Correlation of

Modern Refrigeration and Air Conditioning, **by Althouse, Turnquist, Bracciano**

(Goodheart-Willcox Publisher ©2025)

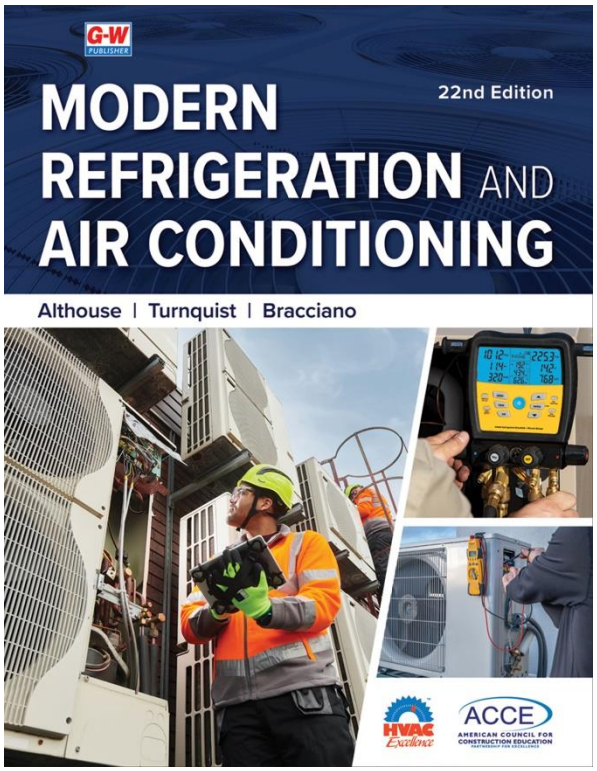
to

HVAC Excellence Competencies Task List: Electric Heat

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 knowledge of and be able to demonstrate proficiency in:	
Electrical safety	Chapters 2, 14, 17, 19, 35
Electric heat theory	Chapter 35
Identifying system components	Chapters 9, 13, 14, 17, 35
Calculating watts	Chapter 14
Describing how electric heating elements are rated	Chapter 35
Describing types and how a sequencer controls heating elements and blower operation	Chapters 35
Defining and calculating furnace Btu output	Chapters 6, 35

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Competency/Task	Textbook Chapters
Defining coefficient of performance	Chapters 36, 40
Describing sensible and latent heat	Chapters 6, 7, 8, 10, 24, 28, 30, 32
Identifying the formula for sensible heat	Chapters 6, 7, 30, 51
Describing the principles of dehumidification and humidification	Chapters 24, 28
Differentiating between a resistive and inductive load	Chapters 14, 35
Identifying the material used to construct electric heater elements	Chapter 35
Describing the insulating properties of mica and ceramics and their application	Chapter 35
Describing the operation and purpose of and evaluating and replacing a fan interlock switch	Chapter 35
Describing snap discs and their sequence of operation	Chapter 33
Describing the operation of and evaluating and replacing a limit switch	Chapters 13, 17, 20, 33, 35
Evaluating, describing its operation, installing, and setting a pressure differential switch	Chapters 17, 35
Describing the effects of relative humidity on comfort and health	Chapters 24, 28, 29, 35
Explaining and measuring temperature rise	Chapters 7, 27, 28, 35, 43
Identifying the various types of motor mounts used on residential furnace blower assemblies	—
Identifying the NEC code requirements for residential thermostat wiring	Chapters 14, 35
Describing and calculating wire sizing as it applies to voltage drop and length of wiring run	Chapters 14, 35
Describing voltage tolerances	Chapter 14
Demonstrating the measurement of and determining the amp draw of an electric heating element	Chapters 18, 35
Describing and demonstrating the method of wiring heating elements in a single-phase system	Chapter 35
Describing and determining the maximum allowable voltage imbalance in a three-phase circuit	Chapter 14
Measuring the voltage imbalance in a three-phase circuit	Chapter 14
Setting the heat anticipation or cycling rate for an electric furnace thermostat	Chapters 19, 35
Identifying the proper location for and installing a conventional thermostat	Chapter 35

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Competency/Task	Textbook Chapters
Explaining the detailed wiring and operation of a setback programmable thermostat	Chapter 23
Describing "R" values and application of various duct insulation materials	Chapter 30
Determining system maximum allowable operating static pressure	Chapter 12, 28
Describing and demonstrating the method of measuring static pressure	Chapters 4, 28, 30
Explaining the procedures for determining cfm	Chapters 28, 30, 31
Stating the recommended air velocities throughout the supply and return duct system	Chapters 28, 30
Stating the recommended air velocities through the return air grilles	Chapter 30
Measuring air velocities throughout the supply and return duct system	Chapters 4, 28, 30
Describing the effects of static pressure on airflow	Chapters 28, 30
Measuring the effects of static pressure on airflow	Chapters 28, 30
Demonstrating the procedure for finding cfm using an anemometer	Chapter 31
Demonstrating the procedure for finding cfm using temperature rise	Chapter 31
Stating the typical operating characteristics of a direct drive blower	—
Performing blower airflow adjustments	Chapter 30
Choosing and installing the proper bearings for a residential belt-driven blower assembly	Chapter 19
Describing and demonstrating the method of wiring heating elements in a three-phase system (wye or delta)	Chapter 35
Choosing and using the proper lubricant for residential blower motor maintenance	Chapter 19
Describing and demonstrating the procedure to replace the belt and adjust airflow on a belt-driven blower assembly	Chapter 30
Describing, fabricating, and install various types of duct connectors	Chapter 30
Describing the application of and performing the installation of turning vanes	Chapter 30
Describing the construction and efficiencies of varying filtering media and systems	Chapter 30

Competency/Task	Textbook Chapters
Electric heat troubleshooting and problem solving	Chapters 13, 14, 17, 18, 19, 35
Evaluating and replacing a heating element and a sequencer	Chapters 13, 14, 17, 19, 35
Describing installation and service procedures for central heating systems	Chapters 13, 14, 16, 17, 19, 35
Stating the minimum required clearances for service and safety of an electric furnace	Chapter 35
Evaluating, describing its operation, and installing a duct heater	Chapters 13, 14, 17, 19, 35
Describing procedures for retrofit of a system to electric heat	Chapter 35
Students should have knowledge of and be able to describe and demonstrate the following safety requirements:	
Ladder safety procedures	Chapters 2, 25
Describing and performing “lock out and tag” procedures	Chapters 2, 38, 48, 49, 50
Identifying the safety ground	Chapter 14
Identifying the “hot” conductors	Chapter 14
Identifying “neutral” conductors	Chapter 14
Describing and installing a GFCI circuit breaker	Chapter 14
Describing and demonstrating safety grounding procedures for electric motors	Chapters 14, 16, 19
Describing the application of and testing a fusible link	Chapter 35
Electrical shock prevention and first aid	Chapters 13, 14, 16, 18, 35
Electrical burn prevention and first aid	Chapters 13, 14, 15, 19, 35
Describing and demonstrating emergency first-aid procedures	Chapter 2
Electric heat troubleshooting and problem solving:	
Troubleshooting and problem solving involves diagnostic procedures requiring the use of test instruments, data plate information, and wiring diagrams. All of the HVACR electric furnace system components, circuits, air distribution system, and/or power supply should be part of the troubleshooting and problem-solving question area.	Chapters 4, 11, 13, 14, 15, 16, 17, 18, 19, 28, 30, 31, 35
Knowledge of the following test instruments and tools is required:	

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Competency/Task	Textbook Chapters
Ohmmeter Multimeter Ammeter Voltmeter Wattmeter Megger meter Capacitor analyzer	Chapters 4, 11, 18, 19, 28