



**Correlation of**  
***Modern Refrigeration and Air Conditioning*, by Althouse, Turnquist, Bracciano**  
**(Goodheart-Willcox Publisher ©2021)**  
**to**  
**HVAC Excellence Competencies Task List: Light Commercial 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](http://www.hvacexcellence.org).



Competency / Task	Textbook Chapter(s)
<b>Students should have prior knowledge of:</b>	
Leak detectors	Chapters 10, 11
The laws of thermodynamics	Chapters 4, 5, 6, 9, 33, 50
Recovery and recycling processes	Chapters 9, 10, 11
Refrigerant leak detection and types of leak detectors	Chapters 10, 11
Refrigerant piping	Chapters 8, 33
Soldering and brazing	Chapters 8, 47, 50
Refrigerant types	Chapter 9
System components such as: Metering devices Receivers Pressure controls Suction accumulators Refrigerant flow and control valves	Chapters 6, 10, 11, 21, 23, 32, 33
Evacuation methods and equipment	Chapters 10, 11

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Competency / Task	Textbook Chapter(s)
Refrigerant charging methods	Chapters 10, 11
<b>Students must have knowledge of light commercial air conditioning systems, their components, and be able to demonstrate proficiency in:</b>	
Defining enthalpy and entropy	Chapters 4, 6, 9, 27, 31, 33, 35, 36, Appendices
Change of state between liquids, vapor, and solids	Chapters 5, 6, 9, 22, 35, 36, 41, 42, 44
Describing and defining the following: conduction, convection, and radiant heat transfer	Chapters 4, 43, 44
Describing, defining, and converting the following temperature measurements: Fahrenheit, Celsius, Rankine, and Kelvin	Chapters 4, 7
Condensation of a vapor and its effect on heat	Chapters 4, 6, 27, 35, 36, 41, 42
Vaporization of a liquid and its effect on heat	Chapters 4, 6, 27, 35, 36, 41, 42
Describing the thermodynamics of refrigerants	Chapters 9, 22, 50
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, 22
Describing the state of refrigerant and explain what occurs in each major component during normal operation	Chapters 4, 5, 6, 9, 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, and HCs	Chapter 9
Describing temperature glide	Chapters 9, 11, 52, Appendices
Describing fractionation and its causes	Chapter 9
Explain the procedures to retrofit a system from a CFC to an HFC and from an HCFC to an HFC	Chapters 11, 32, Appendices
Describing and defining the following: wet-bulb temperature, dry-bulb temperature, and dew point	Chapters 9, 26, 27, 29
Defining wet-bulb depression	Chapters 27, 37
Measuring wet- and dry-bulb temperatures	Chapters 27, 37
Describing the principles of dehumidification and humidification	Chapters 35, 36
Plotting the refrigeration cycle on a pressure-enthalpy chart	Chapters 9, 27, 37
Defining SEER and EER	Chapters 40, 46

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Competency / Task	Textbook Chapter(s)
Describing a head master and its operation	Chapters 22, 23, 53, 54
Describing the function, selection, and installation of auxiliary heat exchangers	Chapters 22, 23
Select the proper refrigerant oil to add to an operating system	Chapters 9, 10, 11, 19, 20, 25, 31, 32, 55
Adjusting blower fan speed	Chapters 15, 29
Sizing, designing, and installing refrigerant lines	Chapters 7, 8, 9, 10, 11, 37, 50, 51, 52
Installing a condensing unit	Chapters 22, 51, 52
Installing an air handler	Chapters 22, 51, 52
Describing the required cfm for system operation and calculating airflow	Chapters 7, 27, 29, 30, 37, 38
Installing a condensate drain	Chapters 7, 8, 22, 31, 32, 35, 36, 38, 40, 41, 47, 52
Defining reclaim	Chapter 9
Defining and demonstrating refrigerant recycling	Chapters 9, 10, 11
Defining and demonstrating refrigerant recovery	Chapters 9, 10, 11
Explaining the proper use and handling of nitrogen in the leak detection process	Chapters 9, 10, 11, 52, 54, 55
Explaining the method for and pinpointing a leak	Chapters 9, 10, 11, 52, 54, 55
Explaining the proper use of each type of leak detector and their applicability	Chapters 9, 10, 11
Describing the six types of leak detectors and demonstrating the proper use	Chapters 10, 11
Identifying proper charging of a compound refrigerant into an operating system	Chapters 9, 10, 11
Identifying proper charging of a compound refrigerant into an empty system	Chapters 9, 10, 11
Determine superheat and subcooling on an operating system	Chapters 9, 10, 11
Describing and performing a compressor efficiency test	Chapters 51, 53, 54
Selecting the proper refrigerant oil and adding it to an operating system	Chapter 9
Describing the following oils and their applications: mineral, alkylbenzene, glycols, and esters	Chapter 9
Demonstrating charging a mini-split system with two or more evaporators	
Demonstrating charging using the manufacturer's literature	

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Competency / Task	Textbook Chapter(s)
Identifying proper charging of a blended refrigerant by weight into an empty system	Chapters 9, 10, 11
Identifying proper charging of a blended refrigerant into an operating system	Chapters 9, 10, 11
Demonstrating charging using the subcooling method	Chapters 9, 10, 11, 52
Demonstrating charging using the superheat method	Chapters 9, 10, 11, 52
Stating the reason why capillary tube systems require a critical charge	Chapters 6, 21, 25, 26, 53
Describing a capillary/distributor tube sizing and selection procedure	Chapters 8, 9, 19, 21
Calculating and demonstrating the weigh-in charging method	Chapters 11, 52
Describing the triple evacuation method	Chapters 9, 10, 11, 52
Demonstrating the triple evacuation method	Chapters 9, 10, 11, 52
Soldering and brazing using correct techniques	Chapters 8, 52
Evacuating and measuring system evacuation level	Chapters 10, 11
Explaining vacuum pump selection	Chapters 10, 11
Identifying the types of micron gauges and how they should be connected to measure evacuation levels	Chapters 7, 10
Defining vacuum and vacuum levels as required in the HVACR industry	Chapters 5, 9, 10, 11
Obtaining gauge pressure using compound gauges and converting to absolute	Chapters 10, 11, 51
Describing the operation and use of a gauge manifold assembly	Chapters 10, 11, 55
Identifying and differentiating between the various types of service valves	Chapters 10, 23, 33
Defining compression ratio	Chapters 19, 33, 49, 50
Describing the automatic pump-down system and its operation	Chapters 6, 11, 21, 22, 23, 53, 55, Appendices
Describing an air-cooled condenser, its function, and operating parameters	Chapters 6, 22, 51
Installing a water-cooled system and adjusting a water-regulating valve	Chapters 8, 33, 52, 54, 55
Describing the function of and installing a lockout relay in a circuit	Chapters 13, 15, 16
Describing the operation of and installing a contactor	Chapters 13, 15, 16, 18, 19, 43
Describing, testing, and installing a run and start capacitor	Chapters 13, 15, 16, 18, 19, 25, 31

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Competency / Task	Textbook Chapter(s)
Describing and installing a compressor potential start relay	Chapters 13, 14, 15, 16, 18, 24
Describing the operation of and testing of a high-pressure switch	Chapters 13, 14, 15, 16, 18, 20, 40, 53, 54, 55
Describing the operation of and testing of a low-pressure switch	Chapters 7, 10, 13, 14, 15, 16, 18, 20, 40, 53, 54, 55
Describing and wiring the terminal connections of a thermostat temperature control	Chapters 13, 15, 16, 18, 36, 38
Describing and testing thermistor-type temperature sensors (PTC & NTC)	Chapters 13, 14, 16, 20, 22, 24, 36
Describing the function of, checking the operation of, and wiring an oil pressure safety control	Chapters 7, 8, 10, 11, 13, 15, 16, 18, 19, 20
Installing and adjusting a low-ambient temperature control	Chapters 7, 8, 10, 11, 13, 16, 18, 22, 23, 52, 53, 54, 55
Testing a blower or fan motor and its circuit	Chapters 7, 12, 13, 15, 16, 18, 53, 54, 55
Describing the operation of and testing a hot-gas bypass valve	Chapters 7, 8, 10, 11, 13, 15, 16, 18, 22, 23, 54
Describing the operation of and adjusting an inline and pilot-operated evaporator pressure regulator	Chapters 7, 8, 10, 11, 13, 15, 16, 18, 22, 23, 53, 54, 55
Describing and installing a replaceable-core liquid-line drier	Chapters 6, 8, 10, 11, 23, 40, 52, 53, 54
Describing and installing a replaceable-core suction-line filter-drier	Chapters 6, 8, 10, 11, 23, 40, 52, 53, 54
Describing dry-type evaporators and their operation	Chapters 6, 22, 51
Describing the piping configuration for a multiple-evaporator system	Chapters 8, 9, 19, 22, 23, 49
Describing the function and purpose of a multiple-compressor system	Chapters 33, 47, 49, 51
Describing compressor capacity control methods and operation	Chapters 15, 19, 22, 23, 32, 33, 36, 49, 50, 51
Describing a chilled water system and its operation	Chapters 33, 34
Describing cooling towers and their operating limitations	Chapter 33
Describing the operation and function of a flooded-evaporator and its metering device	Chapters 21, 22, 23
Describing the function, checking the operation, and wiring a demand ventilation control	Chapter 33
Describing the function, checking the operation, and wiring a communications-type thermostat	Chapter 36
Describing the function, checking the operation, and installing a variable volume air handler	

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Competency / Task	Textbook Chapter(s)
Describing the function, checking the operation, and installing a variable air volume (VAV) unit	
<b>Students should have knowledge of and be able to describe and demonstrate the following safety requirements:</b>	
Describe and perform “lock out and tag” procedures	Chapters 13, 16, 52, 53, 54, 55
System leak test pressures and nitrogen regulator installation and adjustment	Chapters 10, 11, 54, 55
Explain and demonstrate the proper method of connecting a micron gauge to a system	Chapters 7, 10
<b>Light commercial air conditioning troubleshooting and problem solving:</b>	
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 7, 8, 13, 15, 16, 17, 18, 19, 21, 22, 23, 27, 29, 30, 37, 38
Knowledge of the following test instruments and tools is required:	
Ammeter Oil pressure gauge Ohmmeter Oil pump Voltmeter Nitrogen cylinder Micron gauge Vacuum pump Sling psychrometer Refrigerant throttling valve Thermometers (wet and dry) Recovery equipment Leak detector Charging scale and charging cylinder Gauge manifold assembly Anemometer Soldering and brazing equipment Valve core removal tool Flaring tool/tubing cutters Tubing benders	Chapters 7, 8, 9, 10, 11, 12, 13, 16, 17, 22, 23, 33, 38, 52, 55