

## Instructional/Task Analysis

**Related Information: What  
the Student Should Know**

**Application: What the  
Student Should Be Able to Do**

### Unit 1: Introduction to Diesel Electrical and Electronic Systems

1. Terms and definitions
2. Composition of atoms
3. Electrical charges in atoms
4. Terms relating to electron flow and their definitions
5. Direction that current flows in relation to its electromotive force
6. Conventional and electron theories of current flow
7. Description of current
8. Factors that determine the amount of current flowing through a conductor
9. Types of current and their voltage sources
10. Description of voltage
11. Sources of voltage in vehicle electrical systems
12. Description of resistance
13. Factors that influence resistance as current moves through a circuit
14. Results of resistance as current moves through a conductor
15. Ohm's law
16. Formulas for calculating current, voltage, and resistance in a conductor
17. Description of power

## Instructional/Task Analysis

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### Related Information: What the Student Should Know

### Application: What the Student Should Be Able to Do

#### Unit 1: Introduction to Diesel Electrical and Electronic Systems (continued)

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| 18. Ways electrical devices can be rated  | 25. Calculate current using Ohm's law                                |
| 19. Common electrical devices that are rated in watts                                   | 26. Calculate voltage using Ohm's law                                |
| 20. Kinds of magnets and their definitions  | 27. Calculate resistance using Ohm's law                             |
| 21. Facts about magnets   | 28. Predict changes in voltage, current, and resistance in a circuit |
| 22. Terms relating to magnetism and electromagnets and their definitions                |  |
| 23. Properties of electromagnets that make them useful in a vehicle's electrical system |  |
| 24. Vehicle electrical components that use electromagnetism                             |  |

#### Unit 2: Understanding Circuits and Circuit Devices

1. Terms and definitions
2. Circuit elements on an illustration of a basic vehicle electrical circuit
3. Types of commonly used circuits
4. Power sources for vehicle electrical circuits
5. Why and where electrical circuits are grounded
6. Wiring diagram symbols that indicate a battery and a ground
7. Common control devices, their illustrations, wiring diagram symbols, current factor controlled, and the type of control each has on voltage or resistance in a circuit
8. Common protection devices, their illustrations and wiring diagram symbols
9. Size categories of blade fuses
10. How fuses, fusible links, and circuit breakers protect the circuits on which they are installed
11. Common loads, their illustrations, wiring diagram symbols, and the form of energy into which each converts current

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#### Unit 2: Understanding Circuits and Circuit Devices (continued)

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| 12. How a device that is electronic is different from a device that is electric                                | 22. Explain what the color bands found on resistors represent, and use the color bands on a resistor to determine its resistance value         |
| 13. P-type semiconductors and N-type semiconductors  | 23. Determine correct replacement fuses  |
| 14. Advantages and disadvantages of using electronic devices in circuits                                       | 24. Use wire color and circuit identification codes to locate circuit information  |
| 15. Common electronic circuit devices, their illustrations, wiring diagram symbols, and functions in a circuit | 25. Use wiring diagrams to locate information about circuits   |
| 16. Common conductors, their illustrations and wiring diagram symbols  | 26. Use knowledge of electric/electronic theory and circuit devices to predict changes in current, voltage, and resistance in a series circuit |
| 17. Types of material that are commonly used as insulators in vehicle electrical systems                       | 27. Inspect, test, and replace spike suppression diodes/resistors  |
| 18. Purpose of a wire shield   |  |
| 19. Common wiring hardware and their functions   |  |
| 20. Common circuit features and their wiring diagram symbols   |  |
| 21. Types of wiring diagrams   |  |

#### Unit 3: Developing Basic Diagnosis and Repair Skills

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| 1. Terms and definitions   | 8. Identify types of circuits and circuit devices on a circuit                       |
| 2. Types of common circuits and their electrical characteristics   | 9. Perform calculations using units of electrical measurement                        |
| 3. Common problems with electrical circuits (types, symptoms, causes)  | 10. Prepare to measure current, voltage, resistance, and frequency with a multimeter |
| 4. Types of electrical diagnostic instruments (names and illustrations, usage, calibrated vs. tested requirements) | 11. Calculate resistance in sample circuits  |
| 5. Steps in electrical troubleshooting   | 12. Calculate current in sample circuits   |
| 6. Steps in soldering  | 13. Calculate voltage drop in sample circuits  |
| 7. Guidelines for soldering  | 14. Calculate voltage in sample circuits   |
|  | 15. Calibrate and make functionality tests on electrical diagnostic instruments      |
|  | 16. Check electrical/electronic circuits with jumper wires                           |
|  | 17. Check electrical circuits with a test light                                      |

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### Unit 3: Developing Basic Diagnosis and Repair Skills (continued)

18. Check voltage in electrical/electronic circuits with a multimeter
19. Check voltage drops in electrical/electronic circuits with a multimeter
20. Check current flow in electrical/electronic circuits and components with a multimeter
21. Check continuity and resistance in electrical/electronic circuits and components with a multimeter
22. Find shorts, grounds, opens, and high resistance problems in electrical/electronic circuits
23. Tin a soldering iron or gun
24. Inspect, test, repair, and replace switches, connectors, terminals, and wires of electrical/electronic circuits
25. Inspect, test, and replace fusible links, circuit breakers, and fuses

### Unit 4: Understanding Vehicle Computer Controls

1. Terms and definitions
2. Functions of the basic components of a computer system
3. Common vehicle computers (microprocessors)
4. Types of sensors
5. Types of actuators
6. Analog and digital signals
7. Serial data transfer and parallel data transfer
8. Flow of data through a simplified computer system
9. Ways to retrieve diagnostic information from vehicle computers
10. SAE fault code identifiers
11. Demonstrate how a potentiometer functions as a sensor
12. Interpret SAE fault code identifiers
13. Use a DVOM to measure reference voltage output from the electronic control module
14. Access vehicle fault codes using the vehicle's computerized diagnostic system; determine needed repairs

### Related Information: What the Student Should Know

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#### Unit 5: Battery Diagnosis and Servicing

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| 1. Terms and definitions                             | 9. Evaluate factors in selecting the appropriate battery for a vehicle   |
| 2. Battery service tools                             | 10. Maintain and restore electronic memory functions   |
| 3. Functions of the battery                          | 41. Inspect, clean, fill, and replace a battery, battery cables, connectors, clamps, battery box, and hold-downs |
| 4. Types of vehicle batteries and their descriptions | 12. Make a battery state-of-charge test  |
| 5. Ratings of batteries and their descriptions       | 13. Make a battery capacity (load) test  |
| 6. Factors affecting correct battery selection       | 14. Determine battery state-of-charge using an open circuit voltage test   |
| 7. Safety rules for working with batteries           | 15. Slow and fast charge a battery   |
| 8. Types of battery connections and their systems    | 16. Diagnose parasitic (key-off) battery drain problems  |
|  | 17. Connect batteries in series, parallel, and series-parallel   |
|  | 18. Jump-start a vehicle   |

#### Unit 6: Starting Systems Diagnosis and Repair

1. Terms and definitions
2. Types of starting aids
3. Parts of a starting system and their functions
4. Major parts of a starting motor
5. Component parts of a starting system and their functions
6. Steps in a starting system operation
7. Conversion of electrical energy into mechanical energy
8. How a starting motor is kept running
9. Types of starter field circuits
10. Types of starter field circuits and current flow
11. Types of starting motor switches
12. Ways starter drives are engaged

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#### Unit 6: Starting Systems Diagnosis and Repair (continued)

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| 13. Types of electromagnetic or lever shift drives       | 18. Diagnose starting system problems  |
| 14. Operation of a series-parallel switch                | 19. Make a no-load starter current draw test   |
| 15. Operation of a transformer-rectifier unit            | 20. Make starter circuit voltage drop tests  |
| 16. Starting system tests and their functions            | 21. Inspect, test, and repair or replace switches, connectors, and wires of starter control circuits |
| 17. Starting system test equipment and their connections | 22. Inspect, test, and replace starter relays and solenoids  |
|  | 23. Remove and replace starter   |

#### Unit 7: Charging Systems Diagnosis and Repair

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| 1. Terms and definitions   | 13. Diagnose charging system problems that cause an undercharge, a no-charge, or an overcharge condition |
| 2. Purpose of a charging system, an alternator, and charging system output tests | 14. Inspect, adjust, and replace alternator drive belts, pulleys, and tensioners                         |
| 3. Alternator charging circuit components and their functions                    | 15. Make a charging system output test; determine needed repairs   |
| 4. Major parts of an alternator  | 16. Make a charging circuit voltage drop test; determine needed repairs                                  |
| 5. Construction of stator windings   | 17. Test an S.I. series alternator   |
| 6. Types of alternator circuits  | 18. Inspect, repair, or replace connectors and wires of charging circuits                                |
| 7. Characteristics of a brushless alternator                                     | 19. Remove, inspect, and replace an alternator   |
| 8. Operation of a brushless alternator   |  |
| 9. Operation of a transistorized regulator                                       |  |
| 10. Safety rules for working with alternator charging circuits                   |  |
| 11. Charging system tests with the conditions evaluated by the tests             |  |
| 12. Charging system test equipment and their connections                         |  |

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#### Unit 8: Lighting Systems Diagnosis and Repair

1. Parts of a headlights and daytime running lights circuit and their functions
2. Parts of a parking lights, taillights, clearance lights and marker lights circuit and their functions
3. Parts of a stoplight (brake light) circuit and their functions
4. Parts of a turn signal and hazard lights circuit and their functions
5. Parts of a backup lights circuit and their functions
6. Parts of an instrument lighting circuit and their functions
7. Parts of a courtesy lights circuit and their functions
8. Parts of a tractor-to-trailer multi-wire connector
9. Diagnose the cause of headlights and daytime running lights problems
10. Diagnose the cause of parking lights, clearance lights, and taillights problems
11. Diagnose the cause of stoplight (brake light) problems
12. Diagnose the cause of turn signals and hazard lights problems
13. Diagnose the cause of back-up lights problems
14. Diagnose the cause of instrument lighting problems
15. Diagnose the cause of courtesy lights problems
16. Inspect, replace, and aim headlights/bulbs
17. Inspect, test, and replace light bulbs and test sockets
18. Inspect, test, repair, and replace the components of a headlights and daytime running lights circuit
19. Inspect, test, repair, and replace the components of a parking light, clearance light and taillight circuit
20. Inspect, test, repair, and replace the components of a stoplight (brake light) circuit
21. Inspect, test, repair, and replace the components of a turn signal and hazard lights circuit
22. Inspect, test, repair, and replace the components of a back-up lights circuit
23. Inspect, test, repair, and replace the components of an instrument lighting circuit
24. Inspect, test, repair, and replace the components of a courtesy lights circuit
25. Inspect, test, repair, and replace the components of tractor-to-trailer lights circuit

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#### Unit 9: Driver Information Systems Diagnosis and Repair

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| 1. Basic categories of gauges and their operations   | 11. Diagnose the cause(s) of faulty gauge readings  |
| 2. Types of gauges and descriptions of their operations  | 12. Diagnose the cause(s) of the faulty operation of an electronic instrument cluster, warning light, indicator light, and driver information circuit     |
| 3. Types of gauge sending units and descriptions of their operation  |   |
| 4. Parts of a gauge circuit  | 13. Diagnose the cause(s) of the faulty operation of audible warning devices  |
| 5. Parts of a gauge circuit and descriptions of their functions  | 14. Inspect, test, repair, and replace the components of a gauge circuit  |
| 6. Parts of an electronic instrument cluster, warning light, indicator light, and driver information circuits                      | 15. Inspect, test, repair, and replace the components of an electronic instrument cluster, warning light, indicator light, and driver information circuit |
| 7. Parts of an electronic instrument cluster, warning light, indicator light, and driver information circuits, and their functions |   |
| 8. Types of driver information commonly given by audible warning devices   | 16. Inspect, test, repair, and replace components of audible warning device circuits  |
| 9. Parts of an audible warning devices circuit   | 17. Inspect, test, replace, and calibrate electronic speedometer, odometer, and tachometer circuits   |
| 10. Outputs of an audible warning device circuit and their functions   |   |

#### Unit 10: Related Electrical Components

1. Parts of a horn circuit and their functions
2. Parts of a wiper circuit
3. Parts of a wiper circuit and their functions
4. Parts of a windshield washer circuit
5. Parts of a windshield washer circuit and their functions
6. Parts of a heater circuit
7. Parts of a heater circuit and their functions
8. Major and secondary components of an expansion valve type A/C system

### Related Information: What the Student Should Know

### Application: What the Student Should Be Able to Do

#### Unit 10: Related Electrical Components (continued)

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| 9. Parts of an air conditioning circuit and their functions | 11. Diagnose the cause of horn problems  |
| 10. Types of engine block heaters and their operations      | 12. Diagnose the cause of wiper problems   |
|   | 13. Diagnose the cause of windshield washer problems                                 |
|   | 14. Diagnose the cause of heater problems  |
|   | 15. Diagnose the cause of air conditioning problems                                  |
|   | 16. Inspect, test, repair, and replace the components of a horn circuit              |
|   | 17. Inspect, test, repair, and replace the components of wiper circuits              |
|   | 18. Inspect, test, repair, and replace intermittent (pulsing) wiper controls         |
|   | 19. Inspect, test, repair, and replace the components of a windshield washer circuit |
|   | 20. Inspect, test, repair, and replace the components of a heater circuit            |
|   | 21. Inspect, test, repair, and replace the components of an air conditioning circuit |
|   | 22. Inspect, test, repair, and replace the components of an engine block heater      |

#### Unit 11: Miscellaneous Electrical Accessories

1. Parts of a power window
2. Parts of a power window and their functions
3. Parts of a heated, lighted, and electrically operated mirror and their functions
4. Parts of an electric door lock
5. Parts of an electric door lock and their functions
6. Parts of a keyless and remote lock/unlock device
7. Parts of a keyless and remote lock/unlock device and their functions
8. Parts of an anti-theft system and their functions

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#### Unit 11: Miscellaneous Electrical Accessories (continued)

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| 9. Parts of a sound system  | 14. Diagnose the cause of power window problems   |
| 10. Parts of a sound system and their functions                     | 15. Diagnose the cause of heated, lighted, and electrically operated mirror problems                    |
| 11. Parts of an airbag system                                       | 16. Diagnose the cause of electric door lock problems   |
| 12. Parts of an airbag system and their functions                   | 17. Diagnose the cause of radio reception problems  |
| 13. Steps to take to prevent the accidental deployment of an airbag | 18. Diagnose the cause(s) of the airbag warning light staying on or flashing                            |
|   | 19. Inspect, test, repair, and replace the parts of a power window                                      |
|   | 20. Inspect, test, repair, and replace the parts of a heated, lighted, and electrically operated mirror |
|   | 21. Inspect, test, repair, and replace the parts of an electric door lock                               |
|   | 22. Inspect, test, repair, and replace the parts of anti-theft systems                                  |
|   | 23. Inspect, test, repair, and replace the parts of a sound system                                      |
|   | 24. Remove and reinstall audio system components (unit)   |
|   | 25. Inspect, test, repair, and replace the parts of an airbag system                                    |
|   | 26. Inspect, test, repair, and replace the parts of a cigar lighter/auxiliary power outlet              |
|   | 27. Inspect, test, repair, and replace the parts of a clock   |