Correlation of

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

(Goodheart-Willcox Publisher ©2025)

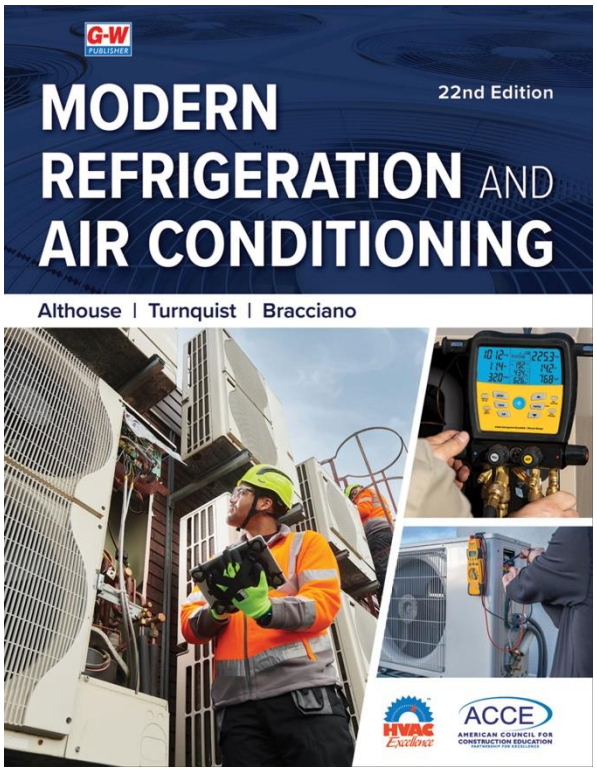
to

HVAC Excellence Competencies Task List: Gas Heat

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
Competencies with an asterisk are recommended by the United States Department of Energy.	
Students must have knowledge of heating systems, their components, and be able to demonstrate proficiency in:	
Describing and explaining the function of up flow, downflow, and horizontal furnaces	Chapters 33
Explaining combustion theory and heating fuels	Chapter 33
Explaining the properties of heating fuels	Chapter 33
Defining Btu	Chapters 6, 33, Appendices
Defining AFUE	Chapters 33, 40

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Competency / Task	Textbook Chapters
Describing and using the formula for sensible heat	Chapters 6, 33, 51
Describing the principles of humidification	Chapter 24
Describing the principles of dehumidification	Chapter 24
Explaining the Btu content of natural gas and propane gas	Chapter 33
Describing the fuel pressures in natural gas and liquefied petroleum (LP) gas piping	Chapter 33
Describing and measuring operating fuel pressures in natural gas and liquefied petroleum (LP) furnaces	Chapter 33
Describing the typical flue gas temperatures of gas-fired furnaces	Chapter 33
Describing the chemical names of natural gas and propane gas	Chapter 33
Determining the quantity of combustion air required to burn 1 cubic foot of natural gas and propane gas	Chapter 33
Defining and differentiating between primary air and excess air	Chapter 33
Stating the maximum percentage of carbon dioxide (CO_2) produced by the perfect combustion of natural gas	Chapter 33
Stating the maximum percentage of carbon dioxide (CO_2) produced by the perfect combustion of propane gas	Chapter 33
Explaining the ignition temperatures of natural gas and propane gas	Chapter 33
Describing and stating the causes of burner “flashback”	Chapter 33
Describing and stating the causes of a lifting flame	Chapter 33
Stating the reason for appropriate polarity wiring on solid-state circuits	Chapters 14, 15, 17, 19
Stating the generally accepted standard gas manifold pressure for a residential furnace	Chapter 33

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Competency / Task	Textbook Chapters
Describing, explaining the function of, evaluating, cleaning, and replacing (when feasible) the following components: Gas valves used with residential furnaces Gas pressure regulating valves Orifice In-shot burner Pilot burner Heat exchanger Flue baffles Residential gas shutoff valve Thermocouple Thermopile Ignition module Spark igniter Hot surface igniter Flame sensor Combination fan and limit switch Door safety switch Blower motor relay Vent blower motor Vent pressure switch Vent motor relay	Chapters 30, 33, 34, 36
Describing, explaining the function of, evaluating, cleaning, and replacing (when feasible) the following components: Single-stage thermostat Dual-stage thermostat Run and start capacitor Gas piping drip leg	Chapter 33
Describing a blower housing cut-off plate	Chapter 33
Identifying the different types of venting systems	Chapter 33
Sizing and installing the vent systems	Chapter 33
Properly sizing, cutting, threading, and connecting gas piping	Chapters 5, 33
Installing a fire-stop support plate	—
Adjusting blower fan speed for proper temperature rise	Chapters 16, 19, 32
Describing the procedure to measure static pressure	Chapter 33
Sizing wire with regards to voltage drop and length of wiring run	Chapter 14
*Describing dual fuel heat pump systems	Chapters 33, 34
*Installing and servicing a dual fuel thermostat	Chapters 33, 34

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Competency / Task	Textbook Chapters
*Describing the system balance point in a dual fuel system and how it is derived	Chapters 33, 34
Describing and demonstrating proper soldering procedures for electrical wiring	Chapter 5, 14
Setting the heat anticipation or cycling rate for a furnace thermostat	Chapter 36
Describing and demonstrating proper installation of a single- and two-stage thermostats	Chapter 36
Describing and demonstrating proper installation of a communication-type thermostat	Chapter 36
Adjusting airflow on a belt-driven blower assembly	Chapters 18, 29, 30, 38, 52
Describing the procedure to de-rate a gas furnace at altitudes of 2,000 feet and above	Chapter 33
Describing and demonstrating proper use of a combustion analyzer	Chapters 33, 34
Identifying the different types of conduits used for power	Chapter 14
Installing duct connectors and hangers	Chapters 29, 30
Describing and demonstrating proper installation of a duct-mounted carbon monoxide detector	Chapter 33
Gas 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 gas furnace system components, circuits, air distribution system, and/or power supply should be part of troubleshooting and problem solving.	Chapters 4, 5, 11, 12, 13, 14, 15, 16, 17, 18, 19, 27, 29, 30, 33, 36, 38
Students should have knowledge of and be able to describe and demonstrate the following safety requirements:	
Ladder safety procedures	Chapter 2
Clearances to combustibles for venting materials	Chapter 33
Maximum level of carbon monoxide in ppm in a flue gas sample	Chapter 33
Proper safety procedures to follow on discovery of a gas leak	Chapter 33
Knowledge of the following test instruments and tools is required:	

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Competency / Task	Textbook Chapters
Combustion analyzer Ohmmeter Combustible gas detector Voltmeter Carbon monoxide detector Manometer Pipe reamers Velometer Ammeter Pipe tap and die set Pipe cutter Pipe reamers	Chapters 4, 5, 11, 12, 17, 27, 33