

ASE EDUCATION FOUNDATION SUMMARY OF CHANGES

Medium/Heavy Truck



Education Foundation

Effective: January 1, 2018

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Administered by:

ASE Education Foundation
1503 Edwards Ferry Rd., Suite 401
Leesburg, VA 20176
(703) 669-6650

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MEDIUM/HEAVY TRUCK MINIMUM REQUIREMENT CHANGES

Inspection, Maintenance and Minor Repair

540 hours

combined classroom and lab/shop instructional activities

Truck Service Technology

740 hours

combined classroom and lab/shop instructional activities

Master Truck Service Technology

1040 hours

combined classroom and lab/shop instructional activities

Accreditation Level	Instructor Qualifications	Tasks/Hours
M/H Truck Inspection, Maintenance, and Minor Repair (IMMR)	<ul style="list-style-type: none">T4,T6,T8 and any other ASE Medium/Heavy Truck certifications	<ul style="list-style-type: none">199 Tasks540 hours
M/H Truck Service Technology (TST)	<ul style="list-style-type: none">T4,T6,T8 plus hold certification in area(s) the instructor teaches	<ul style="list-style-type: none">329 Tasks740 hours
Master M/H Truck Service Technology (MTST)	<ul style="list-style-type: none">T4,T6,T8 plus hold certification in the area(s) the instructor teaches.Program must have instructors ASE-Certified in T2-T8	<ul style="list-style-type: none">399 Tasks1040 hours

PROPOSED MEDIUM/HEAVY TRUCK ACCREDITATION MODEL

- Program Announcement: January 1, 2018
 - Materials will be available on NATEF website
- Phase-out Plan: for current (2014) standards
 - Application submitted by May 31, 2018
 - On-site approved by September 1, 2018
 - Final approval by December 1, 2018
- Applications in after May 31, 2018 must use new standards (2017)

MEDIUM/HEAVY TRUCK TASK LIST CHANGES

2017 INSPECTION, MAINTENANCE, AND MINOR REPAIR (IMMR)

Task List

The tasks included in the Inspection, Maintenance, and Minor Repair option are entry-level technician inspection tasks designed to introduce the student to correct procedures and practices of vehicle inspection in a teaching/learning environment. They are not intended to satisfy the Annual Federal Vehicle Inspection requirement as prescribed in the Federal Motor Carrier Safety Regulations, Part 396, Appendix G to Subchapter B, Minimum Periodic Inspection Standards.

DIESEL ENGINES

For every task in Diesel Engines, the following safety task must be strictly enforced: Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Diesel Engines are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

I. DIESEL ENGINES

A. General

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Inspect level and condition of fuel, oil, diesel exhaust fluid (DEF), and coolant. P-1
3. Inspect engine assembly for fuel, oil, coolant, air, and other leaks. P-1
4. Check engine operation (starting and running) including: noise, vibration, smoke, etc. P-2
5. Use appropriate electronic service tool(s) and procedures to check, record, and clear diagnostic codes; check and record trip/operational data; reset maintenance monitor (if applicable); interpret digital multimeter (DMM) readings. P-1
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. P-1

I. DIESEL ENGINES

B. Cylinder Head and Valve Train

1. Inspect electronic wiring harness and brackets for wear, bending, cracks, and looseness. P-1

I. DIESEL ENGINES

C. Engine Block

1. Inspect crankshaft vibration damper; inspect engine mounts. P-1

I. DIESEL ENGINES

D. Lubrication Systems

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. P-1
2. Check engine oil level, condition, and consumption; take engine oil sample. P-1
3. Determine proper lubricant; perform oil and filter service. P-1

I. DIESEL ENGINES

E. Cooling System

1. Check engine coolant type, level, condition, and test coolant for freeze protection and additive package concentration. P-1
2. Verify coolant temperature; check operation of temperature and level sensors, gauge, and/or sending unit. P-1
3. Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment. P-1
4. Recover coolant, flush, and refill with recommended coolant/additive package; bleed cooling system. P-1
5. Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed. P-1
6. Inspect water pump, hoses, and clamps. P-1
7. Inspect, and pressure test cooling system(s); pressure test cap, tank(s), and recovery systems; inspect radiator and mountings. P-1
8. Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud. P-1
9. Identify engine block heater(s). P-2

I. DIESEL ENGINES

F. Air Induction and Exhaust Systems

1. Inspect turbocharger(s), wastegate(s), and piping systems. P-2
2. Check air induction system including: cooler assembly, piping, hoses, clamps, and mountings; replace air filter as needed; reset restriction indicator (if applicable). P-1

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|---|-----|
| 3. Inspect intake manifold, gaskets, and connections. | P-1 |
| 4. Inspect engine exhaust system, exhaust gas recirculation (EGR) system, and exhaust aftertreatment system for leaks, mounting, proper routing, and damaged or missing components. | P-1 |
| 5. Inspect crankcase ventilation system; service as needed. | P-1 |

I. DIESEL ENGINES

G. Fuel System

- | | |
|--|-----|
| 1. Check fuel level and condition. | P-1 |
| 2. Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, hoses, lines, and fittings. | P-1 |
| 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). | P-1 |
| 4. Replace fuel filter; prime and bleed fuel system. | P-1 |
| 5. Inspect high pressure fuel system components (fuel pump, pump drives, hoses, injection lines, filters, hold-downs, fittings, seals, and mounting hardware). | P-1 |

I. DIESEL ENGINES

H. Engine Brakes

- | | |
|---|-----|
| 1. Inspect engine compression and/or exhaust brake housing, valves, seals, lines, and fittings. | P-1 |
|---|-----|

DRIVE TRAIN

For every task in Drive Train, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Drive Train are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

II. DRIVE TRAIN

A. General

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Identify drive train components, transmission type, and configuration. P-1

II. DRIVE TRAIN

B. Clutch

1. 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; determine needed action. P-1
2. Inspect clutch master cylinder fluid level; check clutch master cylinder, slave cylinder, lines, and hoses for leaks and damage; determine needed action. P-1

II. DRIVE TRAIN

C. Transmission

1. Inspect transmission shifter and linkage; inspect transmission mounts, insulators, and mounting bolts. P-1
2. Inspect transmission for leakage; determine needed action. P-1
3. Replace transmission cover plates, gaskets, seals, and cap bolts; inspect seal surfaces and vents; determine needed action. P-1
4. Check transmission fluid level and condition; determine needed action. P-1
5. Inspect transmission breather; inspect transmission oil filters, coolers and related components; determine needed action. P-2
6. Inspect speedometer components. P-2
7. Inspect and test function of REVERSE light, neutral start, and warning device circuits. P-1

II. DRIVE TRAIN

D. Driveshaft and Universal Joints

1. Inspect, service, and/or replace driveshafts, slip joints, yokes, drive flanges, support bearings, universal joints, boots, seals, and retaining/mounting hardware; check phasing of all shafts. P-1

II. DRIVE TRAIN

E. Drive Axles

1. Check for fluid leaks; inspect drive axle housing assembly, cover plates, gaskets, seals, vent/breather, and magnetic plugs. P-1

2. Check drive axle fluid level and condition; check drive axle filter; determine needed action. P-1
3. Inspect air-operated power divider (inter-axle differential) assembly including: diaphragms, seals, springs, yokes, pins, lines, hoses, fittings, and controls. P-2
4. Inspect drive axle shafts; determine needed action. P-2
5. Remove and replace wheel assembly; check rear wheel seal and axle flange for leaks; determine needed action. P-1

BRAKES

For every task in Brakes, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Brakes are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

III. BRAKES

A. General

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Identify brake system components and configurations (including air and hydraulic systems, parking brake, power assist, and vehicle dynamic brake systems). P-1
3. Identify brake performance problems caused by the mechanical/foundation brake system (air and hydraulic). P-1

III. BRAKES

B. Air Brakes: Air Supply and Service Systems

1. 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). P-1
2. 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. P-1

III. BRAKES

C. Air Brakes: Mechanical/Foundation Brake System

1. Inspect service brake chambers, diaphragms, clamps, springs, pushrods, clevises, and mounting brackets; determine needed action. P-1
2. Identify slack adjuster type; inspect slack adjusters; determine needed action. P-1
3. Check camshafts (S-cams), tubes, rollers, bushings, seals, spacers, retainers, brake spiders, shields, anchor pins, and springs; determine needed action. P-1
4. Inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action. P-1
5. Inspect, clean, and adjust air disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware; perform needed action. P-1
6. 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. P-1

III. BRAKES

D. Air brakes: Parking Brake System

1. Inspect and check parking (spring) brake chamber for leaks; determine needed action. P-1
2. Inspect and test parking (spring) brake check valves, lines, hoses, and fittings; determine needed action. P-1
3. Inspect and test parking (spring) brake application and release valve; determine needed action. P-1
4. Manually release (cage) and reset (uncage) parking (spring) brakes. P-1

III. BRAKES

E. Hydraulic Brakes: Hydraulic System

1. Check master cylinder fluid level and condition; determine proper fluid type for application. P-1
2. Inspect hydraulic brake system components for leaks and damage. P-1
3. Check hydraulic brake system operation including pedal travel, pedal effort, and pedal feel. P-1

III. BRAKES

F. Hydraulic Brakes: Mechanical/Foundation Brake System

1. Inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action. P-1

2. Inspect and clean disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware; determine needed action. P-1
3. 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. P-1

III. BRAKES

G. Hydraulic Brakes: Parking Brake System

1. Check parking brake operation; inspect parking brake application and holding devices. P-1

III. BRAKES

H. Power Assist Systems

1. Check brake assist/booster system (vacuum or hydraulic) hoses and control valves; check fluid level and condition (if applicable). P-1
2. Check operation of emergency (back-up/reserve) brake assist system. P-1

III. BRAKES

I. Vehicle Dynamic Brake Systems (Air and Hydraulic): Antilock Brake System (ABS), Automatic Traction Control (ATC) System, and Electronic Stability Control (ESC) System

1. Observe antilock brake system (ABS) warning light operation including trailer and dash mounted trailer ABS warning light. P-1
2. Observe automatic traction control (ATC) and electronic stability control (ESC) warning light operation. P-2

III. BRAKES

J. Wheel Bearings

1. Clean, inspect, lubricate, and/or replace wheel bearings and races/cups; replace seals and wear rings; inspect spindle/tube; inspect and replace retaining hardware; adjust wheel bearings; check hub assembly fluid level and condition; verify end play with dial indicator method. P-1
2. Identify, inspect, and/or replace unitized/preset hub bearing assemblies. P-2

SUSPENSION AND STEERING

For every task in Suspension and Steering, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Suspension and Steering are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

IV. SUSPENSION AND STEERING SYSTEMS

A. General

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation. P-1
3. Identify suspension and steering system components and configurations. P-1

IV. SUSPENSION AND STEERING SYSTEMS

B. Steering Column

1. 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. P-1
2. Check operation of tilt and telescoping steering column. P-1
3. Check cab mounting. P-2

IV. SUSPENSION AND STEERING SYSTEMS

C. Steering Pump and Gear Units

1. Check power steering pump and gear operation, mountings, lines, and hoses; check fluid level and condition; service filter; inspect system for leaks. P-1
2. Flush and refill power steering system; purge air from system. P-2

IV. SUSPENSION AND STEERING

D. Steering Linkage

1. Inspect tie rod ends, ball joints, kingpins, pitman arms, idler arms, and other steering linkage components; lubricate as needed. P-1

IV. SUSPENSION AND STEERING

E. Suspension Systems

1. Inspect shock absorbers, bushings, brackets, and mounts; determine needed action. P-1
2. Inspect leaf springs, center bolts, clips, pins, bushings, shackles, U-bolts, insulators, brackets, and mounts; determine needed action. P-1
3. Inspect axle and axle aligning devices such as: radius rods, track bars, stabilizer bars, and torque arms; inspect related bushings, mounts, and shims. P-1
4. Inspect tandem suspension equalizer components. P-3
5. Inspect and test air suspension pressure regulator and height control valves, lines, hoses, dump valves, and fittings; check and record ride height. P-1

6. Inspect air springs, mounting plates, springs, suspension arms, and bushings. P-1

IV. SUSPENSION AND STEERING

F. Wheel Alignment

1. Demonstrate understanding of alignment angles. P-3

IV. SUSPENSION AND STEERING

G. Wheels and Tires

1. Inspect tire condition; identify tire wear patterns; measure tread depth; verify tire matching (diameter and tread); inspect valve stem and cap; set tire pressure. P-1
2. Identify wheel/tire vibration, shimmy, pounding, and hop (tramp) problems. P-2
3. Check wheel mounting hardware; check wheel condition; remove and install wheel/tire assemblies (steering and drive axle); torque fasteners to manufacturer's specification using torque wrench. P-1

IV. SUSPENSION AND STEERING

H. Frame and Coupling Devices

1. Inspect, service, and/or adjust fifth wheel, pivot pins, bushings, locking mechanisms, mounting hardware, air lines, and fittings. P-1
2. Inspect frame and frame members for cracks, breaks, corrosion, distortion, elongated holes, looseness, and damage. P-1
3. Inspect frame hangers, brackets, and cross members. P-3
4. Check pintle hook and mounting (if applicable). P-1

ELECTRICAL/ELECTRONIC SYSTEMS

For every task in Electrical/Electronic Systems, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Electrical/Electronic Systems are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

V. ELECTRICAL/ELECTRONIC SYSTEMS

A. General

1. Research vehicle service information, including vehicle service history, service precautions, and technical service bulletins. P-1
2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law). P-1

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|---|-----|
| 3. Demonstrate proper use of test equipment when measuring source voltage, voltage drop (including grounds), current flow, continuity, and resistance. | P-1 |
| 4. Demonstrate knowledge of the causes and effects of shorts, grounds, opens, and resistance problems in electrical/electronic circuits. | P-1 |
| 5. Use wiring diagrams to trace electrical/electronic circuits. | P-1 |
| 6. Measure parasitic (key-off) battery drain. | P-1 |
| 7. Demonstrate knowledge of the function, operation, and testing of fusible links, circuit breakers, relays, solenoids, diodes, and fuses. | P-1 |
| 8. Inspect, repair (including solder repair), and/or replace connectors, seals, terminal ends, and wiring; verify proper routing and securement. | P-1 |
| 9. Use appropriate electronic service tool(s) and procedures to check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. | P-2 |
| 10. Check for malfunctions caused by faults in the data bus communications network. | P-2 |
| 11. Identify electrical/electronic system components and configuration. | P-1 |

V. ELECTRICAL/ELECTRONIC SYSTEMS

B. Battery System

- | | |
|---|-----|
| 1. Identify battery type and system configuration. | P-1 |
| 2. Confirm proper battery capacity for application; perform battery state-of-charge test; perform battery capacity test, determine needed action. | P-1 |
| 3. Inspect battery, battery cables, connectors, battery boxes, mounts, and hold-downs; determine needed action. | P-1 |
| 4. Charge battery using appropriate method for battery type. | P-1 |
| 5. Jump-start vehicle using a booster battery and jumper cables or using an appropriate auxiliary power supply. | P-1 |
| 6. Identify low voltage disconnect (LVD) systems. | P-2 |

V. ELECTRICAL/ELECTRONIC SYSTEMS

C. Starting System

- | | |
|---|-----|
| 1. Demonstrate understanding of starter system operation. | P-1 |
| 2. Perform starter circuit cranking voltage and voltage drop tests. | P-1 |
| 3. Inspect starter control circuit switches, relays, connectors, terminals, wires, and harnesses (including over-crank protection). | P-1 |

V. ELECTRICAL/ELECTRONIC SYSTEMS

D. Charging System

1. Identify and understand operation of the generator (alternator). P-1
2. Check instrument panel mounted voltmeters and/or indicator lamps. P-1
3. Inspect generator (alternator) drive belt condition; check pulleys and tensioners for wear; check fans and mounting brackets; verify proper belt alignment. P-1
4. Inspect cables, wires, and connectors in the charging circuit. P-1
5. Perform charging system voltage and amperage output tests; perform AC ripple test. P-1

V. ELECTRICAL/ELECTRONIC SYSTEMS

E. Lighting Systems

1. Inspect for brighter-than-normal, intermittent, dim, or no-light operation; determine needed action. P-1
2. Test, replace, and aim headlights. P-1
3. Inspect cables, wires, and connectors in the lighting systems. P-1
4. Inspect tractor-to-trailer multi-wire connectors, cables, and holders. P-1

V. ELECTRICAL/ELECTRONIC SYSTEMS

F. Instrument Cluster and Driver Information Systems

1. Check gauge and warning indicator operation. P-1
2. Identify the sensor/sending units, gauges, switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, printed circuits, and control components/modules of the instrument cluster, driver information system, and warning systems. P-2

HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

For every task in Heating, Ventilation and Air Conditioning (HVAC), the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Heating, Ventilation, & Air Conditioning are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

All practices and procedures must be performed according to current mandates, standards, and regulations.

A. General

1. Research vehicle service information, including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Identify heating, ventilation, and air conditioning (HVAC) components and configuration. P-1
3. Use appropriate electronic service tool(s) and procedures to check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. P-1

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

B. Refrigeration System Components

1. Inspect A/C compressor drive belts, pulleys, and tensioners; verify proper belt alignment. P-1
2. Check A/C system operation including system pressures; visually inspect A/C components for signs of leaks; check A/C monitoring system (if applicable). P-1
3. Inspect A/C condenser for airflow restrictions; determine needed action. P-1

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

C. Heating, Ventilation, and Engine Cooling Systems

1. Inspect engine cooling system and heater system hoses and pipes; determine needed action. P-1
2. Inspect HVAC system-heater ducts, doors, hoses, cabin filters, and outlets; determine needed action. P-1
3. Identify the source of A/C system odors. P-2

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

D. Operating Systems and Related Controls

1. Verify blower motor operation; confirm proper air distribution; confirm proper temperature control; determine needed action. P-1

CAB

For every task in Cab the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Cab are to listen to and verify operator's concern, review past maintenance documents, and record condition on appropriate document.

VII. CAB

A. General

1. Research vehicle service information including, vehicle service history, service precautions, and technical service bulletins. P-1
2. Use appropriate electronic service tool(s) and procedures to check, record, and clear diagnostic codes; check and record trip/operational data; reset maintenance monitor (if applicable); interpret digital multimeter (DMM) readings. P-1

VII. CAB

B. Instruments and Controls

1. Inspect mechanical key condition; check operation of ignition switch; check operation of indicator lights, warning lights and/or alarms; check instruments; record oil pressure and system voltage; check operation of electronic power take-off (PTO) and engine idle speed controls (if applicable). P-1
2. Check operation of all accessories. P-1
3. Understand operation of auxiliary power unit (APU)/electric power unit (EPU). P-3

VII. CAB

C. Safety Equipment

1. Check operation of horns (electric and air); check warning device operation (reverse, air pressure, etc.); check condition of spare fuses, safety triangles, fire extinguisher, and all required decals; inspect seat belts and sleeper restraints; inspect condition of wiper blades and arms. P-1

VII. CAB

D. Hardware

1. Check operation of wipers and washer; inspect windshield glass for cracks or discoloration; check sun visor; check seat condition, operation, and mounting; check door glass and window operation; verify operation of door and cab locks; inspect steps and grab handles; inspect mirrors, mountings, brackets, and glass. P-1
2. Record all physical damage. P-2
3. Lubricate all cab grease fittings; inspect and lubricate door and hood hinges, latches, strikers, lock cylinders, safety latches, linkages, and cables. P-2
4. Inspect cab mountings, hinges, latches, linkages, and ride height. P-1
5. Inspect quarter fender, mud flaps, and brackets. P-1

HYDRAULICS

For every task in Hydraulics, the following safety task must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Hydraulics are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

VIII. HYDRAULICS

A. General

1. Research vehicle service information, including vehicle service history, service precautions, fluid type, and technical service bulletins. P-3
2. Verify placement of equipment/component safety labels and placards; determine needed action. P-3
3. Identify hydraulic system components; locate filtration system components; service filters and breathers. P-3
4. Check fluid level and condition; take a hydraulic fluid sample for analysis. P-3
5. Inspect hoses and connections for leaks, proper routing, and proper protection; determine needed action. P-3

2017 MEDIUM/HEAVY TRUCK SERVICE TECHNOLOGY (TST)

Task List

DIESEL ENGINES

For every task in Diesel Engines, the following safety task must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Diesel Engines are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

I. DIESEL ENGINES

A. General

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Inspect level and condition of fuel, oil, diesel exhaust fluid (DEF), and coolant. P-1
3. Inspect engine assembly for fuel, oil, coolant, air, and other leaks; determine needed action. P-1
4. Check engine operation (starting and running) including: noise, vibration, smoke, etc.; determine need action. P-2
5. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; check and record trip/operational data; reset maintenance monitor (if applicable); interpret digital multimeter (DMM) readings. P-1
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. P-1
7. Check engine no-crank, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed action. P-2
8. Check engine surging, rough operation, misfiring, and/or shut down problems; determine needed action. P-2

I. DIESEL ENGINES

B. Cylinder Head and Valve Train

1. Inspect electronic wiring harness and brackets for wear, bending, cracks, and proper securement; determine needed action. P-1
2. Inspect cylinder head for cracks/damage; check mating surfaces for warpage; check condition of passages; inspect core/expansion and gallery plugs; determine needed action. P-2

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| 3. Inspect injector sleeves and seals; determine needed action. | P-3 |
| 4. Inspect valve train components; determine needed action. | P-1 |
| 5. Adjust valve bridges (crossheads); adjust valve clearances and injector settings. | P-2 |

I. DIESEL ENGINES

C. Engine Block

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| 1. Inspect crankshaft vibration damper; inspect engine mounts; determine needed action. | P-1 |
| 2. Remove, inspect, service, and install pans, covers, gaskets, seals, wear rings, and crankcase ventilation components. | P-1 |
| 3. Perform crankcase pressure test. | P-1 |
| 4. Install and align flywheel housing; inspect flywheel housing(s) to transmission housing/engine mating surface(s); measure flywheel housing face and bore runout; determine needed action. | P-2 |
| 5. Inspect flywheel/flexplate (including ring gear) and mounting surfaces for cracks and wear; measure runout; determine needed action. | P-2 |

I. DIESEL ENGINES

D. Lubrication Systems

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| 1. Test engine oil pressure; check operation of pressure sensor, gauge, and/or sending unit; test engine oil temperature and check operation of temperature sensor; determine needed action. | P-1 |
| 2. Check engine oil level, condition, and consumption; take engine oil sample; determine needed action. | P-1 |
| 3. Determine proper lubricant; perform oil and filter service. | P-1 |
| 4. Inspect, clean, and test oil cooler and components. | P-2 |
| 5. Inspect turbocharger lubrication systems. | P-2 |

I. DIESEL ENGINES

E. Cooling System

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| 1. Check engine coolant type, level, and condition; test coolant for freeze protection and additive package concentration. | P-1 |
| 2. Test coolant temperature; test operation of temperature and level sensors, gauge, and/or sending unit; determine needed action. | P-1 |
| 3. Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment. | P-1 |

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| 4. Recover coolant; flush and refill with recommended coolant/additive package; bleed cooling system. | P-1 |
| 5. Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed. | P-1 |
| 6. Inspect water pump, hoses, and clamps; determine needed action. | P-1 |
| 7. Inspect and pressure test cooling system(s); pressure test cap, tank(s), and recovery systems; inspect radiator and mountings; determine needed action. | P-1 |
| 8. Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud; determine needed action. | P-1 |
| 9. Identify engine block heater(s). | P-2 |
| 10. Diagnose engine coolant consumption; determine needed action. | P-1 |
| 11. Inspect thermostat(s), by-passes, housing(s), and seals; replace as needed. | P-1 |
| 12. Inspect turbocharger cooling systems. | P-2 |

I. DIESEL ENGINES

F. Air Induction and Exhaust Systems

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| 1. Inspect turbocharger(s), wastegate(s), and piping systems; determine needed action. | P-2 |
| 2. Check air induction system including: cooler assembly, piping, hoses, clamps, and mountings; replace air filter as needed; reset restriction indicator (if applicable). | P-1 |
| 3. Inspect intake manifold, gaskets, and connections; determine needed action. | P-1 |
| 4. Inspect engine exhaust system, exhaust gas recirculation (EGR) system, and exhaust aftertreatment system for leaks, mounting, proper routing, and damaged or missing components; determine needed action. | P-1 |
| 5. Inspect crankcase ventilation system; service as needed. | P-1 |
| 6. Demonstrate knowledge of exhaust gas recirculation (EGR) system including: EGR valve, cooler, piping, filter, electronic sensors, controls, and wiring; determine needed action. | P-1 |
| 7. Perform air intake system restriction and leakage tests; determine needed action. | P-1 |
| 8. Perform intake manifold pressure (boost) test; determine needed action. | P-3 |
| 9. Check exhaust back pressure. | P-3 |

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| 10. Inspect variable ratio geometry turbocharger (VGT), controls, and actuators (pneumatic, hydraulic, and electronic). | P-2 |
| 11. Demonstrate knowledge of charge air cooler operation and testing. | P-1 |
| 12. Demonstrate knowledge of exhaust aftertreatment systems, operation, and components. | P-1 |
| 13. Inspect and/or replace preheater/inlet air heater or glow plug system and controls. | P-2 |

I. DIESEL ENGINES

G. Fuel System

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|---|-----|
| 1. Check fuel level and condition; determine needed action. | P-1 |
| 2. Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, hoses, lines, and fittings; determine needed action. | P-1 |
| 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); determine needed action. | P-1 |
| 4. Replace fuel filter; prime and bleed fuel system. | P-1 |
| 5. Inspect high pressure fuel system components (fuel pump, pump drives, hoses, injection lines, filters, hold-downs, fittings, seals, and mounting hardware). | P-1 |
| 6. Demonstrate knowledge and understanding of the different types of fuel systems. | P-1 |
| 7. Perform fuel supply and return system tests; determine needed action. | P-1 |
| 8. Perform cylinder contribution test using electronic service tool(s). | P-1 |

I. DIESEL ENGINES

H. Engine Brakes

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| 1. Inspect engine compression and/or exhaust brake housing, valves, seals, lines, and fittings; determine needed action. | P-1 |
| 2. Inspect and adjust engine compression and/or exhaust brake systems; determine needed action. | P-2 |
| 3. Inspect, test, and adjust engine compression and/or exhaust brake control circuits, switches, and solenoids; determine needed action. | P-2 |

DRIVE TRAIN

For every task in Drive Train, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Drive Train are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

II. DRIVE TRAIN

A. General

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Identify drive train components, transmission type, and configuration. P-1
3. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. P-1

II. DRIVE TRAIN

B. Clutch

1. 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; determine needed action. P-1
2. Inspect clutch master cylinder fluid level; check clutch master cylinder, slave cylinder, lines, and hoses for leaks and damage; determine needed action. P-1
3. Inspect, adjust, repair, and/or replace hydraulic clutch slave and master cylinders, lines, and hoses; bleed system. P-2
4. Inspect, adjust, lubricate, or replace release (throw-out) bearing, sleeve, bushings, springs, housing, levers, release fork, fork pads, rollers, shafts, and seals. P-1
5. Inspect, adjust, and/or replace single-disc clutch pressure plate and clutch disc. P-1
6. Inspect, adjust, and/or replace two-plate clutch pressure plate, clutch discs, intermediate plate, and drive pins/lugs. P-1
7. Inspect and/or replace clutch brake assembly; inspect input shaft and bearing retainer; determine needed action. P-1
8. Inspect, adjust, and/or replace self-adjusting/continuous-adjusting clutch mechanisms. P-1
9. Inspect and/or replace pilot bearing. P-1

II. DRIVE TRAIN

C. Transmission

1. Inspect transmission shifter and linkage; inspect and/or replace transmission mounts, insulators, and mounting bolts. P-1
2. Inspect transmission for leakage; determine needed action. P-1
3. Replace transmission cover plates, gaskets, seals, and cap bolts; inspect seal surfaces and vents; determine needed action. P-1
4. Check transmission fluid level and condition; determine needed action. P-1
5. Inspect transmission breather; inspect transmission oil filters, coolers, and related components; determine needed action. P-2
6. Inspect speedometer components; determine needed action. P-2
7. Inspect and test function of REVERSE light, NEUTRAL start, and warning device circuits; determine needed action. P-1
8. Inspect, adjust, and replace transmission covers, rails, forks, levers, bushings, sleeves, detents, interlocks, springs, and lock bolts/safety wires. P-2
9. Identify causes of transmission noise, shifting concerns, lockup, jumping out-of-gear, overheating, and vibration problems. P-1
10. Inspect, test, repair, and/or replace air shift controls, lines, hoses, valves, regulators, filters, and cylinder assemblies. P-2
11. Remove and reinstall transmission. P-2
12. Inspect input shaft, gear, spacers, bearings, retainers, and slingers. P-3
13. Inspect and adjust power take-off (PTO) assemblies, controls, and shafts. P-3
14. Inspect and test transmission temperature gauge, wiring harnesses, and sensor/sending unit. P-2
15. Inspect operation of automatic transmission, components, and controls; diagnose automatic transmission system problems; determine needed action. P-2
16. Inspect operation of automated mechanical transmission, components, and controls; diagnose automated mechanical transmission system problems; determine needed action. P-2

II. DRIVE TRAIN

D. Driveshaft and Universal Joints

1. Inspect, service, and/or replace driveshafts, slip joints, yokes, drive flanges, support bearings, universal joints, boots, seals, and retaining/mounting hardware; check phasing of all shafts. P-1

2. Identify causes of driveshaft and universal joint noise and vibration problems. P-1
3. Inspect driveshaft center support bearings and mounts; determine needed action. P-1
4. Measure driveline angles; determine needed action. P-2

II. DRIVE TRAIN

E. Drive Axles

1. Check and repair fluid leaks; inspect drive axle housing assembly, cover plates, gaskets, seals, vent/breather, and magnetic plugs. P-1
2. Check drive axle fluid level and condition; check drive axle filter; determine needed action. P-1
3. Inspect and/or adjust air-operated power divider (inter-axle differential) assembly including: diaphragms, seals, springs, yokes, pins, lines, hoses, fittings, and controls. P-2
4. Inspect drive axle shafts; determine needed action. P-2
5. Remove and replace wheel assembly; check rear wheel seal and axle flange for leaks; determine needed action. P-1
6. Inspect, repair, or replace drive axle lubrication system pump, troughs, collectors, slingers, tubes, and filters. P-3
7. Identify causes of drive axle(s) drive unit noise and overheating problems. P-2
8. Inspect and test drive axle temperature gauge, wiring harnesses, and sending unit/sensor; determine needed action. P-2
9. Remove and replace differential carrier assembly. P-2
10. Identify causes of drive axle wheel bearing noise and check for damage; perform needed action. P-1

BRAKES

For every task in Brakes, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Brakes are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

III. BRAKES

A. General

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Identify brake system components and configurations (including air and hydraulic systems, parking brake, power assist, and vehicle dynamic brake systems). P-1
3. Identify brake performance problems caused by the mechanical/foundation brake system (air and hydraulic). P-1
4. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. P-1

III. BRAKES

B. Air Brakes: Air Supply and Service Systems

1. Inspect and test 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); determine needed action. P-1
2. Test gauge operation and readings; test 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; determine needed action. P-1
3. Demonstrate knowledge and understanding of air supply and service system components and operations. P-1
4. Inspect air compressor drive gear components (gears, belts, tensioners, and/or couplings); determine needed action. P-3
5. Inspect air compressor inlet; inspect oil supply and coolant lines, fittings, and mounting brackets; repair or replace as needed. P-1
6. Inspect and test air tank relief (safety) valves, one-way (single) check valves, two-way (double) check valves, manual and automatic drain valves; determine needed action. P-1
7. Inspect and clean air drier systems, filters, valves, heaters, wiring, and connectors; determine needed action. P-1
8. Inspect and test brake application (foot/treadle) valve, fittings, and mounts; check pedal operation; determine needed action. P-1

III. BRAKES

C. Air Brakes: Mechanical/Foundation Brake System

1. Inspect and test service brake chambers, diaphragms, clamps, springs, pushrods, clevises, and mounting brackets; determine needed action. P-1
2. Identify slack adjuster type; inspect slack adjusters; perform needed action. P-1
3. Check camshafts (S-cams), tubes, rollers, bushings, seals, spacers, retainers, brake spiders, shields, anchor pins, and springs; perform needed action. P-1
4. Inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action. P-1
5. Inspect, clean, and adjust air disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware; perform needed action. P-1
6. 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. P-1
7. Identify concerns related to the mechanical/foundation brake system including poor stopping, brake noise, premature wear, pulling, grabbing, or dragging; determine needed action. P-1

III. BRAKES

D. Air brakes: Parking Brake System

1. Inspect, test, and/or replace parking (spring) brake chamber. P-1
2. Inspect, test, and/or replace parking (spring) brake check valves, lines, hoses, and fittings. P-1
3. Inspect, test, and/or replace parking (spring) brake application and release valve. P-1
4. Manually release (cage) and reset (uncage) parking (spring) brakes. P-1
5. Identify and test anti-compounding brake function. P-2

III. BRAKES

E. Hydraulic Brakes: Hydraulic System

1. Check master cylinder fluid level and condition; determine proper fluid type for application. P-1
2. Inspect hydraulic brake system for leaks and damage; test, repair, and/or replace hydraulic brake system components. P-1
3. Check hydraulic brake system operation including pedal travel, pedal effort, and pedal feel; determine needed action. P-1
4. Identify poor stopping, premature wear, pulling, dragging, imbalance, or poor pedal feel caused by problems in the hydraulic system; determine needed action. P-2

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| 5. Test master cylinder for internal/external leaks and damage; replace as needed. | P-2 |
| 6. Test metering (hold-off), load sensing/proportioning, proportioning, and combination valves; determine needed action. | P-3 |
| 7. Test brake pressure differential valve; test warning light circuit switch, bulbs/LEDs, wiring, and connectors; determine needed action. | P-2 |
| 8. Bleed and/or flush hydraulic brake system. | P-2 |

III. BRAKES

F. Hydraulic Brakes: Mechanical/Foundation Brake System

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|---|-----|
| 1. Inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action. | P-1 |
| 2. Inspect and clean disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware and slides; perform needed action. | P-1 |
| 3. 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. | P-1 |

III. BRAKES

G. Hydraulic Brakes: Parking Brake System

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| 1. Check parking brake operation; inspect parking brake application and holding devices; adjust, repair, and/or replace as needed. | P-1 |
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III. BRAKES

H. Power Assist Systems

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| 1. Check brake assist/booster system (vacuum or hydraulic) hoses and control valves; check fluid level and condition (if applicable). | P-1 |
| 2. Check operation of emergency (back-up/reserve) brake assist system. | P-1 |
| 3. Identify concerns related to the power assist system (vacuum or hydraulic), including stopping problems caused by the brake assist/booster system; determine needed action. | P-2 |
| 4. Inspect, test, repair, and/or replace hydraulic brake assist/booster systems, hoses, and control valves. | P-1 |

III. BRAKES

I. Vehicle Dynamic Brake Systems (Air and Hydraulic): Antilock Brake System (ABS), Automatic Traction Control (ATC) System, and Electronic Stability Control (ESC) System

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| 1. Observe antilock brake system (ABS) warning light operation including trailer and dash mounted trailer ABS warning light; determine needed action. | P-1 |
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2. Observe automatic traction control (ATC) and electronic stability control (ESC) warning light operation; determine needed action. P-2
3. Identify stopping concerns related to the vehicle dynamic brake systems: ABS, ATC, and ESC; determine needed action. P-2
4. Diagnose problems in the vehicle dynamic brake control systems; determine needed action. P-3
5. Check and test operation of vehicle dynamic brake system (air and hydraulic) mechanical and electrical components; determine needed action. P-1
6. Test vehicle/wheel speed sensors and circuits; adjust, repair, and/or replace as needed. P-1
7. Bleed ABS hydraulic circuits. P-2
8. Verify power line carrier (PLC) operation. P-3

III. BRAKES

J. Wheel Bearings

1. Clean, inspect, lubricate, and/or replace wheel bearings and races/cups; replace seals and wear rings; inspect spindle/tube; inspect and replace retaining hardware; adjust wheel bearings; check hub assembly fluid level and condition; verify end play with dial indicator method. P-1
2. Identify, inspect, and/or replace unitized/preset hub bearing assemblies. P-2

SUSPENSION AND STEERING

For every task in Suspension and Steering, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Suspension and Steering are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

IV. SUSPENSION AND STEERING SYSTEMS

A. General

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation. P-1
3. Identify suspension and steering system components and configurations. P-1
4. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. P-1

IV. SUSPENSION AND STEERING SYSTEMS

B. Steering Column

1. 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. P-1
2. Identify causes of fixed and driver adjustable steering column and shaft noise, looseness, and binding problems. P-1
3. Check cab mounting and adjust cab ride height. P-2
4. Remove the steering wheel (includes steering wheels equipped with electrical/electronic controls and components); install and center the steering wheel. P-1
5. Inspect, test, replace, and calibrate steering angle sensor. P-2

IV. SUSPENSION AND STEERING SYSTEMS

C. Steering Pump and Gear Units

1. Check power steering pump and gear operation, mountings, lines, and hoses; check fluid level and condition; service filter; inspect system for leaks. P-1
2. Flush and refill power steering system; purge air from system. P-1
3. Identify causes of power steering system noise, binding, darting/oversteer, reduced wheel cut, steering wheel kick, pulling, non-recovery, turning effort, looseness, hard steering, overheating, fluid leakage, and fluid aeration problems. P-1
4. Inspect, service, and/or replace power steering reservoir, seals, and gaskets. P-2
5. Inspect and/or replace power steering system cooler, lines, hoses, clamps, mountings, and fittings. P-2
6. Inspect and/or replace power steering gear(s) (single and/or dual) and mountings. P-2

IV. SUSPENSION AND STEERING

D. Steering Linkage

1. Inspect, service, repair, and/or replace tie rod ends, ball joints, kingpins, pitman arms, idler arms, and other steering linkage components. P-1

IV. SUSPENSION AND STEERING

E. Suspension Systems

1. Inspect, service, repair, and/or replace shock absorbers, bushings, brackets, and mounts. P-1

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| 2. Inspect, repair, and/or replace leaf springs, center bolts, clips, pins, bushings, shackles, U-bolts, insulators, brackets, and mounts; determine needed action. | P-1 |
| 3. Inspect, repair, and/or replace axle and axle aligning devices such as: radius rods, track bars, stabilizer bars, and torque arms; inspect related bushings, mounts, shims and attaching hardware; determine needed action. | P-1 |
| 4. Inspect, repair, and/or replace tandem suspension equalizer components; determine needed action. | P-3 |
| 5. Inspect, repair, and/or replace air springs, mounting plates, springs, suspension arms, and bushings; replace as needed. | P-1 |
| 6. Inspect, test, repair, and/or replace air suspension pressure regulator and height control valves, lines, hoses, dump valves, and fittings; check and record ride height. | P-1 |
| 7. Inspect and service kingpins, steering knuckle bushings, locks, bearings, seals, and covers. | P-1 |
| 8. Measure, record and adjust ride height; determine needed action. | P-1 |
| 9. Identify rough ride problems. | P-3 |

IV. SUSPENSION AND STEERING

F. Wheel Alignment Diagnosis and Repair

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| 1. Demonstrate understanding of alignment angles. | P-1 |
| 2. Identify causes of vehicle wandering, pulling, shimmy, hard steering, and off-center steering wheel problems. | P-1 |
| 3. Check and record camber. | P-2 |
| 4. Check and record caster. | P-2 |
| 5. Check, record, and adjust toe settings. | P-1 |
| 6. Check rear axle(s) alignment (thrustline/centerline) and tracking. | P-2 |
| 7. Identify turning/Ackerman angle (toe-out-on-turns) problems. | P-3 |
| 8. Check front axle alignment (centerline). | P-2 |

IV. SUSPENSION AND STEERING

G. Wheels and Tires

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| 1. Inspect tire condition; identify tire wear patterns; measure tread depth; verify tire matching (diameter and tread); inspect valve stem and cap; set tire pressure; determine needed action. | P-1 |
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2. Identify wheel/tire vibration, shimmy, pounding, and hop (tramp) problems; determine needed action. P-2
3. Check wheel mounting hardware; check wheel condition; remove and install wheel/tire assemblies (steering and drive axle); torque fasteners to manufacturer's specification using torque wrench. P-1
4. Inspect tire and wheel for proper application (size, load range, position, and tread design); determine needed action. P-2

IV. SUSPENSION AND STEERING

H. Frame and Coupling Devices

1. Inspect, service, and/or adjust fifth wheel, pivot pins, bushings, locking mechanisms, mounting hardware, air lines, and fittings. P-1
2. Inspect frame and frame members for cracks, breaks, corrosion, distortion, elongated holes, looseness, and damage; determine needed action. P-1
3. Inspect and install frame hangers, brackets, and cross members; determine needed action. P-3
4. Inspect, repair, or replace pintle hooks and draw bars (if applicable). P-2
5. Inspect, service, and/or adjust sliding fifth wheel, tracks, stops, locking systems, air cylinders, springs, lines, hoses, and controls. P-2

ELECTRICAL/ELECTRONIC SYSTEMS

For every task in Electrical/Electronic Systems, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Electrical/Electronic Systems are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

V. ELECTRICAL/ELECTRONIC SYSTEMS

A. General

1. Research vehicle service information including, vehicle service history, service precautions, and technical service bulletins. P-1
2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law). P-1
3. Demonstrate proper use of test equipment when measuring source voltage, voltage drop (including grounds), current flow, continuity, and resistance. P-1
4. Demonstrate knowledge of the causes and effects of shorts, grounds, opens, and resistance problems in electrical/electronic circuits; identify and locate faults in electrical/electronic circuits. P-1

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| 5. Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems. | P-1 |
| 6. Measure parasitic (key-off) battery drain; determine needed action. | P-1 |
| 7. Demonstrate knowledge of the function, operation, and testing of fusible links, circuit breakers, relays, solenoids, diodes, and fuses; perform inspection and testing; determine needed action. | P-1 |
| 8. Inspect, test, repair (including solder repair), and/or replace components, connectors, seals, terminal ends, harnesses, and wiring; verify proper routing and securement; determine needed action. | P-1 |
| 9. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. | P-2 |
| 10. Check for malfunctions caused by faults in the data bus communications network. | P-2 |
| 11. Identify electrical/electronic system components and configuration. | P-1 |
| 12. Check frequency, pulse width, and waveforms of electrical/electronic signals using appropriate test equipment; interpret readings; determine needed repairs. | P-2 |

V. ELECTRICAL/ELECTRONIC SYSTEMS

B. Battery System

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| 1. Identify battery type and system configuration. | P-1 |
| 2. Confirm proper battery capacity for application; perform battery state-of-charge test; perform battery capacity test, determine needed action. | P-1 |
| 3. Inspect battery, battery cables, connectors, battery boxes, mounts, and hold-downs; determine needed action. | P-1 |
| 4. Charge battery using appropriate method for battery type. | P-1 |
| 5. Jump-start vehicle using a booster battery and jumper cables or using an appropriate auxiliary power supply. | P-1 |
| 6. Check low voltage disconnect (LVD) systems; determine needed action. | P-2 |
| 7. Inspect, clean, and service battery; replace as needed. | P-1 |
| 8. Inspect and clean battery boxes, mounts, and hold-downs; repair or replace as needed. | P-1 |
| 9. Test and clean battery cables and connectors; repair or replace as needed. | P-1 |
| 10. Identify electrical/electronic modules, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery. | P-3 |

V. ELECTRICAL/ELECTRONIC SYSTEMS

C. Starting System

1. Demonstrate understanding of starter system operation. P-1
2. Perform starter circuit cranking voltage and voltage drop tests; determine needed action. P-1
3. Inspect and test starter control circuit switches (key switch, push button, and/or magnetic switch), relays, connectors, terminals, wires, and harnesses (including over-crank protection); determine needed action. P-1
4. Identify causes of no-crank or slow crank condition; differentiate between electrical and engine mechanical problems; determine needed action. P-1
5. Perform starter current draw tests; determine needed action. P-3
6. Remove and replace starter; inspect flywheel ring gear or flex plate. P-1

V. ELECTRICAL/ELECTRONIC SYSTEMS

D. Charging System

1. Identify and understand operation of the generator (alternator). P-1
2. Test instrument panel mounted voltmeters and/or indicator lamps; determine needed action. P-1
3. Inspect, adjust, and/or replace generator (alternator) drive belt; check pulleys and tensioners for wear; check fans and mounting brackets; verify proper belt alignment; determine needed action. P-1
4. Inspect cables, wires, and connectors in the charging circuit; determine needed action. P-1
5. Perform charging system voltage and amperage output tests; perform AC ripple test; determine needed action. P-1
6. Perform charging circuit voltage drop tests; determine needed action. P-1
7. Remove, inspect, and/or replace generator (alternator). P-1

V. ELECTRICAL/ELECTRONIC SYSTEMS

E. Lighting Systems

1. Identify causes of brighter-than-normal, intermittent, dim, or no-light operation; determine needed action. P-1
2. Test, replace, and aim headlights P-1
3. Inspect cables, wires, and connectors in the lighting systems. P-1
4. Inspect tractor-to-trailer multi-wire connectors, cables, and holders. P-1

5. Inspect switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of exterior lighting systems; determine needed action. P-2
6. Inspect switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of interior lighting systems; determine needed action. P-2
7. Inspect switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of auxiliary lighting circuits; determine needed action P-2

V. ELECTRICAL/ELECTRONIC SYSTEMS

F. Instrument Cluster and Driver Information Systems

1. Check gauge and warning indicator operation. P-1
2. Identify faults in the sensor/sending units, gauges, switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, printed circuits, and control components/modules of the instrument cluster, driver information systems, and warning systems; determine needed action. P-2
3. Inspect electronic speedometer, odometer, and tachometer systems. P-3

HEATING, VENTILATION, AND AIR CONDITIONING (HVAC).

For every task in Heating, Ventilation and Air Conditioning (HVAC), the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Heating, Ventilation, & Air Conditioning are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

A. General

1. Research vehicle service information, including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Identify heating, ventilation, and air conditioning (HVAC) components and configuration. P-1
3. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. P-1
4. Identify and interpret heating and air-conditioning problems. P-1
5. Identify refrigerant type; test for contamination; select and connect proper gauge set/test equipment; record temperature and pressure readings. P-1

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| 6. Demonstrate understanding of A/C system performance test. | P-1 |
| 7. Demonstrate understanding of A/C system leak test. | P-1 |
| 8. Inspect condition of refrigerant oil removed from A/C system; determine needed action. | P-1 |
| 9. Determine oil and oil capacity for system application and/or component replacement. | P-1 |

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

B. Refrigeration System Components

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| 1. Inspect, remove, and replace A/C compressor drive belts, pulleys, and tensioners; verify proper belt alignment. | P-1 |
| 2. Check A/C system operation including system pressures; visually inspect A/C components for signs of leaks; check A/C monitoring system (if applicable). | P-1 |
| 3. Inspect A/C condenser for airflow restrictions; determine needed action. | P-1 |
| 4. Inspect A/C compressor and clutch assembly; check compressor clutch air gap; determine needed action. | P-1 |
| 5. Inspect AC system hoses, lines, fittings, O-rings, seals, and service valves; determine needed action. | P-1 |
| 6. Inspect receiver/drier or accumulator/drier; determine needed action. | P-1 |
| 7. Inspect expansion valve or orifice (expansion) tube; determine needed action. | P-1 |
| 8. Inspect evaporator housing water drain; determine needed action. | P-1 |
| 9. Understand A/C system conditions that cause the protection devices (pressure, thermal, and/or control module) to interrupt system operation. | P-2 |
| 10. Understand procedure to remove and reinstall evaporator. | P-2 |
| 11. Understand procedure to inspect and/or replace condenser. | P-2 |

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

C. Heating, Ventilation, and Engine Cooling Systems

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| 1. Inspect engine cooling system and heater system hoses and pipes; determine needed action. | P-1 |
| 2. Inspect HVAC system heater ducts, doors, hoses, cabin filters, and outlets; determine needed action. | P-1 |
| 3. Identify the source of A/C system odors; determine needed action. | P-2 |

4. Identify temperature control problems in the HVAC system; determine needed action. P-2
5. Understand procedure to remove, inspect, reinstall, and/or replace engine coolant and heater system components. P-2

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

D. Operating Systems and Related Controls

1. Verify HVAC system blower motor operation; confirm proper air distribution; confirm proper temperature control; determine needed action. P-1
2. Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices P-1
3. Demonstrate understanding of A/C compressor clutch control systems. P-2
4. Demonstrate understanding of vacuum, mechanical, and electrical components and controls of the HVAC system. P-2

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

E. Refrigerant Recovery, Recycling, and Handling

1. Understand correct use and maintenance of refrigerant handling equipment. P-1
2. Understand how to identify A/C system refrigerant; test for sealants; recover, evacuate, and charge A/C system; add refrigerant oil as required. P-1
3. Understand how to recycle, label, and store refrigerant. P-1

CAB

For every task in Cab the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Cab are to listen to and verify operator's concern, review past maintenance documents, and record condition on appropriate document.

VII. CAB

A. General

1. Research vehicle service information, including, vehicle service history, service precautions, and technical service bulletins. P-1
2. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; check and record trip/operational data; reset maintenance monitor (if applicable); interpret digital multimeter (DMM) readings. P-1

VII. CAB

B. Instruments and Controls

1. Inspect mechanical key condition; check operation of ignition switch; check operation of indicator lights, warning lights and/or alarms; check instruments; record oil pressure and system voltage; check operation of electronic power take-off (PTO) and engine idle speed controls (if applicable). P-1
2. Check operation of all accessories. P-1
3. Understand operation of auxiliary power unit (APU)/electric power unit (EPU). P-3

VII. CAB

C. Safety Equipment

1. Test operation of horns (electric and air); test warning device operation (reverse, air pressure, etc.); check condition of spare fuses, safety triangles, fire extinguisher, and all required decals; inspect seat belts and sleeper restraints; inspect condition of wiper blades, arms, and linkage; determine needed action. P-1

VII. CAB

D. Hardware

1. Test operation of wipers and washer; inspect windshield glass for cracks or discoloration; check sun visor; check seat condition, operation, and mounting; check door glass and window operation; verify operation of door and cab locks; inspect steps and grab handles; inspect mirrors, mountings, brackets, and glass; determine needed action. P-1
2. Record all physical damage. P-2
3. Lubricate all cab grease fittings; inspect and lubricate door and hood hinges, latches, strikers, lock cylinders, safety latches, linkages, and cables. P-2
4. Inspect cab mountings, hinges, latches, linkages, and ride height; determine needed action. P-1
5. Inspect quarter fender, mud flaps, and brackets; determine needed action. P-1

HYDRAULICS

For every task in Hydraulics, the following safety task must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Hydraulics are to listen to and verify operator's concern, review past maintenance documents, and record condition on appropriate document.

VIII. HYDRAULICS

A. General

1. Research vehicle service information, including vehicle service history, service precautions, fluid type, and technical service bulletins. P-3
2. Verify placement of equipment/component safety labels and placards; determine needed action. P-3
3. Identify hydraulic system components; locate filtration system components; service filters and breathers. P-3
4. Check fluid level and condition; take a hydraulic fluid sample for analysis; determine needed action. P-3
5. Inspect hoses and connections for leaks, proper routing, and proper protection; determine needed action. P-3

2017 MEDIUM/HEAVY TRUCK MASTER SERVICE TECHNOLOGY (MTST)

Task List

DIESEL ENGINES

For every task in Diesel Engines, the following safety task must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Diesel Engines are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

I. DIESEL ENGINES

A. General

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Inspect level and condition of fuel, oil, diesel exhaust fluid (DEF), and coolant. P-1
3. Inspect engine assembly for fuel, oil, coolant, air, and other leaks; determine needed action. P-1
4. Diagnose engine operation (starting and running) including: noise, vibration, smoke, etc.; determine needed action. P-2
5. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; check and record trip/operational data; reset maintenance monitor (if applicable); interpret digital multimeter (DMM) readings. P-1
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. P-1
7. Diagnose engine no-crank, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed action. P-2
8. Diagnose engine surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and/or shut down problems; determine needed action. P-2

I. DIESEL ENGINES

B. Cylinder Head and Valve Train

1. Inspect electronic wiring harness and brackets for wear, bending, cracks, and proper securement; determine needed action. P-1
2. Inspect cylinder head for cracks/damage; check mating surfaces for warpage; check condition of passages; inspect core/expansion and gallery plugs; determine needed action. P-2

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| 3. Inspect injector sleeves and seals; determine needed action. | P-3 |
| 4. Inspect valve train components; determine needed action. | P-1 |
| 5. Inspect, measure, and replace/reinstall camshaft; measure/adjust end play and backlash. | P-3 |
| 6. Adjust valve bridges (crossheads); adjust valve clearances and injector settings. | P-2 |
| 7. Disassemble cylinder head; inspect valves, guides, seats, springs, retainers, rotators, locks, and seals; determine needed action. | P-3 |
| 8. Measure valve head height relative to deck; measure valve face-to-seat contact; determine needed action. | P-3 |
| 9. Reassemble cylinder head. | P-3 |
| 10. Inspect, measure, and replace/reinstall camshaft; measure end play and backlash; determine needed action. | P-3 |

I. DIESEL ENGINES

C. Engine Block

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| 1. Inspect crankshaft vibration damper; inspect engine mounts; determine needed action. | P-1 |
| 2. Remove, inspect, service, and install pans, covers, gaskets, seals, wear rings, and crankcase ventilation components; determine needed action. | P-1 |
| 3. Perform crankcase pressure test; determine needed action. | P-1 |
| 4. Install and align flywheel housing; inspect flywheel housing(s) to transmission housing/engine mating surface(s); and measure flywheel housing face and bore runout; determine needed action. | P-2 |
| 5. Inspect flywheel/flexplate (including ring gear) and mounting surfaces for cracks and wear; measure runout; determine needed action. | P-2 |
| 6. Disassemble and clean engine block; inspect engine block for cracks/damage; measure mating surfaces for warpage; check condition of passages, core/expansion plugs, and gallery plugs; inspect threaded holes, studs, dowel pins, and bolts for serviceability; determine needed action. | P-2 |
| 7. Inspect cylinder sleeve counter bore and lower bore; check bore distortion; determine needed action. | P-2 |
| 8. Clean, inspect, and measure cylinder walls or liners for wear and damage; determine needed action. | P-2 |
| 9. Replace/reinstall cylinder liners and seals; check and adjust liner height (protrusion). | P-2 |

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| 10. Inspect camshaft bearings for wear and damage; determine needed action. | P-3 |
| 11. Inspect, measure, and replace/reinstall camshaft; measure end play and backlash; determine needed action. | P-3 |
| 12. Clean and inspect crankshaft for surface cracks and journal damage; check condition of oil passages; check passage plugs; measure journal diameter; determine needed action. | P-2 |
| 13. Inspect main bearings for wear patterns and damage; replace as needed; check bearing clearances; check and correct crankshaft end play. | P-2 |
| 14. Inspect, install, and time gear train; measure gear backlash; determine needed action. | P-2 |
| 15. Inspect connecting rod and bearings for wear patterns; measure pistons, pins, retainers, and bushings; determine needed action. | P-3 |
| 16. Determine piston-to-cylinder wall clearance; check ring-to-groove fit and end gap; install rings on pistons. | P-3 |
| 17. Assemble pistons and connecting rods; install in block; install rod bearings and check clearances. | P-2 |
| 18. Check condition of piston cooling jets (nozzles); determine needed action. | P-2 |

I. DIESEL ENGINES

D. Lubrication Systems

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| 1. Test engine oil pressure; check operation of pressure sensor, gauge, and/or sending unit; test engine oil temperature; check operation of temperature sensor; determine needed action. | P-1 |
| 2. Check engine oil level, condition, and consumption; take engine oil sample; determine needed action. | P-1 |
| 3. Determine proper lubricant; perform oil and filter service. | P-1 |
| 4. Inspect, clean, and test oil cooler and components; determine needed action. | P-2 |
| 5. Inspect turbocharger lubrication systems; determine needed action. | P-2 |
| 6. Inspect and measure oil pump, drives, inlet pipes, and pick-up screens; check drive gear clearances; determine needed action. | P-2 |
| 7. Inspect oil pressure regulator valve(s), by-pass and pressure relief valve(s), oil thermostat, and filters; determine needed action. | P-2 |

I. DIESEL ENGINES

E. Cooling System

1. Check engine coolant type, level, and condition; test coolant for freeze protection and additive package concentration. P-1
2. Test coolant temperature; test operation of temperature and level sensors, gauge, and/or sending unit; determine needed action. P-1
3. Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment. P-1
4. Recover coolant; flush and refill with recommended coolant/additive package; bleed cooling system. P-1
5. Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed. P-1
6. Inspect water pump, hoses, and clamps; determine needed action. P-1
7. Inspect and pressure test cooling system(s); pressure test cap, tank(s), and recovery systems; inspect radiator and mountings; determine needed action. P-1
8. Inspect, test, and repair thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud; determine needed action. P-1
9. Test engine block heater(s); determine needed action. P-2
10. Diagnose engine coolant consumption; determine needed action. P-1
11. Inspect thermostat(s), by-passes, housing(s), and seals; replace as needed. P-1
12. Inspect turbocharger cooling systems; determine needed action. P-2

I. DIESEL ENGINES

F. Air Induction and Exhaust Systems

1. Inspect turbocharger(s), wastegate(s), and piping systems; determine needed action P-2
2. Diagnose air induction system problems; inspect, clean, and/or replace cooler assembly, piping, hoses, clamps, and mountings; replace air filter as needed; reset restriction indicator (if applicable). P-1
3. Inspect intake manifold, gaskets, and connections; determine needed action. P-1
4. Inspect engine exhaust system, exhaust gas recirculation (EGR) system, and exhaust aftertreatment system for leaks, mounting, proper routing, and damaged or missing components; determine needed action. P-1
5. Inspect crankcase ventilation system; service as needed. P-1

6. Diagnose problems/faults in the exhaust gas recirculation (EGR) system including: EGR valve, cooler, piping, filter, electronic sensors, controls, and wiring; determine needed action. P-1
7. Perform air intake system restriction and leakage tests; determine needed action. P-1
8. Perform intake manifold pressure (boost) test; determine needed action. P-3
9. Check exhaust back pressure; determine needed action. P-3
10. Inspect variable ratio geometry turbocharger (VGT), controls, and actuators (pneumatic, hydraulic, and electronic); determine needed action. P-2
11. Demonstrate knowledge of charge air cooler operation and testing. P-1
12. Diagnose exhaust aftertreatment system performance problems; determine needed action. P-1
13. Diagnose preheater/inlet air heater or glow plug system and controls; determine needed action. P-2

I. DIESEL ENGINES

G. Fuel System

1. Check fuel level and condition; determine needed action. P-1
2. Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, hoses, lines, and fittings; determine needed action. P-1
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); determine needed action. P-1
4. Replace fuel filter; prime and bleed fuel system. P-1
5. Inspect high pressure fuel system components (fuel pump, pump drives, hoses, injection lines, filters, hold-downs, fittings, seals, and mounting hardware). P-1
6. Demonstrate knowledge and understanding of the different types of fuel systems. P-1
7. Perform fuel supply and return system tests; determine needed action. P-1
8. Perform cylinder contribution test using electronic service tool(s). P-1
9. Demonstrate knowledge of how to set performance parameters using electronic service tools and service information system access. P-2

I. DIESEL ENGINES

H. Engine Brakes

1. Inspect engine compression and/or exhaust brake housing, valves, seals, lines, and fittings; determine needed action. P-1
2. Inspect and adjust engine compression and/or exhaust brake systems; determine needed action. P-2
3. Inspect, test, and adjust engine compression and/or exhaust brake control circuits, switches, and solenoids; determine needed action. P-2

DRIVE TRAIN

For every task in Drive Train, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Drive Train are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

II. DRIVE TRAIN

A. General

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Identify drive train components, transmission type, and configuration. P-1
3. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. P-1

II. DRIVE TRAIN

B. Clutch

1. 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; determine needed action. P-1
2. Inspect clutch master cylinder fluid level; check clutch master cylinder, slave cylinder, lines, and hoses for leaks and damage; determine needed action. P-1
3. Inspect, adjust, repair, and/or replace hydraulic clutch slave and master cylinders, lines, and hoses; bleed system. P-2
4. Inspect, adjust, lubricate, or replace release (throw-out) bearing, sleeve, bushings, springs, housing, levers, release fork, fork pads, rollers, shafts, and seals. P-1

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| 5. Inspect, adjust, and/or replace single-disc clutch pressure plate and clutch disc. | P-1 |
| 6. Inspect, adjust, and/or replace two-plate clutch pressure plate, clutch discs, intermediate plate, and drive pins/lugs. | P-1 |
| 7. Inspect and/or replace clutch brake assembly; inspect input shaft and bearing retainer; determine needed action. | P-1 |
| 8. Inspect, adjust, and/or replace self-adjusting/continuous-adjusting clutch mechanisms. | P-1 |
| 9. Inspect and/or replace pilot bearing. | P-1 |
| 10. Identify causes of clutch noise, binding, slippage, pulsation, vibration, grabbing, dragging, and chatter problems; determine needed action. | P-1 |
| 11. Remove and install flywheel; inspect mounting area on crankshaft; inspect rear main oil seal; measure crankshaft end play; determine needed action. | P-1 |
| 12. Inspect flywheel and starter ring gear; measure flywheel face; measure pilot bore runout; determine needed action. | P-1 |
| 13. Inspect flywheel housing-to-transmission housing/engine mating surface(s); measure flywheel housing face and bore runout; determine needed action. | P-2 |

II. DRIVE TRAIN

C. Transmission

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| 1. Inspect transmission shifter and linkage; inspect and/or replace transmission mounts, insulators, and mounting bolts. | P-1 |
| 2. Inspect transmission for leakage; determine needed action. | P-1 |
| 3. Replace transmission cover plates, gaskets, seals, and cap bolts; inspect seal surfaces and vents; determine needed action. | P-1 |
| 4. Check transmission fluid level and condition; determine needed action. | P-1 |
| 5. Inspect transmission breather; inspect transmission oil filters, coolers, and related components; determine needed action. | P-2 |
| 6. Inspect speedometer components; determine needed action. | P-2 |
| 7. Inspect and test function of REVERSE light, NEUTRAL start, and warning device circuits; determine needed action. | P-1 |
| 8. Inspect, adjust, and replace transmission covers, rails, forks, levers, bushings, sleeves, detents, interlocks, springs, and lock bolts/safety wires. | P-2 |
| 9. Identify causes of transmission noise, shifting concerns, lockup, jumping out-of-gear, overheating, and vibration problems; determine needed repairs. | P-1 |

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| 10. Inspect, test, repair, and/or replace air shift controls, lines, hoses, valves, regulators, filters, and cylinder assemblies. | P-2 |
| 11. Remove and reinstall transmission. | P-2 |
| 12. Inspect input shaft, gear, spacers, bearings, retainers, and slingers; determine needed action. | P-3 |
| 13. Inspect and adjust power take-off (PTO) assemblies, controls, and shafts; determine needed action. | P-3 |
| 14. Inspect and test transmission temperature gauge, wiring harnesses, and sensor/sending unit; determine needed action. | P-2 |
| 15. Inspect and test operation of automatic transmission, components, and controls; diagnose automatic transmission system problems; determine needed action. | P-2 |
| 16. Inspect and test operation of automated mechanical transmission, components, and controls; diagnose automated mechanical transmission system problems; determine needed action. | P-2 |

II. DRIVE TRAIN

D. Driveshaft and Universal Joints

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| 1. Inspect, service, and/or replace driveshafts, slip joints, yokes, drive flanges, support bearings, universal joints, boots, seals, and retaining/mounting hardware; check phasing of all shafts. | P-1 |
| 2. Identify causes of driveshaft and universal joint noise and vibration problems; determine needed action. | P-1 |
| 3. Inspect driveshaft center support bearings and mounts; determine needed action. | P-1 |
| 4. Measure driveline angles; determine needed action. | P-2 |

II. DRIVE TRAIN

E. Drive Axles

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| 1. Check and repair fluid leaks; inspect drive axle housing assembly, cover plates, gaskets, seals, vent/breather, and magnetic plugs. | P-1 |
| 2. Check drive axle fluid level and condition; check drive axle filter; determine needed action. | P-1 |
| 3. Inspect, adjust, repair, and/or replace air-operated power divider (inter-axle differential) assembly including: diaphragms, seals, springs, yokes, pins, lines, hoses, fittings, and controls. | P-2 |
| 4. Inspect drive axle shafts; determine needed action. | P-2 |

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| 5. Remove and replace wheel assembly; check rear wheel seal and axle flange for leaks; determine needed action. | P-1 |
| 6. Inspect, repair, or replace drive axle lubrication system pump, troughs, collectors, slingers, tubes, and filters. | P-3 |
| 7. Identify causes of drive axle(s) drive unit noise and overheating problems; determine needed action. | P-2 |
| 8. Inspect and test drive axle temperature gauge, wiring harnesses, and sending unit/sensor; determine needed action. | P-2 |
| 9. Remove and replace differential carrier assembly. | P-2 |
| 10. Identify causes of drive axle wheel bearing noise and check for damage; determine needed action. | P-1 |
| 11. Inspect and/or replace components of differential case assembly including spider gears, cross shaft, side gears, thrust washers, case halves, and bearings. | P-3 |
| 12. Inspect and replace components of locking differential case assembly. | P-3 |
| 13. Inspect differential carrier housing and caps, side bearing bores, and pilot (spigot, pocket) bearing bore; determine needed action. | P-3 |
| 14. Inspect and replace ring and drive pinion gears, spacers, sleeves, bearing cages, and bearings. | P-3 |
| 15. Measure ring gear runout; determine needed action. | P-2 |
| 16. Measure and adjust drive pinion bearing preload. | P-3 |
| 17. Measure and adjust drive pinion depth. | P-3 |
| 18. Measure and adjust side bearing preload and ring gear backlash. | P-2 |
| 19. Check and interpret ring gear and pinion tooth contact pattern; determine needed action. | P-2 |
| 20. Inspect, adjust, or replace ring gear thrust block/screw. | P-3 |

BRAKES

For every task in Brakes, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Brakes are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

III. BRAKES

A. General

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Identify brake system components and configurations (including air and hydraulic systems, parking brake, power assist, and vehicle dynamic brake systems). P-1
3. Identify brake performance problems caused by the mechanical/foundation brake system (air and hydraulic). P-1
4. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. P-1

III. BRAKES

B. Air Brakes: Air Supply and Service Systems

1. Inspect, test, repair, and/or replace 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); determine needed action. P-1
2. Test gauge operation and readings; test 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; determine needed action. P-1
3. Demonstrate knowledge and understanding of air supply and service system components and operations. P-1
4. Inspect air compressor drive gear components (gears, belts, tensioners, and/or couplings); determine needed action. P-3
5. Inspect air compressor inlet; inspect oil supply and coolant lines, fittings, and mounting brackets; repair or replace as needed. P-1
6. Inspect and test air tank relief (safety) valves, one-way (single) check valves, two-way (double) check valves, manual and automatic drain valves; determine needed action. P-1
7. Inspect and clean air drier systems, filters, valves, heaters, wiring, and connectors; determine needed action. P-1
8. Inspect and test brake application (foot/treadle) valve, fittings, and mounts; check pedal operation; determine needed action. P-1

III. BRAKES

C. Air Brakes: Mechanical/Foundation Brake System

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| 1. Inspect, test, repair, and/or replace service brake chambers, diaphragms, clamps, springs, pushrods, clevises, and mounting brackets; determine needed action. | P-1 |
| 2. Identify slack adjuster type; inspect slack adjusters; perform needed action. | P-1 |
| 3. Check camshafts (S-cam), tubes, rollers, bushings, seals, spacers, retainers, brake spiders, shields, anchor pins, and springs; perform needed action. | P-1 |
| 4. Inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action. | P-1 |
| 5. Inspect, clean, and adjust air disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware; perform needed action. | P-1 |
| 6. 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. | P-1 |
| 7. Diagnose concerns related to the mechanical/foundation brake system including poor stopping, brake noise, premature wear, pulling, grabbing, or dragging; determine needed action. | P-1 |

III. BRAKES

D. Air Brakes: Parking Brake System

- | | |
|---|-----|
| 1. Inspect, test, and/or replace parking (spring) brake chamber. | P-1 |
| 2. Inspect, test, and/or replace parking (spring) brake check valves, lines, hoses, and fittings. | P-1 |
| 3. Inspect, test, and/or replace parking (spring) brake application and release valve. | P-1 |
| 4. Manually release (cage) and reset (uncage) parking (spring) brakes. | P-1 |
| 5. Identify and test anti-compounding brake function; determine needed action. | P-2 |

III. BRAKES

E. Hydraulic Brakes: Hydraulic System

- | | |
|--|-----|
| 1. Check master cylinder fluid level and condition; determine proper fluid type for application. | P-1 |
| 2. Inspect hydraulic brake system for leaks and damage; test, repair, and/or replace hydraulic brake system components. | P-1 |
| 3. Check hydraulic brake system operation including pedal travel, pedal effort, and pedal feel; determine needed action. | P-1 |

4. Diagnose poor stopping, premature wear, pulling, dragging, imbalance, or poor pedal feel caused by problems in the hydraulic system; determine needed action. P-2
5. Test master cylinder for internal/external leaks and damage; replace as needed. P-2
6. Test metering (hold-off), load sensing/proportioning, proportioning, and combination valves; determine needed action. P-3
7. Test brake pressure differential valve; test warning light circuit switch, bulbs/LEDs, wiring, and connectors; determine needed action. P-2
8. Bleed and/or flush hydraulic brake system. P-2

III. BRAKES

F. Hydraulic Brakes: Mechanical/Foundation Brake System

1. Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine necessary action. P-1
2. Inspect and clean disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware; perform needed action. P-1
3. Remove, clean and inspect brake drums; measure brake drum diameter; measure brake lining thickness; inspect brake lining condition; inspect wheel cylinders; determine serviceability. P-1
4. Check disc brake caliper assembly mountings and slides; replace as needed. P-2

III. BRAKES

G. Hydraulic Brakes: Parking Brake System

1. Check parking brake operation; inspect parking brake application and holding devices; adjust, repair, and/or replace as needed. P-1

III. BRAKES

H. Power Assist Systems

1. Check brake assist/booster system (vacuum or hydraulic) hoses and control valves; check fluid level and condition (if applicable). P-1
2. Check operation of emergency (back-up/reserve) brake assist system. P-1
3. Identify concerns related to the power assist system (vacuum or hydraulic), including stopping problems caused by the brake assist (booster) system; determine needed action. P-2
4. Inspect, test, repair, and/or replace hydraulic brake assist/booster systems, hoses, and control valves. P-1

III. BRAKES

I. Vehicle Dynamic Brake Systems (Air and Hydraulic): Antilock Brake System (ABS), Automatic Traction Control (ATC) System, and Electronic Stability Control (ESC) System

1. Observe antilock brake system (ABS) warning light operation including trailer and dash mounted trailer ABS warning light; determine needed action. P-1
2. Observe automatic traction control (ATC) and electronic stability control (ETC) warning light operation; determine needed action. P-2
3. Identify stopping concerns related to the vehicle dynamic brake systems: ABS, ATC, and ESC; determine needed action. P-2
4. Diagnose problems in the vehicle dynamic brake control systems; determine needed action. P-2
5. Check and test operation of vehicle dynamic brake system (air and hydraulic) mechanical and electrical components; determine needed action. P-1
6. Test vehicle/wheel speed sensors and circuits; adjust, repair, and/or replace as needed. P-1
7. Bleed ABS hydraulic circuits. P-2
8. Verify power line carrier (PLC) operation. P-3

III. BRAKES

J. Wheel Bearings

1. Clean, inspect, lubricate, and/or replace wheel bearings and races/cups; replace seals and wear rings; inspect spindle/tube; inspect and replace retaining hardware; adjust wheel bearings; check hub assembly fluid level and condition; verify end play with dial indicator method. P-1
2. Identify, inspect, and/or replace unitized/preset hub bearing assemblies. P-2

SUSPENSION AND STEERING

For every task in Suspension and Steering, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Suspension and Steering are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

IV. SUSPENSION AND STEERING SYSTEMS

A. General

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1

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| 2. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation. | P-1 |
| 3. Identify suspension and steering system components and configurations. | P-1 |
| 4. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. | P-1 |

IV. SUSPENSION AND STEERING SYSTEMS

B. Steering Column

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|--|-----|
| 1. 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. | P-1 |
| 2. Diagnose causes of fixed and driver adjustable steering column and shaft noise, looseness, and binding problems. | P-1 |
| 3. Check cab mounting and adjust cab ride height. | P-2 |
| 4. Remove the steering wheel (includes steering wheels equipped with electrical/electronic controls and components); install and center the steering wheel. | P-1 |
| 5. Inspect, test, replace, and calibrate steering angle sensor. | P-2 |

IV. SUSPENSION AND STEERING SYSTEMS

C. Steering Pump and Gear Units

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|--|-----|
| 1. Check power steering pump and gear operation, mountings, lines, and hoses; check fluid level and condition; service filter; inspect system for leaks. | P-1 |
| 2. Flush and refill power steering system; purge air from system. | P-1 |
| 3. Diagnose causes of power steering system noise, binding, darting/oversteer, reduced wheel cut, steering wheel kick, pulling, non-recovery, turning effort, looseness, hard steering, overheating, fluid leakage, and fluid aeration problems. | P-1 |
| 4. Inspect, service, and/or replace power steering reservoir, seals, and gaskets. | P-2 |
| 5. Inspect and/or replace power steering system cooler, lines, hoses, clamps, mountings, and fittings. | P-2 |
| 6. Inspect and/or replace power steering gear(s) (single and/or dual) and mountings. | P-2 |

IV. SUSPENSION AND STEERING

D. Steering Linkage

1. Inspect, service, repair, and/or replace tie rod ends, ball joints, kingpins, pitman arms, idler arms, and other steering linkage components. P-1

IV. SUSPENSION AND STEERING

E. Suspension Systems

1. Inspect, service, repair, and/or replace shock absorbers, bushings, brackets, and mounts. P-1
2. Inspect, repair, and/or replace leaf springs, center bolts, clips, pins, bushings, shackles, U-bolts, insulators, brackets, and mounts. P-1
3. Inspect, repair, and/or replace axle and axle aligning devices such as: radius rods, track bars, stabilizer bars, and torque arms; inspect related bushings, mounts, shims and attaching hardware; determine needed action. P-1
4. Inspect, repair, and/or replace tandem suspension equalizer components; determine needed action. P-3
5. Inspect, repair, and/or replace air springs, mounting plates, springs, suspension arms, and bushings. P-1
6. Inspect, test, repair, and/or replace air suspension pressure regulator and height control valves, lines, hoses, dump valves, and fittings; check and record ride height. P-1
7. Inspect and service kingpins, steering knuckle bushings, locks, bearings, seals, and covers. P-1
8. Measure, record and adjust ride height; determine needed action. P-1
9. Diagnose rough ride problems; determine needed action. P-3

IV. SUSPENSION AND STEERING

F. Wheel Alignment Diagnosis and Repair

1. Demonstrate understanding of alignment angles. P-1
2. Diagnose causes of vehicle wandering, pulling, shimmy, hard steering, and off-center steering wheel problems. P-1
3. Check, record, and adjust camber. P-2
4. Check, record, and adjust caster. P-2
5. Check, record, and adjust toe settings. P-1
6. Check rear axle(s) alignment (thrustline/centerline) and tracking. P-2
7. Identify turning/Ackerman angle (toe-out-on-turns) problems. P-3
8. Check front axle alignment (centerline). P-2

IV. SUSPENSION AND STEERING

G. Wheels and Tires

1. Inspect tire condition; identify tire wear patterns; measure tread depth; verify tire matching (diameter and tread); inspect valve stem and cap; set tire pressure; determine needed action. P-1
2. Diagnose wheel/tire vibration, shimmy, pounding, and hop (tramp) problems; determine needed action. P-2
3. Check wheel mounting hardware; check wheel condition; remove and install wheel/tire assemblies (steering and drive axle); torque fasteners to manufacturer's specification using torque wrench. P-1
4. Inspect tire and wheel for proper application (size, load range, position, and tread design); determine needed action. P-2

IV. SUSPENSION AND STEERING

H. Frame and Coupling Devices

1. Inspect, service, and/or adjust fifth wheel, pivot pins, bushings, locking mechanisms, mounting hardware, air lines, and fittings. P-1
2. Inspect frame and frame members for cracks, breaks, corrosion, distortion, elongated holes, looseness, and damage; determine needed action. P-1
3. Inspect, install, and/or replace frame hangers, brackets, and cross members; determine needed action. P-3
4. Inspect, repair, or replace pintle hooks and draw bars (if applicable). P-2
5. Inspect, service, and/or adjust sliding fifth wheel, tracks, stops, locking systems, air cylinders, springs, lines, hoses, and controls. P-2

ELECTRICAL/ELECTRONIC SYSTEMS

For every task in Electrical/Electronic Systems, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Electrical/Electronic Systems are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

V. ELECTRICAL/ELECTRONIC SYSTEMS

A. General

1. Research vehicle service information, including vehicle service history, service precautions, and technical service bulletins. P-1
2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law). P-1

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| 3. Demonstrate proper use of test equipment when measuring source voltage, voltage drop (including grounds), current flow, continuity, and resistance. | P-1 |
| 4. Demonstrate knowledge of the causes and effects of shorts, grounds, opens, and resistance problems in electrical/electronic circuits; identify and locate faults in electrical/electronic circuits. | P-1 |
| 5. Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems. | P-1 |
| 6. Measure parasitic (key-off) battery drain; determine needed action. | P-1 |
| 7. Demonstrate knowledge of the function, operation, and testing of fusible links, circuit breakers, relays, solenoids, diodes, and fuses; perform inspection and testing; determine needed action. | P-1 |
| 8. Inspect, test, repair (including solder repair), and/or replace components, connectors, seals, terminal ends, harnesses, and wiring; verify proper routing and securement; determine needed action. | P-1 |
| 9. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. | P-1 |
| 10. Diagnose faults in the data bus communications network; determine needed action. | P-2 |
| 11. Identify electrical/electronic system components and configuration. | P-1 |
| 12. Check frequency, pulse width, and waveforms of electrical/electronic signals using appropriate test equipment; interpret readings; determine needed repairs. | P-2 |
| 13. Understand the process for software transfer, software updates, and/or reprogramming of electronic modules. | P-3 |

V. ELECTRICAL/ELECTRONIC SYSTEMS

B. Battery System

- | | |
|---|-----|
| 1. Identify battery type and system configuration. | P-1 |
| 2. Confirm proper battery capacity for application; perform battery state-of-charge test; perform battery capacity test, determine needed action. | P-1 |
| 3. Inspect battery, battery cables, connectors, battery boxes, mounts, and hold-downs; determine needed action. | P-1 |
| 4. Charge battery using appropriate method for battery type. | P-1 |
| 5. Jump-start vehicle using a booster battery and jumper cables or using an appropriate auxiliary power supply. | P-1 |
| 6. Check low voltage disconnect (LVD) systems; determine needed action. | P-1 |

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|---|-----|
| 7. Inspect, clean, and service battery; replace as needed. | P-1 |
| 8. Inspect and clean battery boxes, mounts, and hold-downs; repair or replace as needed. | P-1 |
| 9. Test, and clean battery cables and connectors; repair or replace as needed. | P-1 |
| 10. Identify electrical/electronic modules, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery. | P-2 |

V. ELECTRICAL/ELECTRONIC SYSTEMS

C. Starting System

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|---|-----|
| 1. Demonstrate understanding of starter system operation. | P-1 |
| 2. Perform starter circuit cranking voltage and voltage drop tests; determine needed action. | P-1 |
| 3. Inspect and test starter control circuit switches (key switch, push button, and/or magnetic switch), relays, connectors, terminals, wires, and harnesses (including over-crank protection); determine needed action. | P-1 |
| 4. Diagnose causes of no-crank or slow crank condition; differentiate between electrical and engine mechanical problems; determine needed action. | P-1 |
| 5. Perform starter current draw tests; determine needed action. | P-2 |
| 6. Remove and replace starter; inspect flywheel ring gear or flex plate. | P-1 |

V. ELECTRICAL/ELECTRONIC SYSTEMS

D. Charging System

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|---|-----|
| 1. Identify and understand operation of the generator (alternator). | P-1 |
| 2. Test instrument panel mounted voltmeters and/or indicator lamps; determine needed action. | P-1 |
| 3. Inspect, adjust, and/or replace generator (alternator) drive belt; check pulleys and tensioners for wear; check fans and mounting brackets; verify proper belt alignment; determine needed action. | P-1 |
| 4. Inspect cables, wires, and connectors in the charging circuit. | P-1 |
| 5. Perform charging system voltage and amperage output tests; perform AC ripple test; determine needed action. | P-1 |
| 6. Perform charging circuit voltage drop tests; determine needed action. | P-1 |
| 7. Remove, inspect, and/or replace generator (alternator). | P-1 |

V. ELECTRICAL/ELECTRONIC SYSTEMS

E. Lighting Systems

- | | |
|---|-----|
| 1. Diagnose causes of brighter-than-normal, intermittent, dim, or no-light operation; determine needed action. | P-1 |
| 2. Test, replace, and aim headlights. | P-1 |
| 3. Inspect cables, wires, and connectors in the lighting systems. | P-1 |
| 4. Diagnose faults in tractor-to-trailer multi-wire connector(s), cables, and holders; determine needed action. | P-2 |
| 5. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of <u>exterior lighting</u> systems; determine needed action. | P-2 |
| 6. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of <u>interior lighting</u> systems; determine needed action. | P-2 |
| 7. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of <u>auxiliary lighting</u> circuits; determine needed action. | P-2 |

V. ELECTRICAL/ELECTRONIC SYSTEMS

F. Instrument Cluster and Driver Information Systems

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|--|-----|
| 1. Check gauge and warning indicator operation. | P-1 |
| 2. Diagnose faults in the sensor/sending units, gauges, switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, printed circuits, and control components/modules of the instrument cluster, driver information systems, and warning systems; determine needed action. | P-2 |
| 3. Inspect, test, replace, and calibrate (if applicable) electronic speedometer, odometer, and tachometer systems. | P-3 |

V. ELECTRICAL/ELECTRONIC SYSTEMS

G. Cab and Chassis Electrical Systems

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|--|-----|
| 1. Diagnose operation of horn(s), wiper/washer, and occupant restraint systems. | P-1 |
| 2. Understand operation of safety systems and related circuits (such as: speed control, collision avoidance, lane departure, and camera systems). | P-3 |
| 3. Understand operation of comfort and convenience systems and related circuits (such as: power windows, power seats, power locks, remote keyless entry, steering wheel controls, and cruise control). | P-3 |
| 4. Understand operation of entertainment systems and related circuits (such as: radio, DVD, navigation, speakers, antennas, and voice-activated accessories). | P-3 |

5. Understand the operation of power inverter, protection devices, connectors, terminals, wiring, and control components/modules of auxiliary power systems. P-3
6. Understand operation of telematics systems. P-3
7. Diagnose faults in engine block and engine oil heater(s); determine needed action. P-2

HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

For every task in Heating, Ventilation and Air Conditioning (HVAC), the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Heating, Ventilation, & Air Conditioning are to listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

A. General

1. Research vehicle service information, including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Identify heating, ventilation, and air conditioning (HVAC) components and configuration. P-1
3. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. P-1
4. Diagnose heating and air conditioning problems; determine needed action. P-1
5. Identify refrigerant type; test for contamination; select and connect proper gauge set/test equipment; record temperature and pressure readings. P-1
6. Perform A/C system performance test; determine needed action. P-1
7. Perform A/C system leak test; determine needed action. P-1
8. Inspect condition of refrigerant oil removed from A/C system; determine needed action. P-1
9. Determine oil and oil capacity for system application and/or component replacement. P-1

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

B. Refrigeration System Components

1. Inspect, remove, and replace A/C compressor drive belts, pulleys, and tensioners; verify proper belt alignment. P-1
2. Check A/C system operation including system pressures; visually inspect A/C components for signs of leaks; check A/C monitoring system (if applicable). P-1
3. Inspect A/C condenser for airflow restrictions; determine needed action. P-1
4. Inspect, test, service, and/or replace A/C compressor and clutch assembly; check compressor clutch air gap; determine needed action. P-2
5. Inspect, service, and/or replace A/C system hoses, lines, fittings, O-rings, seals, and service valves. P-2
6. Inspect, remove, and/or replace receiver/drier or accumulator/drier. P-1
7. Inspect, remove, and/or replace expansion valve or orifice (expansion) tube. P-2
8. Inspect evaporator housing water drain; perform needed action. P-1
9. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and/or control module) to interrupt system operation; determine needed action. P-2
10. Determine procedure to remove and reinstall evaporator. P-3
11. Determine procedure to inspect and/or replace condenser. P-2

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

C. Heating, Ventilation, and Engine Cooling Systems

1. Inspect engine cooling system and heater system hoses and pipes; determine needed action. P-1
2. Inspect HVAC system heater ducts, doors, hoses, cabin filters, and outlets; determine needed action. P-1
3. Identify the source of A/C system odors; determine needed action. P-1
4. Diagnose temperature control problems in the HVAC system; determine needed action. P-2
5. Determine procedure to remove, inspect, reinstall, and/or replace engine coolant and heater system components. P-2

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

D. Operating Systems and Related Controls

1. Verify HVAC system blower motor operation; confirm proper air distribution; confirm proper temperature control; determine needed action. P-1

2. Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action. P-1
3. Diagnose A/C compressor clutch control systems; determine needed action. P-2
4. Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the HVAC system; determine needed action. P-3

VI. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

E. Refrigerant Recovery, Recycling, and Handling

1. Understand correct use and maintenance of refrigerant handling equipment. P-1
2. Understand how to identify A/C system refrigerant; test for sealants; recover, evacuate, and charge A/C system; add refrigerant oil as required. P-1
3. Understand how to recycle, label, and store refrigerant. P-1

CAB

For every task in Cab the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Cab are to listen to and verify operator's concern, review past maintenance documents, and record condition on appropriate document.

VII. CAB

A. General

1. Research vehicle service information, including vehicle service history, service precautions, and technical service bulletins. P-1
2. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; check and record trip/operational data; reset maintenance monitor (if applicable); interpret digital multimeter (DMM) readings. P-1

VII. CAB

B. Instruments and Controls

1. Inspect mechanical key condition; check operation of ignition switch; check operation of indicator lights, warning lights and/or alarms; check instruments; record oil pressure and system voltage; check operation of electronic power take-off (PTO) and engine idle speed controls (if applicable). P-1
2. Check operation of all accessories. P-1
3. Understand operation of auxiliary power unit (APU)/electric power unit (EPU). P-3

VII. CAB

C. Safety Equipment

1. Test operation of horns (electric and air); test warning device operation (reverse, air pressure, etc.); check condition of spare fuses, safety triangles, fire extinguisher, and all required decals; inspect seat belts and sleeper restraints; inspect condition of wiper blades, arms, and linkage; determine needed action. P-1

VII. CAB

D. Hardware

1. Test operation of wipers and washer; inspect windshield glass for cracks or discoloration; check sun visor; check seat condition, operation, and mounting; check door glass and window operation; verify operation of door and cab locks; inspect steps and grab handles; inspect mirrors, mountings, brackets, and glass; determine needed action. P-1
2. Record all physical damage. P-2
3. Lubricate all cab grease fittings; inspect and lubricate door and hood hinges, latches, strikers, lock cylinders, safety latches, linkages, and cables. P-2
4. Inspect cab mountings, hinges, latches, linkages, and ride height; determine needed action. P-1
5. Inspect quarter fender, mud flaps, and brackets; determine needed action. P-1

HYDRAULICS

For every task in Hydraulics, the following safety task must be strictly enforced:

Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

The first tasks in Hydraulics are to listen to and verify operator's concern, review past maintenance documents, and record condition on appropriate document.

VIII. HYDRAULICS

A. General

1. Research vehicle service information, including vehicle service history, service precautions, fluid type, and technical service bulletins. P-3
2. Verify placement of equipment/component safety labels and placards; determine needed action. P-3
3. Identify hydraulic system components; locate filtration system components; service filters and breathers. P-3
4. Check fluid level and condition; purge and/or bleed system; take a hydraulic fluid sample for analysis; determine needed action. P-3

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|--|-----|
| 5. Inspect hoses and connections for leaks, proper routing, and proper protection; determine needed action. | P-3 |
| 6. Use appropriate electronic service tool(s) and procedures to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. | P-3 |
| 7. Read and interpret system diagrams and schematics. | P-3 |
| 8. Perform system temperature, pressure, flow, and cycle time tests; determine needed action. | P-3 |
| 9. Perform system operational tests; determine needed action. | P-3 |

VIII. HYDRAULICS

B. Pumps

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|---|-----|
| 1. Identify causes of pump failure, unusual pump noises, temperature, flow and leakage problems; determine needed action. | P-3 |
| 2. Determine pump type, rotation, and drive system. | P-3 |
| 3. Remove and install pump; prime and/or bleed system. | P-3 |
| 4. Inspect pump inlet and outlet for restrictions and leaks; determine needed action. | P-3 |

VIII. HYDRAULICS

C. Filtration/Reservoirs (Tanks)

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| 1. Identify type of filtration system; verify filter application and flow direction. | P-3 |
| 2. Service filters and breathers. | P-3 |
| 3. Identify causes of system contamination; determine needed action. | P-3 |
| 4. Inspect, repair, and/or replace reservoir, sight glass, vents, caps, mounts, valves, screens, supply, and return lines. | P-3 |

VIII. HYDRAULICS

D. Hoses, Fittings, and Connections

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|---|-----|
| 1. Diagnose causes of component leakage, damage, and restriction; determine needed action. | P-3 |
| 2. Inspect hoses and connections for leaks, proper routing, and proper protection; determine needed action. | P-3 |
| 3. Assemble hoses, tubes, connectors, and fittings. | P-3 |

VIII. HYDRAULICS

E. Control Valves

1. Pressure test system safety relief valve; determine needed action. P-3
2. Perform control valve operation pressure and flow tests; determine needed action. P-3
3. Inspect, test, and adjust valve controls (electrical/electronic, mechanical, and pneumatic). P-3
4. Identify causes of control valve leakage problems (internal and external); determine needed action. P-3
5. Inspect pilot control valve linkages, cables, and PTO controls; adjust, repair, or replace as needed. P-3

VIII. HYDRAULICS

F. Actuators

Comply with manufacturers' and industry accepted safety practices associated with equipment lock out/tag out, pressure line release, implement support (blocked or resting on ground), and articulated cylinder devices/machinery safety locks.

1. Identify actuator type (single-acting, double-acting, multi-stage, telescopic, and motor). P-3
2. Identify the cause of seal failure; determine needed action. P-3
3. Identify the cause of incorrect actuator movement and/or leakage (internal and external); determine needed action. P-3
4. Inspect actuator mounting, frame components, and hardware for looseness, cracks, and damage; determine needed action. P-3
5. Remove, repair, and/or replace actuators. P-3
6. Inspect actuators for dents, cracks, damage, and leakage; determine needed action. P-3

TASK LIST PRIORITY ITEM TOTALS (by accreditation level)

Inspection, Maintenance and Minor Repair		Medium/Heavy Truck Service Technology		Medium/Heavy Master Truck Service Technology	
P-1 = 128	95% = 122 tasks	P-1 = 191	95% = 181 tasks	P-1 = 194	95% = 184 tasks
P-2 = 19	70% = 13 tasks	P-2 = 72	70% = 50 tasks	P-2 = 92	70% = 64 tasks
P-3 = 9	25% = 2 tasks	P-3 = 23	25% = 6 tasks	P-3 = 70	25% = 18 tasks
Required Supplemental Tasks = 43		Required Supplemental Tasks = 43		Required Supplemental Tasks = 43	

TOOLS AND EQUIPMENT

Local employer needs and the availability of funds are key factors for determining each program's structure and operation. The NATEF Standards recognize that not all programs have the same needs, nor do all programs teach 100 % of the NATEF tasks. Therefore, the basic philosophy for the tools and equipment requirement is as follows: for all tasks which are taught in the program, the training should be as thorough as possible with the tools and equipment necessary for those tasks. In other words, if a program does not teach a particular task, the tool from the tool list associated with that task is not required (unless of course it is required for a task that is taught in another area).

The NATEF tool lists are organized into three basic categories: Hand Tools, General Lab/Shop Equipment, and Specialty Tools and Equipment. The specialty tools section is further separated into the eight NATEF task categories. When referring to the tools and equipment list, please note the following:

- A. The organization of the tool list is not intended to dictate how a program organizes its tool crib or student tool sets (i.e., which tools should be in a student set, if utilized, and which should be in the tool crib or shop area).
- B. Quantities for each tool or piece of equipment are determined by the program needs; however, sufficient quantities to provide quality instruction should be on hand.
- C. For Specialty Tools and Equipment, the program need only have those tools for the areas being accredited.
- D. Programs may meet the equipment requirements by borrowing special equipment or providing for off-site instruction (e.g., in a dealership or independent repair shop). Use of borrowed or off-site equipment must be appropriately documented.
- E. No specific brand names for tools and equipment are specified or required.
- F. Although the NATEF Standards recommend that programs encourage their students to begin to build their own individual tools sets prior to entry into the industry, there is no requirement to do so. NOTE: Industry surveys indicate that most (90%) employers require that a candidate for employment provide his/her own basic hand tool set in order to be hired as an entry-level truck technician.

HAND TOOLS

(Contained in individual sets or the tool crib in sufficient quantities to permit efficient instruction)

Battery Stud-to-Post or Charging/Test Adapter		Starter (3/16" - 3/8")	
Chisels:		Taper	
Cold 5/8", 3/4"		Scraper - 1" Wide or Larger	
Chisel Holder		Screwdriver - Blade Type:	
Combination Wrenches:		1", 6", 9", and 12"	
Standard (3/8" - 1") (up to 1 1/4" optional)		Offset	
Metric (6mm - 19mm) (up to 24mm optional)		Screwdriver - Phillips:	
Digital Multimeter (DMM) - Minimum 10 Meg Ohm Impedance		1" #2	
Eye Protection - Safety Glasses (side panels) and Goggles (per OSHA Requirements)		6" #1, #2	
Files and handles:		12" #3	
Coarse 12"		Socket Set - 1/4" Drive:	
Fine 12"		3/16" - 1/2" Standard Depth	
Half Round 12"		3/16" - 1/2" Deep	
Flare Nut Wrench Set:		4mm - 13mm Standard Depth	
3/8" - 3/4"		4mm - 13mm Deep	
7mm - 19mm		Extensions - Short, Medium, and Long	
Flashlight/Inspection Light		Ratchet Handle	
Hack Saw		Universal Joint	
Hammers:		Socket Set - 3/8" Drive:	
16 oz. Ball Peen		3/8" - 3/4" Standard Depth (12 point) (Impact or Chrome)	
24 oz. Ball Peen		3/8" - 3/4" Deep (6-point) (Impact or Chrome)	
Soft Face		10mm - 19mm Standard Depth (6-point) (Impact or Chrome)	
Hearing Protection (per OSHA Requirements)		10mm - 19mm Deep (6-point) (Impact or Chrome)	
Hex Key Wrench Sets:		Socket Set - 1/2" Drive:	
Standard (.050" - 3/8") (7/16" - 1/2" optional)		1/2" - 1 1/8" Standard Depth (Impact or Chrome)	
Metric (2mm - 12mm)		1/2" - 1 1/8" Deep (Impact or Chrome)	
Inspection Mirror		13mm - 32mm Standard Depth (Impact or Chrome)	
Machinists/Mechanics Steel Rule		13mm - 32mm Deep (Impact or Chrome)	
Magnetic Pickup Tool		Breaker Bar	
Pliers:		Extensions - Short, Medium, and Long	
Adjustable		Ratchet Handle	
Electrical - Crimper/Stripper		Universal Joint	
Locking		Tape Measure - 25'	
Needle Nose		Tire Pressure Gauge (Truck)	
Side Cutters		Tire Tread Depth Gauge	
Slip Joint		Tool Box	
Punches:		Wire Brush	
Aligning			
Center			
Brass			
Pin (3/16" - 3/8")			

GENERAL LAB/SHOP EQUIPMENT

The tools and equipment on this list are used in general lab/shop work but are not generally considered to be individually owned hand tools. A well-equipped, accredited program should have all of these general tools and equipment readily available and in sufficient quantity to provide quality instruction. A few items on this General Lab/Shop Equipment list are specifically needed for programs accredited at the Truck Service Technology (TST) level and/or the Master Truck Service Technology (MTST) level. Those are indicated by the appropriate acronym.

Adjustable Wrenches (up to 18")	Filter Wrenches - Small, Medium, and Large
Air Blow Gun – Rubber Tip (per OSHA requirements)	Funnels
A/C Condenser/Radiator Fin Comb Set	Gear Oil Dispenser
Back Support Belt	Grease gun
Belt Tension Gauge	Grinder (Bench or Pedestal)
Belt Wear Gauge	Hammers:
Bushing Driver Set	48 oz. Ball Peen
C-Clamps	24 oz. Brass
Cleaning Tank (per OSHA and Local Requirements)	12 lb. Hand Sledge
Clutch Adjusting Tools	Heat Gun
Combination Wrench Sets:	Hydraulic Press - 20 Ton Minimum (TST and MTST Programs)
Standard 3/8" - 1 1/2"	Impact Driver Set (Manual/Hand)
Metric 6 mm - 32 mm	Impact Wrenches:
Standard Offset 3/8" - 3/4"	1/2" Drive (Air or Electric) with Impact Sockets
Metric Offset 7 mm - 15 mm	3/4" Drive (Air or Electric) with Impact Sockets
Coolant Conditioner Test Kit (Test Strips)	1" Drive with Impact Sockets (TST and MTST Programs)
Cooling System Pressure Tester and Adapters	Impact Universal Joints - 3/8", 1/2"
Creepers	Jacks - Bottle-style, Air Jack, Frame Jack, etc.
Diagnostic Information Platform - PC with appropriate software and/or internet access for reading electronic service information	Lifting Chains (MST and TMST Programs)
Dial Indicator Set - Magnetic Base	Lifting Eyes (MST and TMST Programs)
Digital or Dial Caliper - Standard and Metric	Micrometers:
Drain Pans	Outside - Standard (0" - 6")
Drills:	Outside - Metric (0 mm - 150 mm)
3/8" variable speed, reversible	Inside - Standard (0" - 6')
1/2" variable speed, reversible	Depth - Standard (0" - 6")
Drill Bit Set: 1/16" - 1/2"	Pipe Wrenches (Up to 18" or 24")
Electronic Service Tool - PC or Data Scan Tool with Appropriate Software	Pliers:
Extractor Set (Broken Bolt)	Snap Ring - Internal
Face Shields	Snap Ring – External
Feeler gauges - Blade Type:	Portable Crane/Engine Hoist - 2 Ton Minimum (TMST Programs)
0.005" 0.050"	Pressure Gauge Set (MST and TMST Programs):
0.005 mm - 0.070 mm	0-300 psi
Brass Feeler Gauge	0-150 psi

Puller Sets (MST and TMST Programs):	
Two-Jaw	
Three-Jaw	
Refractometer (Antifreeze/Battery)	
Safety (Jack) Stands - Minimum 6 Ton	
Seal Puller	
Socket Sets:	
3/4" Drive Set	
Axle Nut Sockets	
Crow's Feet (Standard and Metric)	
Hex Key Drivers (Standard 3/16" - 3/4" and Metric 4mm - 19mm)	
Torx ® Drive T15 - T55	
Torx ® Drive E4 - E18	
Wheel Fastener Socket Set	
Soldering Gun	
Stop Watch	
Tap and Die Sets (Standard and Metric)	
Thermometer - Hand-held Infrared	
Thread Chaser Set	
Tire Cage (TMST Programs)	
Tire Gauge - Master (For Tire Gauge Calibration Checks)	
Tire Inflator Chuck - Truck	
Tire Pressure Gauge - Truck	
Torch Set: Oxy-Acetylene	
Torque Angle Gauge (MST and TMST Programs)	
Torque Multiplier with Adapters (MST and TMST Programs) (Optional)	
Torque Wrenches:	
1/4" Drive (0 - 150 lb. in.)	
3/8" Drive (0 - 100 lb. ft.)	
1/2" Drive (0 - 250 lb. ft.)	
3/4" Drive (up to 600 lb. ft.)	
Tubing Cutter/Flaring Set	
Valve Core Replacement Tool - Tire	
Wheel Chocks	
Wheel Dolly (MST and TMST Programs)	
Wheel Weight Tool	

SPECIALTY TOOLS AND EQUIPMENT WITHIN EACH ACCREDITATION CATEGORY

This section covers the tools and equipment a lab/shop should have for training in any given specialty area. This equipment is specialized and it must be available in the lab/shop. No specific type or brand names are identified because they will vary in each local situation.

For all tasks which are taught in the program, the training should be as thorough as possible with the tools and equipment necessary for those tasks. In other words, if a program does not teach a particular task, the tool from the tool list associated with that task is not required.

INSPECTION, MAINTENANCE, AND MINOR REPAIR

Diesel Engines		Electrical/Electronic Systems	
Diesel Exhaust Fluid (DEF) Refractometer		Battery Charger (AGM/Gel Compatible)	
Fuel System/Air Induction System Dust Cover Cap Set		Battery Terminal Adapters	
Soft Jaw Vise or Adapters		Die Type Terminal Crimper (optional)	
		Graphing Multimeter (GMM), Oscilloscope, or Digital Multimeter (DMM) with scope capability	
Suspension and Steering		Inductive (Clamp-on) Ammeter	
Fifth Wheel Test Pin		Jumper Cable Set (Heavy-Duty)	
Tape Measure (50')		Low AMP Automatic Charger or equivalent device to maintain shop batteries	
Tire Square		Starting, Charging, and Battery System Tester	
		Terminal Repair Kits	
Brakes		Test Lead Kit	
Bearing Packer (optional)			
Brake Bleeder			
Brake Fluid Tester or Test Strips			
Brake Lining Thickness Gauge			
Brake Rotor (Disc) Micrometer			
Drum Brake Gauge			
Method for removing asbestos contamination (Parts Cleaner) meeting EPA Standards			
Seal Installers			
Slack Adjuster Installation Index Tool (Templates)			
Trailer Electrical Cord Tester			
Heating, Ventilation, and Air Conditioning			
Gloves			
Thermometer			

MEDIUM/HEAVY TRUCK SERVICE TECHNOLOGY

Diesel Engines		Brakes	
Ball/Small Hole Gauges		Air Pressure Gauge Set	
Cooling System Vacuum Fill Equipment		Bearing Packer (optional)	
Dial Bore Gauge or Telescoping Gauges		Bearing Race Installer	
Diesel Exhaust Fluid (DEF) Refractometer		Brake Bleeder	
Engine Stands		Brake Fluid Tester or Test Strips	
Fan Hub Wrenches		Brake Lining Thickness Gauge	
Fuel System/Air Induction System Dust Cover Cap Set		Brake Rotor (Disc) Micrometer	
Injector Removal Tool(s)		Brake Spring Tool	
Liner Installer (universal)		Disc Caliper Tool for Compressing Caliper Pistons	
Liner Puller (universal)		Drum Brake Gauge	
Precision Straight Edge		Method for removing asbestos contamination (Parts Cleaner) meeting EPA Standards	
Protrusion Gauge (Cylinder Liner Height)		Seal Installers	
Ring Compressor		Slack Adjuster Installation Index Tool (Templates)	
Ring Expander(s)			
Rod Bolt Protectors		Drive Train	
Soft Jaw Vise or Adapters		3/4" Drive Pinion Nut Sockets	
Valve Spring Compressor		Aligning Studs - 3/8", 1/2", & 5/8"	
Vibration Damper Puller		Axle Shaft Removal Tool	
		Blind Hole/Pilot Bearing Puller	
Suspension and Steering		Clutch Adjusting Tools (Pull Type)	
Air Hammer with Chisels		Clutch Disc Aligning Tools	
Ball Joint Separator		Clutch Jack and/or Transmission Jack Attachments	
Fifth Wheel Test Pin		Protractor (Angle Gauge)	
Pitman Arm Puller		Transmission Jack	
Power Steering Analyzer		U-Joint Puller	
Tape Measure (50')		Yoke Puller	
Tire Square			
		Heating, Ventilation, and Air Conditioning	
Electrical/Electronic Systems		A/C Leak Detection Tool (Halogen or UV Dye)	
Battery Charger (AGM/Gel Compatible)		Gloves	
Battery Terminal Adapters			
Die Type Terminal Crimper (optional)			
Graphing Multimeter (GMM), Oscilloscope, or Digital Multimeter (DMM) with scope capability			
Inductive (Clamp-on) Ammeter			
Jumper Cable Set (Heavy-Duty)			
Low AMP Automatic Charger or equivalent device to maintain shop batteries			
Starting, Charging, and Battery System Tester			
Test Lead Kit			
Terminal Repair Kits			

MEDIUM/HEAVY TRUCK MASTER SERVICE TECHNOLOGY

Diesel Engines		Brakes	
Ball/Small Hole Gauges		Air Pressure Gauge Set	
Charge Air Cooler Tester		Bearing Packer (optional)	
Cooling System Vacuum Fill Equipment		Bearing Race Installer	
Diagnostic Smoke Machine (Optional)		Brake Bleeder	
Dial Bore Gauge or Telescoping Gauges		Brake Fluid Tester or Test Strips	
Diesel Exhaust Fluid (DEF) Refractometer		Brake Lining Thickness Gauge	
Engine Stands		Brake Rotor (Disc) Micrometer	
Fan Hub Wrenches		Brake Spring Tool	
Fuel System/Air Induction System Dust Cover Cap Set		Disc Caliper Tool for Compressing Caliper Pistons	
Injector Removal Tool(s)		Drum Brake Gauge	
Liner Installer (universal)		Method for removing asbestos contamination (Parts Cleaner) meeting EPA Standards	
Liner Puller (universal)		Seal Installers	
Manometer - (Water) or Magnehelic Gauge (optional)		Slack Adjuster Installation Index Tool (Templates)	
Precision Straight Edge		Trailer Electrical Cord Tester	
Protrusion Gauge (Cylinder Liner Height)			
Ring Compressor		Electrical/Electronic Systems	
Rod Bolt Protectors		Battery Charger (AGM/Gel Compatible)	
Soft Jaw Vise or Adapters		Battery Terminal Adapters	
Valve Spring Compressor		Die Type Terminal Crimper (optional)	
Vibration Damper Puller		Graphing Multimeter (GMM), Oscilloscope, or Digital Multimeter (DMM) with scope capability	
		Inductive (Clamp-on) Ammeter	
Suspension and Steering		Jumper Cable Set (Heavy-Duty)	
Air Hammer with Chisels		Low AMP Automatic Charger or equivalent device to maintain shop batteries	
Alignment Equipment: Minimum to perform tasks (including tandem alignment)		Starting, Charging, and Battery System Tester	
Ball Joint Separator		Test Lead Kit	
Fifth Wheel Test Pin		Terminal Repair Kits	
Pitman Arm Puller			
Power Steering Analyzer		Drive Train	
Tire Square		3/4" Drive Pinion Nut Sockets	
		Aligning Studs - 3/8", 1/2", & 5/8"	
Hydraulics		Axle Shaft Removal Tool	
Fittings and adapters for specific applications		Blind Hole/Pilot Bearing Puller	
Hose Crimper Tool and Pump (either air over hydraulic or hand pump)-(optional)		Clutch Adjusting Tools (Pull Type)	
1000 PSI Liquid Filled or Electronic Gauge and Hose Assembly		Clutch Disc Aligning Tools	
5000 PSI Liquid Filled or Electronic Gauge and Hose Assembly		Clutch Jack and/or Transmission Jack Attachments	
Pressure/Flow Meter		Protractor (Angle Gauge)	
Thermometer (up to 250 degrees) Standard or Infrared			

Heating, Ventilation, and Air Conditioning	
A/C Compressor Clutch Removal & Installation Tools	
A/C Leak Detection Tool (Halogen or UV Dye)	
A/C Manifold Gauge Set*	
A/C Recovery/Recharging and/or Recycling Station*	
A/C Refrigerant Identifier	
Gloves	
Heater Hose Clamp-Off Tool	
Measuring Cup	
Micron Meter (Electronic Vacuum Gauge) – (optional)	
Orifice Tube Remover	
Portable Vacuum Pump (may be included with Recovery/Recycling/Recharging Station)	
Spring Lock Coupler Removers	
Thermometer	
Valve Core (Shrader Type) Replacement Tool	
* Meeting EPA Regulations and SAE “J” Standards	