



# Job Ready Assessment Blueprint

## HVACR-Installation and Start-up



Test Code: 2111 / Version: 01

## General Assessment Information

### Blueprint Contents

General Assessment Information	Sample Written Items
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**Test Type:** The HVAC-Installation and Start-up industry-based credential is included in NOCTI's Job Ready assessment battery. Job Ready assessments measure technical skills at the occupational level and include items which gauge factual and theoretical knowledge. Job Ready assessments typically offer both a written and performance component and can be used at the secondary and post-secondary levels. Job Ready assessments can be delivered in an online or paper/pencil format.

**Revision Team:** The assessment content is based on input from secondary, post-secondary, and business/industry representatives from the states of Connecticut, Mississippi, New Jersey, New York, Pennsylvania, and Tennessee.



47.0201- Heating, Air Conditioning, Ventilation, and Refrigeration Maintenance Technology/Technician



Career Cluster 2- Architecture and Construction



49-9021.01- Heating and Air Conditioning Mechanics and Installers



The Association for Career and Technical Education (ACTE), the leading professional organization for career and technical educators, commends all students who participate in career and technical education programs and choose to validate their educational attainment through rigorous technical assessments. In taking this assessment you demonstrate to your school, your parents and guardians, your future employers and yourself that you understand the concepts and knowledge needed to succeed in the workplace. Good Luck!



North American Technician Excellence (NATE) is the nation's largest non-profit certification organization for heating, ventilation, air conditioning and refrigeration (HVACR) technicians. NATE is the only certification organization that was developed by, and supported by, the entire HVACR industry for nearly 20 years. NATE offers over 20 HVACR certificates and certifications that represent and validate a technician's real world working knowledge of HVACR systems. Students passing NOCTI assessments in the area of Secondary HVACR Installer and Start-up, and Secondary HVACR Service and Repair are prime candidates to enter today's workforce and achieve success earning NATE certifications in the future.



NATIONAL COLLEGE CREDIT RECOMMENDATION SERVICE  
University of the State of New York - Regents Research Fund

In the lower division baccalaureate/associate degree category, 3 semester hours in HVAC, Refrigeration, or General Technology.

## Written Assessment

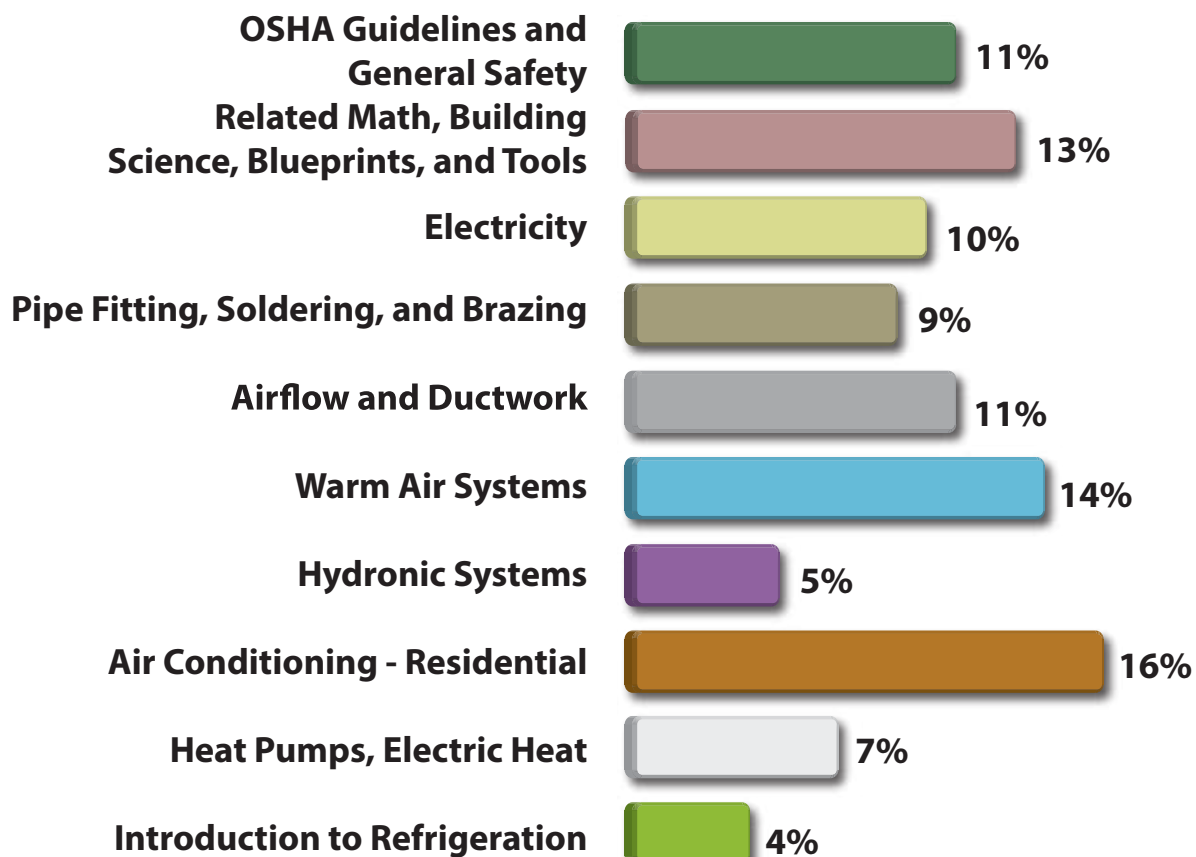
NOCTI written assessments consist of questions to measure an individual's factual theoretical knowledge.

**Administration Time:** 3 hours

**Number of Questions:** 143

**Number of Sessions:** This assessment may be administered in one, two, or three sessions.

### Areas Covered



## Specific Standards and Competencies Included in this Assessment

### **OSHA Guidelines and General Safety**

- Apply personal and environmental safety procedures, including personal protective equipment (PPE)
- Demonstrate understanding of fire protection equipment and procedures
- Demonstrate knowledge of electrical safety procedures
- Demonstrate knowledge of HVAC-specific safety procedures

### **Related Math, Building Science, Blueprints, and Tools**

- Demonstrate understanding of modes of heat transfer and British Thermal Unit (BTU)
- Measure with a ruler, correctly identify fractions
- Calculate GPM, CFM, and CFM per ton
- Understand the properties of air
- Accurately interpret blueprints and electrical diagrams
- Identify, use, and maintain hand and power tools

### **Electricity**

- Demonstrate understanding of basic electrical theory and codes
- Exhibit knowledge of series and parallel circuits
- Identify, install, and test various electrical circuits and components (thermostats, transformers, fuses, relays, etc.)

### **Pipe Fitting, Soldering, and Brazing**

- Solder and/or braze, and leak test tubings and fittings
- Set up and operate torch and equipment
- Properly use various piping and tubing types and fittings

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## Specific Standards and Competencies (continued)

### Airflow and Ductwork

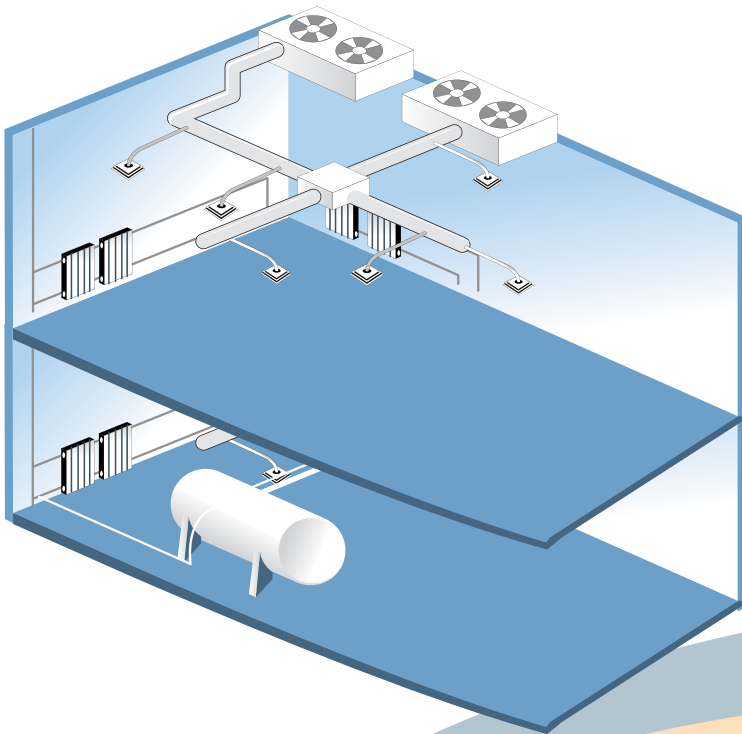
- Identify proper duct design and sizing
- Understand how to fabricate a fiberglass or metal duct
- Understand how to install duct, fasteners, supports, and hangers
- Understand how to insulate ducts
- Identify duct fabrication tools

### Warm Air Systems

- Demonstrate knowledge of sequence of operation
- Properly set up and adjust warm air equipment, including verification of ignition and flame proving devices
- Understand flue installation and sizing, adhering to appropriate gas codes

### Hydronic Systems

- Demonstrate understanding of hydronic system operation
- Demonstrate understanding of hydronic operating pressures and temperatures



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## Specific Standards and Competencies (continued)

### Air Conditioning – Residential

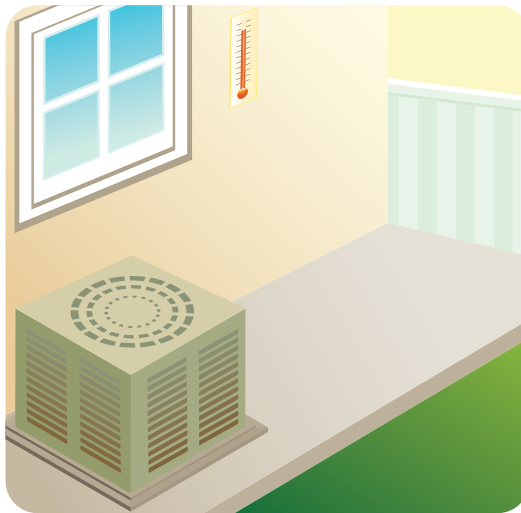
- Identify refrigerants by pressure and temperature relationship
- Identify system components and metering devices
- Measure system temperatures and pressures, including sub-cooling and superheat
- Understand how to recover, pressure test, evacuate, and charge an air conditioning system, according to EPA 608 Clean Air Act requirements

### Heat Pumps, Electric Heat

- Demonstrate understanding of proper operation of heat pumps, reversing valve, defrost controls, and various other component functions
- Install and wire auxiliary/emergency heat, including outdoor thermostats
- Identify types of heat pumps (water sourced, air-to-air, dual fuel)

### Introduction to Refrigeration

- Demonstrate knowledge of refrigeration components
- Identify various types of refrigeration systems



## Sample Questions

**When referring to wire size, the larger the gauge number, the**

- A. larger the diameter of wire
- B. smaller the diameter of wire
- C. larger the ampacity
- D. thicker the insulation

**When closing duct board, the staple configuration is a/an \_\_\_\_\_ staple.**

- A. 9/16 inch carpet
- B. ceiling
- C. outward-clinch
- D. inward-clinch

**What is the color code of a tank of R-410A refrigerant?**

- A. white
- B. green
- C. sky blue
- D. rose

**Reciprocating compressors are cooled by**

- A. liquid refrigerant
- B. suction vapor
- C. discharge gas
- D. subcooled refrigerant

**In a gas burner system, the color of a correctly adjusted natural gas flame is**

- A. blue
- B. green
- C. red
- D. yellow

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**Sample Questions (continued)**

**During the brazing operation, nitrogen is purged through ACR tubing to**

- A. prevent an explosion
- B. prevent discoloration
- C. prevent oxidation
- D. provide tube washout

**The amp draw of each leg of a three-phase motor should be**

- A. within  $\pm 20$  percent of each other
- B. almost equal to each other
- C. higher on one leg
- D. lower on the start winding

**Scroll compressors are used primarily in**

- A. large industrial refrigeration and air conditioning
- B. residential air conditioning
- C. small commercial refrigeration units
- D. domestic refrigerators

**Use a/an \_\_\_\_\_ to check a defrost solenoid coil.**

- A. amp-probe
- B. velometer
- C. monometer
- D. multi-meter

**Hydronics is the science of**

- A. gas furnaces
- B. refrigeration study
- C. heating with water
- D. pneumatics



## Performance Assessment

NOCTI performance assessments allow individuals to demonstrate their acquired skills by completing actual jobs using the tools, materials, machines, and equipment related to the technical area.

**Administration Time:** 2 hours and 25 minutes

**Number of Jobs:** 3

### Areas Covered:

#### 37% Brazing and Soldering

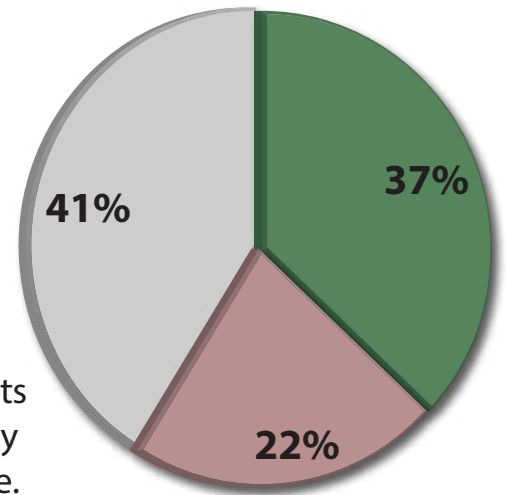
Participants will follow safety criteria, use correct flare and solder/braze, and correctly use the torch. Participants will measure dimensions and follow procedures correctly for a final project with no leaks and a correct appearance.

#### 22% Refrigerant Recovery

Participants will calibrate the manifold gauges, install and remove gauges properly and safely, purge the gauge hoses, adjust the service valves, recover refrigerant, and complete system conditions sheet.

#### 41% Gas Furnace Start-Up and Check-Out

Participants will test, verify, and adjust incoming gas pressure, leak test gas connections, check electrical connections and unit supply voltage, install digital thermostat, start equipment, test and adjust burner manifold pressure and temperature rise, check fan amperage, perform steady-state efficiency test, calculate unit CFM, and complete systems operations sheet.



## Sample Job

### Refrigerant Recovery

**Maximum Time:** 30 minutes

**Participant Activity:** The participant will secure the required materials, tools, and equipment, adjust manifold gauges, install gauges properly and safely, purge manifold gauge hoses using De minimis venting, adjust/set position of service valves to read pressures or other pertinent conditions, recover the refrigerant using a recovery unit and DOT 49 cylinder utilizing the vapor recovery method, and complete the System Conditions information sheet.

