

## Heating, Ventilation & Air Conditioning (HVAC)

### Level II Unit Outline

#### **Unit 1: Agenda Book Review/Classroom Rules**

- Class discussion of student agenda book
- Review of classroom rules
- School safety protocols, district drills and emergency evacuations, behavior and meeting locations
- Review expectations and school policies for electronic devices

#### **Unit 2: Safety, First Aid, Personal Protective Equipment and Shop Attire**

- Identify, discuss, locate first aid and blood borne kits
- Identify, locate and demonstrate function and purpose of the Emergency Eye Station
- Identify, discuss, locate fire extinguisher
- Identify, distribute and discuss function and uses of protective eyewear, appropriate personal protective equipment (PPE) required in shop, and acceptable shop attire
- Identify, show location and discuss function and uses of the SDS (Safety Data Sheets) and how to interpret the information about paints and aerosols, content precautions, material labeling
- Equipment safety protocols
- Identify, demonstrate shop ventilation systems where applicable
- Identify locate and discuss function of shop flammable cabinet where applicable
- Discuss and demonstrate shop housekeeping of supplies, work stations and room maintenance
- Discuss and identify electrical safety considerations in the shop area
- Compile a safety section in the student shop notebook
- Identify, demonstrate air gauge function and operation where applicable
- Completion of online safety course and successful passing of safety test(s)

#### **Unit 3 – Cooling Tools, Parts and Equipment**

- Students will list and identify all relevant basic hand tools
- Students will note and learn to identify types of tubing
- Students will differentiate between tubing and fitting
- Students will list and identify specialty tools
- Conduct proper assessment of student understanding of items listed above

#### **Unit 4 – Specialized Tools, System Identification, Specific Application Materials**

- Students will differentiate between tubing and fitting to be used in specific applications

- Students will demonstrate the ability to recognize various refrigeration systems and equipment
- Students will list and identify specialty tools and apply them in a shop environment
- Conduct proper assessment of student understanding of items listed above

#### **Unit 5 – Advanced Industry Skills**

- Students will show proficiency determining tubing and fitting sizes and applications
- Students will demonstrate the ability to cut piping correctly
- Students will display the skill to bend tubing with advanced proficiency correctly
- Students will perform soldering and brazing of copper pipe
- Students will perform cutting and threading of steel pipe
- Students will design drainage systems for refrigeration equipment utilizing PVC
- Students will fabricate sheet metal components and basic duct systems
- Conduct proper assessment of student understanding of items listed above

#### **Unit 6 – Applied Theory of Heat**

- Students will identify equipment with the appropriate corresponding mode of heat transfer
- Apply the total heat formula to calculated heat totals in various substances
- Practical application of gas laws as related to refrigerants and other industry gases
- Practical application of the pressure temperature chart
- Practical and theoretical application of superheat and sub-cooling calculations

#### **Unit 7 – Refrigeration**

- Practical exploration of refrigeration components and their related application
- Assign compressors by their individual qualities and applications
- Utilize specific evaporators in exact applications
- Install and set metering devices
- Utilize specific condensers in exact applications
- Utilize accessories in specific conditions
- Exhibit an understanding of the most common refrigerants and their applications
- Conduct proper assessment of student understanding of items listed above

#### **Unit 8 – Applied Electrical Concepts**

- Utilize various conductors for specific applications
- Learn to apply Ohms law in a practical experiment and explore its utility in the HVAC field
- Differentiating between the use of direct and alternating current within equipment
- Identify series circuits and alternating circuits within a specific system

- Practical use of electrical schematics both as ladder and pictorial drawings
- List all related electrical components and detail each purpose and application
- Utilize the appropriate measuring device to acquire measurements of various electrical qualities
- Demonstrate advanced proficiency in the use circuit interrupting devices and related safety

### **Unit 9 – Controls**

- Identify the purpose and usage of controls
  - Relays
  - Contactors
  - Switches
  - Control boards
  - Digital controls
- Identify the purpose and usage of loads
  - Compressor Motors
  - Relay Coils
  - Timer motors
  - Fan and blower motors
  - Pump motors
- Conduct proper assessment of student understanding of items listed above

### **Unit 10 – Air Conditioning**

- Explain the specific qualities of high temperature refrigeration
- List types of compressors and their individual qualities and applications
- Catalog types of evaporators and their individual qualities and applications
- List types of metering devices and their individual qualities and applications
- Record types of condensers and their individual qualities and applications
- Have the ability to differentiate between package and split unit qualities and applications
- Identify the purpose and usage of mechanical sequencing
- Identify the different types of equipment
- Catalog air qualities
- Understand and explain the differences between the various cooling mediums

### **Unit 11 – Refrigeration: Mechanical**

- Discuss medium and low temperature refrigeration
- Identify mechanical components such as compressors, condensers, evaporators, metering devices, accumulators, and receivers
- Explain the mechanical sequence of operations

- Identify the different types of equipment

#### **Unit 12 – Introduction to Installation Practices**

- Students will list general installation practices
- Students will outline and note specific practices according to local codes
- Students will explore limitation of work according to specific licensing and other credentials

#### **Unit 13 – Service and Maintenance Procedures**

- Students will learn how to clean condenser coils
- Students will learn how to clean evaporator coils
- Students will list various air quality accessories
- Students will replace appropriate filters
- Students will explore the adverse effects resulting from lack of maintenance
- Students will learn to document all pertinent information when performing a service

#### **Unit 14 – Troubleshooting**

- Discuss the troubleshooting process
- Outline mechanical troubleshooting procedures
- Apply troubleshooting techniques and procedures to actual mechanical and electrical equipment
- Exhibit proper service procedures for Air conditioning package units as well as split systems
- Demonstrate field acceptable refrigeration service procedures

#### **Unit 15 – Green HVAC Technology: Cooling**

- Research the various alternative cooling systems and produce a PowerPoint presentation discussing their findings
- Acquire an understanding of alternative cooling systems
- Explain the difference between Ultra-High efficiency systems and the varying types of green technology
- Introduction and application of Low GWP (Global Warming Potential) Refrigerants and Safety
  - Low GWP refrigerant safety and application

HVAC

New Jersey Student Learning Standards

**NJ Learning Standards 9.3**

<b>CONTENT AREA:</b>	<b>9.3 CAREER AND TECHNICAL EDUCATION</b>
<b>MANUFACTURING CAREER CLUSTER®</b>	
<b>Number</b>	<b>Standard Statement</b>
<i>By the end of Grade 12, Career and Technical Education Program completers will be able to:</i>	
<b>CAREER CLUSTER®:</b>	<b>MANUFACTURING (MN)</b>
<b>PATHWAY:</b>	<b>MAINTENANCE, INSTALLATION, &amp; REPAIR (MN-MIR)</b>
<b>9.3.MN-MIR.1</b>	Demonstrate maintenance skills and proficient operation of equipment to maximize manufacturing performance.
<b>9.3.MN-MIR.2</b>	Demonstrate the safe use of manufacturing equipment to ensure a safe and healthy environment.
<b>9.3.MN-MIR.3</b>	Diagnose equipment problems and effectively repair manufacturing equipment.
<b>9.3.MN-MIR.4</b>	Investigate and employ techniques to maximize manufacturing equipment performance.
<b>9.3.MN-MIR.5</b>	Implement a preventative maintenance schedule to maintain manufacturing equipment, tools and workstations.
<b>9.3.MN-MIR.6</b>	Implement an effective, predictive and preventive manufacturing equipment maintenance program.