



BAKER COLLEGE
STUDENT LEARNING OUTCOMES

DSL 2410 Heavy Duty Heating and Air Conditioning
4 Semester Hours

Student Learning Outcomes & Enabling Objectives

1. Evaluate HVAC Systems
 - a. Verify the need for service or repair of HVAC systems based on unusual operating noises.
 - i. Determine needed action.
 - b. Verify the need for service or repair of HVAC systems based on unusual visual, smell, and touch conditions.
 - i. Determine needed action.
 - c. Identify system type and components (cycling clutch orifice tube – CCOT, expansion valve).
 - i. Conduct performance test(s) on HVAC systems.
 - ii. Determine needed action.
 - d. Retrieve diagnostic codes.
 - i. Determine needed action.

2. Evaluate A/C System and Components – A/C System-General
 - a. Identify the causes of temperature control problems in the A/C system.
 - i. Determine needed action.
 - b. Identify refrigerant and lubricant types.
 - i. Check for contamination.
 - ii. Determine needed action.
 - c. Identify A/C system problems indicated by pressure gauge and temperature readings.
 - i. Determine needed action.
 - d. Identify A/C system problems indicated by visual, audible, smell, and touch procedures.
 - i. Determine needed action.
 - e. Perform A/C system leak test.

- i. Determine needed action.
 - f. Service A/C system using appropriate equipment.
 - i. Recover A/C system using appropriate equipment.
 - ii. Evacuate A/C system using appropriate equipment.
 - iii. Recharge A/C system using appropriate equipment.
 - g. Identify contamination in the A/C system components.
 - i. Determine needed action.
 - h. Interact with vehicle's on-board computer.
 - i. Perform diagnostic procedures using recommended electronic service tool(s) (including PC based software and/or data scan tools).
 - ii. Determine needed action.
- 3. Examine A/C System and Components – Compressor and Clutch
 - a. Identify A/C system problems that cause protection devices (pressure, thermal, and electronic) to interrupt system operation.
 - i. Determine needed action.
 - b. Test A/C system pressure, thermal, and electronic protection services.
 - i. Replace as needed.
 - c. Inspect A/C compressor drive belts, pulleys, and tensioners.
 - d. Replace A/C compressor drive belts, pulleys, and tensioners.
 - i. Adjust belt tension
 - ii. Check alignment.
 - e. Test A/C compressor clutch components or assembly.
 - i. Service as needed, i.e. adjust or replace.
 - f. Inspect A/C compressor lubricant level (if applicable).
 - i. Adjust as needed.
 - g. Inspect A/C compressor mountings and hardware.
 - i. Repair as needed.
 - ii. Replace as needed.
- 4. Examine A/C System and Components – Evaporator, Condenser, and Related Components
 - a. Correct system lubricant level when replacing the evaporator, condenser, receiver/drier or accumulator/drier, and hoses.
 - b. Inspect A/C system hoses, lines, filters, fittings, and seals.
 - i. Determine needed action.
 - c. Test A/C system condenser.
 - i. Check for proper airflow and mountings.
 - ii. Determine needed action.
 - d. Inspect receiver/drier or accumulator/drier.
 - i. Replace as needed.

- e. Test cab/sleeper refrigerant solenoid, expansion valve(s).
 - i. Check placement of thermal bulb (capillary tube).
 - ii. Determine needed action.
 - f. Remove orifice tube.
 - g. Replace orifice tube.
 - h. Test cab/sleeper evaporator core.
 - i. Determine needed action.
 - i. Inspect evaporator housing and water drain.
 - i. Clean as needed.
 - ii. Repair as needed.
 - j. Service evaporator air filter.
 - k. Inspect A/C system service ports (gauge connections).
 - i. Determine needed action.
 - l. Identify the cause of system failures resulting in refrigerant loss from the A/C system high pressure relief device.
 - i. Determine needed action
5. Evaluate Heating and Engine Cooling Systems
- a. Identify causes of outlet air temperature control problems in the HVAC system.
 - i. Determine needed action.
 - b. Identify window fogging problems.
 - i. Determine needed action.
 - c. Perform engine cooling system tests for leaks, protection level, contamination, coolant level, coolant type, temperature, and conditioner concentration.
 - i. Determine needed action.
 - d. Inspect engine cooling and heating system hoses, lines, and clamps.
 - i. Determine needed action.
 - e. Test radiator, pressure cap, and coolant recovery system (surge tank).
 - i. Determine needed action.
 - f. Inspect water pump.
 - i. Determine needed action.
 - g. Test thermostats, by-passes, housings, and seals.
 - i. Determine needed repairs.
 - h. Service (i.e. recover, flush, and refill) with recommended coolant/additive package.
 - i. Bleed cooling system.
 - i. Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud.
 - i. Determine needed action.
 - j. Test heating system coolant control valve(s) and manual shutoff valves.
 - i. Determine needed action.

- k. Inspect heater core.
 - i. Flush heater core.
 - ii. Determine needed action.
6. Evaluate Operating Systems and Related Controls – Electrical
- a. Identify causes of HVAC electrical control system problems.
 - i. Determine needed action.
 - b. Test HVAC blower motors, resistors, switches, relays, modules, wiring, and protection devices.
 - i. Determine needed action.
 - c. Test A/C compressor clutch relays, modules, wiring, sensors, switches, diodes, and protection devices.
 - i. Determine needed action.
 - d. Test A/C related electronic engine control systems.
 - i. Determine needed action.
 - e. Test engine cooling/condenser fan motors, relays, modules, switches, sensors, wiring, and protection devices.
 - i. Determine needed action.
 - f. Test electric actuator motors, relays/modules, switches, sensors, wiring, and protection devices.
 - i. Determine needed action.
 - g. Test HVAC system electrical/electronic control panel assemblies.
 - i. Determine needed action.
 - h. Communicate with vehicle's on-board computer.
 - i. Perform diagnostic procedures using recommended electronic service tool(s) (including PC based software and/or data scan tools).
 - ii. Determine needed action.
7. Evaluate Operating Systems and Related Controls – Air/Mechanical
- a. Identify causes of HVAC air and mechanical control problems.
 - i. Determine needed action.
 - b. Test HVAC system air and mechanical control panel assemblies.
 - i. Determine needed action.
 - c. Test HVAC system air and mechanical control cables and linkages.
 - i. Service as needed.
 - d. Test HVAC system actuators and hoses.
 - i. Service as needed.
 - e. Test HVAC system ducts, doors, and outlets.
 - i. Service as needed.
8. Evaluate Refrigerant Recovery, Recycling, and Handling

- a. Maintain correct operation of certified equipment.
 - i. Verify certification of equipment.
- b. Identify A/C system refrigerant.
 - i. Recover A/C system refrigerant.
- c. Recycle refrigerant.
- d. Properly dispose of refrigerant.
- e. Properly handle refrigerant.
- f. Properly label refrigerant.
- g. Properly store refrigerant.
- h. Test recycled refrigerant for non-condensable gases.

Big Ideas

Path of refrigerant flow through the A/C system.

Temperature and Pressure relationships.

Latent heat of evaporation and condensation.

A/C clutch Cycle time and performance.

Essential questions

What is the path that refrigerant takes through an A/C system?

Where does the refrigerant change states in an A/C system and what causes the changes?

What safety precautions must be followed when working with mobile A/C systems?

What equipment is needed to safely and environmentally safely work on mobile A/C systems?

These SLOs are approved for experiential credit.

Effective: Fall 2021