Lesson 1 - Test Equipment (Part 1)
Objectives:

- Describe the basic operation of the d'Arsonval meter movement.
- Explain the difference between analog and digital measuring instruments.
- Distinguish between voltmeters, ammeters, ohmmeters, and multimeters, and describe the operational principles of each.
- Explain how the sensitivity of a voltmeter is calculated.
- Describe how various electrical meters are used to measure resistance, voltage, and current, and to check for continuity.
- Demonstrate how clamp-on ammeters are used.
- Describe the basic operation of a Wheatstone bridge, and explain how it can be configured to act as a resistance bridge or a capacitance bridge.

Lesson 2 - Test Equipment (Part 2)
Objectives:

- Explain the operation of a wattmeter.
- Demonstrate how to read a watt-hour meter.
- Describe how to determine the power factor of a circuit by using a power factor meter.
- Describe how a varmeter can be used in correcting power factor problems.
- Explain the purposes and use of various instrument transformers.
- Explain the operation of megohmmeter.
- Explain the purpose and use of various recording instruments.
- Describe how a compressor analyzer can be used in troubleshooting.

Lesson 3 - Resistors
Objectives:

- Observe the proper safety precautions when taking ohmmeter readings.
- Select the best range for a particular resistance measurement.
- "zero adjust" an analog ohmmeter.
- Determine the resistance values of various types of resistors.
- Use an ohmmeter to test resistors, potentiometers, rheostats, bleeder resistors, thermistors, PTC start-assist devices, and diodes.

Lesson 4 - Capacitors
Objectives:

- Observe the proper safety precautions when taking capacitance readings.
- Explain the differences between start and run capacitors.
- Discharge a capacitor safely.
- Describe the four main problems or conditions that identify a faulty capacitor.
- Describe the operation of various types of instruments used for testing capacitors.

Lesson 5 - Relays, Contactors, and Starters
Objectives:

- List common causes of relay failure.
- Describe the physical indications that identify defective relays and contactors.
- Explain how to test pilot-duty relays and line-duty relays.
- Explain how to test contactors and starters.
- Explain how to test potential relays and current relays.

- Explain how to test time-delay relays.

Lesson 6 - Transformers
Objectives:

- Describe the conditions that cause transformers to fail.
- Describe the physical indications that identify defective transformers.
- Explain the differences between residential and commercial transformers.
- Determine the current-carrying capacity of a control transformer.
- Explain how to test different types of transformers.
- Define open circuit voltage (OCV).
- Test continuity between the primary and secondary windings of a transformer.

Lesson 7 - Thermostats
Objectives:

- Describe the basic construction operation of a bimetal mechanical thermostat.
- Explain the concept of anticipation.
- Describe some of the physical indications that identify defective thermostats.
- Test a mechanical thermostat with a voltmeter and/or ohmmeter.
- Set an adjustable anticipator.
- Calibrate a mechanical thermostat.
- Explain the differences between residential and commercial thermostats.
- Identify common problems that affect electronic thermostats, and explain basic troubleshooting techniques.

Lesson 8 - Motors
Objectives:

- List the basic types of motors used in the HVACR industry.
- Describe some of the visual indications that identify defective motors.
- Explain the difference between fractional-horsepower motors and integral-horsepower motors.
- Determine the speed and rotation of a motor.
- Use appropriate test instruments to troubleshoot various types of motors and their associated starting circuits.
- Describe some of the causes of overheating in electric motors.
- Explain what causes single phasing in a three-phase motor.
- Calculate voltage and current imbalances in three-phase motors.
- Describe basic motor replacement procedures.
- Read a motor nameplate.
- Use NEMA data to determine motor frame sizes and dimensions.

Lesson 9 - Hermetic Compressors
Objectives:

- Explain the differences among open, semi-hermetic, and hermetic compressors.
- Describe the various starting methods used for single-phase hermetic compressors.
- Explain the function and operation of overload protection devices use in hermetic compressors.

- Check a single-phase hermetic compressor for proper resistance, voltage, and current readings.
- Identify the terminals of a single-phase hermetic compressor, even if they are unmarked.
- Check a three-phase hermetic compressor for proper resistance, voltage, and current readings.
- Calculate voltage and current imbalances in three-phase hermetic compressors.

Lesson 10 - Semi-Hermetic Compressors
Objectives:

- Explain the differences between hermetic and semi-hermetic compressors.
- Describe the various starting methods used for single-phase semi-hermetic compressors.
- Check a single-phase semi-hermetic compressor for proper resistance, voltage, and current readings.
- Identify the terminals of a single-phase semi-hermetic compressor, even if they are unmarked.
- Check a three-phase semi-hermetic compressor for proper resistance, voltage, and current readings.
- Calculate voltage and current imbalances in three-phase semi-hermetic compressors.
- Explain what causes single phasing in three-phase semi-hermetic compressors.
- Explain the function and operation of overload protection devices use in semi-hermetic compressors.

Lesson 11 - Electronic Components
Objectives:

- Explain how to test diodes, both with an analog meter and a digital meter.
- Explain how to test NPN and PNP transistors.
- Explain how to test silicon-controlled rectifiers (SCRs).
- Explain how to test triacs.
- Describe the effects that electrostatic discharge (ESD) can have on electronic components.
- List the precautions that you should take to prevent ESD damage when servicing electronic components.
- Demonstrate logical troubleshooting procedures when diagnosing printed circuit (PC) boards.

Lesson 12 - Wiring Systems
Objectives:

- Describe the different types of wiring systems used in the HVACR industry.
- Test single-phase residential power circuits for voltage drop, voltage imbalance, and current imbalance.
- Test three-phase commercial power circuits for voltage drop, voltage imbalance, and current imbalance.
- Define ampacity, and explain how wire sizes are selected for given applications.
- Troubleshoot low-voltage control circuits.
- Troubleshoot high-voltage ac control circuits.
- Troubleshoot direct digital control (DDC) circuits.
- Describe some of the basic problems encountered in all wiring systems.

Lesson 13 - Glossary of Terms