DIESEL ELECTRICITY FUNDAMENTALS
Course Syllabus

Course Number: TRUK-0167
OCAS Code: None
Course Length: 135 Hours
Career Cluster: Transportation, Distribution, and Logistics
Career Pathway: Medium/Heavy Diesel Truck Repair
Career Major(s): Diesel Service Technician

Pre-requisite(s):

This course takes students to a higher level of diagnosis and repair on electrical systems. Students will perform Automotive Service Excellence (ASE) tasks on the battery system, starter system, charging system, and ignition system. They will identify oscilloscope patterns and troubleshoot electronic ignition components.

Textbooks/Materials:
PTTTS Truck Web-Based Training Online Courses

Course Objectives:

A. Listen to and verify the operator's concern's; review past maintenance and repair documents; determine necessary action. (Electrical/Electronic Systems – V)

B. Diagnose and Service the Battery System.
1. Comply with personal and environmental safety practices associated with clothing; eye protection; hand protection; proper lifting practices; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of fuels/chemicals/materials in accordance with federal, state, and local regulations. (Electrical/Electronic Systems – V)
2. Discuss the function and construction of a battery.
3. Differentiate between a primary and secondary cell.
4. Inspect, test, and clean battery cables and connectors; repair or replace as needed. (P1-V.B.6)
5. Explain the chemical action that goes on during battery charge and discharge, or methods of rating batteries.
6. Perform battery hydrometer test; determine specific gravity of each cell. (P3-B1)
7. Inspect, clean and service battery; replace as needed. (P1-V.B.3)
8. Inspect and clean battery boxes, mounts, and hold downs; repair or replace as needed. (P1-V.B.4)
9. Determine battery state of charge using an open circuit voltage test. (P1-V.B.2)
10. Charge battery using slow or fast charge method as appropriate. (P1-V.B.5)
11. Perform battery load test; determine needed action. (P1-V.B.1)
12. Perform a 3-minute charge test.
13. Diagnose the cause of unusual battery drain.
14. List the steps for jump starting a battery.
15. Jump start a vehicle with jumper cables and a booster battery or auxiliary power supply using proper safety procedures. (P1-V.B.7)
16. Perform battery capacitance test; determine needed action. (P2-V.B.8)

C. Diagnose and Repair the Starter System.
1. Discuss the basic principles of magnetism/electromagnetism used in diesel applications.
2. Compare the operation of electric, pneumatic, and hydraulic starters.
3. Define CEMF (counterelectromotive force) and induced voltage.
4. Describe the operation of a Bendix drive and an overrunning clutch.
5. State the purpose of a starter solenoid.
6. Compare Ford’s positive engagement starter to gear reduction starters.
7. Give advantages of permanent magnet starting motors.
8. Discuss the purpose and operation of the neutral safety switch.
9. On a wiring diagram, trace the three different types of starting systems in use today.
10. Perform starter circuit cranking voltage and voltage drop tests; determine needed action. (P1-V.C.1)
11. Inspect and test components (key switch, push button and/or magnetic switch) and wires in the starter control circuit; replace as needed. (P2-V.C.2)
12. Inspect and test, starter relays and solenoids/switches; replace as needed. (P2-V.C.3)
13. Remove and replace starter; inspect flywheel ring gear or flex plate. (P2-V.C.4)
15. Diagnose series/parallel (12/24 volt) starting system problems; determine needed repairs.
16. Perform starter free-running (bench) tests and determine needed repairs.

D. Diagnose and Repair the Charging System.
1. List the two main functions of the charging system.
2. Identify the three major components of the charging system.
3. Explain how the alternator turns the mechanical motion of the engine into electrical power.
4. Discuss the purpose, types, and operation of regulators.
5. Diagnose the cause of a no-charge, low charge, or overcharge condition; determine needed action. (P1-V.D.2)
6. Diagnose instrument panel mounted volt meters and/or indicator lamps that show a no charge, low charge, or overcharge condition; determine needed action. (P2-V.D.1)
7. Inspect and replace alternator drive belts, pulleys, fans, tensioners, and mounting brackets; adjust drive belts and check alignment. (P1-V.D.3)
8. Perform charging system voltage and amperage output tests; determine needed action. (P1-V.D.4) (P1-VII.C.2.3)
9. Perform alternator output test and determine repairs. (P1-VII.C.2.2)
10. Perform alternator oscilloscope pattern tests and determine needed repairs.
11. Inspect, test, repair/replace voltage regulator and determine needed repairs.
12. Perform charging circuit voltage drop tests; determine needed action. (P1-V.D.5)
13. Inspect, repair, or replace connectors and wires in the charging circuits. (P2-V.D.7)
14. Remove and replace alternator. (P2-V.D.6)
15. Disassemble, clean, inspect, test, and replace alternator components.
E. Diagnose and Repair the Ignition System.
1. State the basic purpose of the ignition system.
2. Discuss the changes seen in ignition systems in the past ten years.
3. List and explain design features of spark plugs that help determine their proper application.
4. Discuss the importance of spark plug gap and how the correct setting is determined.
5. Explain special precautions that should be taken when removing spark plugs from aluminum cylinder heads.
6. Demonstrate how to read a used spark plug and use this information in engine diagnosis.
7. Discuss the evolution of spark plug wires/cables.
8. Define firing order and discuss its importance.
9. Identify a distributor cap, rotor, and ignition coil and explain their usage.
10. Discuss primary resistance and the control devices used.
11. Describe what is meant by variable dwell.
12. Explain engine timing and how it is controlled.
13. Use a feeler gauge to set air gaps in spark plugs and pick-up coils.
14. Measure engine speed and ignition dwell with a tach dwell meter.
15. Set initial timing with a timing light.
16. Use an advance timing light or a digital timing meter to measure advance.
17. Identify common oscilloscope patterns.
18. Test ignition system operation with an oscilloscope.
19. Diagnose electronic ignition components and determine repairs for a no-spark condition.

1 ODCTE Objective
Coding indicates NATEF alignment.
All unmarked objectives are TTC instructor developed.

Teaching Methods: The class will primarily be taught by the lecture and demonstration method and supported by various media materials to address various learning styles. There will be question and answer sessions over material covered in lecture and media presentations. Supervised lab time is provided for students to complete required projects.

Grading Procedures:
1. Students are graded on theory and shop practice and performance.
2. Each course must be passed with seventy (70%) percent or better.
3. Grading scale: A=90-100%, B=80-89%, C=70-79%, D=60-69%, F=50-59%.

Description of Classroom, Laboratories, and Equipment:
Tulsa Technology Center campuses are owned and operated by Tulsa Technology Center School District No. 18. All programs provide students the opportunity to work with professionally certified instructors in modern, well-equipped facilities.
### Available Certifications/College Credit

The student may be eligible to take state, national or industry exam after completion of the program. College credit may be issued from Oklahoma State University-Okmulgee or Tulsa Community College. See program counselor for additional information.

### College Credit Eligibility:

The student must maintain a grade point average of 2.0 or better.