



DIESEL ENGINE REPAIR 43.0202.00

TECHNICAL STANDARDS

An Industry Technical Standards Validation Committee updated the program technical standards by aligning them to the recently updated Automotive Service Excellence (ASE) Task and Standards List and the Tool and Equipment Lists. Students completing the program are eligible to earn the ASE Certification. The Arizona Career and Technical Education Quality Commission, the validating authority for the Arizona Skills Standards Assessment System, endorsed these standards on January 24, 2024.

Note: Arizona's Professional Skills are taught as an integral part of the Diesel Engine Repair program.

The Technical Skills Assessment for Diesel Engine Repair is available SY2024-2025.

Note: In this document i.e. explains or clarifies the content and e.g. provides examples of the content that must be taught.

STANDARD 1.0 PERFORM AUTOMOTIVE SHOP AND SAFETY TASKS

- 1.1 Identify general shop safety rules and procedures
- 1.2 Utilize safe procedures for handling of tools and equipment
- 1.3 Identify and use proper placement of floor jacks and jack stands
- 1.4 Identify and use proper procedures for safe lift operation
- 1.5 Utilize proper ventilation procedures for working within the lab/shop area
- 1.6 Identify marked safety areas
- 1.7 Identify the location and the types of fire extinguishers and other fire safety equipment
- 1.8 Identify procedures for using fire extinguishers and other fire safety equipment
- 1.9 Identify the location and use of eye wash stations
- 1.10 Identify the location of the posted evacuation routes
- 1.11 Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities
- 1.12 Identify and wear appropriate clothing for lab/shop activities
- 1.13 Secure hair and jewelry for lab/shop activities
- 1.14 Explain the safety aspects of vehicle systems that can operate automatically when the vehicle is off (e.g., supplemental restraint systems (SRS), electronic brake control systems, and electrified vehicle systems)
- 1.15 Explain the safety aspects of high voltage circuits (i.e., high intensity discharge (HID) lamps, ignition systems, injection systems, electrified vehicle powertrain, etc.)
- 1.16 Locate and demonstrate knowledge of safety data sheets (SDS)
- 1.17 Identify tools and their usage in medium/heavy truck applications
- 1.18 Identify standard and metric designation
- 1.19 Demonstrate safe handling and use of appropriate tools
- 1.20 Demonstrate proper cleaning, storage, and maintenance of tools and equipment
- 1.21 Demonstrate proper use of precision measuring tools (i.e., micrometer, dial-indicator, dial-caliper, torque wrench, etc.)
- 1.22 Identify information necessary and the service requested on a repair order

STANDARD 2.0 PERFORM PRE-TRIP INSPECTION

- 2.1 Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins
- 2.2 Inspect level and condition of fuel, oil, diesel exhaust fluid (DEF), and coolant
- 2.3 Inspect engine assembly for fuel, oil, coolant, air, and other leaks
- 2.4 Check engine operation (starting and running) including noise, vibration, smoke, etc.
- 2.5 Use appropriate electronic service tool(s) to check and record diagnostic codes; check and record trip/operational data; reset maintenance monitor (if applicable)
- 2.6 Identify system components, configurations, and types of the following: cylinder head(s), valve train, engine block, engine lubrication, engine cooling, air induction, exhaust, fuel, and engine braking

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STANDARD 3.0 PERFORM LUBRICATION SYSTEM PM

- 3.1 Test engine oil pressure and check operation of pressure sensor, gauge, and/or sending unit; test engine oil temperature and check operation of temperature sensor
- 3.2 Check engine oil level, condition, and consumption; take engine oil sample
- 3.3 Determine proper lubricant; perform oil and filter service

STANDARD 4.0 PERFORM COOLING SYSTEM PM

- 4.1 Check engine coolant type, level, condition, and test coolant for freeze protection and additive package concentration
- 4.2 Verify coolant temperature; check operation of temperature and level sensors, gauge, and/or sending unit
- 4.3 Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment
- 4.4 Recover coolant, flush, and refill with recommended coolant/additive package; bleed cooling system
- 4.5 Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed
- 4.6 Inspect water pump, hoses, and clamps
- 4.7 Inspect and pressure test cooling system(s); pressure test cap, tank(s), and recovery systems; inspect radiator and mountings
- 4.8 Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud
- 4.9 Identify engine block heater(s)

STANDARD 5.0 PERFORM AIR INDUCTION AND EXHAUST SYSTEM PM

- 5.1 Inspect turbocharger(s), wastegate(s), and piping systems
- 5.2 Check air induction system including cooler assembly, piping, hoses, clamps, and mountings; replace air filter as needed; reset restriction indicator (if applicable)
- 5.3 Inspect intake manifold, gaskets, and connections
- 5.4 Inspect engine exhaust system, exhaust gas recirculation (EGR) system, and exhaust after treatment systems [e.g., Diesel Exhaust Fluid (DEF), Selective Catalyst Reduction (SCR), Diesel Particulate Filter (DPF)] for leaks, mounting, proper routing, and damaged or missing components
- 5.5 Inspect and maintain crankcase ventilation components
- 5.6 Inspect engine compression and/or exhaust brake operation

STANDARD 6.0 PERFORM FUEL SYSTEM PM

- 6.1 Check fuel level and condition
- 6.2 Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, hoses, lines, and fittings
- 6.3 Inspect low pressure fuel system components (fuel pump, pump drives, screens, fuel/water separators/indicators, hoses, lines, filters, heaters, coolers, ECM cooling plates, check valves, pressure regulator valves, restrictive fittings, and mounting hardware)
- 6.4 Replace fuel filter; prime and bleed fuel system
- 6.5 Inspect high pressure fuel system components (fuel pump, pump drives, hoses, injection lines, filters, hold-downs, fittings, seals, and mounting hardware)

STANDARD 7.0 PERFORM DRIVE TRAIN PM

- 7.1 Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins
- 7.2 Identify drive train components, transmission type, and configuration
- 7.3 Inspect and adjust clutch, clutch brake, linkage, cables, levers, brackets, bushings, pivots, springs, and clutch safety switch (includes push-type and pull-type); check pedal height and travel
- 7.4 Inspect clutch master cylinder fluid level and condition; check clutch master cylinder, slave cylinder, lines, and hoses for leaks and damage
- 7.5 Inspect transmission shifter and linkage; inspect transmission mounts, insulators, and mounting bolts
- 7.6 Inspect transmission for leakage
- 7.7 Inspect transmission cover plates, gaskets, seals, and cap bolts; inspect seal surfaces and vents
- 7.8 Check transmission fluid level and condition; determine needed action
- 7.9 Inspect transmission oil filters, coolers and related components
- 7.10 Inspect speedometer components
- 7.11 Inspect and test function of REVERSE light, neutral start, and warning device circuits

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- 7.12 Inspect and service if applicable driveshafts, slip joints, yokes, drive flanges, support bearings, universal joints, boots, seals, and retaining/mounting hardware; check phasing of all shafts
- 7.13 Check for fluid leaks; inspect drive axle housing assembly, cover plates, gaskets, seals, vent/breather, and magnetic plugs
- 7.14 Check drive axle fluid level and condition; check drive axle filter
- 7.15 Inspect air-operated power divider (inter-axle differential) assembly
- 7.16 Inspect drive axle shafts; determine needed action
- 7.17 Remove and replace wheel assembly; check rear wheel seal and axle flange for leaks; determine needed action

STANDARD 8.0 PERFORM AIR BRAKE SYSTEM PM

- 8.1 Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins
- 8.2 Identify brake system components and configurations (including air and hydraulic systems, parking brake, power assist, and vehicle dynamic brake systems)
- 8.3 Identify brake performance problems caused by the mechanical/foundation brake system (air and hydraulic)
- 8.4 Inspect air supply system components such as compressor, governor, air drier, tanks, and lines; inspect service system components such as lines, fittings, mountings, and valves (hand brake/trailer control, brake relay, quick release, tractor protection, emergency/spring brake control/modulator, pressure relief/safety)
- 8.5 Verify proper gauge operation and readings; verify low pressure warning alarm operation; perform air supply system tests such as pressure build-up, governor settings, and leakage; drain air tanks and check for contamination
- 8.6 Inspect service brake chambers, diaphragms, clamps, springs, pushrods, clevises, and mounting brackets; determine needed action
- 8.7 Identify slack adjuster/brake adjuster type; check free stroke and applied stroke; inspect and lubricate slack adjusters/brake adjusters; determine needed action
- 8.8 Inspect and lubricate camshafts (S-cams), tubes, rollers, bushings, seals, spacers, retainers, brake spiders, shields, anchor pins, and springs; determine needed action
- 8.9 Inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action
- 8.10 Inspect, clean, and adjust air disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware; determine needed action
- 8.11 Remove brake drum; clean and inspect brake drum and mounting surface; measure brake drum diameter; measure brake lining thickness; inspect brake lining condition; determine needed action
- 8.12 Inspect and check parking (spring) brake chamber for leaks; determine needed action
- 8.13 Inspect and test parking (spring) brake check valves, lines, hoses, and fittings; determine needed action
- 8.14 Inspect and test parking (spring) brake application and release valve; determine needed action
- 8.15 Manually release (cage) and reset (uncage) parking (spring) brakes
- 8.16 Observe antilock brake system (ABS) warning light operation including trailer and dash mounted trailer ABS warning light
- 8.17 Observe automatic traction control (ATC) and electronic stability control (ESC) warning light operation

STANDARD 9.0 PERFORM HYDRAULIC BRAKE SYSTEM PM

- 9.1 Check master cylinder fluid level and condition; determine proper fluid type for application
- 9.2 Inspect hydraulic brake system components for leaks and damage
- 9.3 Check hydraulic brake system operation including pedal travel, pedal effort, and pedal feel
- 9.4 Inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action
- 9.5 Inspect and clean disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware and slides; determine needed action
- 9.6 Remove brake drum; clean and inspect brake drum and mounting surface; measure brake drum diameter; measure brake lining thickness; inspect brake lining condition; inspect wheel cylinders; determine needed action
- 9.7 Check parking brake operation; inspect parking brake application and holding devices
- 9.8 Check brake assist/booster system (vacuum or hydraulic) hoses, pump, switches, and control valves; check fluid level and condition (if applicable)
- 9.9 Check operation of emergency (back-up/reserve) brake assist system
- 9.10 Observe antilock brake system (ABS) warning light operation including trailer and dash mounted trailer ABS warning light
- 9.11 Observe automatic traction control (ATC) and electronic stability control (ESC) warning light operation

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STANDARD 10.0 PERFORM SUSPENSION AND STEERING SYSTEMS PM

- 10.1 Research vehicle service information, including fluid type, vehicle service history, service precautions, technical service bulletins, special service message(s)
- 10.2 Disable and enable supplemental restraint system (SRS); verify indicator lamp operation
- 10.3 Identify suspension and steering system components and configurations
- 10.4 Check steering wheel for free play, binding, and proper centering; inspect and service steering shaft U-joint(s), slip joint(s), bearings, bushings, and seals; phase steering shaft
- 10.5 Check operation of tilt and telescoping steering column
- 10.6 Check cab mounts, suspension, and ride height
- 10.7 Check power steering pump and gear operation, mountings, lines, and hoses; check fluid level and condition; service filter; inspect system for leaks
- 10.8 Flush and refill power steering system; purge air from system
- 10.9 Inspect and lubricate tie rod ends, ball joints, kingpins, pitman arms, idler arms, and other steering linkage components
- 10.10 Inspect shock absorbers, bushings, brackets, and mounts; determine needed action
- 10.11 Inspect leaf springs, center bolts, clips, pins, bushings, shackles, U-bolts, insulators, brackets, and mounts; determine needed action
- 10.12 Inspect axle and axle aligning devices such as: radius rods, track bars, stabilizer bars, and torque arms; inspect related bushings, mounts, and shims
- 10.13 Inspect tandem suspension equalizer components
- 10.14 Inspect and test air suspension pressure regulator and height control valves, lines, hoses, dump valves, and fittings; measure and record ride height
- 10.15 Inspect air springs, mounting plates, springs, suspension arms, and bushings

STANDARD 11.0 PERFORM TIRE AND WHEEL PM

- 11.1 Explain alignment angles and their influence on tire wear and vehicle tracking
- 11.2 Inspect tire condition; identify tire wear patterns; measure tread depth; verify tire matching (diameter and tread); inspect valve stem and cap; set tire pressure; verify tire pressure monitoring system (TPMS) operation (if applicable)
- 11.3 Explain causes for wheel/tire vibration, shimmy, pounding, and hop (tramp) problems
- 11.4 Check wheel mounting hardware; check wheel condition and runout; remove and install wheel/tire assemblies (steering and drive axle); torque fasteners to manufacturer's specification using torque wrench

STANDARD 12.0 PERFORM FRAME AND FIFTH WHEEL PM

- 12.1 Inspect, service, and/or adjust fifth wheel, pivot pins, bushings, locking mechanisms, mounting hardware, air lines, and fittings
- 12.2 Inspect frame and frame members for cracks, breaks, corrosion, distortion, elongated holes, looseness, and damage
- 12.3 Inspect frame hangers, brackets, and cross members
- 12.4 Check pintle hook and mounting (if applicable)

STANDARD 13.0 PERFORM GENERAL ELECTRICAL/ELECTRONIC SYSTEM DIAGNOSIS AND REPAIR

- 13.1 Research vehicle service information, including vehicle service history, service precautions, and technical service bulletins
- 13.2 Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law)
- 13.3 Demonstrate operation and proper use of digital multimeters and other test equipment when measuring source voltage, voltage drop (including grounds), current flow, continuity, and resistance
- 13.4 Demonstrate the causes and effects of shorts, grounds, opens, and resistance problems in electrical/electronic circuits
- 13.5 Use wiring diagrams to trace electrical/electronic circuits
- 13.6 Measure parasitic (key-off) battery drain
- 13.7 Demonstrate the function, operation, and testing of fusible links, circuit breakers, relays, solenoids, actuators, diodes, and fuses
- 13.8 Inspect, repair (including solder repair, mechanical crimp repair, and sealed heat shrink), and/or replace connectors, seals, terminal ends, and wiring; verify proper routing and securement
- 13.9 Use appropriate electronic service tool(s) and procedures to diagnose problems; check and record diagnostic codes; interpret digital multimeter (DMM) readings
- 13.10 Check for malfunctions caused by faults in the data bus communications network

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13.11 Identify electrical/electronic system components and configuration

STANDARD 14.0 PERFORM BATTERY DIAGNOSIS AND REPAIR

- 14.1 Identify battery type and system configuration
- 14.2 Confirm proper battery capacity for application; perform battery state-of-charge test; perform battery capacity test, determine needed action
- 14.3 Inspect and clean battery, battery cables, connectors, battery boxes, mounts, and hold-downs; determine needed action
- 14.4 Charge battery using appropriate method for battery type
- 14.5 Jump-start vehicle using a booster battery and jumper cables or using an appropriate auxiliary power supply
- 14.6 Identify low voltage disconnect (LVD) systems

STANDARD 15.0 PERFORM STARTING SYSTEM DIAGNOSIS AND REPAIR

- 15.1 Explain starter system operation
- 15.2 Perform starter circuit cranking voltage and voltage drop tests
- 15.3 Inspect starter control circuit switches, relays, connectors, terminals, wires, and harnesses (including over-crank protection)

STANDARD 16.0 PERFORM CHARGING SYSTEM DIAGNOSIS AND REPAIR

- 16.1 Explain the operation of the alternator
- 16.2 Check instrument panel mounted gauges and/or indicator lamps
- 16.3 Inspect alternator drive belt condition; check pulleys and tensioners for wear; check fans and mounting brackets; verify proper belt alignment
- 16.4 Inspect cables, wires, and connectors in the charging circuit, including remote sense circuit
- 16.5 Perform charging system voltage and amperage output tests; perform AC ripple test

STANDARD 17.0 PERFORM LIGHTING SYSTEM DIAGNOSIS AND REPAIR

- 17.1 Inspect for brighter-than-normal, intermittent, dim, or no-light operation; determine needed action
- 17.2 Test, replace, and aim headlights
- 17.3 Inspect cables, wires, and connectors in the lighting systems
- 17.4 Inspect tractor-to-trailer multi-wire connectors, cables, and holders

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