



Correlation of
***Modern Refrigeration and Air Conditioning*, by Althouse, Turnquist, Bracciano**
(Goodheart-Willcox Publisher ©2021)
to
HVAC Excellence Competencies Task List: Residential Air Conditioning

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 air-conditioning components and be able to demonstrate proficiency in:	
The three states of matter	Chapters 4, 5
The laws of thermodynamics	Chapter 4, 5, 50
Heat transfer: convection, conduction, and radiation	Chapter 4
Atmospheric pressure and the effect of altitude	Chapters 4, 5, 25
Absolute and gauge pressures	Chapters 5, 10
Psychrometrics	Chapters 27, 35, 36
Refrigerant charging methods	Chapters 11, 52
Refrigerant piping	Chapters 8, 52
Soldering and brazing	Chapters 8, 52
Refrigerant leak detection and types of leak detectors	Chapter 10

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Competency / Task	Textbook Chapter(s)
Recovery and recycling processes	Chapters 10, 11, Appendices
Defining enthalpy and entropy	Chapters 4, 5, 8, 27
Change of state between liquids, vapors, and solids	Chapters 4, 5, 6
Describing and defining the following: conduction, convection, and radiant heat transfer	Chapters 4, 43
Describing, defining, and converting the following temperature measurements: Fahrenheit, Celsius, Rankine, and Kelvin	Chapter 4
Condensation of a vapor and its effect on heat	Chapters 4, 5, 9
Vaporization of a liquid and its effect on heat	Chapters 4, 5, 6, 9
Describing the thermodynamics of refrigerants	Chapter 9
Describing and defining the following: Btu, latent heat, sensible heat	Chapters 4, 5, 6, 9
Describing and defining the following: subcooled liquid, superheated vapor	Chapters 4, 5, 6, 9
Describing the state of refrigerant and explaining what occurs in each major component during normal operation	Chapters 6, 19, 21, 22
Using saturation tables	Chapter 9, Appendices
Identifying and defining the following types of blends: binary, ternary, azeotropic, and near azeotropic	Chapter 9
Identifying and defining: CFCs, HCFCs, HFCs, HFOs, & HCs	Chapter 9
Describing temperature glide	Chapter 9
Describing fractionation and its causes	Chapter 9
Describing and defining the following: wet-bulb temperature, dry-bulb temperature, and dew point	Chapters 27, 29
Measuring wet- and dry-bulb temperatures	Chapter 27
Defining wet-bulb depression	Chapters 27, 37
Describing the principles of dehumidification and humidification	Chapter 35

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Competency / Task	Textbook Chapter(s)
<p>Describing, explaining the function, evaluating, cleaning, and replacing (when feasible) of the following components:</p> <p>Compressors (reciprocating, scroll, rotary, and screw)</p> <p>Compressor capacity control methods and operation</p> <p>Condensers air-cooled</p> <p>Condensers water-cooled</p> <p>Metering devices (capillary tube, thermostatic expansion valve, automatic expansion valve, electronic expansion valve)</p> <p>Evaporators</p> <p>Receivers</p> <p>Discharge line</p> <p>Liquid line</p> <p>Suction line</p> <p>Liquid-line filter-drier</p> <p>Sight glass</p> <p>Suction-line filter</p> <p>Accumulator</p> <p>Head pressure controls</p> <p>Low pressure controls</p> <p>Pump down solenoid</p>	Chapters 6, 16, 19, 20, 21, 22, 31, 32, 33
Plotting the refrigeration cycle on a pressure-enthalpy chart	Chapters 27, 36
Defining SEER and EER	Chapters 40, 46
Describing the operation and use of a gauge manifold assembly	Chapters 10, 32, 33, 53, 54, 55
Identifying and differentiating between the various types of service valves	Chapters 6, 10, 23
Obtaining gauge pressure using compound gauges and converting to absolute	Chapters 10, 11, 49, 50, 55
Defining vacuum and vacuum levels as required in the HVACR industry	Chapters 10, 11
Identifying the types of micron gauges and how they should be connected to measure evacuation levels	Chapters 7, 10
Explaining vacuum pump selection	Chapters 10, 11
Evacuating and measuring system evacuation level	Chapters 10, 11
Describing the triple evacuation method	Chapters 10, 11

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Competency / Task	Textbook Chapter(s)
Soldering and brazing using correct techniques	Chapters 8, 52, 55
Demonstrating the triple evacuation method	Chapters 10, 11
Calculating and demonstrating the weigh-in charging method	Chapters 10, 11
Demonstrating charging using the superheat method	Chapters 9, 11, 52
Demonstrating charging using the subcooling method	Chapters 9, 11, 52
Identifying proper charging of a blended refrigerant into an operating system	Chapters 9, 11, 52
Identifying proper charging of a blended refrigerant by weight into an empty system	Chapters 9, 11, 52
Demonstrating charging using the manufacturer's literature	Chapters 9, 10, 11, 52
Demonstrating charging a mini-split system with two or more evaporators	
Describing the following oils and their applications: mineral, alkylbenzene, glycols, and esters	Chapter 9
Select the proper refrigerant oil and add it to an operating system	Chapters 9, 10, 11, 55
Defining compression ratio	Chapters 49, 50
Describing and performing a compressor efficiency test	Chapters 51, 53, 54
Determine superheat and subcooling on an operating system	Chapters 4, 5, 6, 9, 10, 11
Identifying proper charging of a compound refrigerant into an empty system	Chapters 9, 11, 52
Identifying proper charging of a compound refrigerant into an operating system	Chapters 9, 11, 52
Identifying proper charging of a blended refrigerant by weight into an empty system	Chapters 9, 11, 52
Describing the six types of leak detectors and demonstrating their proper use	Chapter 10
Explaining the proper use of each type of leak detector and their applicability	Chapters 10, 11
Explaining the method for and pinpointing a leak	Chapters 10, 54
Explaining the proper use and handling of nitrogen in the leak detection process	Chapters 10, 54
Defining and demonstrating refrigerant recovery	Chapters 9, 10, 11

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Competency / Task	Textbook Chapter(s)
Defining and demonstrating refrigerant recycling	Chapters 9, 10, 11
Defining reclaim	Chapters 9, 10, 11
Installing an air handler	Chapter 38
Installing a condensing unit	Chapter 32
Adjusting blower fan speed	Chapters 15, 29
Selecting the proper refrigerant oil and adding it to an operating system	Chapters 9, 10, 11, 55
Performing a compressor efficiency test	Chapters 51, 53, 54
Students should have knowledge of and be able to describe and demonstrate the following safety requirements:	
Ladder and fall protection safety procedures	Chapters 2, 33
Lock out and tag out procedures	Chapters 13, 16, 52, 53, 54, 55
Proper and safe handling of refrigerants	Chapters 9, 10, 11, 32, 33, 53, 54
Proper PPE requirements	Chapters 2, 7, 8, 10, 11, 32, 33, 54, 55
Emergency first-aid procedures	
Proper use of hand tools	Chapters 7, 8, 18, 32, 33
Air-conditioning troubleshooting and problem solving:	
Troubleshooting and problem solving involve diagnostic procedures requiring the use of test equipment, manufacturer's installation and start-up procedures, and data plate information.	Chapters 31, 32, 33, 53, 54, 55
Knowledge of the following test instruments and tools is required:	
Thermometers (wet and dry) Gauge manifold assembly Refrigerant throttling valve Charging scale and charging cylinder Soldering and brazing equipment Flaring tool/ tubing cutters Tubing benders Nitrogen cylinder Leak detector Valve core removal tool Micron gauge Vacuum pump Recovery equipment	Chapters 7, 8, 10, 11, 31, 32, 33, 52, 53, 54, 55