

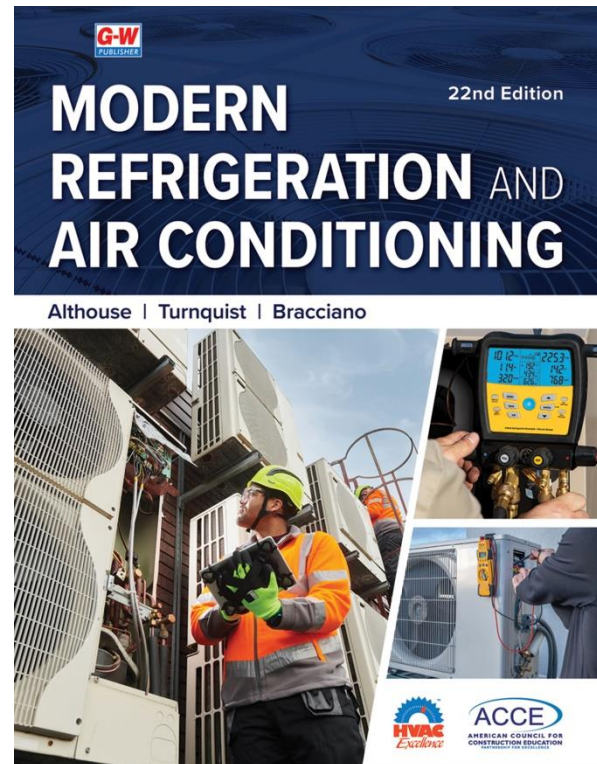


Correlation of
Modern Refrigeration and Air Conditioning, by Althouse, Turnquist, Bracciano
 (Goodheart-Willcox Publisher ©2025)
 to
HVAC Excellence Competencies Task List: Heat Pump

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:	
Refrigerant thermodynamics	Chapters 6, 7, 10, 23, 51
Psychrometrics	Chapter 28
Residential air-conditioning and electric heating systems	Chapters 22, 23, 35
Refrigerant charging	Chapters 10, 11, 12, 36
Refrigerant recovery	Chapters 10, 11, 12, 50
Soldering and brazing techniques	Chapters 5, 47
Refrigerant recycling	Chapters 10, 11, 12, 40
Refrigerant reclamation	Chapters 10, 11, 12, 40

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

Competency/Task	Textbook Chapters
Students must have knowledge of heat pump system components and be able to demonstrate proficiency in:	
Describing a heat pump's design configuration for both the heating and cooling cycle	Chapter 36, 37
Defining SEER, SEER2, HSPF, and COP	Chapters 16, 36, 40, 49
Identifying and differentiating between the various types of service valves	Chapters 9, 11
Differentiate between a single-stage, multi-stage, and variable speed compressor	Chapter 46
Differentiate between ducted, ductless, and packaged terminal air source heat pumps, as well as ground-source and water-source heat pumps	Chapters 35, 36, 37
Identify and evaluate suitable heat pump equipment choices for a specified location	Chapters 36, 37
Describing variable speed compressor sequence of operation	Chapter 36
Describe low temperature or cold climate heat pump performance at different outdoor temperatures	Chapters 36, 37
Explain minimum and maximum system capacity in variable speed systems	Chapters 15, 16, 36
Explain the difference between systems with constant speed supply fans and variable speed supply fans	Chapter 30
Explain the sequence of operation for systems with variable speed supply fans	Chapter 36
Describe dual fuel heat pump systems	Chapter 36
Explain different approaches for sizing heat pumps: sizing for cooling, partial heating, full heating	Chapters 36, 37
Explain how different climates and outdoor temperature levels affect the approach for sizing heat pumps	Chapters 36, 37
Explain differences in operation and comfort between heat pumps and fossil fuel heating systems	Chapter 39
Describe requirements for installing outdoor units	Chapters 22, 23
Assessing an electrical panel to determine if the building's electrical capacity can account for a heat pump's load	Chapters 18, 28, 36
Describing the operation and use of a wireless probe set and smart diagnostic application	Chapters 11, 23

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

Competency/Task	Textbook Chapters
Differentiating between a compressor designed for use in a heat pump and one that is designed for use in a cooling-only air conditioner	Chapters 17, 36
Demonstrating the proper connection and use of a gauge manifold assembly	Chapters 11, 12, 47, 48
Describing the operation of a reversing valve	Chapters 23, 36
Describing the procedures for testing the operation of a reversing valve	Chapters 22, 23, 36, 45
Performing a reversing valve replacement	Chapter 36
Stating the purpose of an accumulator and how it is constructed	Chapters 36, 43
Evaluating and replacing an accumulator	Chapters 36, 43
Describing the principle of operation of a capillary tube as used on a heat pump	Chapters 36
Describing the principle of operation of a fixed orifice as used on a heat pump	Chapters 8, 36
Describing the principle of operation of a thermostatic expansion valve used with and without check valves	Chapter 36
Describing the principle of operation of an electronic expansion valve	Chapters 8, 36, 45
Evaluating and replacing a capillary tube	Chapter 48
Servicing, selecting, and installing a fixed orifice	Chapters 8, 12, 23, 33, 36
Servicing, selecting, and installing a thermostatic expansion valve	Chapters 5, 8, 11, 12, 36, 47
Servicing, selecting, and installing an electronic expansion valve	Chapters 5, 8, 11, 12, 36, 50
Describing a check valve, its function, and operation	Chapters 36, 44
Evaluating and replacing a check valve	Chapters 36, 44, 45, 47
Describing the operation of a heat/cool relay	Chapters 23, 49
Describing the operation of the following defrost controls: mechanical, time/temperature, and solid-state	Chapters 9, 20, 36, 44, 49, 51
Describing the function of and testing method for an outdoor thermostat	Chapters 19, 23
Describing the sequence of the defrost cycle	Chapter 36, 44
Describing the sequence of operation and the testing methods for a defrost relay	Chapters 14, 17, 19, 36, 44
Installing a solid-state defrost control	Chapters 5, 11, 14, 17, 19, 36, 44

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

Competency/Task	Textbook Chapters
Stating the purpose of and testing method for a bimetal outdoor coil temperature sensor	Chapters 4, 5, 11, 14, 17, 36, 44
Evaluating and replacing a defrost board	Chapters 14, 15, 17, 19
Servicing and installing a thermistor-type temperature sensor (PTC and NTC)	Chapters 4, 5, 11, 14, 15, 17, 19
Replacing a printed circuit control board (PC) in the indoor and outdoor units	Chapter 15
Describing crankcase heating methods and how they operate	Chapters 12, 36, 43, 47, 49, 50
Describing a heat pump thermostat with emergency heat feature	Chapter 36
Describing the function of and the testing method for a control circuit fuse	Chapters 14, 17, 19
Explaining how the set points for outdoor thermostats are established	Chapters 14, 17, 19
Installing and servicing a thermostat used with a dual fuel system	Chapter 33
Describing the system balance point in a dual fuel system and how it is derived	Chapter 33
Describing the function and the control methods used by an indoor electronic thermostat	Chapters 14, 17, 19, 33
Measuring system airflow	Chapters 28, 30, 31
Describing the system balance point in a dual fuel system and how it is derived	Chapter 36
Explaining the function of a liquid-line bi-flow drier	Chapters 8, 47, 48, 49
Installing and evaluating a liquid-line bi-flow drier	Chapters 8, 47, 48, 49
Installing and evaluating a liquid-line drier	Chapters 8, 47, 48, 49
Explaining the function of a suction-line filter-drier	Chapters 8, 47, 48, 49
Installing and evaluating a suction-line filter-drier	Chapters 8, 47, 48, 49
Identifying the types of micron gauges	Chapters 10, 11, 12, 36
Explaining the method for connecting a micron gauge to a system	Chapters 10, 11, 12, 36
Describing and performing the triple evacuation method	Chapters 10, 11, 12, 36
Describing heat pump charging procedures	Chapters 36, 37
Explaining charging using the manufacturer's literature	Chapters 10, 11, 12, 36, 37
Calculating and demonstrating the weigh-in charging method	Chapters 10, 11, 12, 36, 37

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

Competency/Task	Textbook Chapters
Determining required superheat and subcooling for an operating system	Chapters 10, 11, 12, 36, 37
Explaining charging using the superheat method	Chapters 10, 11, 12, 36, 37
Selecting the proper refrigerant oil for an operating system	Chapters 10, 11, 12, 36, 37, 43
Explaining charging using the subcooling method	Chapters 10, 11, 12, 36, 37
Demonstrating charging using the manufacturer's literature	Chapters 10, 11, 12
Demonstrating proper charging of HCFC and HFC refrigerants into an operating system	Chapters 10, 11, 12, 36, 37
Demonstrating proper charging of HCFC and HFC refrigerants into an empty system	Chapters 10, 11, 12, 36, 37
Describing the operation of and the testing method for a high-pressure switch	Chapters 14, 15, 16, 17, 19, 36, 37, 48, 49, 50
Describing the operation of and the testing method for a low-pressure switch	Chapters 14, 15, 16, 17, 19, 36, 37, 48, 49, 50
Describing the procedure to perform a compressor efficiency test	Chapters 48, 49, 52
Students should have knowledge of and be able to describe and demonstrate the following safety requirements:	
Ladder safety procedures	Chapters 2, 25
Fall prevention procedures	Chapters 2, 25
Refrigerant handling	Chapters 10, 11, 12
Nitrogen handling procedures	Chapters 5, 10, 11, 12, 21, 47, 48, 49, 50
Heat pump troubleshooting and problem solving:	
Troubleshooting and problem solving involves diagnostic procedures requiring the use of test equipment, manufacturer's installation and start-up procedures, and data plate information	Chapters 4, 5, 11, 12, 14, 17, 18, 19, 36, 37
Knowledge of the following test instruments and tools is required:	

**Correlation of *Modern Refrigeration and Air Conditioning, 22e* to
HVAC Excellence Competencies Task List: Heat Pump—page 6**

Competency/Task	Textbook Chapters
Anemometer Thermometers (wet and dry) Gauge manifold assembly Recovery equipment Vacuum pump Micron gauge Leak detector Nitrogen cylinder Soldering and brazing equipment Charging scale and charging cylinder Refrigerant throttling valve Ohmmeter Ammeter Voltmeter Valve core removal tool Flaring tool/ tubing cutters Tubing benders Wireless refrigeration probes and apps Sling psychrometer	Chapters 4, 5, 11, 12, 13, 14, 18, 19, 28, 31, 36, 37