

Appendix X

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

MOBILE EQUIPMENT MAINTENANCE PATHWAY DIESEL TECHNICIAN UNIT 16

Diesel Technician Unit

PM = Preventive Maintenance

Competency (Work Tasks)	Performance Standards What employer checks for while doing task. Train YA Student on. YA student will ...	Learning Objectives What to know/learn to do this task. Content Suggested for Class/Reading/On-the-Job Training.
GENERAL SKILLS		
<p>1. Obtain & apply basic diesel servicing knowledge</p>	<p>Demonstrate diesel vehicle/engine systems knowledge based on current understanding Comply with personal safety practices concerning clothing, hand and power tool usage, proper ventilation of fumes and lifting and securing of vehicles Comply with environmental safety standards concerning handling, storage and disposal of hazardous materials and chemicals in accordance with local, state and federal regulations Identify approved service procedure prior to completing any work on a vehicle Perform all procedures according to manufacturer and regulatory requirements</p>	<p>VEHICLE/DIESEL ENGINE SYSTEMS Describe the purpose of the fundamental diesel vehicle systems and components including brake systems, electrical/electronic systems, suspension and steering systems, transmission systems, engine performance systems and heating/air conditioning systems Explain the interaction of vehicle systems List and describe basic components of vehicle systems Identify commonly used vehicle fasteners Explain common broken fastener removal techniques Describe basic diesel engine classifications Compare gasoline and diesel engines Discuss alternative engine types Compare two- and four-stroke cycle engines</p> <p>MOTORS Explain the principles of an electric motor Explain the operation of solenoids</p> <p>MOTION Explain how friction, force, inertia, momentum, speed, power, work and torque apply to brake systems Explain the effects of weight and speed on braking and stopping distance</p> <p>FLUIDS and PRESSURE Define characteristics of liquids Identify the fundamental laws of hydraulics Define Pascal's Law Explain thermal expansion of fluids, gases, and solids Explain energy conversion of motion changed to heat energy Compare lubricants used in various medium/heavy truck systems</p>

		<p>ELECTRICITY</p> <p>Explain the principles of electricity</p> <p>Describe the action of basic electric circuits</p> <p>Compare voltage, current, and resistance</p> <p>Describe the principles of magnetism and magnetic fields</p> <p>Identify basic electric and electronic terms and components</p> <p>Describe fundamental electrical tests</p> <p>Identify factors that will determine how much current will flow in a circuit</p> <p>Discuss electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law)</p> <p>Identify sources of AC(alternating current)/DC (direct current) voltages and their applications</p> <p>Identify series and parallel circuits as they apply to typical lighting circuits</p> <p>Describe characteristics of a series circuit</p> <p>Describe characteristics of a parallel circuit</p> <p>Describe characteristics of a series/parallel circuit</p> <p>Define voltage, voltage drop, current flow and resistance and their common units of measurement</p> <p>Explain the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.)</p>
<p>2. Operate tools & equipment safely</p>	<p>Operate only equipment that he/she is trained on</p> <p>Choose correct tool or equipment for the task</p> <p>Verify tool/equipment is available for use and in working order</p> <p>Verify tool/equipment is current for preventative maintenance and/or calibration</p> <p>Verify safety equipment and any Personal Protective Equipment (PPE) needed for tool/equipment use</p> <p>Operate tool/equipment safely with guarding devices if applicable in the manner required for the job task</p> <p>Monitor tool/equipment for safe operation while operating</p> <p>Follow procedures for cleanup and shut down after use</p> <p>Perform any required preventative maintenance</p>	<p>Identify tools and their usage in diesel vehicle repair applications</p> <p>Describe how to properly and safely position a truck for different types of service</p> <p>Describe and demonstrate the safety requirements for each tool and equipment</p> <p>Discuss start up and shut down procedures for each tool/equipment you will operate</p> <p>Explain the purpose of preventative maintenance</p> <p>Describe emergency shutdown procedures for the tool/equipment you will operate</p> <p>Explain how to recognize and address malfunctions for the tool/equipment you will operate</p> <p>Describe how to recognize wear and tear on</p>

	<p>procedures</p> <p>Investigate and promptly report abnormal tool/equipment conditions</p> <p>Properly shut down and label any tool/equipment that is not operating as expected, if applicable</p> <p>Follow Lock Out/Tag Out procedures as applicable</p> <p>Document use and maintenance as required</p> <p>Demonstrate safe handling and use of appropriate tools</p> <p>Demonstrate proper cleaning, storage, and maintenance of tools and equipment</p> <p>Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dial-caliper)</p> <p>Utilize safe procedures for handling of tools and equipment</p> <p>Identify and use proper placement of floor jacks and jack stands</p> <p>Identify and use proper procedures for safe lift operation</p>	<p>equipment components</p> <p>List the Occupational Safety and Health Administration (OSHA) and other regulatory requirements as they apply to the equipment that you operate</p> <p>Describe proper techniques for lifting loads</p> <p>List the safeguards that apply to the equipment used in your facility for tools, automated machines, material handling equipment, and lifts</p> <p>Explain Lock Out/Tag Out indications and procedures in your facility</p> <p>Describe the function and use of a thermometer, pyrometer, manometer</p> <p>Describe the function and use of an oscilloscope or DMM (digital multimeter) to diagnose engine concerns</p>
3. Maintain work area	<p>Identify general shop safety rules and procedures</p> <p>Identify marked safety areas</p> <p>Utilize proper ventilation procedures for working within the lab/shop area</p> <p>Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment</p> <p>Identify the location and use of eye wash stations</p> <p>Identify the location of the posted evacuation routes</p> <p>Maintain shop manuals and/or electronic retrieval systems</p> <p>Organize tools</p> <p>Sweep work area</p> <p>Put shop equipment away</p> <p>Clean work area and work bench</p> <p>Dispose of parts properly</p>	<p>Describe the typical layout and sections of a diesel engine or trucking maintenance shop</p> <p>Explain the importance of proper housekeeping in the shop</p> <p>List the types of accidents that can occur in a shop</p> <p>Explain how to prevent shop accidents</p> <p>Describe general safety rules for the shop</p>
4. Assist to process work order	<p>Verify customer complaint</p> <p>Research information</p> <p>Review service history</p> <p>Document customer concern and complaint</p>	<p>Identify a repair business' internal and external customers</p> <p>Define customer service</p> <p>Describe how customer service affects a company's</p>

	<p>information on repair order</p> <p>Complete work order to include customer information, truck identifying information, customer concern, related service history, cause, and correction</p> <p>Handle complaints tactfully without insult or conflict</p>	<p>“bottom line”</p> <p>List strategies to maximize customer satisfaction</p> <p>List the steps to follow when handling complaints</p>
5. Research information	<p>Locate and find resources for service information and history, service precautions, and technical service bulletins</p> <p>Retrieve shop manuals and/or electronic retrieval systems</p> <p>Locate and identify information necessary to the task</p>	<p>Explain the basic truck classifications</p> <p>Classify a truck by the number of axles it has</p> <p>Define Gross Vehicle Weight (GVW)</p> <p>Define the purpose and use of the vehicle identification number (VIN), engine numbers, and date codes</p> <p>Identify references that are used to estimate vehicle repair charges</p> <p>Describe the different types of service manuals</p> <p>Explain how to use computer-based service information</p> <p>Discuss basic structure and information found in shop manuals, online manuals, and technical service bulletins</p> <p>Define the role of the Federal Motor Carrier Safety Administration (FMSCA) in commercial carrier safety</p> <p>Explain the requirements for annual inspections of commercial motor vehicles</p>
6. Acquire parts	<p>Collect necessary information to determine part required</p> <p>Locate and interpret vehicle and component identification numbers such as make, model, year, vehicle identification number (VIN), vehicle certification labels, calibration decals</p> <p>Check part price</p> <p>Check part availability</p> <p>Obtain part</p> <p>Verify correct part upon receipt</p> <p>NOTE: Driving to get parts CANNOT be part of student's <u>regular job tasks</u> per Child Labor Laws</p>	<p>Explain how to use service manuals to locate component part information</p> <p>Identify sources available for replacement parts</p> <p>List requirements of replacement parts</p> <p>Explain the information needed to in order to obtain the correct replacement part</p> <p>Describe how parts are purchased and charged to the customer</p> <p>Compare and contrast new, used, rebuilt and remanufactured automotive parts</p> <p>Describe situations in which one type of part is desirable over new parts</p> <p>Define original equipment manufacturer (OEM) and how this affects automotive servicing</p>
7. Assist to diagnose common concerns & determine action	<p>Consult with worksite professional to determine appropriate inspections and test(s) to perform based on customer concern</p> <p>Research information</p>	<p>Explain the 3 Cs (concern, cause, correction) of mobile equipment service</p> <p>Describe the basic types of troubleshooting charts found in service manuals</p>

	<p>Assist worksite professional to complete diagnostic tests necessary to identify cause of customer concern</p>	<p>Explain how to use the following testing instruments: Voltmeter, Test Light, Ammeter, and Ohmmeter List the most common engine performance problems Describe the symptoms for common engine performance problems Explain typical causes of engine performance problems Discuss common problems relating to abnormal engine noise or vibration concerns, unusual exhaust color, odor, and sound, and fuel, and ignition concerns Explain common poor stopping, pulling or dragging concerns caused by problems in the hydraulic system Explain common causes of wheel bearing noises, wheel shimmy, and vibration Discuss wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system Identify common causes of electrical circuit or component failures Discuss common problems relating to a suspension system Describe special issues related to electronically-controlled suspension systems Discuss common problems due to short and long arm suspension systems, body sway, and uneven ride height Explain common causes for steering column noises, looseness, and binding concerns Explain common problems that cause wheel/tire vibration, shimmy, and noise Describe common causes of vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns</p>
<p>8. Assist to retrieve, record, interpret diagnostic codes</p>	<p>Obtain equipment and materials needed Review safety and service procedures Activate on-board diagnostics and read trouble codes with and without a scan tool Verify malfunction indicator light trouble codes using the scan tool Obtain the appropriate scan tool and program cartridge</p>	<p>Discuss the purpose and operation of on-board diagnostic systems Explain the use of scan tools to simplify reading of trouble codes Compare on-board diagnostics (OBD) I and II systems Describe the different types of gauges and sending units</p>

	<p>for the vehicle, system and/or date Locate the data link connector (DLC) in the vehicle Attach the scan tool cable into the DLC; use an adaptor if needed Connect the scan tool to battery power if needed Follow the prompts to access the trouble codes Consult the trouble code chart or scan tool code conversion Consult worksite professional to determine further tests, inspections or repairs Erase diagnostic trouble codes when applicable</p>	<p>Explain how different types of gauges and sending units operate Locate the data link connector on most makes and models of trucks Describe how to use a trouble code chart in a service manual or code conversion by a scan tool Describe the importance of running all OBDII monitors for repair verification</p>
DIESEL ENGINE SYSTEM		
9. Perform engine lubrication PM	<p>Obtain equipment and materials needed Review safety and service procedures Check engine oil level Fill oil to appropriate level if needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify common components and their functions in a diesel engine List common engine maintenance functions and services List common problems associated with faulty engine components Discuss safety precautions required before servicing diesel engines List the basic parts of a lubrication system Summarize the operation of a lubrication system Explain the importance of lubrication fluids</p>
10. Perform oil & filter change	<p>Obtain equipment and materials needed Review safety and service procedures Place oil container under drain spot Remove drain plug Drain engine oil Take oil sample if needed for condition testing Clean plug Torque drain plug to specification Replace oil filter Refill to recommended amount Run engine and check for leaks After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Explain why it is best to run the vehicle prior to changing oil Identify different types of engine oils and their purposes Explain how to determine correct oil capacity Discuss the disposal procedures for engine oil Explain the characteristics and ratings of engine oil</p>
11. Perform fuel system checks	<p>Obtain equipment and materials needed Review safety and service procedures</p>	<p>Summarize how crude oil is converted into gasoline, diesel fuel, liquefied petroleum gas, and other products</p>

	<p>Check fuel tanks, mounts, lines, caps, and fittings for damage and deterioration- Refer to worksite professional for repair/replacement</p> <p>Check fuel level</p> <p>Draw off fuel sample if needed for condition testing</p> <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Describe properties of gasoline and diesel fuel</p> <p>Explain octane and octane ratings</p> <p>Describe normal and abnormal combustion of gasoline and diesel fuel</p> <p>Identify common components and functions of fuel systems</p> <p>List common preventive maintenance functions and services for fuel systems</p> <p>List common problems associated with faulty fuel systems</p> <p>Discuss alternative fuels</p>
<p>12. Perform air induction & exhaust PM</p>	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Check air induction piping, hoses, clamps and mountings for looseness, leaks, and damage- Refer to worksite professional for repair/replacement</p> <p>Assist to remove air filter</p> <p>Check for dust</p> <p>Assist to replace air filter or install new air filter as needed</p> <p>Check exhaust manifold, piping, mufflers, and mounts</p> <p>Check and replace the diesel particulate filter (DPF)</p> <p>Assist to repair and replace manifold if needed</p> <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify common components and functions of air induction and exhaust systems</p> <p>List common preventive maintenance functions and services for air induction and exhaust systems</p> <p>List common problems associated with faulty air induction and exhaust systems</p> <p>Discuss safety precautions required before servicing air induction and exhaust systems</p> <p>Describe the construction and action of air filters</p> <p>Summarize the operation and interaction of heating, ventilation, and air conditioning systems</p> <p>Describe basic problem colors of diesel exhaust smoke</p> <p>Explain the relationship between engine performance and exhaust emission</p> <p>Compare emission systems</p> <p>Describe the basic parts of an exhaust system</p> <p>Explain the construction and design of intake and exhaust manifolds</p> <p>Discuss the purpose of diesel exhaust fluid (DEF) and exhaust gas recirculation (EGR)</p> <p>Explain the most common reasons for exhaust system failures</p> <p>Describe the appearance of exhaust leaks on components</p> <p>Explain the fundamental parts of a turbocharging system</p> <p>Summarize the construction and operation of a supercharging system</p>

<p>13. Perform cooling system PM</p>	<p>Obtain equipment and materials needed Review safety and service procedures Inspect radiator and mountings</p> <ul style="list-style-type: none"> ○ Check air flow through radiator core, ○ For leaks, ○ Mountings <p>Inspect fan assembly and shroud Inspect coolant hoses and clamps Check engine coolant type and level</p> <ul style="list-style-type: none"> ○ Fill to appropriate level if needed ○ Check coolant for contamination, additive concentration, freeze point <p>Replace coolant filter Assist to test coolant temperature Check operation of temperature and level sensors, gauges, sending unit Inspect water pump for leaks Check belts, tensioners, and pulleys</p> <ul style="list-style-type: none"> ○ Assist to replace if needed <p>Check belt tension and alignment</p> <ul style="list-style-type: none"> ○ Assist to adjust if needed <p>Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify common components and functions of a cooling system List common preventive maintenance functions and services for a cooling system List common problems associated with faulty cooling system Discuss safety precautions required before servicing a cooling system Describe the most common causes of system leakage, overheating, and overcooling Explain the importance of antifreeze Discuss the hazards and dangers of ethylene glycol in antifreeze coolant Explain the required disposal methods for all stages of drain material Discuss the importance of cooling the engine first Explain what debris in drained coolant means Describe the purpose of a vehicle's engine drive belts Discuss the composition of drive belts and common wear tear Locate common accessory drive belts and what they run Describe the issues with stretched belts Explain why belts should not be over-tightened Describe the purpose and common components associated with the water pump Describe common problems associated with the water pump Discuss common safety precautions for servicing water pumps</p>
<p>14. Pressure test cooling system</p>	<p>Obtain equipment and materials needed Review safety and service procedures Pressure test radiator cap Pressure test radiator system Checks for leaks Compare results to recommendations Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper</p>	<p>Explain the purpose and common components associated with the radiator Describe common problems associated with the radiator Discuss common safety precautions for servicing a radiator</p>

	location, complete appropriate documentation	
15. Assist to bleed cooling system	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Obtain adequate size container</p> <p>Drain coolant</p> <p>Assist to flush cooling system</p> <p>Refill cooling system with recommended coolant</p> <p>Run the engine</p> <p>Shut down and check coolant level</p> <p>Assist to bleed the cooling system</p> <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>List reasons for bleeding a cooling system</p> <p>Discuss common safety precautions for bleeding a cooling system</p> <p>Describe the appearance and possible causes of oil in coolant: engine oil leaks, external coolant leaks, engine blowby, engine vacuum leaks, engine exhaust leaks, and engine smoking</p>
16. Assist to perform engine brake PM	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Inspect engine compression/exhaust brakes</p> <p>Assist to adjust engine compression/exhaust brakes</p> <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify common components and functions of engine brakes</p> <p>List common preventive maintenance functions and services for engine brakes</p> <p>List common problems associated with faulty engine brakes</p> <p>Discuss safety precautions required before servicing engine brakes</p>
CAB & HOOD SYSTEM		
17. Perform instrument checks	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Check warning indicators</p> <p>Check instruments</p> <p>Check operation of accessories</p> <p>Check operation of power take off and engine idle speed controls</p> <p>Check phone systems and GPS units</p> <p>Refer to worksite professional for repair/replacement</p> <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Explain both analog and digital instrumentation</p> <p>Explain the operating principles of automotive light, wiper, and horn systems</p> <p>Discuss the diagnostic questions to determine problems in light, wiper, and horn systems</p> <p>Summarize automatic light and wiper systems</p> <p>Compare and contrast warning lights, sending units, switches, and basic display systems</p> <p>Discuss the purpose and operation of the vehicle on board radar (VORAD) and electronic data recording (EDR) systems</p> <p>Discuss the use of accessory systems such as phones and global positioning system (GPS) units</p>
18. Perform safety equipment checks	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Check operation of horns</p> <p>Check safety equipment- triangles, fire extinguishers, decals</p>	<p>Identify common components and functions of safety equipment</p> <p>List common problems associated with faulty safety equipment</p> <p>Discuss safety precautions required before servicing</p>

	<p>Inspect seat belts and sleeper restraints Inspect wiper blades and arms Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>safety equipment Compare types and sizes of typical wiper blades Discuss checks required for fire extinguishers</p>
<p>19. Perform hardware checks</p>	<p>Obtain equipment and materials needed Review safety and service procedures Check wiper and washer operation Inspect windshield glass for cracks or discoloration Check sun visor Check seat condition, operation and mounting Check door glass and window operation Inspect steps and grab handles Inspect mirrors, mountings, brackets, glass Inspect door and hood hinges, latches, strikers, lock cylinders, safety latches, linkages and cables Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Discuss safety precautions required before servicing truck hardware including cracked glass Describe the components of a typical wiper/washer system Trace the flow of solution Discuss components of washer solutions Compare the types of pumps used in washer systems</p>
<p>20. Check HVAC operation</p>	<p>Obtain equipment and materials needed Review safety and service procedures Check heating, ventilation, and air conditioning (HVAC) controls Check that all vent outlet louvres are free to move Check air flow at each fan speed control Check air conditioning (A/C) temperature at lowest setting and fan speed Check A/C temperature at highest setting and fan speed Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify common components and functions of a heating, ventilation, and air conditioning (HVAC) system List common preventive maintenance functions and services for an HVAC system List common problems associated with faulty HVAC systems Discuss safety precautions required before servicing HVAC systems Describe the common location for air cabin filters List common reasons for clogged air filters Describe the importance of a clean air filter Identify the source of heating and air conditioning (A/C) system odors Explain the purpose and function of an auxiliary power unit (APU)</p>
<p>21. Lubricate grease fittings</p>	<p>Obtain equipment and materials needed Review safety and service procedures Lubricate all cab and hood grease fittings</p>	<p>Demonstrate proper use of lubrication equipment Compare types of vehicle grease and when each type is used</p>

	<p>Lubricate door and hood hinges, latches, strikers, lock cylinders, safety latches, linkages, and cables as needed</p> <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	
DRIVE TRAIN SYSTEM		
22. Perform transmission PM	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Check transmission oil level and condition</p> <ul style="list-style-type: none"> ○ Fill with correct fluid to recommended level ○ Collect a sample if needed for testing <p>Inspect transmission case, seals, vents, hoses for cracks and leaks</p> <ul style="list-style-type: none"> ○ Replace transmission cover plates, gaskets, seals, and cap bolts if needed <p>Inspect transmission breather and mounts</p> <p>Lubricate all drive train grease fittings</p> <p>Refer to worksite professional for other types of repair/replacement</p> <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify common components and functions of transmission systems</p> <p>List common preventive maintenance functions and services for transmission systems</p> <p>List common problems associated with faulty transmission systems</p> <p>Discuss safety precautions required before servicing transmission systems</p> <p>Compare basic components and operation of automatic transmissions to manual transmissions</p> <p>Trace the flow of power through an automatic transmission</p> <p>Explain how an automatic transmission shifts gears</p> <p>Explain the relationship between speed and torque to different gear arrangements</p> <p>Describe the shift mechanisms used in medium/heavy truck transmissions</p> <p>Explain the role of torque convertors</p> <p>Demonstrate proper use of lubrication equipment</p> <p>Compare types of vehicle grease and when each type is used</p>
23. Change transmission oil & filter	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Position adequate size drain pan</p> <p>Remove plug and gasket</p> <p>Collect sample for testing if needed</p> <p>Drain oil</p> <p>Clean magnetic plugs</p> <p>Remove and discard old filter</p> <p>Lubricate new seal ring</p> <p>Install new filter and seal</p> <p>Install plug, gasket and pan</p> <p>Fill transmission fluid to recommended level</p>	<p>Describe the function of transmission fluid</p> <p>Discuss common characteristics of transmission fluid</p> <p>Compare types of transmission fluid</p> <p>Explain how to clean and lubricate a seal</p>

	<p>Recheck oil level After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	
24. Perform clutch PM	<p>Obtain equipment and materials needed Review safety and service procedures Assist to check operation of clutch, clutch brake, gearshift Check clutch linkage/cable for looseness or binding Inspect (throw out) bearing and crop shafts Adjust, lubricate, release bearing and crop shafts Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify common components and functions of clutches List common preventive maintenance functions and services for clutches List common problems associated with faulty clutches Discuss safety precautions required before servicing clutches Explain the difference between pull- and push-type clutches Describe the function of the clutch brake</p>
25. Perform drive axle PM	<p>Obtain equipment and materials needed Review safety and service procedures Check drive axle fluid level <ul style="list-style-type: none"> ○ Fill with correct fluid to recommended level ○ Collect a sample if needed for testing Inspect axle housing for cracks and leaks Lubricate all drive train grease fittings Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify common components and functions of drive axles List common preventive maintenance functions and services for drive axles List common problems associated with faulty drive axles Discuss safety precautions required before servicing drive axles Identify the components of a truck driveline Identify types of axles used on trucks and trailers Describe the operation of various drive axle configurations Demonstrate proper use of lubrication equipment Compare types of vehicle grease and when each type is used Demonstrate proper use of lubrication equipment Compare types of vehicle grease and when each type is used</p>
26. Change drive axle oil & filter	<p>Obtain equipment and materials needed Review safety and service procedures Position adequate size drain pan Remove plug Collect sample for testing if needed Drain oil Clean magnetic plugs</p>	<p>Describe the function of drive axle oil Discuss common characteristics of drive axle oil Discuss the function of the magnetic plugs</p>

	<p>Remove and discard old filter Clean axle filler plugs Install new filter Install plug Fill drive axle oil to recommended level After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	
27. Inspect driveshaft	<p>Obtain equipment and materials needed Review safety and service procedures Inspect driveshaft, slip joints, universal joints, boots and seals, and retaining hardware Inspect driveshaft center support bearings and mounts Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify common components and functions of the driveshaft List common preventive maintenance functions and services for the driveshaft List common problems associated with a faulty driveshaft Discuss safety precautions required before servicing driveshaft Discuss joint inspection and indications for replacement Explain how to measure driveline angles</p>
ELECTRICAL/ELECTRONICS SYSTEM		
28. Use wiring diagrams	<p>Obtain equipment and materials needed Review safety and service procedures Locate the parts to be tested for electrical problems Follow the lines to show how wiring is attached into each component of the circuit Look for faulty relays and wires in the faulty part After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Explain the purpose and use of wiring diagrams Describe common components and symbols used on wiring diagrams Identify types of circuit protection devices used in an electrical circuit Outline the purpose and properties of conductors, insulators, and semiconductors Compare circuit breakers to fuses Define the functions of a fuse, fuse box, fusible link, circuit breaker Explain the common functions and locations of fuses and breakers in a vehicle Define the role of gates in electronic circuits Describe types of circuit faults Discuss common safety precautions for servicing fuses and breakers</p>
29. Properly use a digital multimeter (DMM)	<p>Obtain equipment and materials needed Review safety and service procedures Set the digital multimeter (DMM) to the correct voltage scale</p>	<p>Discuss causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits Explain the use of wiring diagrams during the</p>

	<p>Connect the red lead to the appropriate point in the circuit to be measured</p> <p>Connect the black lead to the appropriate position on the circuit depending on the function to be measured</p> <p>Measure voltage, voltage drop, current flow and resistance</p> <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>diagnosis (troubleshooting) of electrical/electronic circuit problems</p> <p>Explain the function of the digital multimeter (DMM)</p> <p>Describe how the DMM works to measure voltage, voltage drop, current flow and resistance</p> <p>Describe the purpose of the ground lead in using the DMM</p> <p>Identify the function codes on a typical DMM</p> <p>Identify common components and functions of instrument control systems</p> <p>List common preventive maintenance functions and services for instrument control systems</p> <p>List common problems associated with faulty instrument control systems</p> <p>Discuss safety precautions required before servicing instrument control systems</p>
30. Perform battery PM	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Inspect battery box(es), cover(s), and mountings</p> <p>Inspect battery hold-downs, connections, cables, and cable routing</p> <p>Clean battery box(es), mounts, hold downs, cables and connectors with appropriate solution</p> <p>Refer to worksite professional for repair/replacement</p> <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Describe the basic parts of a battery</p> <p>Identify safety precautions when performing battery service</p> <p>Explain how temperature and other factors affect battery performance</p> <p>Describe the components of mixtures used for cleaning</p> <p>Discuss when to use pliers to remove battery cables</p> <p>Discuss precautions to take around battery fill openings</p> <p>Explain why over-tightening terminals is a problem</p> <p>Discuss how size of battery relates to motor performance and battery service life</p> <p>Compare battery power ratings</p> <p>Identify electronic modules, security systems, radios, and other accessories that require re-initialization or code entry after reconnecting vehicle battery.</p>
31. Perform battery load test	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Confirm battery capacity for vehicle</p> <p>Select appropriate battery load tester</p> <p>Test load as required</p> <p>Record readings</p> <p>Refer to worksite professional for repair/replacement</p>	<p>List common problems associated with a faulty battery</p> <p>Describe the purpose of the battery load test</p> <p>Identify safety precautions when performing battery load testing</p> <p>Compare inductive and non-inductive capacity testers</p> <p>Explain how to calculate battery load values</p> <p>Identify and explain the operation of the auxiliary</p>

	After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	power unit (APU)
32. Determine battery state of charge test	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Select appropriate battery tester</p> <p>Make sure engine is off and battery stabilized</p> <p>Check voltage at rest</p> <p>Verify battery cables are not chafing on chassis or potential grounding point</p> <p>Record readings</p> <p>Refer to worksite professional for repair/replacement</p> <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify safety precautions when performing battery state of charge tests</p> <p>Explain the operating principles of a lead-acid battery</p> <p>Compare conventional and maintenance-free batteries</p> <p>Explain how to remove surface charge from a battery</p> <p>Define specific gravity and how it indicates battery charge</p> <p>Describe how to do the hydrometer test</p> <p>Describe how to do the capacity test</p> <p>Describe how to do the open circuit voltage test</p> <p>Explain how to use the voltage chart to determine charge</p> <p>List levels which require a new battery vs. re-charging</p>
33. Jump start a vehicle	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Verify vehicle manufacturer allows jump starting</p> <p>Connect jumper cables as required</p> <p>Start engine</p> <p>Remove cables in reverse order as they were installed</p> <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>List the components and operation of jumper cables</p> <p>Discuss common safety precautions when using jumper cables</p> <p>Describe problems that can occur if jumper cables are not connected properly</p>
34. Engage starter	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Inspect starter is fully secure to engine block and mounting bolts tight</p> <p>Check connections and connector</p> <p>With vehicle out of gear, start the engine to assess concerns</p> <p>Refer to worksite professional for issues or repair/replacement</p> <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Explain the function of a starter</p> <p>List the components and operation of a starter</p> <p>List common problems associated with a faulty starter</p> <p>Discuss common safety precautions for servicing a starter system</p> <p>Explain the purpose of the current draw test on a starter</p> <p>Define the order for starting system tests</p> <p>Explain typical procedures for a starting motor rebuild</p> <p>Describe the function of major ignition system components</p> <p>Explain vacuum, centrifugal, and electronic ignition timing advance</p>
35. Perform charging	Obtain equipment and materials needed	Identify common components and functions of

<p>system PM</p>	<p>Review safety and service procedures Inspect instrument panel mounted volt meters and/or indicator lamps Inspect cables, wires, connections in the charging circuit Repair/replace cables, wires, connectors if needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>charging systems List common preventive maintenance functions and services for charging systems List common problems associated with faulty charging systems Discuss safety precautions required before servicing charging systems Identify charging circuit components Trace a charging circuit schematic</p>
<p>36. Assist to remove & replace alternator</p>	<p>Obtain equipment and materials needed Review safety and service procedures Access alternator Remove alternator as required by manufacturer Replace with correct size alternator Install as required by manufacturer After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Explain the function of the alternator List the components and operation of an alternator List common problems associated with a faulty alternator Discuss common safety precautions for servicing an alternator Describe the importance of proper belt tightening</p>
<p>37. Perform lighting system PM</p>	<p>Obtain equipment and materials needed Review safety and service procedures Check operation of interior lights Check operation of exterior lights Check exterior light lenses, reflectors, conspicuity tape, headlight alignment Assist to inspect and test tractor to trailer multi-wire connectors, cables, holders Assist to replace bulbs and headlights if needed Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify common components and functions of lighting systems List common preventive maintenance functions and services for lighting systems List common problems associated with faulty lighting systems Discuss safety precautions required before servicing lighting systems Describe how a truck light bulb functions Explain the operation of the power and switch for lights Explain the principles of halogen and high density discharge (HID) lamps Describe how to check and change light bulbs/lamps Explain how to aim headlights Identify safety precautions when handling halogen bulbs Describe how to load a vehicle prior to aiming headlights Explain how a trailer electrical plug and connector are connected</p>

BRAKES & HYDRAULICS SYSTEM		
<p>38. Perform air brake PM</p>	<p>Obtain equipment and materials needed Review safety and service procedures Check low air pressure warning devices</p> <ul style="list-style-type: none"> ○ With engine off, apply and release brake pedal until air pressure drops and low pressure warning device is activated <p>Check air governor cut-in pressure; check air system safety valves</p> <ul style="list-style-type: none"> ○ Drain air pressure from reservoir; start and run engine; record cut-out pressure <p>Inspect air compressor inlet Check brake chambers and air lines for secure mounting and damage Check and adjust air brakes with slack adjusters Inspect coupling air lines, holders, gladhands Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify common components and functions of air brakes including s-cams, shoes, anchor pins, slack adjusters, chambers, bushings List common preventive maintenance functions and services for air brakes List common problems associated with faulty air brakes Discuss safety precautions required before servicing air brakes Explain the operation of an air compressor and air brake chamber Explain the importance of checking and adjusting air brakes Compare manual and automatic air brake adjustment Define pushrod travel</p>
<p>39. Perform hydraulic brake PM</p>	<p>Obtain equipment and materials needed Review safety and service procedures Check master cylinder fluid level</p> <ul style="list-style-type: none"> ○ Collect sample if needed for testing <p>Inspect brake lines, fittings, flexible hoses, valves for leaks and damage Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify common components and functions of hydraulic brakes List common preventive maintenance functions and services for hydraulic brakes List common problems associated with faulty hydraulic brakes Discuss safety precautions required before servicing hydraulic brakes Describe the function of pumps, valves, actuators, and motors Identify the parts and operation of the brake pedal assembly Describe the construction of brake lines Explain how to verify brake fluid leakage versus another type of fluid Describe the proper procedures for tightening fittings List common problems associated with faulty brake lines Discuss common safety precautions for servicing</p>

		<p>brake lines</p> <p>Describe the function and component of brake fluid</p> <p>Discuss common characteristics of brake fluid- viscosity, corrosion, compressibility</p> <p>Compare types of brake fluids</p> <p>Identify the parts of a basic master cylinder and their function</p> <p>Describe possible causes and conditions of brake fluid in the master cylinder</p> <p>Describe basic procedures for servicing a master cylinder and a brake booster</p> <p>Discuss common safety precautions for servicing a master cylinder</p>
40. Check ABS & ATC warning lights	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Observe anti-lock brake system (ABS) warning light operation</p> <p>Observe automatic traction control (ATC) warning light operation</p> <p>Turn on vehicle ignition and follow confirmation checks for ABS and ATC</p> <p>Refer to worksite professional for further testing</p> <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify common components and functions of an ABS (anti-lock brake system) and ATC (automatic traction control) system</p> <p>List common preventive maintenance functions and services for an ABS and ATC system</p> <p>List common problems associated with faulty ABS and ATC systems</p> <p>Discuss safety precautions required before servicing ABS and ATC systems</p> <p>Explain how ABS and ATC works to prevent wheel lock up</p> <p>Explain what is meant by the number of channels of an ABS system</p> <p>Describe how trailer ABS is managed</p>
41. Read & interpret hydraulic system diagrams	<p>Reference the manual for the correct schematic of component</p> <p>Study the diagram</p> <p>Interpret the circuit and symbols</p> <p>Outline the circuit, power flow and action of each actuator</p>	<p>Explain the mechanics of hydraulic machinery including seals, filters, fittings, hoses, pumps, actuators, reservoirs, and fluids</p> <p>Discuss the purpose of hydraulic system diagrams</p> <p>Describe common components and symbols used on hydraulic system diagrams</p> <p>Discuss the</p>
42. Service filtration/reservoirs (tanks)	<p>Obtain equipment and materials needed</p> <p>Review safety and service procedures</p> <p>Service filters and breathers according to manufacturer</p> <p>Check reservoir fluid level</p> <ul style="list-style-type: none"> o Clean dirt and dust first o Take sample for contamination inspection 	<p>Identify common components and functions of hydraulic reservoirs</p> <p>List common preventive maintenance functions and services for hydraulic reservoirs</p> <p>List common problems associated with faulty hydraulic reservoirs</p>

	Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss safety precautions required before servicing hydraulic reservoirs Identify types of hydraulic filtration systems Discuss causes of system contamination
43. Check hoses, fittings, connections	Obtain equipment and materials needed Review safety and service procedures Inspect hoses for cracks and deterioration Inspect hoses for correct length and size Inspect hoses for correct routing, bends, and radii Inspect hoses for protection Assist to assemble and replace hoses and connections After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of hydraulic hoses, fittings and connections List common preventive maintenance functions and services for hydraulic hoses, fittings and connections List common problems associated with faulty hydraulic hoses, fittings and connections Discuss safety precautions required before servicing hydraulic hoses, fittings and connections Identify common sizes for hydraulic hoses and fittings
SUSPENSION & STEERING SYSTEM		
44. Perform suspension & steering PM	Obtain equipment and materials needed Review safety and service procedures Inspect springs, pins, bushings, bolts and insulators Check power steering pump, mounting and hoses for leaks, condition Check power steering fluid level Check oil level in all non-drive hubs; check for leaks Lubricate all suspension and steering grease fittings Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of suspension and steering systems List common preventive maintenance functions and services for suspension and steering systems List common problems associated with faulty suspension and steering systems Discuss safety precautions required before servicing suspension and steering systems List the components and function of leaf and multi-leaf spring suspensions Identify the function of the components of a power steering system Identify components of electrically controlled power steering systems Explain how hydraulics laws apply to power steering pump operation Compare types of power steering fluid Discuss signs of low power steering fluid Describe how to determine if fluid is contaminated Demonstrate proper use of lubrication equipment Compare types of vehicle grease and when each type is used
45. Perform steering linkage PM	Obtain equipment and materials needed Review safety and service procedures Inspect steering arms, levers and linkages	Identify common components and functions of steering assemblies List common preventive maintenance functions and

	<p>Lubricate as needed Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>services for steering assemblies List common problems associated with faulty steering assemblies Discuss safety precautions required before servicing steering assemblies</p>
46. Perform tire checks	<p>Obtain equipment and materials needed Review safety and service procedures Inspect tires for wear patterns Inspect tires for cuts, cracks, bulges, sidewall damage Inspect valves and caps Measure and record tread depth Check and record air pressure Check for loose lugs and hardware condition Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Identify the parts of a tire and wheel Describe different methods of tire construction Explain tire and wheel sizes Describe tire ratings Identify wheel configurations used on medium/heavy trucks Explain how toe, camber, caster, axle inclination, turning radius, and axle alignment affect tire wear, stability and handling Define tire wear pattern Describe common tire wear patterns and the problems they indicate List common tire, wheel, and wheel bearing problems List common causes of tire air loss List common problems associated with underinflated or overinflated tires Discuss common safety precautions for servicing tires Describe the safe removal and handling of large vehicle tires</p>
47. Assist to remove & install steering & drive axle wheel/tire assemblies	<p>Obtain equipment and materials needed Review safety and service procedures Chock the rear wheels Position the vehicle Remove the dust/grease cap from the hub assembly Clean any oil Remove the locking device from the retaining nut Remove the retaining nut Remove the locking nut Remove the wheel bearings <ul style="list-style-type: none"> o Replace wheel seal if needed o Clean and inspect parts Remove the steering axle wheel/tire assembly Inspect the assembly Lubricate parts as required Reinstall repaired or new assembly</p>	<p>Identify common components and functions of steering and drive axle assemblies List common preventive maintenance functions and services for steering and drive axle assemblies List common problems associated with faulty steering and drive axle assemblies Discuss safety precautions required before servicing steering and drive axle assemblies Identify common components and the purpose of the wheel seal and bearings Discuss safety precautions required before servicing wheel seals and bearings Demonstrate proper use of lubrication equipment Compare types of vehicle grease and when each type is used</p>

	<p>Replace components in reverse order</p> <ul style="list-style-type: none"> ○ Mount wheel ○ Adjust brakes with slack adjuster <p>After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	
<p>48. Perform fifth wheel, frame, trailer PM</p>	<p>Obtain equipment and materials needed Review safety and service procedures Clean fifth wheel and locking mechanism Inspect fifth wheel mounting bolts, air lines, locks Lubricate all fifth wheel grease fittings and plate Check mud flaps and brackets Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation</p>	<p>Describe the chassis frame of medium/heavy trucks Describe characteristics of frame and trailer materials Explain the elements of frame and trailer construction Compare semi-trailers and full trailers Compare hitching mechanisms Outline basic frame and trailer welding techniques Describe locking principles for types of fifth wheels Define high hitch and how to avoid it Demonstrate proper use of lubrication equipment Compare types of vehicle grease and when each type is used Compare welding torches and their uses with truck frames Compare types of metals and their qualities for trucks and welding Compare welding and cutting processes used with truck frames</p>