

## Residential Air Conditioning

Standard Met

Competencies with an asterisk are recommended by the United States Department of Energy

|   |  | Page Number  |                                     |
|---|--|--------------|-------------------------------------|
| The three states of matter  |  | 9            | <input checked="" type="checkbox"/> |
| The laws of Thermodynamics  |  | 341, 342     | <input checked="" type="checkbox"/> |
| Heat transfer Convection, Conduction, and Radiation   |  | 343          | <input checked="" type="checkbox"/> |
| Atmospheric pressure and the effect of altitude   |  | 54           | <input checked="" type="checkbox"/> |
| Absolute and gauge pressures  |  | 54, 55       | <input checked="" type="checkbox"/> |
| Psychrometrics  |  | 344          | <input checked="" type="checkbox"/> |
| Refrigerant charging methods  |  | 90, 108      | <input checked="" type="checkbox"/> |
| Refrigerant piping  |  | 185, 320     | <input checked="" type="checkbox"/> |
| Soldering and brazing   |  | 187, 188     | <input checked="" type="checkbox"/> |
| Refrigerant leak detection and types of leak detectors  |  | 194          | <input checked="" type="checkbox"/> |
| Recovery and recycling processes  |  | 164          | <input checked="" type="checkbox"/> |
| Defining enthalpy and entropy   |  | 342, 344     | <input checked="" type="checkbox"/> |
| Change of state between liquids, vapor, and solids  |  | 9, 10        | <input checked="" type="checkbox"/> |
| Describing and defining the following; conduction, convection and radiant heat transfer                               |  | 343          | <input checked="" type="checkbox"/> |
| Describing, defining, and converting the following temperature measurements; Fahrenheit, Celsius, Rankine, and Kelvin |  | 342, 343     | <input checked="" type="checkbox"/> |
| Condensation of a vapor, and its effect on heat   |  | 10, 19, 34   | <input checked="" type="checkbox"/> |
| Vaporization of a liquid, and its effect on heat  |  | 10, 19, 35   | <input checked="" type="checkbox"/> |
| Describing the thermodynamics of refrigerants   |  | 11, 12, 28   | <input checked="" type="checkbox"/> |
| Describing and defining the following; BTU, latent heat, sensible heat  |  | 9, 108, 239  | <input checked="" type="checkbox"/> |
| Describing and defining the following; subcooled liquid, superheated vapor  |  | 14, 35, 36   | <input checked="" type="checkbox"/> |
| Describing the state of refrigerant, and explain what occurs in each major component during normal operation          |  | 20, 28       | <input checked="" type="checkbox"/> |
| Using saturation tables   |  | 40, 46       | <input checked="" type="checkbox"/> |
| Identifying and defining the following types of blends; Binary, Ternary, Azeotropic, and Near Azeotropic              |  | 47, 48       | <input checked="" type="checkbox"/> |
| Identifying and defining; CFC's, HCFC's, HFC's, HFO's & HC's  |  | 2, 3, 4      | <input checked="" type="checkbox"/> |
| Describing temperature glide  |  | 48, 49, 50   | <input checked="" type="checkbox"/> |
| Describing fractionation and its causes   |  | 338          | <input checked="" type="checkbox"/> |
| Describing and defining the following; wet bulb temperature, dry bulb temperature, and dew point                      |  | 49, 100, 238 | <input checked="" type="checkbox"/> |
| Measuring wet and dry-bulb temperatures   |  | 101, 102     | <input checked="" type="checkbox"/> |
| Defining wet bulb depression  |  | 101          | <input checked="" type="checkbox"/> |
| Describing the principles of dehumidification and humidification  |  | 38, 239      | <input checked="" type="checkbox"/> |
| Describing, explaining the function, evaluating, cleaning, and replacing (when feasible) of the following components: |  |              | <input checked="" type="checkbox"/> |
| <i>Compressors (reciprocating, scroll, rotary, and screw)</i>   |  | 308          | <input checked="" type="checkbox"/> |

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| Compressor capacity control methods and operation  |   | 310, 312, 331 | <input checked="" type="checkbox"/> |
| Condensers air cooled  |   | 19, 34, 323   | <input checked="" type="checkbox"/> |
| Condensers water cooled  |   | 19            | <input checked="" type="checkbox"/> |
| Metering devices (capillary tube, thermostatic expansion valve, automatic expansion valve, electronic expansion valve) |   | 37, 38, 289   | <input checked="" type="checkbox"/> |
| Evaporators  |   | 19, 35, 323   | <input checked="" type="checkbox"/> |
| Receivers  |   | 330           | <input checked="" type="checkbox"/> |
| Discharge line   |   | 226, 258, 325 | <input checked="" type="checkbox"/> |
| Liquid line  |   | 319, 320, 321 | <input checked="" type="checkbox"/> |
| Suction line   |   | 319, 320, 321 | <input checked="" type="checkbox"/> |
| Liquid line filter/drier   |   | 314           | <input checked="" type="checkbox"/> |
| Sight glass  |   | 330, 331      | <input checked="" type="checkbox"/> |
| Suction line filter  |   | 317           | <input checked="" type="checkbox"/> |
| Accumulator  |   | 323           | <input checked="" type="checkbox"/> |
| Head pressure controls   |   |               | <input type="checkbox"/>            |
| Low pressure controls  |   | 330, 331      | <input checked="" type="checkbox"/> |
| Pump down solenoid   |   | 330, 331      | <input checked="" type="checkbox"/> |
| Plotting the refrigeration cycle on a pressure enthalpy chart  |   |               | <input type="checkbox"/>            |
| Defining SEER and EER  |   | 237           | <input checked="" type="checkbox"/> |
| Describing the operation and use of a wireless probe set and smart diagnostic application                              | * | 62, 101, 233  | <input checked="" type="checkbox"/> |
| Describing the operation and use of a gauge manifold assembly  |   | 57, 58        | <input checked="" type="checkbox"/> |
| Identifying and differentiate between the various types of service valves  |   | 84            | <input checked="" type="checkbox"/> |
| Obtaining gauge pressure using compound gauges and convert to absolute   |   | 54, 55        | <input checked="" type="checkbox"/> |
| Defining vacuum and vacuum levels as required in the HVACR industry  |   | 199, 200      | <input checked="" type="checkbox"/> |
| Identifying the types of micron gauges and how they should be connected to measure evacuation levels                   |   | 200, 201, 204 | <input checked="" type="checkbox"/> |
| Explaining vacuum pump selection   |   | 199, 205, 206 | <input checked="" type="checkbox"/> |
| Evacuating and measuring system evacuation level   |   | 200, 210      | <input checked="" type="checkbox"/> |
| Describing the triple evacuation method  |   | 225           | <input checked="" type="checkbox"/> |
| Soldering and brazing using correct techniques   |   | 187, 188      | <input checked="" type="checkbox"/> |
| Demonstrating the triple evacuation method   |   | 225           | <input checked="" type="checkbox"/> |
| Calculating and demonstrating the weigh-in charging method   |   | 112, 114, 214 | <input checked="" type="checkbox"/> |
| Demonstrating charging using the superheat method  |   | 104           | <input checked="" type="checkbox"/> |
| Demonstrating charging using the subcooling method   |   | 95            | <input checked="" type="checkbox"/> |
| Identifying proper charging of a blended refrigerant into an operating system  |   | 118, 144      | <input checked="" type="checkbox"/> |
| Identifying proper charging a blended refrigerant by weight into an empty system                                       |   | 113, 216      | <input checked="" type="checkbox"/> |
| Demonstrating charging using the manufacturers literature  |   | 110, 115, 232 | <input checked="" type="checkbox"/> |
| Demonstrating charging a mini-split system with two or more evaporators  |   |               | <input type="checkbox"/>            |
| Describing the following oils and their applications; Mineral, Alkylbenzene, Glycols, and Esters                       |   | 312           | <input checked="" type="checkbox"/> |

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| Select the proper refrigerant oil and add it to an operating system   |  | 312           | <input checked="" type="checkbox"/> |
| Defining compression ratio  |  | 233           | <input checked="" type="checkbox"/> |
| Describing and performing a compressor efficiency test  |  |               | <input type="checkbox"/>            |
| Determine superheat and subcooling on an operating system   |  | 96, 104, 108  | <input checked="" type="checkbox"/> |
| Identifying proper charging of a compound refrigerant into an empty system  |  | 113, 123      | <input checked="" type="checkbox"/> |
| Identifying proper charging of a compound refrigerant into an operating system  |  | 130, 162      | <input checked="" type="checkbox"/> |
| Describing the six types of leak detectors and demonstrating the proper use   |  | 193, 194      | <input checked="" type="checkbox"/> |
| Explaining the proper use of each type of leak detector and their applicability   |  | 193, 194      | <input checked="" type="checkbox"/> |
| Explaining the method for and pinpointing a leak  |  | 195, 196      | <input checked="" type="checkbox"/> |
| Explaining the proper use and handling of nitrogen in the leak detection process  |  | 190           | <input checked="" type="checkbox"/> |
| Defining and demonstrating refrigerant recovery   |  | 171, 172      | <input checked="" type="checkbox"/> |
| Defining and demonstrating refrigerant recycling  |  | 177           | <input checked="" type="checkbox"/> |
| Defining reclaim  |  | 177           | <input checked="" type="checkbox"/> |
| Installing an air handler   |  | 185, 186      | <input checked="" type="checkbox"/> |
| Installing a condensing unit  |  | 185, 186      | <input checked="" type="checkbox"/> |
| Adjusting blower fan speed  |  | 244, 245      | <input checked="" type="checkbox"/> |
| Select the proper refrigerant oil it to an operating system   |  | 312           | <input checked="" type="checkbox"/> |
| Perform a compressor efficiency test  |  |               | <input type="checkbox"/>            |
|   |  |               |                                     |
| Ladder and fall protection safety procedures  |  | 340           | <input checked="" type="checkbox"/> |
| Lock Out and Tag Out procedures   |  | 341           | <input checked="" type="checkbox"/> |
| Proper and safe handling of refrigerants  |  | 117, 340      | <input checked="" type="checkbox"/> |
| Proper PPE requirements   |  | 340           | <input checked="" type="checkbox"/> |
| Emergency First Aid procedures  |  | 340           | <input checked="" type="checkbox"/> |
| Proper use of hand tools  |  | 53, 66, 79    | <input checked="" type="checkbox"/> |
|   |  |               |                                     |
| Troubleshooting and Problem Solving involve diagnostic procedures requiring the use of test equipment, manufacturers' installation and start up procedures, and data plate information. |  | 244, 246      | <input checked="" type="checkbox"/> |
|   |  |               |                                     |
| Thermometers (wet and dry)  |  | 101           | <input checked="" type="checkbox"/> |
| Gauge manifold assembly   |  | 58, 72        | <input checked="" type="checkbox"/> |
| Refrigerant throttling valve  |  | 122           | <input checked="" type="checkbox"/> |
| Charging scale and charging cylinder  |  | 113, 114, 118 | <input checked="" type="checkbox"/> |
| Soldering and brazing equipment   |  | 187, 188      | <input checked="" type="checkbox"/> |
| Flaring tool/ tubing cutters  |  |               | <input type="checkbox"/>            |
| Tubing benders  |  |               | <input type="checkbox"/>            |
| Nitrogen Cylinder   |  | 191, 192      | <input checked="" type="checkbox"/> |

|                               |   |          |                                     |
|-------------------------------|---|----------|-------------------------------------|
| Leak detector                 |   | 194, 195 | <input checked="" type="checkbox"/> |
| Valve Core removal tool       |   | 79       | <input checked="" type="checkbox"/> |
| Micron gauge                  |   | 200      | <input checked="" type="checkbox"/> |
| Vacuum pump                   |   | 208      | <input checked="" type="checkbox"/> |
| Recovery equipment            |   | 172      | <input checked="" type="checkbox"/> |
| Wireless refrigeration probes | * | 52, 62   | <input checked="" type="checkbox"/> |