

# 2024 Heavy Duty Truck and Equipment

## Program Standards

### CONTENT STANDARD 1.0: PROFESSIONAL ORGANIZATIONS AND LEADERSHIP

Performance Standard 1.1: Student Leadership in Career Technical Student Organizations (CTSO) and Professional Associations

- 1.1.1 Explore the role of professional organizations and/or associations in the heavy equipment/diesel industry.
- 1.1.2 Define the value, role, and opportunities provided through career technical student organizations.
- 1.1.3 Engage in career exploration and leadership development.

### CONTENT STANDARD 2.0: TRANSPORTATION AND HEAVY EQUIPMENT CAREERS

Performance Standard 2.1: Career Exploration

- 2.1.1 Describe the value of the transportation and equipment industry and its effects on society.
- 2.1.2 Investigate new and emerging technologies in the transportation and equipment industry.
- 2.1.3 Research the different career opportunities in the transportation and equipment career pathway.
- 2.1.4 Describe requirements (e.g., education, training, credentials, legal choices) for entering and continuing a career pathway.

Performance Standard 2.2: Industry Ethics and Standards

- 2.2.1 Describe the Occupational Safety and Health Administration (OSHA) and the Mine Safety and Health Administration (MSHA) safety standards and the consequences for violating them.
- 2.2.2 Describe common environmental practices and the role of the Environmental Protection Agency (EPA) in the diesel industry.
- 2.2.3 Identify Department of Labor Federal Employment Laws.
- 2.2.4 Describe personal accountability and responsibility for your career and safety.

### CONTENT STANDARD 3.0: SAFETY AND TOOLS

Performance Standard 3.1: Lab Safety

- 3.1.1 Perform a job hazard analysis (e.g., manual lifting requirements, high-voltage commercial, alternative fuel-powered vehicles/equipment, high-pressure fluids, stored energy) before service.
- 3.1.2 Describe the importance of maintaining a positive and active safety culture.
- 3.1.3 Adhere to ventilation requirements and procedures when working in the lab/shop area.
- 3.1.4 Identify marked safety areas.
- 3.1.5 Identify the location and the types of fire extinguishers and other fire safety equipment.
- 3.1.6 Describe procedures for using fire extinguishers and other fire safety equipment.
- 3.1.7 Identify the location and use of eye wash stations and chemical showers.
- 3.1.8 Identify site-specific emergency procedures and the location of evacuation routes.
- 3.1.9 Comply with safety glasses, ear protection, gloves, and shoes (i.e., personal protection equipment [PPE]) during lab/shop activities.
- 3.1.10 Identify clothing, jewelry, and hair hazards before engaging in lab/shop activities.
- 3.1.11 Describe the location of safety data sheets (SDS) and their purpose.
- 3.1.12 Describe common shop hazards and housekeeping duties.

3.1.13 Describe the requirements for reporting workplace safety incidents.

**Performance Standard 3.2: Tool and Equipment Safety**

- 3.2.1 Identify tools and equipment used in the lab/shop.
- 3.2.2 Identify standard and metric designations on tools and equipment.
- 3.2.3 Identify hazards associated with the use of hand and power tools and equipment.
- 3.2.4 Demonstrate safe handling of tools and equipment.
- 3.2.5 Reference procedures for handling tools, fuels, and equipment, including EV-related and alternative fuels.
- 3.2.6 Demonstrate lifting procedures and use of support equipment (e.g., jacks and jackstand placement, lifts, cribbing, hoists, rigging).
- 3.2.7 Maintain tools and equipment, inspecting them before use and removing tools from service when in need of repair or replacement.
- 3.2.8 Demonstrate accurate measurement techniques when using precision measuring tools (e.g., micrometer, dial-indicator, dial-caliper).

**CONTENT STANDARD 4.0: BASIC VEHICLE/EQUIPMENT**

**Performance Standard 4.1: Vehicle/Equipment Service Information**

- 4.1.1 Interpret vehicle/equipment service information.
- 4.1.2 Record diagnostic codes using electronic service tools and manufacturer's procedures.
- 4.1.3 Interpret technical service bulletins (TSBs), special service messages, quotes, service campaigns/recalls, vehicle/equipment/service warranty applications, and service interval recommendations.
- 4.1.4 Identify vehicle/equipment identification number (VIN) and production-date code.
- 4.1.5 Identify other vehicle/equipment information (e.g., engine, tire, emissions).

**Performance Standard 4.2: Vehicle/Equipment Handling for Service and Returning to Customer**

- 4.2.1 Identify information needed (e.g., miles, hours, make/model, VIN/serial number) and the service requested on a repair order.
- 4.2.2 Perform a 360-degree vehicle/equipment walk-around inspection.
- 4.2.3 Identify the need for fender covers, seat covers, and floor mats.
- 4.2.4 Describe the three Cs (i.e., concern, cause, correction) when inspecting and repairing vehicles/equipment.
- 4.2.5 Interpret vehicle/equipment service and repair history and its possible effects on current repair.
- 4.2.6 Identify types of information (e.g., pictures, video) needed to complete a repair.
- 4.2.7 Describe the process of creating and completing a work order and service report.
- 4.2.8 Prepare the vehicle/equipment for return to the customer (e.g., cleanup, floor mats, steering wheel cover).

**CONTENT STANDARD 5.0: DIESEL ENGINE SERVICE**

**Performance Standard 5.1: Diesel Engine Theory, Components, and Operation**

- 5.1.1 Describe the operation of a diesel engine.
- 5.1.2 Describe the operations of a diesel engine's subsystems.
- 5.1.3 Identify internal and external base engine components related to common diesel engines.
- 5.1.4 Identify emission/after-treatment system components.

**Performance Standard 5.2: Preliminary Engine Inspection**

- 5.2.1 Inspect fuel, oil, diesel exhaust fluid (DEF) and coolant levels, and condition; determine needed action.
- 5.2.2 Identify engine fuel, oil, coolant, air, and other leaks; determine needed action.
- 5.2.3 Interpret observed engine exhaust smoke color and quantity.
- 5.2.4 Interpret diagnostic codes related to engine function.
- 5.2.5 Identify causes for power derate and inducement levels.

**CONTENT STANDARD 6.0: DRIVE TRAIN OVERVIEW**

**Performance Standard 6.1: Basic Drive Train Introduction**

- 6.1.1 Identify drive train components, transmission type, and configuration.
- 6.1.2 Describe the functions of drive train components.

**CONTENT STANDARD 7.0: STEERING AND SUSPENSION OVERVIEW**

**Performance Standard 7.1: Basic Steering and Suspension Introduction**

- 7.1.1 Identify steering components.
- 7.1.2 Identify suspension components.
- 7.1.3 Describe the functions of steering and suspension components.

**CONTENT STANDARD 8.0: PREVENTATIVE MAINTENANCE INSPECTIONS**

**Performance Standard 8.1: Preventative Maintenance Inspection**

- 8.1.1 Perform a Form A Preventative Maintenance Inspection.
- 8.1.2 Perform a Form B Preventative Maintenance Inspection.
- 8.1.3 Perform a Federal Motor Carrier Safety Administration (FMCSA) Safety Inspection.
- 8.1.4 Describe the development, practices, and procedures of preventative maintenance programs.

**CONTENT STANDARD 9.0: HYDRAULIC SYSTEMS**

**Performance Standard 9.1: Hydraulic System Operation and Theory**

- 9.1.1 Identify hydraulic system theory and safety procedures.
- 9.1.2 Interpret system diagrams and schematics.
- 9.1.3 Identify hydraulic system units of measurement (e.g., pressure, flow).

**Performance Standard 9.2: Basic Hydraulic System Components**

- 9.2.1 Identify system fluid type and warning labels.
- 9.2.2 Describe system type (i.e., closed or open) and proper operation.
- 9.2.3 Identify pump types, actuators, and controls.

**CONTENT STANDARD 10.0: BRAKE SYSTEM**

**Performance Standard 10.1: Brake Theory and Operation**

- 10.1.1 Describe brake service safety procedures.
- 10.1.2 Identify brake components for hydraulic brake systems.
- 10.1.3 Identify brake components for air brake systems.
- 10.1.4 Describe wear limits and failures in brake linings, drums, and rotors.

**Performance Standard 10.2: Air Brakes—Mechanical/Foundation Brakes**

- 10.2.1 Inspect and measure brake shoes or pads; replace them as needed.
- 10.2.2 Inspect and measure brake drums or rotors; replace as needed.
- 10.2.3 Perform wheel bearing service and repair.
- 10.2.4 Inspect and service wheel bearings according to the manufacturer's specifications.

**CONTENT STANDARD 11.0: ELECTRIC/ELECTRONIC SYSTEMS**

**Performance Standard 11.1: General Electrical Systems**

- 11.1.1 Identify safety procedures related to electrical system service.
- 11.1.2 Prepare the D.V.M. (digital volt/ohm meter) before use.
- 11.1.3 Identify the electrical measuring units.
- 11.1.4 Describe the distinctions between series, parallel, and series-parallel circuits.
- 11.1.5 Calculate total resistance in series, parallel, and series-parallel circuits.
- 11.1.6 Interpret electrical/electronic circuits using wiring diagrams.
- 11.1.7 Check continuity in electrical/electronic circuits using appropriate test equipment.
- 11.1.8 Check applied voltages, circuit voltages, and voltage drops in electrical/electronic circuits using appropriate test equipment.
- 11.1.9 Check current flow in electrical/electronic circuits and components using appropriate test equipment.
- 11.1.10 Check resistance in electrical/electronic circuits and components using appropriate test equipment.
- 11.1.11 Locate shorts, grounds, and opens in electrical/electronic circuits.

- 11.1.12 Inspect and test fusible links, circuit breakers, relays, solenoids, and fuses; replace as needed.
- 11.1.13 Describe the basic functions and structure of a controller area network (i.e., CAN/BUS).
- 11.1.14 Demonstrate wire repair techniques to OEM standards.

#### Performance Standard 11.2: Battery Service

- 11.2.1 Perform battery load test per battery type; determine needed action.
- 11.2.2 Determine the battery state of charge using an open circuit voltage test.
- 11.2.3 Inspect, clean, and service battery; replace as needed.
- 11.2.4 Inspect and clean battery boxes, mounts, and hold-downs; repair or replace as needed.
- 11.2.5 Charge the battery using the appropriate method for battery type (e.g., 12V/24V).
- 11.2.6 Inspect, test, and clean battery cables and connectors; repair or replace as needed.
- 11.2.7 Jumpstart vehicle/equipment using jumper cables and a booster battery or appropriate auxiliary power supply.
- 11.2.8 Identify series and parallel system arrangements.
- 11.2.9 Perform battery capacitance test; determine needed action.

#### Performance Standard 11.3: Starting System Service

- 11.3.1 Perform starter circuit cranking voltage and voltage drop tests; determine needed action.
- 11.3.2 Inspect and test components (e.g., key switch, push button, magnetic switch) and wires and harnesses in the starter control circuit; replace as needed.
- 11.3.3 Inspect and test starter relays and solenoids/switches; replace as needed.
- 11.3.4 Replace the starter and inspect the flywheel ring gear or flex plate.

#### Performance Standard 11.4: Charging System Diagnosis and Repair

- 11.4.1 Identify causes of no charge, low charge, or overcharge problems; determine needed action.
- 11.4.2 Inspect and replace alternator drive belts, pulleys, fans, tensioners, and mounting brackets; adjust drive belts and check alignment.
- 11.4.3 Perform charging system voltage and amperage output tests (e.g., AC ripple test); determine needed action.
- 11.4.4 Perform charging circuit voltage drop tests; determine needed action.
- 11.4.5 Remove and replace the alternator.
- 11.4.6 Inspect, repair, or replace cables, wires, and connectors in the charging circuit.

#### Performance Standard 11.5: Lighting Systems Diagnosis and Repair

- 11.5.1 Identify causes of brighter than normal, intermittent, dim, or no headlight.
- 11.5.2 Test, replace, and aim headlights.
- 11.5.3 Test headlight and dimmer circuit switches, relays, wires, terminals, connectors, sockets, and control components/modules; repair or replace as needed.
- 11.5.4 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.
- 11.5.5 Inspect and test tractor-to-trailer multi-wire connector(s); repair or replace as needed.
- 11.5.6 Inspect, test, and adjust stop light circuit switches, bulbs/LEDs, sockets, connectors, terminals, wires, and control components/modules; repair or replace as needed.
- 11.5.7 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.
- 11.5.8 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.