Arkansas CTE

Diesel Electrical Systems: Grades 10, 11, 12

Adopted 2015

Demonstrate the employability skills necessary to obtain and maintain employment in the automotive industry.

1.1 Demonstrate personal business etiquette for the automotive industry.

1. Report to work daily on time; able to take directions and motivated to accomplish the task at hand. 1.1.1
2. Dress appropriately and use language and manners suitable for the workplace. 1.1.2
3. Maintain appropriate personal hygiene. 1.1.3
4. Meet and maintain employment eligibility criteria, such as drug/alcohol-free status, clean driving record, etc. 1.1.4
5. Demonstrate honesty, integrity and reliability. 1.1.5

1.2 Demonstrate personal work ethic and habits.

1. Comply with workplace policies/laws. 1.2.1
2. Contribute to the success of the team by assisting others and requesting help when needed. 1.2.2
3. Identify and address the needs of all customers, providing helpful, courteous and knowledgeable service and advice as needed. 1.2.3
4. Negotiate solutions to interpersonal and workplace conflicts. 1.2.4
5. Contribute ideas and initiatives for workplace effectiveness. 1.2.5
6. Follow directions for shop protocol. 1.2.6
7. Demonstrate appropriate communication effectively with customers and coworkers. 1.2.7
8. Read and interpret workplace policies and procedures. 1.2.8
9. Analyze and resolve problems that arise in completing assigned tasks. 1.2.9
10. Organize and implement a productive plan of work. 1.2.10
11. Use technical principles, problem solving and critical thinking skills to accomplish assigned tasks. 1.2.11

1.3 Investigate training and entrepreneurial opportunities in the diesel industry.

1. Evaluate the personal characteristics of a successful professional in the industry. 1.3.1
2. Identify the training opportunities within the architecture and construction industry. 1.3.2
3. Explore extended learning and leadership opportunities in career and technical education student organizations. 1.3.3
4. Examine work-based learning opportunities for students in the industry. 1.3.4
5. Locate in-demand career opportunities within a chosen region of the state. 1.3.5
6. Demonstrate the ability to apply for employment within the industry. 1.3.6

Demonstrate personal and shop safety measures.

2.1 Identify general shop safety rules and procedures.

1. Locate and demonstrate knowledge of material safety data sheets (MSDS). 2.1.1
2. Explain purposes for marked safety areas. 2.1.2
3. Identify the location and use of eye wash stations. 2.1.3
4. Identify the location of the posted evacuation routes. 2.1.4
5. Identify and wear appropriate clothing for lab/shop activities. 2.1.5
6. Utilize proper ventilation procedures for working within the lab/shop area. 2.1.6
7. Secure hair and jewelry for lab/shop activities. 2.1.7
8. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. 2.1.8
9. Demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. 2.1.9

2.2 Utilize safe procedures for handling of tools.

1. Demonstrate safe handling and use of automotive tools. 2.2.1
2. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. 2.2.2

2.3 Demonstrate knowledge of the procedures for using safety equipment.

1. Identify and use proper placement of floor jacks and jack stands. 2.3.1
2. Identify and use proper procedures for safe lift operation. 2.3.2
3. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. 2.3.3
4. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.). 2.3.4

2.4 Demonstrate knowledge of engine safety.

1. Check engine starting/operation (including unusual noises, vibrations, exhaust smoke, etc.); record idle and governed rpm. 2.4.1
2. Inspect vibration damper. 2.4.2
3. Inspect belts, tensioners, and pulleys; check and adjust belt tension; check belt alignment. 2.4.3
4. Check engine oil level and condition; check dipstick seal. 2.4.4
5. Inspect engine mounts for looseness and deterioration. 2.4.5
6. Check engine for oil, coolant, air, fuel, and exhaust leaks (Engine Off and Running). 2.4.6
7. Check engine compartment wiring harnesses, connectors, and seals for damage and proper routing. 2.4.7

Demonstrate knowledge and application of vehicle maintenance and repair preparation.

3.1 Demonstrate appropriate use of diesel electrical systems service tools.

1. Identify tools and their usage in electrical systems applications. 3.1.1
2. Identify standard and metric designation. 3.1.2
3. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dial-caliper). 3.1.3

3.2 Demonstrate the ability to prepare the vehicle for service.

1. Identify information needed and the service requested on a repair order. 3.2.1
2. Demonstrate proper use of fender covers, and mats. 3.2.2
3. Demonstrate awareness of customer expectations for vehicle repair. 3.3.3

Inspect, analyze, test, and replace general diesel electrical systems.

4.1 Demonstrate the ability to inspect, analyze and test electrical systems.

1. Read and interpret electrical/electronic circuits using wiring diagrams. 4.1.1
2. Check continuity in electrical/electronic circuits using appropriate test equipment. 4.1.2
3. Check applied voltages, circuit voltages, and voltage drops in electrical/electronic circuits using appropriate test equipment 4.1.3
4. Check current flow in electrical/electronic circuits and components using appropriate test equipment. 4.1.4
5. Check resistance in electrical/electronic circuits and components using appropriate test equipment. 4.1.5
6. Locate shorts, grounds, and opens in electrical/electronic circuits. 4.1.6
7. Identify parasitic (key-off) battery drain problems; perform tests; determine needed action. 4.1.7
8. Inspect and test fusible links, circuit breakers, relays, solenoids, and fuses; replace as needed. 4.1.8
9. Inspect and test spike suppression devices; replace as needed. 4.1.9
10. Check frequency and pulse width signal in electrical/electronic circuits using appropriate test equipment. 4.1.10

4.2 Demonstrate the ability to inspect, analyze and test the starting system.

1. Perform starter circuit cranking voltage and voltage drop tests; determine needed action. 4.2.1
2. Inspect and test components (key switch, push button and/or magnetic switch) and wires and harnesses in the starter control circuit; replace as needed. 4.2.2
3. Inspect and test, starter relays and solenoids/switches; replace as needed. 4.2.3
4. Remove and replace starter; inspect flywheel ring gear or flex plate. 4.2.4

4.3 Demonstrate the ability to inspect, test and repair the charging system.

1. Test instrument panel mounted volt meters and/or indicator lamps; determine needed action. 4.3.1
2. Identify causes of a no charge, low charge, or overcharge problems; determine needed action. 4.3.2
3. Inspect and replace alternator drive belts, pulleys, fans, tensioners, and mounting brackets; adjust drive belts and check alignment. 4.3.3
4. Perform charging system voltage and amperage output tests; perform AC ripple test; determine needed action. 4.3.4
5. Perform charging circuit voltage drop tests; determine needed action. 4.3.5
6. Remove and replace alternator. 4.3.6
7. Inspect, repair, or replace cables, wires, and connectors in the charging circuit. 4.3.7

4.4 Demonstrate the ability to inspect, analyze and test the lighting systems.

1. Interface with vehicle's on-board computer; perform diagnostic procedures using recommended electronic service tool(s) and determine needed action. 4.4.1
2. Identify causes of brighter than normal, intermittent, dim, or no headlight and daytime running light (DRL) operation. 4.4.2
3. Test, aim, and replace headlights. 4.4.3
4. Test headlight and dimmer circuit switches, relays, wires, terminals, connectors, sockets, and control components/modules; repair or replace as needed. 4.4.4
5. Inspect and test switches, bulbs/LEDs, sockets, connectors, terminals, relays, wires, and control components/modules of parking, clearance, and taillight circuits; repair or replace as needed. 4.4.5
6. Inspect and test instrument panel light circuit switches, relays, bulbs/LEDs, sockets, connectors, terminals, wires, and printed circuits/control modules; repair or replace as needed. 4.4.6
7. Inspect and test interior cab light circuit switches, bulbs/LEDs, sockets, low voltage disconnect (LVD), connectors, terminals, wires, and control components/modules; repair or replace as needed. 4.4.7
8. Inspect and test tractor-to-trailer multi-wire connector(s); repair or replace as needed. 4.4.8
9. Inspect, test, and adjust stoplight circuit switches, bulbs/LEDs, sockets, connectors, terminals, wires and control components/modules; repair or replace as needed. 4.4.9
10. Inspect and test turn signal and hazard circuit flasher(s), switches, relays, bulbs/LEDs, sockets, connectors, terminals, wires and control components/modules; repair or replace as needed. 4.4.10
11. Inspect and test reverse lights and warning device circuit switches, bulbs/LEDs, sockets, horns, buzzers, connectors, terminals, wires and control components/modules; repair or replace as needed. 4.4.11

4.5 Demonstrate the ability to inspect, analyze and test the gauges and warning devices.

1. Interface with vehicle's on-board computer; perform diagnostic procedure, verify instrument cluster operations using recommended electronic service tool(s) (including PC based software and/or data scan tools); determine needed action. 4.5.1
2. Identify causes of intermittent, high, low, or no gauge readings; determine needed action. 4.5.2
3. Identify causes of data bus-driven gauge malfunctions; determine needed action. 4.5.3
4. Inspect and test gauge circuit sensor/sending units, gauges, connectors, terminals, and wires; repair or replace as needed. 4.5.4
5. Inspect and test warning devices (lights and audible) circuit sensor/sending units, bulbs/LEDs, sockets, connectors, wires, and control components/modules; repair or replace as needed. 4.5.5
6. Inspect, test, replace, and calibrate (if applicable) electronic speedometer, odometer, and tachometer systems. 4.5.6

4.6 Demonstrate the ability to inspect, analyze and test related electrical systems.

1. Interface with vehicle's on-board computer; perform diagnostic procedures using recommended electronic service tool(s) (including PC based software and/or data scan tools); determine needed action. 4.6.1
2. Identify causes of constant, intermittent, or no horn operation; determine needed action. 4.6.2
3. Inspect and test horn circuit relays, horns, switches, connectors, wires, clock springs, and control components/modules; repair or replace as needed. 4.6.3
4. Identify causes of constant, intermittent, or no wiper operation; diagnose the cause of wiper speed control and/or park problems; determine needed action. 4.6.4
5. Inspect and test wiper motor, resistors, park switch, relays, switches, connectors, wires and control components/modules; repair or replace as needed. 4.6.5
6. Inspect wiper motor transmission linkage, arms, and blades; adjust or replace as needed. 4.6.6
7. Inspect and test windshield washer motor or pump/relay assembly, switches, connectors, terminals, wires, and control components/modules; repair or replace as needed. 4.6.7
8. Inspect and test side view mirror motors, heater circuit grids, relays, switches, connectors, terminals, wires and control components/modules; repair or replace as needed. 4.6.8
9. Inspect and test heater and A/C electrical components including: A/C clutches, motors, resistors, relays, switches, connectors, terminals, wires, and control components/modules; repair or replace as needed. 4.6.9
10. Inspect and test auxiliary power outlet, integral fuse, connectors, terminals, wires, and control components/modules; repair or replace as needed. 4.6.10
11. Identify causes of slow, intermittent, or no power window operation; determine needed action. 4.6.11
12. Inspect and test motors, switches, relays, connectors, terminals, wires, and control components/modules of power window circuits; repair or replace as needed. 4.6.12
13. Inspect and test block heaters; determine needed repairs. 4.6.13
14. Inspect and test cruise control electrical components; repair or replace as needed. 4.6.14
15. Inspect and test switches, relays, controllers, actuator/solenoids, connectors, terminals, and wires of electric door lock circuits. 4.6.15
16. Check operation of keyless and remote lock/unlock devices; determine needed action. 4.6.16
17. Inspect and test engine cooling fan electrical control components/modules, wiring; repair or replace as needed. 4.6.17

18. Identify causes of data bus communication problems; determine needed action. 4.6.18

4.7 Demonstrate the ability to inspect, analyze and test the battery and starting systems.

1. Inspect battery box(es), cover(s), and mountings. 4.7.1
2. Inspect battery hold-downs, connections, cables, and cable routing; service as needed. 4.7.2
3. Check/record battery state-of-charge (open circuit voltage) and condition. 4.7.3
4. Perform battery test (load and/or capacitance). 4.7.4
5. Inspect starter, mounting, and connections. 4.7.5
6. Engage starter; check for unusual noises, starter drag, and starting difficulty. 4.7.6

4.8 Demonstrate the ability to inspect, analyze and test instruments and controls.

1. Inspect key condition and operation of ignition switch. 4.8.1
2. Check warning indicators. 4.8.2
3. Check instruments; record oil pressure and system voltage. 4.8.3
4. Check operation of electronic power take off (PTO) and engine idle speed controls (if applicable). 4.8.4
5. Check HVAC controls. 4.8.5
6. Check operation of all Using electronic service tool(s) or on-board diagnostic system; retrieve engine monitoring information; check and record diagnostic codes and trip/operational data (including engine, transmission, ABS, and other systems). 4.8.6