



**Correlation of**  
**Modern Refrigeration and Air Conditioning, by Althouse, Turnquist, Bracciano**  
**(Goodheart-Willcox Publisher ©2021)**  
**to**  
**AHRI Curriculum Guide: VII. Controls**

The following chart correlates the *Modern Refrigeration and Air Conditioning* textbook (©2021) to a section of the Curriculum Guide developed by Air-Conditioning, Heating, and Refrigeration Institute (AHRI) and used for PAHRA accreditation.

The chart lists the Curriculum Guide’s knowledge and task competency objectives and the corresponding chapter numbers from *Modern Refrigeration and Air Conditioning*.

For more information on the Partnership for Air-Conditioning, Heating, Refrigeration Accreditation (PAHRA) and related accreditation, please visit: [www.pahrahvacr.org](http://www.pahrahvacr.org)



<b>VII.A. Gas Valves</b>	
<b>Knowledge</b>	<b>Textbook Chapter(s)</b>
1. Identify types of gas valves:	
a. Low voltage	Chapter 41
b. Line voltage	Chapter 41
c. Redundant	Chapter 41
d. Two-stage	Chapter 41
e. Modulating	Chapter 41
2. Explain the operation of solenoid valves used to control gas flow.	Chapter 41
3. Describe function and application of regulators.	Chapter 41

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<b>VII.A. Gas Valves (continued)</b>	
<b>Knowledge</b>	<b>Textbook Chapter(s)</b>
4. Describe the methods of pilot/burner ignition:	
a. Standing pilot thermocouple	Chapter 41
b. Glow coil pilot ignition	Chapter 41
c. Intermittent spark pilot ignition	Chapter 41
d. Direct spark burner ignition	Chapter 41
e. Hot surface burner ignition	Chapter 41
5. Describe methods of fan control for the three categories of gas furnaces:	
a. Low-efficiency - 60-70% efficient	Chapters 38, 41
b. Mid-efficiency - 78-80% efficient	Chapters 38, 41
c. High-efficiency - 90%+ efficient	Chapters 38, 41
6. Describe the sequence of operation for 78-80% efficient gas furnaces.	Chapters 38, 41
7. Identify the components used in all types of gas furnaces:	
a. Low-efficiency - 60-70% efficient	Chapters 38, 41
b. Mid-efficiency - 78-80% efficient	Chapters 38, 41
c. High-efficiency - 90%+ efficient	Chapters 38, 41
8. Explain the operation of a redundant gas valve.	Chapter 41
<b>Tasks</b>	<b>Textbook Chapter(s)</b>
1. Check gas valve operation.	Chapter 41
2. Check flame sensing current of flame sensing device.	Chapter 41
3. Check and adjust inlet and outlet pressure of a gas valve.	Chapter 41
4. Perform conversion on gas valve from natural gas to liquefied petroleum (LP) or reverse.	Chapter 41
5. Check the operation of an induced draft blower by blocking flue outlet.	Chapter 41
<b>VII.B. Fuel Controls</b>	
<b>Knowledge</b>	<b>Textbook Chapter(s)</b>
1. Explain the operation of ignition and pilot proving devices.	Chapters 41, 42
2. Explain operation of an oil delay valve.	Chapter 42
<b>Tasks</b>	<b>Textbook Chapter(s)</b>
1. Test and change a thermocouple flame sensor.	Chapters 39, 41, 42
2. Test spark ignition modules.	Chapters 39, 41, 42

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<b>VII.B. Fuel Controls (continued)</b>	
<b>Tasks</b>	<b>Textbook Chapter(s)</b>
3. Perform safety lockout procedures for burners.	Chapters 39, 41, 42
4. Measure resistance of cad cell.	Chapter 42
<b>VII.C. Residential Control Systems</b>	
<b>Knowledge</b>	<b>Textbook Chapter(s)</b>
1. Identify residential heating and cooling thermostats.	Chapters 36, 38, 39, 40, 41, 42, 43
2. Identify controls for heating and cooling.	Chapters 36, 38, 39, 40, 41, 42, 43
3. Explain heat and cooling anticipators.	Chapters 36, 38, 39, 40, 41, 42, 43
<b>Task</b>	<b>Textbook Chapter(s)</b>
1. Install and test a fan/limit control to identify set point of control.	Chapters 13, 16, 18, 31, 32, 36, 38, 41, 42
2. Wire a complete heating system - line and low voltage.	Chapters 13, 15, 16, 18, 32, 36, 38, 41, 42, 43
3. Wire a humidistat into an electrical circuit.	Chapters 13, 15, 16, 18, 35, 36, 38, 41, 42, 43
4. Wire an electronic air cleaner into an electrical circuit.	Chapters 13, 15, 16, 18, 28, 32, 36, 38, 41
5. Program a programmable thermostat for heating, cooling, and heat pump operation including set-up and set back.	Chapters 12, 13, 14, 16, 18, 29, 31, 32, 36, 38
6. Set heat anticipator on system thermostat.	Chapters 12, 13, 14, 16, 18, 29, 31, 32, 36, 38
7. Install residential heating and cooling thermostats.	Chapters 12, 13, 14, 16, 18, 29, 31, 32, 36, 38
<b>VII.D. Commercial Control Systems</b>	
<b>Knowledge</b>	<b>Textbook Chapter(s)</b>
1. Identify types of control systems:	
a. Electromechanical	Chapters 12, 13, 14, 15, 16, 18, 20, 21, 26, 31, 32, 38, 40, 41
b. Pneumatic	Chapter 33
c. Electronic	Chapters 12, 13, 14, 15, 16, 18, 32, 36, 38, 45, 46
d. Programmable	Chapters 12, 13, 14, 15, 16, 18, 32, 36, 38, 45, 46
e. Building management	Chapters 12, 13, 14, 15, 16, 18, 32, 36, 38, 44, 45, 46

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<b>VII.D. Commercial Control Systems (continued)</b>	
<b>Knowledge</b>	<b>Textbook Chapter(s)</b>
2. Identify control system components.	Chapters 12, 13, 14, 15, 16, 18, 29, 31, 32, 36, 38, 44, 45, 46
3. Describe electrical/mechanical sequences of operation of control systems.	Chapters 6, 12, 13, 14, 15, 16, 18, 29, 31, 32, 36, 38, 44, 45, 46
<b>Tasks</b>	<b>Textbook Chapter(s)</b>
1. Draw a schematic diagram using all components necessary to safely operate an air conditioner, heat pump, furnace or chiller system.	Chapters 6, 12, 13, 14, 15, 16, 17, 18, 29, 31, 32, 36, 38, 40, 41, 42, 43, 44, 45, 46
2. Wire the control circuit of an air-conditioning heating or chiller system.	Chapters 6, 12, 13, 14, 15, 16, 18, 29, 31, 32, 36, 38, 40, 41, 42, 43, 44, 45, 46
<b>VII.E. Heat Pump Controls</b>	
<b>Knowledge</b>	<b>Textbook Chapter(s)</b>
1. Explain the operation and function of a reversing valve.	Chapters 22, 40
2. Identify the main types of defrost controls.	Chapters 21, 22, 40
3. Identify and explain the operation of each type of defrost control.	Chapters 21, 22, 40
4. Identify and explain the operation of flow and safety control for a geothermal system.	Chapter 40
5. Describe the purpose and function of outdoor thermostats.	Chapter 40
6. Describe the sequence and purpose of emergency heat controls.	Chapter 40
7. Identify and explain the operation of check valves in heat pumps.	Chapters 22, 40
8. Describe the sequence between first stage and second stage heating thermostat.	Chapter 36
9. Describe the auxiliary heat controls.	Chapters 36, 40
<b>Tasks</b>	<b>Textbook Chapter(s)</b>
1. Select and install appropriate system thermostat.	Chapters 36, 40
2. Wire the control circuit of a heat pump system.	Chapters 12, 13, 14, 15, 16, 18, 36, 38, 40
3. Install or replace a heat sequencing relay.	Chapters 12, 13, 14, 15, 16, 18, 36, 40, 43
4. Perform tests on reversing valve to determine if mechanical or electrical failure.	Chapters 12, 13, 14, 15, 16, 18, 36, 40

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<b>VII.F. Direct Digital Controls (DDC)</b>	
<b>Knowledge</b>	<b>Textbook Chapter(s)</b>
1. Explain the history of DDC systems.	Chapters 16, 45
2. Discuss the definition of DDC systems.	Chapters 16, 45
3. Explain wiring methods.	Chapters 13, 16, 17, 45
4. Explain peripheral devices.	Chapters 16, 45
5. Explain input and output.	Chapters 16, 45
6. Explain central processors.	Chapters 16, 45
7. Explain the difference between DDC and Energy Management Systems (EMS).	Chapters 16, 45
8. Discuss remote communications, monitoring, and alarming.	Chapters 16, 45
9. Describe a programmable thermostat.	Chapters 16, 36, 45
10. Describe several applications for electronic controls.	Chapters 16, 18, 32, 33, 36, 38, 45
11. Describe why electronic controls are more applicable to some situations than are electromechanical controls.	Chapters 13, 14, 16, 18, 32, 33, 38, 45, 46, 52, 53, 54, 55
<b>Tasks</b>	<b>Textbook Chapter(s)</b>
1. Troubleshoot a basic electronic control circuit board.	Chapters 12, 13, 14, 16, 18
2. Program different types of thermostats.	Chapter 36
<b>VII.G. Energy Management System (EMS) (Computer Controls)</b>	
<b>Knowledge</b>	<b>Textbook Chapter(s)</b>
1. Explain the history of DDC systems.	Chapter 45
2. Discuss the definition of DDC systems.	Chapters 16, 45
3. Explain wiring methods.	Chapters 12, 13, 16, 18, 36, 45
4. Explain peripheral devices.	Chapters 16, 45
5. Explain input and output.	Chapters 16, 45
6. Explain central processors.	Chapters 16, 45
7. Explain the difference between DDC and Energy Management Systems (EMS).	Chapters 16, 45
8. Discuss remote communications, monitoring, and alarming.	Chapters 16, 45
9. Describe a programmable thermostat.	Chapters 36, 45
10. Describe several applications for electronic controls.	Chapters 11, 16, 18, 30, 32, 33, 36, 45

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<b>VII.G. Energy Management System (EMS) (Computer Controls)</b>	
<b>Knowledge</b>	<b>Textbook Chapter(s)</b>
11. Describe why electronic controls are more applicable to some situations than are electromechanical controls.	Chapters 11, 16, 18, 30, 32, 33, 36, 45, 52, 53, 54, 55
<b>Tasks</b>	<b>Textbook Chapter(s)</b>
1. Draw basic diagrams of how input and output modules function.	Chapters 12, 13, 14, 16, 17, 36, 45
2. Enter a program into a programmable controller.	Chapters 36, 45