



## ***CUSTOMIZED TEACHER ASSESSMENT BLUEPRINT***

### **HVAC MAINTENANCE TECHNOLOGY**

**Test Code: 5937**

**Version: 01**

#### ***Specific competencies and skills tested in this assessment:***

##### **Introduction to HVAC**

Identify HVAC systems

Demonstrate awareness of occupational requirements

##### **Basic Safety**

Identify causes of jobsite accidents and measures to prevent them

Identify jobsite hazards and describe measures to prevent them from occurring

Identify and demonstrate the use of personal protective equipment

Demonstrate the knowledge of OSHA regulations

##### **Tools for HVAC/R**

Identify and safely use basic hand tools used in the trade

Identify and safely use basic power tools used in the trade

##### **Blueprint Reading**

Identify types of blueprint plans

Read and interpret blueprint plans

##### **Piping Practices**

Select, measure, cut, and ream piping and tubing

Assemble piping projects and pressure test according to trade standards

Identify and assemble PVC pipe and fittings

Assemble copper tubing projects and pressure test according to trade standards

Solder copper tubing

Braze and silver solder ACR tubing

Identify and demonstrate proper use of fittings and tools for steel (black) pipe

Assemble corrugated stainless steel gas tubing (CSST) projects

Identify piping material such as PVC, ABS, copper, black iron

##### **Basic Electricity**

Calculate basic electrical quantities using Ohm's Law

Recognize and draw various types of electrical schematics and symbols

Demonstrate electrical testing to include mechanical/electronic relays

Wire series circuit, parallel circuit, and series/parallel circuit

Install electric disconnects, circuit breakers, and fuses

Identify and test capacitors

Identify electrical motors and their applications

Recognize motor control protection and start devices

Demonstrate knowledge of transformers and their applications

## *HVAC Maintenance Technology (continued)*

### **Introduction to Cooling**

Measure temperature and pressure of a cooling system  
Calculate superheat and subcooling  
Locate and describe components of the basic refrigeration cycle  
Apply pressure temperature charts for various refrigerants  
Describe the functions of compressors  
Describe the functions of condensers  
Describe the functions of evaporators  
Describe the functions of metering devices  
Evaluate effects of airflow on system performance

### **Introduction to Heating**

Describe the principles of combustion  
Identify temperatures and pressures of a heating system  
Identify components of various heating systems  
Perform maintenance on a gas furnace  
Troubleshoot conventional/condensing gas heating equipment  
Identify oil heating equipment  
Install and adjust oil fired equipment  
Perform annual preventive maintenance on oil fired equipment  
Troubleshoot oil fired equipment  
Identify electric heating equipment  
Install heating/air conditioning thermostats according to manufacturer's standards  
Perform combustion analysis on oil and gas fired equipment

### **Air Distribution Systems**

Identify and describe the different types of duct system components  
Measure temperature, humidity, and air velocities  
Determine velocity, static, and total air pressures in a system  
Perform basic duct fabrication functions

### **Introduction to Hydronic Systems**

Describe hot water heating system components  
Install and service hydronic systems

### **Leak Detection, Evacuation, Recovery, and Charging**

Locate refrigerant leaks using common types of leak detectors  
Perform refrigerant recovery  
Perform system evacuation and dehydration  
Determine when to charge with liquid versus vapor  
Weigh in correct system charge (when appropriate)

*HVAC Maintenance Technology (continued)*

**Troubleshooting Gas Heating**

Perform gas burner flame proving tests according to trade standards

Demonstrate how to install, troubleshoot, and service gas heating equipment

**Troubleshooting Cooling**

Identify control system components

Demonstrate, install, troubleshoot, and service cooling equipment

**Heat Pumps**

Explain heat pump modes of operation

Identify and describe heat pump components

Demonstrate how to install heat pumps

**Computer Fundamentals**

Identify and demonstrate skills with computer software relating to HVAC

*HVAC Maintenance Technology (continued)*

**Written Assessment:**

Administration Time: 3 hours  
Number of Questions: 194

***Areas Covered:***

2%	Introduction to HVAC
7%	Basic Safety
2%	Tools for HVAC/R
2%	Blueprint Reading
12%	Piping Practices
14%	Basic Electricity
12%	Introduction to Cooling
15%	Introduction to Heating
7%	Air Distribution Systems
5%	Introduction to Hydronic Systems
7%	Leak Detection, Evacuation, Recovery, and Charging
4%	Troubleshooting Gas Heating
4%	Troubleshooting Cooling
5%	Heat Pumps
2%	Computer Fundamentals

**Sample Questions:**

When using a ladder around electrical lines, the worker should

- A. make sure the ladder has a good base
- B. use wooden stand-offs
- C. not use a metal ladder
- D. wrap the ladder in rags

What is capillary attraction when soldering or brazing?

- A. when the filler metal flows away from the heat
- B. when the capillary tube is connected to the suction line
- C. when the filler metal flows toward the heat
- D. when hot fluid metal rises only to the top of the pipe

The purpose of a step-down transformer is to

- A. decrease secondary current
- B. increase the current for the control circuit
- C. decrease secondary voltage
- D. reduce voltage for control circuit safety

Incomplete combustion results from a lack of

- A. fuel
- B. oxygen
- C. carbon monoxide
- D. carbon dioxide

A hydronic zone-control valve is actuated by the

- A. temperature of water
- B. circulator
- C. thermostat
- D. pressure of water

*HVAC Maintenance Technology (continued)*

**Performance Assessment:**

Administration Time: 3 hours  
Number of Jobs: 3

***Areas Covered:***

- 34%      **Brazing or Soldering**  
*Participant will use safety considerations to flare and braze or solder using a torch. Assemble pieces according to figure shown and absence of leaks.*
- 33%      **Refrigerant Recovery**  
*Participant will calibrate manifold gauges, install and remove gauges properly and safely. Purge manifold gauge hoses, adjust/position service valves to read pressures. Recover and replace the correct amount of refrigerant and complete System Conditions Sheet for Job 2.*
- 33%      **Gas Furnace Start-Up and Check-Out**  
*Participant will test, verify, and adjust manifold gas pressure. Leak test gas connections, check electrical connections, measure and record unit supply voltage. Install thermostat, start equipment, test and adjust burner manifold pressure. Test temperature rise, check fan motor amperage draw, perform steady-state efficiency test, and calculate unit CFM.*

***Sample Job:***                      Refrigerant Recovery

***Maximum Job Time:***              60 minutes

***Participant Activity:***              Participant will secure the required materials, tools, and equipment, adjust manifold gauges, install gauges properly and safely, purge manifold gauge hoses using the *de minimis rule*, adjust/position service valves to read pressures or other pertinent conditions, recover the refrigerant using the recovery unit and cylinder, utilizing the *vapor recovery method*, complete the System Conditions Sheet, turn the system on, and return the refrigerant.