Correlation of

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

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to

HVAC Excellence Competencies Task List: Electric Heat

The following chart correlates the *Modern Refrigeration and Air Conditioning* textbook (©2021) 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 Chapter(s)
Students should have knowledge of and be able to demonstrate proficiency in:	
Electrical safety	Chapters 13, 16, 18, 43
Electric heat theory	Chapter 43
Identifying system components	Chapters 12, 13, 16, 36, 43
Calculating watts	Chapter 13
Describing how electric heating elements are rated	Chapter 43
Describing types and how a sequencer controls heating elements and blower operation	Chapters 36, 43
Defining and calculating furnace Btu output	Chapters 4, 43
Defining coefficient of performance	Chapters 40, 46
Describing sensible and latent heat	Chapters 4, 5, 6, 9, 27, 35, 36
Identifying the formula for sensible heat	Chapters 4, 5, 29, 50
Describing the principles of dehumidification and humidification	Chapters 27, 35

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Competency / Task	Textbook Chapter(s)
Differentiating between a resistive and inductive load	Chapters 13, 43
Identifying the material used to construct electric heater elements	Chapter 43
Describing the insulating properties of mica and ceramics and their application	Chapter 43
Describing the operation and purpose of and evaluating and replacing a fan interlock switch	Chapters 38, 43
Describing snap discs and their sequence of operation	Chapters 16, 18, 36, 38, 43
Describing the operation of and evaluating and replacing a limit switch	Chapters 12, 16, 36, 38, 43
Evaluating, describing its operation, installing, and setting a pressure differential switch	Chapters 16, 36, 43
Describing the effects of relative humidity on comfort and health	Chapters 27, 28, 35, 36, 43
Explaining and measuring temperature rise	Chapters 7, 27, 43
Identifying the various types of motor mounts used on residential furnace blower assemblies	Chapter 38
Identifying the NEC code requirements for residential thermostat wiring	Chapters 36, 43
Describing and calculating wire sizing as it applies to voltage drop and length of wiring run	Chapters 13, 43
Describing voltage tolerances	Chapter 13
Demonstrating the measurement of and determining the amp draw of an electric heating element	Chapters 17, 43
Describing and demonstrating the method of wiring heating elements in a single-phase system	Chapter 43
Describing and determining the maximum allowable voltage imbalance in a three-phase circuit	
Measuring the voltage imbalance in a three-phase circuit	
Setting the heat anticipation or cycling rate for an electric furnace thermostat	Chapters 18, 36, 43
Identifying the proper location for and installing a conventional thermostat	Chapters 36, 43
Explaining the detailed wiring and operation of a setback programmable thermostat	Chapter 36
Describing “R” values and application of various duct insulation materials	Chapter 29
Determining system maximum allowable operating static pressure	

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Competency / Task	Textbook Chapter(s)
Describing and demonstrating the method of measuring static pressure	Chapters 7, 27, 29
Explaining the procedures for determining cfm	Chapters 27, 29, 30
Stating the recommended air velocities throughout the supply and return duct system	Chapters 27, 29
Stating the recommended air velocities through the return air grilles	Chapter 29
Measuring air velocities throughout the supply and return duct system	Chapters 7, 27, 29
Describing the effects of static pressure on airflow	Chapters 27, 29
Measuring the effects of static pressure on airflow	Chapters 27, 29
Demonstrating the procedure for finding cfm using an anemometer	Chapter 30
Demonstrating the procedure for finding cfm using temperature rise	Chapter 30
Stating the typical operating characteristics of a direct drive blower	
Performing blower airflow adjustments	Chapter 29
Choosing and installing the proper bearings for a residential belt-driven blower assembly	Chapter 18
Describing and demonstrating the method of wiring heating elements in a three-phase system (wye or delta)	Chapter 43
Choosing and using the proper lubricant for residential blower motor maintenance	Chapter 18
Describing and demonstrating the procedure to replace the belt and adjust airflow on a belt-driven blower assembly	Chapter 29
Describing, fabricating, and install various types of duct connectors	Chapter 29
Describing the application of and performing the installation of turning vanes	Chapter 29
Describing the construction and efficiencies of varying filtering media and systems	Chapter 28
Electric heat troubleshooting and problem solving	Chapters 12, 13, 16, 17, 18, 43
Evaluating and replacing a heating element and a sequencer	Chapters 12, 13, 16, 18, 38, 43
Describing installation and service procedures for central heating systems	Chapters 12, 13, 15, 16, 18, 43

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Competency / Task	Textbook Chapter(s)
Stating the minimum required clearances for service and safety of an electric furnace	Chapters 38, 43
Evaluating, describing its operation, and installing a duct heater	Chapters 12, 13, 16, 18, 43
Describing procedures for retrofit of a system to electric heat	Chapter 43
Students should have knowledge of and be able to describe and demonstrate the following safety requirements:	
Ladder safety procedures	Chapter 33
Describing and performing “lock out and tag” procedures	Chapters 13, 16, 52, 53, 54, 55
Identifying the safety ground	Chapter 13
Identifying the “hot” conductors	Chapter 13
Identifying “neutral” conductors	Chapter 13
Describing and installing a GFCI circuit breaker	Chapter 13
Describing and demonstrating safety grounding procedures for electric motors	Chapters 13, 15, 18
Describing the application of and testing a fusible link	Chapter 43
Electrical shock prevention and first aid	Chapters 12, 13, 15, 18, 43
Electrical burn prevention and first aid	Chapters 12, 13, 15, 18, 43
Describing and demonstrating emergency first-aid procedures	
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 7, 10, 12, 13, 14, 15, 16, 17, 18, 27, 29, 30, 38, 43
Knowledge of the following test instruments and tools is required:	
Ohmmeter Multimeter Ammeter Voltmeter Wattmeter Megger meter Capacitor analyzer	Chapters 7, 10, 17, 18, 27