions.

Assessment Strategies

12.1. Presentation

Criteria

You will know you are successful when

- 12.1. learner breaks control diagrams down into individual control loops.
- 12.2. learner dissects a sequence of operation to determine information required for individual control loops.
- 12.3. learner matches control diagrams to written descriptions.
- 12.4. learner diagrams control loops given written descriptions.
- 12.5. learner describes control loops given system diagrams.

Learning Objectives

- 12.a. Break down a diagram into individual control loops.
- 12.b. Dissect a written description into sub categories.
- 12.c. Associate written descriptions with diagrams.
- 12.d. Diagram a system given a written description.
- 12.e. Describe a system given a system diagram.

13. Evaluate HVAC systems and their control loops.

Assessment Strategies

13.1. Project

Criteria

You will know you are successful when

- 13.1. learner describes how the controlled medium is affected as it flows through the system.
- 13.2. learner describes how the controlled medium is affected by system problems.
- 13.3. learner evaluates the response and interactions that occur between individual control loops that make up a control system.

Learning Objectives

- 13.a. Describe how the controlled medium is affected as it flows through the system.
- 13.b. Describe how the controlled medium would be affected if the system were not operating properly.
- 13.c. Analyze the response and interactions that occur between individual control loops that make up a control system.

14. Diagnose HVAC systems and their control loops.

Assessment Strategies

14.1. Project

Criteria

You will know you are successful when

- 14.1. learner articulates a diagnostic procedure.
- 14.2. learner determines control loop problems.
- 14.3. learner determines control system problems.

Learning Objectives

- 14.a. Articulate a diagnostic procedure.
- 14.b. Analyze the system as a whole.
- 14.c. Analyze individual control loops of the system.
- 14.d. Diagnose system problems.

15. Engineer a control system for a HVAC process.

Assessment Strategies

- 15.1. Project

Criteria

You will know you are successful when

- 15.1. learner designs a control system.
- 15.2. learner documents a control system creating an operation and maintenance manual.

Learning Objectives

- 15.a. Identify typical control applications.
- 15.b. Recommend a control strategy.
- 15.c. Design a control system.
- 15.d. Document a control system.