Correlation of

Modern Refrigeration and Air Conditioning, **by Althouse, Turnquist, Bracciano**
(Goodheart-Willcox Publisher ©2025)
to

HVAC Excellence Competencies Task List: Commercial Refrigeration

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*.

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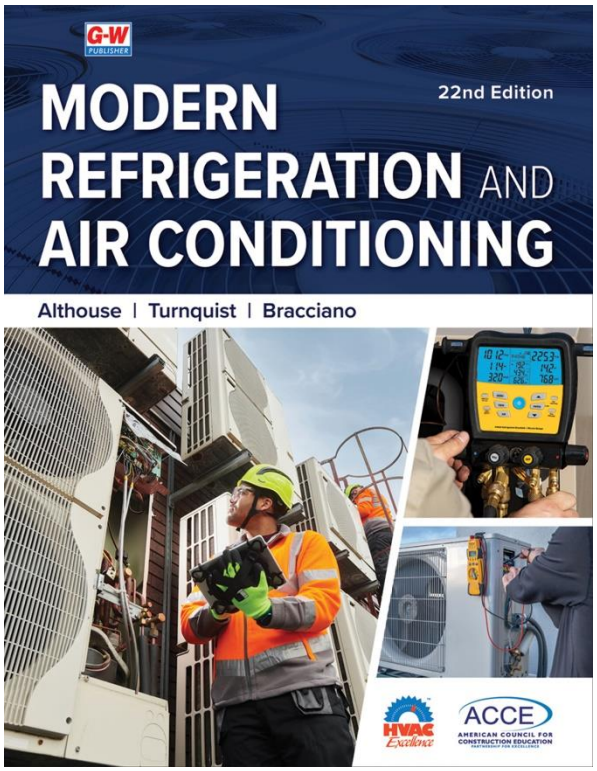

Competency / Task	Textbook Chapters
Students should have prior knowledge of:	
The laws of thermodynamics	Chapters 5, 6, 7, 8, 48, 49, 51, 52
Recovery and recycling processes	Chapters 10, 11, 12
Refrigerant leak detection and types of leak detectors	Chapters 11, 12
Refrigerant piping	Chapters 5, 47, 52
Soldering and brazing	Chapter 5
Refrigerant types	Chapter 10
Leak detectors	Chapters 11, 12

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Competency / Task	Textbook Chapters
Students must have knowledge of light commercial refrigeration systems, their components, and be able to demonstrate proficiency in:	
Defining enthalpy and entropy	Chapters 6, 8, 10, 22, 24, 25, 28, Appendices
Change of state between liquids, vapor, and solids	Chapters 7, 8, 10, 24, 34
Describing and defining the following: conduction, convection, and radiant heat transfer	Chapters 6, 35, 39
Describing, defining, and converting the following temperature measurements: Fahrenheit, Celsius, Rankin, and Kelvin	Chapters 4, 6
Condensation of a vapor and its effect on heat	Chapters 6, 8, 24, 28, 33, 34
Vaporization of a liquid and its effect on heat	Chapters 6, 8, 24, 28, 33, 34
Describing the thermodynamics of refrigerants	Chapters 6, 7, 8, 10, 44, 51
Define cryogenics	Chapter 10
Define and state the applications of high, medium, and low temperature refrigeration	Chapters 10, 41, 44, 45, 48
Define “expendable refrigerant”	Chapter 10
Describing and defining the following: Btu, latent heat, sensible heat	Chapters 6, 7, 8, 10
Describing and defining the following: subcooled liquid, superheated vapor	Chapters 6, 7, 8, 10, 44
Describing the state of refrigerant and explaining what occurs in each major component during normal operation	Chapters 6, 7, 8, 10, 44
Using saturation tables	Chapters 10, 51, 52, Appendices
Identifying and defining the following types of blends: binary, ternary, azeotropic, and near azeotropic	Chapter 10
Identifying and defining: CFCs, HCFCs, HFCs, HFOs, and HCs	Chapter 10
Describing temperature glide	Chapters 10, 12, 47, Appendices
Describing fractionation and its causes	Chapter 10
Explaining the procedures to retrofit a system from a CFC to an HFC and from an HCFC to an HFC	Chapter 12, Appendices
Describing and defining the following: wet-bulb temperature, dry-bulb temperature, and dew point	Chapters 10, 11, 12, 41
Defining wet-bulb depression	Chapter 12
Measuring wet- and dry-bulb temperatures	Chapter 12

Competency / Task	Textbook Chapters
Describing the principles of dehumidification and humidification	Chapter 42
Define and explain the use of high humidity evaporator coils	Chapters 43, 44
Describing, explaining the function, evaluating, cleaning, and replacing (when feasible) of the following components: Compressors (reciprocating, scroll, rotary, and screw) Condensers air cooled Condensers water cooled Metering devices (capillary tube, thermostatic expansion valve, automatic expansion valve, electronic expansion valve) Evaporators Receivers Discharge line Liquid line Suction line Liquid line filter Sight glass Suction line filter Vibration eliminator Accumulator Head pressure controls Low pressure controls Pump down solenoid Oil separator Crankcase heater Economizer Lock out relay Thermostat Oil pressure safety control Defrost heater Defrost terminator Mechanical or electronic defrost timer Crankcase pressure regulator (CPR) Liquid line solenoid valve Evaporator pressure regulator (EPR) Pressure regulator (OPR) Ambient temperature controls Water regulating valve	Chapters 41, 44, 45, 46, 49, 50, 51, 52

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Competency / Task	Textbook Chapters
Plotting the refrigeration cycle on a pressure-enthalpy chart	Chapters 10, 28, 32
Defining SEER and EER	Chapter 40
Describing a cascade system and its application and operation	Chapters 46, 51
Describing the purpose and applicability of a defrost cycle	Chapters 41, 42, 44
Describing defrost cycle initiation and termination	Chapters 43, 44
Describing the basic cycles and operation of ice makers	Chapters 40, 48
Describing a head master and its operation	Chapters 44, 45, 48, 49
Describing the function, selection, and installation of auxiliary heat exchangers	Chapters 44, 45, 52
Selecting the proper refrigerant oil to add to an operating system	Chapters 10, 11, 12, 43, 47, 48, 51, 52
Adjusting blower fan speed	Chapter 16
Sizing, designing, and installing refrigerant lines	Chapters 4, 5, 10, 11, 12, 47, 51, 52
Describing a service valve and its operation	Chapters 11, 48, 49, 50
Determine refrigerant line pressure drop and explain the effects of pressure drop on a system	Chapters 48, 49, 50, 52
Describing proper soldering and brazing techniques	Chapters 5, 11, 14, 45, 50
Describing the function, selection and installation of a vibration eliminator	Chapters 42, 43
Describing the design structure, function, operation, and selection of refrigerant distributors and feeder tubes	Chapters 41, 45, 47
Installing a medium condensing unit	Chapters 41, 47, 50, 52
Installing a low temperature evaporator with electric defrost	Chapters 9, 45, 49
Describing the required cfm for evaporator operation and calculated airflow	Chapters 4, 28, 30, 31, 32
Installing a condensate drain for a low temperature system	Chapters 4, 5, 44, 41, 47
Describing a drain and drain pan heater and their operation	Chapters 9, 44, 47
Defining reclaim	Chapters 10, 11, 12
Defining and demonstrating refrigerant recycling	Chapters 10, 11,12, 47, 50
Defining and demonstrating refrigerant recovery	Chapters 10, 11, 12, 47, 50

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Competency / Task	Textbook Chapters
Explaining the proper use and handling of nitrogen in the leak detection process	Chapters 11, 12, 49, 50
Explaining the method for and pinpointing a leak	Chapters 10, 11, 12, 47, 49, 50
Explaining the proper use of each type of leak detector and their applicability	Chapters 10, 11, 12
Describing the six types of leak detectors and demonstrating their proper use	Chapters 10, 11
Identifying proper charging of a compound refrigerant into an operating system	Chapters 10, 11, 12
Identifying proper charging of a compound refrigerant into an empty system	Chapters 10, 11, 12
Determining superheat and subcooling on an operating system	Chapters 12, 44, 45, 52
Describing and performing a compressor efficiency test	Chapters 48, 49, 52
Selecting the proper refrigerant oil and adding it to an operating system	Chapter 10
Describing the following oils and their applications: mineral, alkylbenzene, glycols, and esters	Chapter 10
Demonstrating charging of a mini-split system with two or more evaporators	Chapter 42, 44, 46
Demonstrating charging using the manufacturer's literature	—
Identifying proper charging of a blended refrigerant by weight into an empty system	Chapters 10, 11, 12
Identifying proper charging of a blended refrigerant into an operating system	Chapters 10, 11, 12
Demonstrating charging using the subcooling method	Chapters 10, 11, 12, 47
Describing the proper procedure for measuring and adjusting evaporator superheat	Chapter 50
Stating the reason why capillary tube systems require a critical charge	Chapters 8, 12, 48
Describing a capillary/distributor tube sizing and selection procedure	Chapters 5, 9, 10, 45, 48
Calculating and demonstrating the weigh-in charging method	Chapters 12, 47
Describing the triple evacuation method	Chapters 12, 47
Demonstrating the triple evacuation method	Chapters 12, 47
Soldering and brazing using correct techniques	Chapters 5, 47

Competency / Task	Textbook Chapters
Evacuating and measuring system evacuation level	Chapters 12, 47
Explaining vacuum pump selection	Chapters 11, 12, 47
Identifying the types of micron gauges and how they should be connected to measure evacuation levels	Chapters 4, 11
Obtaining gauge pressure using compound gauges and converting to absolute	Chapters 11, 12, 52
Describing the operation and use of a gauge manifold assembly	Chapters 11, 12, 50
Identifying and differentiating between the various types of service valves	Chapters 11, 48, 49, 50
Defining compression ratio	Chapters 43, 46, 51
Describing the automatic pump-down system and its operation	Chapters 8, 12, 45, 48, 49, 50
Describing an air-cooled condenser, its function, and operating parameters	Chapters 8, 44, 52
Installing a water-cooled system and adjusting a water-regulating valve	Chapters 6, 47, 49, 50
Describing the function of and installing a lockout relay in a circuit	Chapters 14, 16, 17
Describing the operation of and installing a contactor	Chapters 14, 16, 17, 19, 49
Describing, testing, and installing a run and start capacitor	Chapters 14, 16, 17, 19, 49
Describing and installing a compressor potential start relay	Chapters 14, 16, 17, 19, 49
Describing the operation of and testing a high-pressure switch	Chapters 9, 14, 15, 16, 17, 19, 48, 49, 50
Describing the operation of and testing a low-pressure switch	Chapters 9, 14, 15, 16, 17, 19, 48, 49, 50
Install and adjust a low-pressure switch used for temperature control	Chapters 17, 19, 43, 45
Describing and wiring the terminal connections of a thermostat temperature control	Chapters 14, 16, 17, 19, 43, 45
Describing and testing thermistor-type temperature sensors (PTC and NTC)	Chapters 9, 14, 15, 17, 43
Describing the function, checking the operation, and wiring an oil pressure safety control	Chapters 4, 5, 11, 12, 14, 16, 17, 19, 43
Installing and adjusting a low-ambient temperature control	Chapters 4, 5, 11, 12, 14, 17, 19, 43, 44, 45, 47, 48, 49, 50
Testing a blower or fan motor and its circuit	Chapters 4, 12, 13, 15, 16, 18, 48, 49, 50

Competency / Task	Textbook Chapters
Describing the operation of and testing a hot-gas bypass valve	Chapters 4, 5, 11, 12, 14, 16, 17, 19, 43, 44, 48, 49, 50
Describing the operation of and adjusting an inline and pilot-operated evaporator pressure regulator	Chapters 4, 5, 11, 12, 14, 16, 17, 19, 43, 44, 48, 49, 50
Describing and installing a replaceable-core liquid-line drier	Chapters 5, 8, 11, 12, 45, 47, 48, 49
Describing and installing a replaceable-core suction-line filter-drier	Chapters 5, 8, 11, 12, 45, 47, 48, 49
Describing dry-type evaporators and their operation	Chapters 8, 44, 52
Describing the piping configuration for multiple-evaporator systems	Chapters 5, 10, 44, 45, 46, 47, 49, 50, 52
Describing the function and purpose of a multiple-compressor system	Chapters 41, 46, 52
Describing compressor capacity control methods and operation	Chapters 16, 43, 44, 45, 46, 51, 52
Describing a chilled-water system and its operation	Chapters 41, 43, 44, 45
Describing cooling towers and their operating limitations	Chapter 25, 44
Describing the operation and function of a flooded evaporator and its metering device	Chapters 8, 44, 45, 52
Students should have knowledge of and be able to describe and demonstrate the following safety requirements:	
Describe and perform “lock out and tag” procedures	Chapters 2, 14, 17, 47, 48, 49, 50
System leak-test pressures and nitrogen regulator installation and adjustment	Chapters 11, 12, 49, 50
Explain and demonstrate the proper method of connecting a micron gauge to the system	Chapters 4, 11
Commercial refrigeration 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, 14, 16, 17, 18, 19, 43, 44, 45, 47, 48, 49, 50
Knowledge of the following test instruments and tools is required:	

Competency / Task	Textbook Chapters
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 Soldering and brazing equipment	Chapters 4, 5, 11, 12, 13, 14, 18, 44, 45, 47, 48, 49, 50