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| **CONTENT STANDARD 1.0: TRADE MATH** |
| **Performance Standard 1.1: Basic Math** |
| 1.1.1 | Perform addition, subtraction, multiplication, and division calculations of whole numbers. |
| 1.1.2 | Perform addition and subtraction calculations of common fractions. |
| 1.1.3 | Perform multiplication and division calculations of common fractions. |
| 1.1.4 | Perform addition, subtraction, multiplication, and division calculations of decimal fractions. |
| 1.1.5 | Perform ratio and proportion calculations. |
| 1.1.6 | Perform percent, percentage, and discount calculations. |
| 1.1.7 | Perform angular, length, and converted temperature measure calculations. |
| 1.1.8 | Perform area calculations. |
| 1.1.9 | Perform volume calculations. |
| 1.1.10 | Solve basic equations. |
| 1.1.11 | Demonstrate the use of order of operations. |
| **CONTENT STANDARD 2.0: GENERAL SAFETY** |
| **Performance Standard 2.1: Workplace Safety** |
| 2.1.1 | Describe potential excavation site hazards. |
| 2.1.2 | Explain proper personal protective equipment (PPE) use. |
| 2.1.3 | Describe proper material handling, storage, use, and disposal. |
| 2.1.4 | Describe ladder, stairway, and scaffold hazards and proper use. |
| 2.1.5 | Describe jobsite electrical hazards and proper lockout/tagout use. |
| 2.1.6 | Describe proper refrigerant and pressure vessel usage and storage. |
| 2.1.7 | Identify safety data sheets (SDS) properties of chemicals specific to HVAC. |
| 2.1.8 | Identify and describe environmental hazards (e.g. lead, silica, asbestos, carbon monoxide).  |
| 2.1.9 | Identify the hazards associated with confined spaces. |
| 2.1.10 | Use appropriate fire extinguishers and other such safety devices. |
| 2.1.11 | Identify the importance safety procedures for brazing and soldering. |
| **CONTENT STANDARD 3.0: TOOLS AND MATERIALS** |
| **Performance Standard 3.1: Power and Hand Tool Use** |
| 3.1.1 | Describe proper hand tool use. |
| 3.1.2 | Describe proper power tool use. |
| 3.1.3 | Identify proper use of various types of torches. |
| 3.1.4 | Identify proper use of piping and tubing fabrication tools. |
| **CONTENT STANDARD 4.0: ENERGY SOURCES** |
| **Performance Standard 4.1: Energy Sources** |
| 4.1.1 | Explain natural, LP gas, and fuel oil combustion characteristics. |
| 4.1.2 | Describe the application of geothermal systems. |
| 4.1.3 | Describe the application of renewable energy systems. |
| 4.1.4 | Describe the application of electric production systems. |
| **CONTENT STANDARD 5.0: BASIC SYSTEMS OVERVIEW** |
| **Performance Standard 5.1: Basic Systems Overview** |
| 5.1.1 | Describe fossil-fuel and electrical furnace operations. |
| 5.1.2 | Describe the typical configuration of residential split air conditioning systems. |
| 5.1.3 | List various types of commercial air conditioning systems and their application. |
| 5.1.4 | Describe the configuration of common duct systems. |
| **CONTENT STANDARD 6.0: INTRO TO APPLIED SCIENCE** |
| **Performance Standard 6.1: Intro to Applied Science** |
| 6.1.1 | Perform energy conversion calculations. |
| 6.1.2 | Perform sensible, latent, and total heat calculations. |
| 6.1.3 | Differentiate between saturated, superheated, and subcooled refrigerant. |
| 6.1.4 | Explain atmospheric, absolute, and gauge pressure relationship. |
| 6.1.5 | Convert gauge pressure, absolute pressure, and vacuum. |
| 6.1.6 | Diagram a basic refrigeration cycle identifying pressure, temperature, and state of refrigerant. |
| 6.1.7 | List the type and function of the four major refrigeration components. |
| 6.1.8 | Describe the methods of heat transfer. |
| **CONTENT STANDARD 7.0: APPLIANCE INSTALLATION** |
| **Performance Standard 7.1: Appliance Installation** |
| 7.1.1 | Apply NEC standards to HVAC electrical circuit installations. |
| 7.1.2 | Interpret HVAC manufacturer electrical name plate data. |
| 7.1.3 | Apply appropriate code standards. |
| 7.1.4 | Describe gas, oil, and electrical appliance installation, start-up, and checkout procedures. |
| 7.1.5 | Describe sheet metal, fiberglass, and flex duct installation procedures. |
| 7.1.6 | Describe split and packaged air conditioning system installation, start-up, and checkout procedures. |
| **CONTENT STANDARD 8.0: INTRODUCTION TO CONSTRUCTION DRAWINGS AND SPECIFICATIONS** |
| **Performance Standard 8.1: Introduction to Construction Drawings and Specifications** |
| 8.1.1 | Identify the application of architectural plans and specifications. |
| 8.1.2 | Interpret mechanical, plumbing, and electrical drawing symbols. |
| 8.1.3 | Interpret specification documents and apply to plans. |
| 8.1.4 | Interpret shop drawings and apply to plans and specifications. |
| 8.1.5 | Describe a submittal and its derivation, routing, and makeup. |
| 8.1.6 | Develop cut lists for duct runs from shop drawings. |
| 8.1.7 | Interpret as-built modifications on HVAC mechanical plans. |
| 8.1.8 | Perform HVAC equipment and material takeoff. |
| **CONTENT STANDARD 9.0: BASIC ELECTRICITY** |
| **Performance Standard 9.1: Basic Electricity** |
| 9.1.1 | Describe basic electrical theory. |
| 9.1.2 | Describe series, parallel, and combination circuit characteristics. |
| 9.1.3 | Calculate electrical circuit values. |
| 9.1.4 | Describe electrical meter functions. |
| 9.1.5 | Measure electrical circuit values. |
| 9.1.6 | Identify electrical symbols. |
| 9.1.7 | Draw basic HVAC electrical circuit diagrams. |
| 9.1.8 | Interpret basic residential HVAC schematic diagrams. |
| 9.1.9 | Interpret basic commercial HVAC schematic diagrams. |
| 9.1.10 | Explain AC circuit characteristics. |
| 9.1.11 | Describe power distribution transformer systems. |
| 9.1.12 | Calculate HVAC branch circuit conductor, breaker, and disconnect sizes. |
| 9.1.13 | Describe basic motor theory. |
| 9.1.14 | Describe the five single-phase motor types. |
| 9.1.15 | Identify single-phase motor diagrams. |
| 9.1.16 | Explain single-phase motor starting relay operation. |
| 9.1.17 | Calculate motor capacitor replacement values. |
| 9.1.18 | Explain three-phase motor operation. |
| 9.1.19 | Explain ECM motor operation. |
| 9.1.20 | Perform Ohm’s law calculations to series, parallel, and combination circuits. |
| **CONTENT STANDARD 10.0: INDOOR AIR QUALITY** |
| **Performance Standard 10.1: Indoor Air Quality** |
| 10.1.1 | Describe indoor air quality (IAQ) factors as related to HVAC. |
| 10.1.2 | Identify various indoor air quality pollutant and pollutant pathways. |
| 10.1.3 | Describe indoor air quality evaluation and measurement tools. |
| 10.1.4 | Explain appropriate prevention, control, and resolution strategies for IAQ issues. |
| 10.1.5 | Recognize when to involve IAQ professionals as necessary. |
| **CONTENT STANDARD 11.0: RESIDENTIAL LOAD CALCULATIONS** |
| **Performance Standard 11.1: Residential Load Calculations** |
| 11.1.1 | Identify the importance of heat load calculation in building design. |
| 11.1.2 | Differentiate sensible, latent, and total heat gain/loss. |
| 11.1.3 | Determine U values and R values for various building construction components. |
| 11.1.4 | Calculate Btu gain/loss values using HTM and temperature difference factors. |
| 11.1.5 | Determine heating and cooling load temperature difference and daily range values. |
| 11.1.6 | Explain the relationship between house orientation and solar heat gain. |
| 11.1.7 | Perform building component area and volume calculations from construction drawings. |
| 11.1.811.1.911.1.1011.1.12 | Perform winter/summer infiltration calculations using Manual J procedures.Perform heat gain calculations using Manual J procedures.Perform heat loss calculations using Manual J procedures.Determine sensible, latent, and total heat for house block and room values. |
| **CONTENT STANDARD 12.0: BASIC CONTROLS** |
| **Performance Standard 12.1: Basic Controls** |
| 12.1.1 | Differentiate between operating and safety controls. |
| 12.1.2 | Describe the sequence of operation of standing pilot, intermittent, and direct ignition control systems. |
| 12.1.3 | Interpret basic gas furnace wiring diagrams. |
| 12.1.4 | Explain oil furnace primary control operation. |
| 12.1.5 | Describe electric furnace operating sequence. |
| 12.1.6 | Describe hydronic heating system controls. |
| 12.1.7 | Describe basic motor circuit troubleshooting procedures. |
| 12.1.8 | Interpret packaged and split air conditioning systems and wiring diagrams. |
| 12.1.9 | Identify commercial and industrial air conditioning system control methods. |
| 12.1.10 | Describe basic electronic control system troubleshooting procedures. |
| **CONTENT STANDARD 13.0: SYSTEM AIR FLOW AND DUCT SIZING** |
| **Performance Standard 13.1: System Air Flow and Duct Sizing** |
| 13.1.1 | Describe basic air flow characteristics. |
| 13.1.2 | Explain duct system pressures. |
| 13.1.3 | Calculate duct system air flow. |
| 13.1.4 | Determine proper air flow requirements. |
| 13.1.5 | Describe air distribution system configurations. |
| 13.1.6 | Select primary heating/cooling equipment using nationally recognized standards. |
| 13.1.7 | Determine air-side component pressure drops from manufacturer tables. |
| 13.1.8 | Sketch a residential duct system layout using nationally recognized standards. |
| 13.1.9 | Determine duct size based on nationally recognized standards. |
| **CONTENT STANDARD 14.0: BASIC AIR CONDITIONING AND REFRIGERATION** |
| **Performance Standard 14.1: Basic Air Conditioning and Refrigeration** |
| 14.1.1 | Explain latent, sensible, and total heat differences. |
| 14.1.2 | Diagram refrigeration cycle conditions and components. |
| 14.1.3 | Explain pressure-enthalpy diagrams. |
| 14.1.4 | Describe compressor design differences, efficiencies, and applications. |
| 14.1.5 | Explain water/air-cooled condenser operation and performance. |
| 14.1.6 | Describe metering device design and operation. |
| 14.1.7 | Describe refrigeration accessory components and operation. |
| 14.1.8 | Describe evaporator types. |
| 14.1.9 | Identify proper refrigerant line sizing and installation practices. |
| 14.1.10 | Explain various refrigerant physical and chemical properties. |
| 14.1.11 | Explain refrigerant oil properties and application. |
| 14.1.12 | Describe proper refrigeration system access procedures. |
| 14.1.13 | Differentiate between recovered, recycled, and reclaimed refrigerant. |
| 14.1.14 | Describe proper refrigerant recovery, evacuation, and charging procedures. |
| 14.1.15 | Describe the operation of a variable refrigerant flow system. |
| **CONTENT STANDARD 15.0: INTRODUCTION TO HYDRONIC SYSTEMS** |
| **Performance Standard 15.1: Introduction to Hydronic Systems** |
| 15.1.1 | Identify hydronic piping system configurations. |
| 15.1.2 | Describe hydronic system components. |
| 15.1.3 | Explain hydronic systems drain and fill procedures. |
| 15.1.4 | Diagram basic hydronic system control circuits. |
| **CONTENT STANDARD 16.0: BASIC SHEET METAL** |
| **Performance Standard 16.1: Basic Sheet Metal** |
| 16.1.1 | Define sheet metal layout terms. |
| 16.1.2 | Explain parallel line development procedures. |
| 16.1.3 | Layout and fabricate the following sheet metal fitting: Pittsburgh seam and square elbow. |
| 16.1.4 | Layout and fabricate the following sheet metal fitting: 90 degree elbow and transition. |
| 16.1.5 | Explain radial line development procedures. |
| 16.1.6 | Layout and fabricate the following sheet metal fitting: symmetrical tapered duct. |
| 16.1.7 | Layout and fabricate the following sheet metal fitting: square to square tapered duct. |
| 16.1.8 | Explain triangulation development procedures. |
| 16.1.9 | Layout and fabricate the following sheet metal fitting: two-way offset transition. |
| 16.1.10 | Layout and fabricate the following sheet metal fitting: tapered duct section. |
| **CONTENT STANDARD 17.0: INTRODUCTION TO SERVICE** |
| **Performance Standard 17.1: Introduction to Service** |
| 17.1.1 | Identify air conditioning system problems. |
| 17.1.2 | Prescribe air conditioning system problem solutions. |
| 17.1.3 | Identify gas heating system problems. |
| 17.1.4 | Prescribe gas heating system problem solutions. |
| 17.1.5 | Identify oil heating system problems. |
| 17.1.6 | Prescribe oil heating system problem solutions. |
| 17.1.7 | Identify electric heating system problems. |
| 17.1.8 | Prescribe electric heating system problem solutions. |
| 17.1.9 | List gas, oil, and electric heating and air conditioning maintenance procedures. |
| **CONTENT STANDARD 18.0: ADVANCED HVAC SYSTEMS** |
| **Performance Standard 18.1: HVAC Systems** |
| 18.1.1 | Explain commercial fan coil unit operation. |
| 18.1.2 | Explain package unit building system configurations. |
| 18.1.3 | Describe building chilled water system operation. |
| 18.1.4 | Describe induced and forced draft cooling tower operation. |