

# Diesel Technology: Introduction

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## Instructional/Task Analysis

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

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

### SECTION A: WORKPLACE TOOLS

#### Unit 1–A: Overview of Diesel-Powered Vehicles

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|---|---|
| 1. Terms and definitions  | 19. Identify features for assigned on-road vehicle  |
| 2. Common diesel-powered vehicles                                       | 20. Identify features for assigned off-road vehicle |
| 3. Reasons for new vehicle designs                                      |   |
| 4. Major functional areas of vehicles                                   |   |
| 5. Major vehicle systems  |   |
| 6. Truck weights  |   |
| 7. Gross vehicle weight ranges for on-road truck weight classifications |   |
| 8. Axle and drive wheel configurations                                  |   |
| 9. Basic truck cab designs  |   |
| 10. Common types of trailers  |   |
| 11. Parts of a trailer  |   |
| 12. Types of tractor-trailer combinations                               |   |
| 13. Truck dimensions  |   |
| 14. Agricultural tractor dimensions                                     |   |
| 15. Terms related to tractors   |   |
| 16. Characteristics of final drives                                     |   |
| 17. Characteristics of power takeoffs                                   |   |
| 18. Deck machinery  |   |

#### Unit 2–A: Basic Tools and Equipment

1. Terms and definitions
2. Types of cutting tools
3. Types of hammers
4. Types of pliers
5. Types of pullers
6. Types of screwdrivers

# Instructional/Task Analysis

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## Related Information: What the Student Should Know

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

### Unit 2–A: Basic Tools and Equipment (continued)

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|---|--|
| 7. Types of wrenches  | 14. Use tool catalogs to determine the cost of a quality hand tool set |
| 8. Parts of a socket wrench set   | 15. Dress a grinding wheel   |
| 9. Basic power tools  | 16. Sharpen a twist drill bit  |
| 10. Basic shop equipment  | 17. Drill holes with a drill press                                     |
| 11. Other general shop tools and equipment                                  | 18. Sharpen a cold chisel  |
| 12. Correct and incorrect methods of using and maintaining basic hand tools | 19. Use a file   |
| 13. Safety guidelines for using power tools and equipment                   |  |

### Unit 3–A: Reference Materials

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|---|---|
| 1. Terms and definitions                              | 8. Interpret drawings used in diesel equipment reference materials  |
| 2. Types of reference materials                       | 9. Interpret graphs used in diesel equipment reference materials    |
| 3. Types of illustrations used in reference materials | 10. Interpret diagrams used in diesel equipment reference materials |
| 4. Types of graphs used in reference materials        | 11. Interpret tables used in diesel equipment reference materials   |
| 5. Types of diagrams used in reference materials      | 12. Use reference materials to answer specific questions            |
| 6. Parts of a reference table                         |   |
| 7. Types of tables used in reference materials        |   |

### Unit 4–A: Measuring Instruments

1. Terms and definitions
2. Basic measurement systems
3. Types of rules used by diesel technicians
4. Basic units of measurement found on rules
5. Guidelines for using rules
6. Types of calipers
7. Parts of a dial caliper
8. Guidelines for care of calipers
9. Types of micrometers
10. Parts of an outside micrometer
11. How to select the proper size outside micrometer

## Instructional/Task Analysis

### Related Information: What the Student Should Know

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

#### Unit 4–A: Measuring Instruments (continued)

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|--|--|
| 12. Methods for checking accuracy of an outside micrometer | 24. Read U.S. customary and metric rules                   |
| 13. Parts of an inside micrometer                          | 25. Draw lines to specified lengths                        |
| 14. Accessories for an inside micrometer                   | 26. Measure lines using a steel rule                       |
| 15. Uses of an inside micrometer                           | 27. Measure lines on objects                               |
| 16. Methods for checking accuracy of an inside micrometer  | 28. Measure circle diameters                               |
| 17. Rules for use and care of micrometers                  | 29. Read standard and metric micrometers                   |
| 18. Types of gauges and their uses                         | 30. Use a dial caliper                                     |
| 19. Parts of a dial indicator set                          | 31. Use outside micrometer                                 |
| 20. Types of torque wrenches                               | 32. Use inside micrometer                                  |
| 21. Use and care of torque wrenches                        | 33. Use telescoping gauges                                 |
| 22. Types of feeler gauges                                 | 34. Use a dial indicator                                   |
| 23. Instruments used to measure angles                     | 35. Check a torque wrench for accuracy                     |
|  | 36. Use a small hole gauge to measure valve guide diameter |
|  | 37. Use a cylinder bore gauge                              |

#### Unit 5–A: Shop Operation

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|--|---|
| 1. Terms and definitions                             | 10. Complete a job ticket                             |
| 2. Basic categories of shop operation                | 11. Use a computer system to obtain parts information |
| 3. Purposes of parts management                      |   |
| 4. Guidelines for maintaining good inventory control |   |
| 5. Publications used for identifying part numbers    |   |
| 6. Parts of a job ticket                             |   |
| 7. Reasons for using standard time rate tables       |   |
| 8. Reasons for using employee time cards             |   |
| 9. Payroll record keeping                            |   |

# Instructional/Task Analysis

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

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

## **SECTION B: COMMON MATERIALS**

### **Unit 1–B: Mechanical Fasteners**

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|--|--|
| 1. Terms and definitions   | 16. Measure U.S. customary bolts and threads   |
| 2. Qualities of satisfactory fasteners                             | 17. Measure metric bolts and threads           |
| 3. Typical threaded fasteners                                      | 18. Match bolts with the correct size wrenches |
| 4. Characteristics of threaded fasteners                           | 19. Extract a broken bolt, stud, or screw      |
| 5. Typical bolt head designs                                       | 20. Restore external threads                   |
| 6. Typical machine screw head designs                              | 21. Cut and restore internal threads           |
| 7. Typical nuts  | 22. Install a thread insert                    |
| 8. Typical nuts and bolts with locking or self-locking features    |  |
| 9. Devices used for securing threaded fasteners                    |  |
| 10. Typical nonthreaded fasteners                                  |  |
| 11. Tools used to remove seized threaded fasteners                 |  |
| 12. Anti-seize compounds   |  |
| 13. Parts of a tap and die set                                     |  |
| 14. Tools used to restore or replace threads on threaded fasteners |  |
| 15. Types of taps  |  |

### **Unit 2–B: Lines, Fittings, and Couplings**

1. Terms and definitions
2. Applications that use lines, fittings, and couplings
3. Hazards of incorrect or improperly installed lines, fittings, and couplings
4. Rules for safe use and installation of lines, fittings, and couplings
5. Characteristics of pipe
6. Characteristics of metal tubing
7. Characteristics of nylon and plastic tubing
8. Characteristics of flexible hose
9. Types of fittings commonly used with pipe

## Instructional/Task Analysis

### Related Information: What the Student Should Know

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

#### Unit 2–B: Lines, Fittings, and Couplings (continued)

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|---|--|
| 10. Types of fittings commonly used with tubing | 17. Describe characteristics of pipe, tubing, and hose |
| 11. Types of hose ends                          | 18. Identify fittings and threads                      |
| 12. Common configurations of hose ends          | 19. Replace a skive hose end                           |
| 13. Common valves                               | 20. Replace a no skive hose end                        |
| 14. Types of accessories                        |  |
| 15. Installation of pipe or tubing              |  |
| 16. Installation of hose                        |  |

#### Unit 3–B: Seals and Bearings

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|--|---|
| 1. Terms and definitions   | 23. Install a radial lip seal                             |
| 2. Purposes of seals   | 24. Remove and install an engine oil seal and wear sleeve |
| 3. Basic categories of seals                                     | 25. Install a packing                                     |
| 4. Common seals  | 26. Replace a formed gasket                               |
| 5. Parts of a lip seal   | 27. Replace a formed-in-place gasket                      |
| 6. Common materials for seals                                    | 28. Remove and install a camshaft friction bearing        |
| 7. Types of packings   | 29. Remove and install an antifriction bearing            |
| 8. Causes of sealing failure                                     | 30. Clean and pack an antifriction bearing                |
| 9. Guidelines for installing seals                               |   |
| 10. Types of gaskets   |   |
| 11. Common gasket materials                                      |   |
| 12. Guidelines for installing gaskets                            |   |
| 13. Functions of bearings  |   |
| 14. Basic categories of bearings                                 |   |
| 15. Major types of bearings                                      |   |
| 16. Parts of an antifriction bearing                             |   |
| 17. Load forces of bearings                                      |   |
| 18. Conditions that determine load-carrying capacity of bearings |   |
| 19. Common materials used for bearings                           |   |
| 20. Reasons for bearing failures                                 |   |
| 21. Bearing maintenance procedures                               |   |
| 22. Items to look for when inspecting bearings                   |   |

# Instructional/Task Analysis

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## Related Information: What the Student Should Know

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

### Unit 4–B: Fluids and Lubricants

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|---|---|
| 1. Terms and definitions  | 32. Test for combustion leakage into a cooling system |
| 2. Fluid safety rules   | 33. Test for air in a cooling system                  |
| 3. Basic components of fluid systems                                  | 34. Clean a cooling system                            |
| 4. Common types of filters  | 35. Change oil and oil filter                         |
| 5. Common additives to fluids   |   |
| 6. Effects of contaminants to fluid systems                           |   |
| 7. Practices for ensuring fluid system cleanliness                    |   |
| 8. Applications of fluid systems on diesel/heavy duty equipment       |   |
| 9. Flow of fuel through the fuel system                               |   |
| 10. Grades of diesel fuel used on diesel/heavy duty equipment         |   |
| 11. Alternative fuels that may be used on diesel/heavy duty equipment |   |
| 12. Purpose of a cooling system                                       |   |
| 13. Effects of a malfunctioning cooling system                        |   |
| 14. Parts of a liquid cooling system                                  |   |
| 15. Liquid cooling systems in diesel/heavy duty equipment             |   |
| 16. Characteristics of a good antifreeze                              |   |
| 17. Importance of engine lubrication                                  |   |
| 18. Functions of engine oil   |   |
| 19. Parts of the engine lubrication system                            |   |
| 20. Characteristics of a good engine oil                              |   |
| 21. Viscosity   |   |
| 22. API classification system   |   |
| 23. Oil maintenance procedures  |   |
| 24. Fluids/oils for transmissions and gearboxes                       |   |
| 25. Fluids for power steering   |   |
| 26. Locations of filters in hydraulic systems                         |   |
| 27. Types of filter circuits in hydraulic systems                     |   |
| 28. Chassis lubrication systems                                       |   |
| 29. Chassis grease  |   |
| 30. Maintenance of chassis lubrication systems                        |   |
| 31. Batteries   |   |

## Instructional/Task Analysis

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

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

### SECTION C: BASIC RELATED PRINCIPLES

#### Unit 1–C: Basic Electrical Principles

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|--|--|
| 1. Terms and definitions                                   | 21. Solve problems using Ohm's law                             |
| 2. Electron theory of electricity                          | 22. Interpret electrical values from multimeter settings       |
| 3. Characteristics of electricity                          | 23. Interpret wiring diagrams                                  |
| 4. Basic electrical units                                  | 24. Measure current, voltage, and resistance with a multimeter |
| 5. Ohm's law and Watt's law                                | 25. Test and replace light bulbs and test sockets              |
| 6. Equipment used to measure electrical characteristics    | 26. Tin a soldering iron or gun                                |
| 7. Components of a basic electrical circuit                | 27. Solder-splice electrical wiring                            |
| 8. Types of electrical current flow                        | 28. Install terminals and connectors                           |
| 9. Types of basic electrical circuits                      | 29. Test charge a conventional (non-sealed) battery            |
| 10. Electron flow through a single wire circuit            | 30. Test charge a sealed battery                               |
| 11. Circuit protection devices                             | 31. Slow charge a battery                                      |
| 12. Types of electrical circuit problems                   | 32. Perform a battery load test                                |
| 13. Schematic symbols used on wiring diagrams              | 33. Perform a high-rate battery charge test                    |
| 14. How to read wiring diagrams                            | 34. Emergency jump-start a vehicle                             |
| 15. Steps in soldering                                     |  |
| 16. Guidelines for soldering                               |  |
| 17. Electrical terminals and connectors                    |  |
| 18. Battery service tools                                  |  |
| 19. Guidelines for servicing batteries                     |  |
| 20. Safety procedures to follow when working on batteries. |  |

#### Unit 2–C: Basic Hydraulic Principles

1. Terms and definitions
2. Systems that use hydraulics in diesel technology
3. Advantages and disadvantages of hydraulic systems
4. Components of a basic hydraulic system
5. Steps in the basic operation of a hydraulic system

## Instructional/Task Analysis

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### Related Information: What the Student Should Know

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

#### Unit 2–C: Basic Hydraulic Principles (continued)

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|---|--|
| 6. Basic hydraulic principles   | 17. Draw a block diagram of a simple hydraulic system            |
| 7. Calculating pressure   |  |
| 8. Functions of hydraulic fluid   | 18. Perform general maintenance procedures on a hydraulic system |
| 9. Types of reservoirs  |  |
| 10. Parts of a reservoir  | 19. Change hydraulic fluid and filter                            |
| 11. Causes of damage to hydraulic systems                                   |  |
| 12. Common problems in hydraulic systems                                    |  |
| 13. Reasons for performing preventive maintenance on hydraulic systems      |  |
| 14. Steps for general maintenance of a hydraulic system                     |  |
| 15. Steps in keeping hydraulic systems clean                                |  |
| 16. Safety hazards and safety practices when working with hydraulic systems |  |

#### Unit 3–C: Basic Welding and Cutting

1. Terms and definitions
2. Safety precautions to follow when welding
3. Welding materials
4. Basic arc welding circuit
5. Parts of the arc welding process
6. Types of arc welding machines
7. Polarity
8. Effects of raising and lowering welding machine amperes
9. Common types of arc welding electrodes
10. Common diameter sizes of arc welding electrodes
11. Meanings of AWS electrode classification number
12. Factors to consider when selecting electrodes
13. Purposes of electrode flux
14. Types of welds

## Instructional/Task Analysis

### Related Information: What the Student Should Know

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

#### Unit 3–C: Basic Welding and Cutting (continued)

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|--|---|
| 15. Types of weld joints   | 34. Start, stop, and restart a bead                                     |
| 16. Characteristics of good welds  | 35. Construct a pad weld  |
| 17. Reasons for poor welds   | 36. Construct a butt weld   |
| 18. Methods of striking an arc   | 37. Construct a lap-joint fillet weld in the flat position              |
| 19. Characteristics of proper arc length                                   | 38. Construct a T-joint fillet weld in the flat position                |
| 20. Types of electrode motions   | 39. Set up equipment for oxyacetylene welding/cutting                   |
| 21. Positions used in arc welding  | 40. Turn on, light, adjust, and turn off oxyacetylene welding equipment |
| 22. Parts of an oxyacetylene outfit  | 41. Braze weld a lap joint  |
| 23. Factors that determine selection of welding tip size                   | 42. Cut mild steel at a 90° angle, stop, and restart the cut            |
| 24. Stages of oxyacetylene torch combustion                                | 43. Cut round stock   |
| 25. Types of oxyacetylene flames   |   |
| 26. Flashback and backfire   |   |
| 27. Steps to follow in case of flashback                                   |   |
| 28. Causes of backfire   |   |
| 29. Advantages and disadvantages of oxyacetylene braze welding             |   |
| 30. Importance of having a chemically clean metal surface in braze welding |   |
| 31. Methods of removing oxides from a metal surface                        |   |
| 32. Reactions of molten bronze at different temperatures                   |   |
| 33. Parts of a torch body and cutting attachment                           |   |

