



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

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 must have knowledge of heating systems, their components, and be able to demonstrate proficiency in:	
Describing and explaining the function of upflow, downflow, and horizontal furnaces	Chapters 38, 41
Explaining combustion theory and heating fuels	Chapter 41
Explaining the properties of heating fuels	Chapter 41
Defining Btu	Chapter 41
Defining AFUE	Chapters 38, 41, 46
Describing and using the formula for sensible heat	Chapters 4, 5, 50
Describing the principles of humidification	Chapter 35
Describing the principles of dehumidification	Chapter 35
Explaining the Btu content of natural gas and propane gas	Chapter 41
Describing the fuel pressures in natural gas and liquefied petroleum (LP) gas piping	Chapter 41

**Correlation of *Modern Refrigeration and Air Conditioning* to
HVAC Excellence Competencies Task List: Gas Heat—page 2**

Competency / Task	Textbook Chapter(s)
Describing and measuring operating fuel pressures in natural gas and liquefied petroleum (LP) furnaces	Chapter 41
Describing the typical flue gas temperatures of gas-fired furnaces	Chapters 38, 41
Describing the chemical names of natural gas and propane gas	Chapter 41
Determining the quantity of combustion air required to burn 1 cubic foot of natural gas and propane gas	Chapter 41
Defining and differentiating between primary air and excess air	Chapter 41
Stating the maximum percentage of carbon dioxide (CO ₂) produced by the perfect combustion of natural gas	Chapter 41
Stating the maximum percentage of carbon dioxide (CO ₂) produced by the perfect combustion of propane gas	Chapter 41
Explaining the ignition temperatures of natural gas and propane gas	Chapter 41
Describing and stating the causes of burner “flashback”	Chapter 41
Describing and stating the causes of a lifting flame	Chapter 41
Stating the reason for appropriate polarity wiring on solid-state circuits	Chapters 13, 14, 16, 18, 36
Stating the generally accepted standard gas manifold pressure for a residential furnace	Chapter 41
<p>Describing, explaining the function of, evaluating, cleaning, and replacing (when feasible) the following components:</p> <ul style="list-style-type: none"> 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 12, 13, 14, 15, 16, 17, 21, 23, 29, 36, 38, 40, 41, 42, 43, 52

**Correlation of *Modern Refrigeration and Air Conditioning* to
HVAC Excellence Competencies Task List: Gas Heat—page 3**

Competency / Task	Textbook Chapter(s)
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	Chapters 36, 38
Describing a blower housing cut-off plate	Chapter 32
Identifying the different types of venting systems	Chapter 41
Sizing and installing the vent systems	Chapter 41
Properly sizing, cutting, threading, and connecting gas piping	Chapters 8, 41
Installing a fire-stop support plate	
Adjusting blower fan speed for proper temperature rise	Chapters 15, 16, 18, 38
Describing the procedure to measure static pressure	Chapter 41
Sizing wire with regards to voltage drop and length of wiring run	Chapter 13
Describing and demonstrating proper soldering procedures for electrical wiring	
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 41
Describing and demonstrating proper use of a combustion analyzer	Chapters 41, 42
Identifying the different types of conduit used for power	Chapter 13
Installing duct connectors and hangers	Chapters 29, 30
Describing and demonstrating proper installation of a duct-mounted carbon monoxide detector	
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 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 27, 29, 30, 36, 38, 41

**Correlation of *Modern Refrigeration and Air Conditioning* to
HVAC Excellence Competencies Task List: Gas Heat—page 4**

Competency / Task	Textbook Chapter(s)
Students should have knowledge of and be able to describe and demonstrate the following safety requirements:	
Ladder safety procedures	Chapter 33
Clearances to combustibles for venting materials	Chapters 38, 41
Maximum level of carbon monoxide in ppm in a flue gas sample	Chapter 41
Proper safety procedures to follow on discovery of a gas leak	Chapter 41
Knowledge of the following test instruments and tools is required:	
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 7, 8, 10, 11, 17, 27, 41