

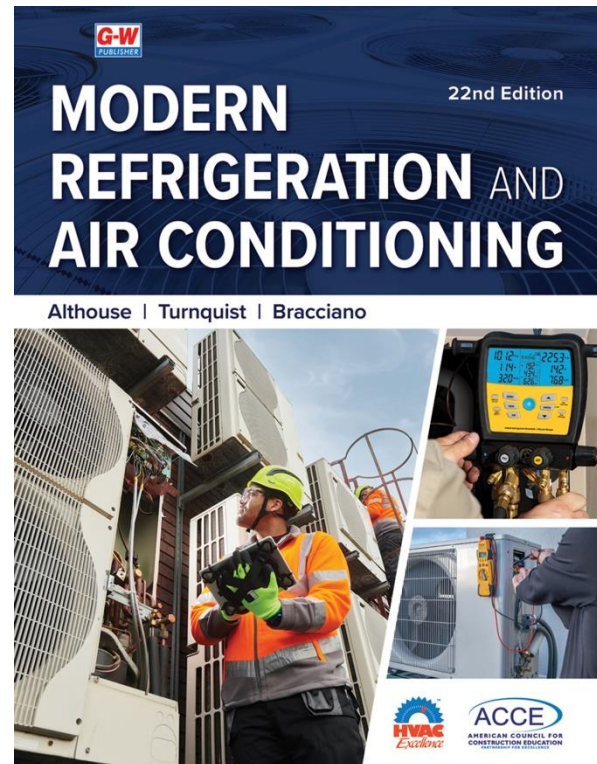


Correlation of
Modern Refrigeration and Air Conditioning, by Althouse, Turnquist, Bracciano
 (Goodheart-Willcox Publisher ©2025)
 to
HVAC Excellence Competencies Task List: Building Automation

The following chart correlates the *Modern Refrigeration and Air Conditioning* textbook (©2025) to an area of the HVAC Excellence Competencies Task List.

The chart lists individual competency and task standards, and the corresponding chapter numbers from *Modern Refrigeration and Air Conditioning*.

For more information on HVAC Excellence and related certifications, please visit:
www.hvacexcellence.org.



Competency / Task	Textbook Chapters
Students should have prior knowledge of:	
Basic computer operations	Chapter 26
Proper use of hand tools	Chapters 4, 5
Electrical principles	Chapters 13, 14, 15, 16, 17, 18, 19
Basic wiring techniques	Chapter 13
Reading schematic diagrams	Chapters 13, 17, 18
Interpreting a systems operational sequence from a schematic diagram	Chapters 9, 27, 31, 33, 39, 41, 51
NEC usage	Chapters 14, 16, 17, 23, 25, 29, 35, 40
Ampacity calculations	Chapter 13

**Correlation of *Modern Refrigeration and Air Conditioning, 22e* to
HVAC Excellence Competencies Task List: Building Automation—page 2**

Competency / Task	Textbook Chapters
Voltage-drop calculations	Chapter 13
Psychrometer principles	Chapter 28
Identifying what property each line on a psychrometric chart represents	Chapter 28
The ability to plot any two basic points on the psychrometric chart and evaluate the data	Chapter 28
Define standard air volume, velocity, and static pressure	Chapters 28, 31
Students must have knowledge of and be able to demonstrate proficiency in DDC fundamentals:	
Defining the following: range, setpoint, dead band, bias, trending, scheduling, digital, analog, input, output, variable, logic, actuator, positioner, ethernet, fieldbus	Chapters 15, 17, 26
Reading and interpreting commercial building prints—lighting, electrical, mechanical, plumbing, and HVACR	Chapter 15
Reading and interpreting commercial building schedules located on prints	—
Defining and describing the function of a DDC system	Chapters 17, 26
Describing the functions and advantages of a building automation system	Chapters 23, 26
Explaining how DDC systems are used to improve the energy management of a building	Chapters 17, 26
Explaining proportional control theory	—
Explaining integral control theory	—
Explaining derivative control theory	—
Listing the major NEC articles related to low-voltage systems/networks	—
Describing the low-voltage licensing process in your state	—
Creating flow charts to illustrate the operational sequence of-VAV, AHU, cooling towers, rooftop units, etc	Chapter 25
Creating and maintain documentation related to a BAS install, to include hardware components and address schema	Chapter 27
Students must have knowledge of and be able to demonstrate proficiency in building automation networks:	
Listing the layers 1–7 of the OSI model	—
Explaining TCP/IP protocols	Chapter 26

**Correlation of *Modern Refrigeration and Air Conditioning, 22e* to
HVAC Excellence Competencies Task List: Building Automation—page 3**

Competency / Task	Textbook Chapters
Defining and describing the following network topologies: bus, ring, star	Chapter 26
Describing ethernet applications and operations	Chapter 26
Explaining RS-485 network standards	—
Explaining RS-232 network standards	—
Comparing different bus architecture used in the BAS industry	Chapter 26
Contrasting open networks to closed networks	Chapter 17
Listing and contrasting the most common BAS open network protocols: Modbus, LonWorks, BACnet, OPC	Chapter 26
Explaining BAS network-addressing formats used in the BAS industry	Chapter 26
Defining and describing "points" in a DDC control system	Chapters 17, 26
Creating network diagrams using MS Visio or related software	—
Fabricating of an ethernet patch-cable	Chapter 26
Demonstrating common cabling practices used in the BAS industry, per NEC requirements	Chapter 26
Wiring/networking a unit controller to a room operator, per NEC requirements	—
Students must have knowledge of and be able to demonstrate proficiency in building automation controllers:	
Describing the function and application of a Java Application Control Engine (JACE) controller	—
Describing the function and application of a field controller	Chapter 17
Describing the function and application of a room operator	—
Describing the function of and a PLC used in refrigeration applications	Chapter 26
Comparing programmable controllers and configurable controllers	Chapters 16, 17, 23, 26
Installing controllers, per NEC requirements	—
Wiring a power supply to a controller, per NEC requirements.	Chapters 17, 19, 26
Configuring a room operator/controller	Chapter 26
Adding virtual points to network database	Chapter 26

**Correlation of *Modern Refrigeration and Air Conditioning, 22e* to
HVAC Excellence Competencies Task List: Building Automation—page 4**

Competency / Task	Textbook Chapters
Adding network addresses to network database	Chapter 26
Students must have knowledge of and be able to demonstrate proficiency in digital logic and programming:	
Comparing the following expressions of logic—relay logic, truth tables, ladder logic, Boolean algebra, logic gates	Chapters 17, 18
Defining and describing the following digital numbering systems- decimal, binary, octal, hexadecimal	—
Contrasting analog and digital communications	Chapters 17, 26
Defining microprocessor control systems	Chapters 17, 26
Identifying different types of data points: numeric, Boolean, enumerated, string	—
Converting between the different expressions of logic (e.g., relay logic to Truth Tables)	—
Developing flow charts for simple programs using MS Visio or related software	—
Connecting a laptop/workstation to a field controller	Chapter 26
Using a laptop to configure a field controller	Chapter 26
Programming controllers using line-programming, icon-based programming, or block programming	Chapters 16, 17, 23, 26
Students must have knowledge of and be able to demonstrate proficiency in sensor installation and application:	
Identifying the types of sensors that measure- temperature, humidity, pressure, velocity, level, proximity, CO2, motion, photoelectric diode	Chapters 4, 15, 48
Describing the proper application of sensors that measure- temperature, humidity, pressure, velocity, level, proximity, CO2, motion, photoelectric diode	Chapter 17
Wiring sensors to unit controllers, per NEC requirements	Chapters 16, 17, 26
Addressing points for various input sensor types	Chapter 17
Configuring inputs to unit controllers	Chapters 16, 17
Students must have knowledge of and be able to demonstrate proficiency in actuator installation and applications:	
Identifying the types of the following output components—control valve, regulators, dampers, variable-speed drive, solid-state relay, triac	Chapters 15, 17, 30, 38, 42, 44, 45

**Correlation of *Modern Refrigeration and Air Conditioning, 22e* to
HVAC Excellence Competencies Task List: Building Automation—page 5**

Competency / Task	Textbook Chapters
Describing the proper application of the following output components- control valve, regulators, dampers, variable-speed drive, solid-state relay, triac	Chapters 15, 17, 30, 38, 42, 44, 45
Wiring actuators to unit controllers, per NEC requirements	Chapters 17, 26
Addressing points for various output devices	Chapters 14, 17, 26, 30, 32, 33, 34, 36
Configuring outputs to unit controllers	Chapter 23
Configuring a VFD to operate with a BAS network	Chapter 26
Students must have knowledge of and be able to demonstrate proficiency in digital logic and programming:	
Ladder safety procedures	Chapter 2
Fall protection safety procedures	Chapter 2
Lock out and tag out procedures	Chapter 2
Electrical shock prevention	Chapter 2
Identifying the safety ground	Chapters 2, 14
Identifying the “hot” conductor	Chapters 2, 14
Identifying the “neutral” conductor	Chapters 2, 14
Proper PPE requirements	Chapter 2
Emergency first aid procedures	Chapter 2
Safe use of power tools	Chapters 2, 4
Knowledge of the following test instruments and/or tool is required:	
Personal computer	—
Digital voltmeter	Chapters 14, 18
Digital ohmmeter	Chapters 2, 15, 18
Digital clamp-on ammeter	Chapter 18
Digital balometer	—
Digital manometer	Chapters 4, 31, 33
Digital anemometer	Chapter 28
Digital psychrometer	Chapter 28
Pressure gauges	Chapter 11