

The Official ASE Study Guide



MIL1: **Military Fundamentals**



**Military Tactical Wheeled
Vehicle Technician
Certification Program**

Overview

Introduction

This guide is designed to help you prepare for the MIL1 Military Fundamentals ASE test. The MIL1 test is intended as an end-of-course test for those completing 91-series Advanced Individual Training (AIT) at the United States Army Ordnance School (USAOS) and can also be taken by mechanics and maintenance supervisors to test general mechanical knowledge on tactical wheeled vehicle systems. This guide includes detailed information on test content and should help you identify weak areas in your technical knowledge that need additional review.

Although ASE produces the tests and administers the testing program, the test questions are written by military and civilian personnel with expert-level knowledge of tactical wheeled vehicles. Questions are written in meetings where military instructors, working technicians, and civilian OEM training staff collaborate to ensure that each question accurately reflects the tasks that entry-level wheeled vehicle mechanics will be expected to know and do in their day-to-day job as a tactical wheeled vehicle maintainer.

The MIL1 Military Fundamentals test contains 50 scored questions as well as 10 unscored questions that are being assessed for future use. You will not know which questions are scored, so it is important to answer every question to the best of your ability. You will have 1 hour and 15 minutes to complete the test.

How To Use This Guide

The material in this guide is in three sections.

1. The **Test Specification** lists the major content areas covered by the test and the number of test questions in each area. You will see at a glance, for example, that 20% of questions on the test are in the Engines content area.
2. The **Task List**, divided into the major content areas, describes in detail the work activities you will be expected to perform as an

entry-level tactical wheeled vehicle mechanic. You should use it as a checklist covering the knowledge you will need to be successful on the test and on the job. Any task listed here may be covered on the test.

3. **Sample Questions** make up the third section. These specific questions will not be on the test, but they show the varied question formats used. All questions on the test are multiple-choice.

What's Next?

After you gain some experience in the field, you may want to take more advanced tests in the ASE Military Tactical Wheeled Vehicle Technician Certification Program. Not only does ASE voluntary certification help you prove your abilities to yourself and your supervisor, but successful completion will also result in promotion points and potential career opportunities after you leave military service. The tests in this series are:

- MIL2 - Diesel Engines
- MIL3 - Drive Train
- MIL4 - Chassis
- MIL5 - Suspension, Steering, & Hydraulics
- MIL6 - Electrical/Electronics
- MIL7 - Heating, Ventilation, & Air Conditioning (HVAC)
- MIL8 - Preventive Maintenance Checks & Services (PMCS)

Study guides for all ASE tests can be found online at www.ase.com/ase-study-guides.

TACTICAL WHEELED VEHICLES COVERED BY MIL1: Military Fundamentals

The **High Mobility Multipurpose Wheeled Vehicle (HMMWV)** is a family of light, four-wheel drive, military trucks and utility vehicles produced by AM General.

The **Joint Light Tactical Vehicle (JLTV)** is a four-wheel drive vehicle manufactured by Oshkosh and designed in-part to replace the HMMWV with a family of more survivable vehicles with a greater payload.

The **Family of Medium Tactical Vehicles (FMTV)** is a series of vehicles, built by Oshkosh and based on a common chassis, that vary by payload and mission requirements. The FMTV family consists of the LMTV (with a single rear axle) and MTV (with dual rear axles).

The **Mine-Resistant Ambush Protected (MRAP)** is a US Military light tactical vehicle produced by Navistar Defense that is designed specifically to withstand improvised explosive device (IED) attacks and ambushes. The MRAP is no longer in production. Technology specific to these vehicles will eventually be phased out of the ASE Tests.

The **Heavy Expanded Mobility Tactical Truck (HEMTT)** is an eight-wheel drive, diesel-powered, 10-short-ton (9,100 kg), tactical truck manufactured by Oshkosh.

Specifications and Task List for MILITARY FUNDAMENTALS TEST (MIL1)

Content Area	Questions in Test	Percent of Test
A. Engines	10	20%
B. Drive Train	6	12%
C. Chassis	8	16%
D. Suspension, Steering, and Hydraulics	6	12%
E. Electrical/Electronics	12	24%
F. Heating, Ventilation, and Air Conditioning (HVAC)	4	8%
G. Cab	4	8%
Total	50	100%

Test time is 1 hour and 15 minutes.

Note: The test could contain additional questions that are included for statistical research purposes only. Your answers to these questions will not affect your score, but since you do not know which ones they are, you should answer all questions in the test.

For every task, 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.

A. Diesel Engines (10 questions)

► General

1. Determine vehicle identification information and utilize to identify applicable technical manual warnings, cautions, procedures, and notes.
2. Research vehicle service information, including fluid types, vehicle service history, service precautions, and technical service bulletins.
3. Inspect level and condition of fuel, oil, and coolant.
4. Inspect engine assembly for fuel, oil, coolant, air, and other leaks; determine needed action.
5. Check engine operation (starting and running) including: noise, vibration, smoke, etc.; determine need action.
6. Use appropriate procedures to diagnose problems; check record, and clear diagnostic codes; interpret digital multimeter (DMM) readings.
7. Identify system components, configurations, and types of the following: cylinder head(s), valve train, engine block, engine lubrication, engine cooling, air induction, exhaust, and fuel.
8. Check the engine for no-crank, or cranks but fails to start conditions; determine needed action.

► Engine Block

9. Inspect crankshaft vibration damper; inspect engine mounts; determine needed action.
10. Inspect pans, covers, gaskets, seals, wear rings, and crankcase ventilation components.
11. Inspect flywheel/flexplate (including ring gear) and mounting surfaces for cracks and wear; determine needed action.

► Cylinder Head and Valve Train

12. Inspect electronic wiring harness and brackets for wear, bending, cracks, and proper securement; determine needed action.

► Lubrication Systems

13. 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.
14. Check engine oil level, condition, and consumption; determine needed action.
15. Determine proper lubricant; perform oil and filter service.
16. Inspect and clean oil cooler and components.

► Cooling Systems

17. Check engine coolant type, level, and condition; test coolant for freeze protection.
18. Test coolant temperature; test operation of temperature and level sensors, gauge, and/or sending unit; determine needed action.
19. Inspect and reinstall/replace pulleys, tensioners, and drive belts; adjust drive belts and check alignment.
20. Recover coolant; flush and refill with recommended coolant.
21. Identify coolant filter; inspect coolant valves, lines, and fittings; determine needed action.
22. Inspect water pump, hoses, and clamps; determine needed action.

23. Inspect and pressure test cooling system(s); pressure test cap, tank(s), and recovery systems; inspect radiator and mountings; determine needed action.
24. Inspect thermostatic cooling fan system (hydraulic and electronic) and fan shroud; determine needed action.
25. Inspect thermostat(s), by-passes, housing(s), and seals; replace as needed.

► Air Induction Systems

26. Inspect turbocharger(s), wastegate(s), and piping systems; determine needed action.
27. Check air induction system including: cooler assembly, piping, hoses, clamps, and mountings; replace air filter as needed; reset restriction indicator (if applicable).
28. Inspect intake manifold, gaskets, and connections; determine needed action.
29. Inspect engine exhaust system for leaks, mounting, proper routing, and damaged or missing components; determine needed action.
30. Inspect crankcase ventilation system; service as needed.
31. Perform intake manifold pressure (boost) test; determine needed action.
32. Demonstrate knowledge of charge air cooler operation.
33. Check, inspect, and test intake heater system/glow plug system and components.

► Fuel Systems

34. Check fuel level and condition; determine needed action.
35. Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, hoses, lines, and fittings; determine needed action.
36. Inspect low pressure fuel system components (fuel pump, pump drives, screens, fuel/water separators/indicators, hoses, lines, filters, coolers, check valves, pressure regulator valves, restrictive fittings, and mounting hardware); determine needed action.
37. Replace fuel filter; prime and bleed fuel system.
38. Inspect high pressure fuel system components (fuel pump, pump drives, hoses, injection lines, filters, hold-downs, fittings, seals, and mounting hardware).
39. Demonstrate knowledge and understanding of the different types of diesel fuel systems.

B. Drive Train (6 questions)

► General

1. Determine vehicle identification information and utilize to identify applicable technical manual warnings, cautions, procedures, and notes.
2. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.
3. Identify drive train components, transfer case, transmission, differentials, etc., and configurations.
4. Use maintenance support device (MSD) and appropriate technical manual (TM) to diagnose problems; check, record, and clear diagnostic codes; interpret digital multi-meter (DMM) readings.

► Transmission

5. Inspect transmission shifter and linkage; inspect and/or replace transmission mounts, insulators, and mounting bolts.
6. Inspect transmission for leakage; determine needed action.
7. Check transmission fluid level and condition; determine needed action.

8. Inspect transmission breather; inspect transmission oil filters, coolers, and related components; determine needed action.
9. Inspect speedometer components; determine needed action.
10. Inspect and test function of REVERSE light, NEUTRAL start, and warning device circuits; determine needed action.
11. Inspect and test transmission temperature gauge, wiring harnesses, and sensor/sending unit.
12. Inspect operation of automatic transmission, components, and controls; diagnose automatic transmission system problems; determine needed action.

► **Driveshaft and Universal Joints**

13. Inspect, service, and/or replace driveshafts, slip joints, yokes, drive flanges, support bearings, universal joints, CV joints, boots, seals, and retaining/mounting hardware; check phasing of all shafts.
14. Identify causes of driveshaft and universal joint noise and vibration problems.
15. Inspect driveshaft center support bearings and mounts; determine needed action.

► **Drive Axles**

16. Check and repair fluid leaks; inspect drive axle housing assembly, cover plates, gaskets, seals, vent/breather, and magnetic plugs.
17. Check drive axle fluid level and condition; determine needed action.
18. Inspect drive axle shafts; determine needed action.
19. Remove and replace wheel assembly; check wheel seal and axle flange for leaks; determine needed action.

C. Chassis (8 questions)

► **General**

1. Determine vehicle identification information and utilize to identify applicable technical manual warnings, cautions, procedures, and notes.
2. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.
3. Identify brake system components and configurations (including air and hydraulic systems, parking brake, power assist, and vehicle dynamic brake systems).
4. Identify brake performance problems caused by the mechanical/foundation brake system (air and hydraulic).
5. Use maintenance support device (MSD) and technical manuals (TM) to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings.

► **Air Brake Supply and Service Systems**

6. 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.
7. 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.

8. Demonstrate knowledge and understanding of air supply and service system components and operations.
9. Inspect air compressor drive gear components (gears, belts, tensioners, and/or couplings); determine needed action.
10. Inspect air compressor inlet; inspect oil supply and coolant lines, fittings, and mounting brackets; repair or replace as needed.
11. Understand operation and theory of brake application (foot/treadle) valve, fittings, and mounts; check pedal operation; determine needed action.

► **Air Brake Mechanical/Foundation Brake System**

12. Inspect and understand theory of service brake and parking brake chambers, diaphragms, clamps, springs, pushrods, clevises, and mounting brackets; determine needed action.
13. Identify slack adjuster type; inspect slack adjusters; determine needed action.
14. Check foundation brake hardware for S-cam and wedge brake systems to include camshafts (S-cams), wedge brake rollers, tubes, S-cam rollers, bushings, seals, spacers, retainers, brake spiders, shields, anchor pins, and springs; perform needed action.
15. Remove brake drum; clean and inspect brake drum and mounting surface; inspect brake lining condition; determine needed action.

► **Air Brake Parking Brake System**

16. Inspect, test, and/or replace parking (spring) brake chamber assembly.
17. Inspect, test, and/or replace parking (spring) brake system check valves, lines, hoses, and fittings.
18. Manually release (cage) and reset (uncage) parking (spring) brakes.

► **Hydraulic Brake Hydraulic Systems**

19. Check master cylinder fluid level and condition; determine proper fluid type for application.
20. Inspect hydraulic brake system for leaks and damage; determine needed repairs.
21. Check hydraulic brake system operation including pedal travel, pedal effort, and pedal feel; determine needed action.
22. Bleed and/or flush hydraulic brake system.

► **Hydraulic Brake Mechanical/Foundation Brake Systems**

23. Inspect rotor and mounting surface; determine needed action.
24. Inspect and clean disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware and slides; determine needed action.

► **Hydraulic Brake Parking Brake Systems**

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

► **Power Assist Systems**

26. Check brake assist/booster system hoses and control valves; check fluid level and condition.
27. Inspect and replace hydraulic brake assist/booster systems, hoses, and control valves.

► **Vehicle Dynamic Brake Systems (Air and Hydraulic): Antilock Brake System (ABS) and Automatic Traction Control (ATC) System**

28. Observe antilock brake system (ABS) warning light operation; determine needed action.

► **Wheel Bearings/Central Tire Inflation System (CTIS)**

29. 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.
30. Identify, inspect, and/or replace unitized/preset hub bearing assemblies.
31. Understand theory of operation of central tire inflation systems (CTIS).
32. Identify, inspect, and diagnose central tire inflation system (CTIS) components.

► **Wheels and Tires**

33. Inspect tire condition; identify tire wear patterns; measure tread depth; verify tire matching across axle; inspect valve stem and cap; set tire pressure.
34. Identify causes of wheel/tire vibration and shimmy problems.
35. Check wheel mounting hardware; check wheel condition; remove and install wheel/tire assemblies; torque fasteners to technical manual specifications.

► **Automatic Fire Extinguishing Systems (AFES)**

36. Inspect and diagnose the Automatic Fire Extinguishing System (AFES).
37. Inspect and replace fire bottles in accordance with technical manual (TM) specifications and safety guidelines.

D. Suspension, Steering, and Hydraulics (6 questions)

► **General**

1. Determine vehicle identification information and utilize to identify applicable technical manual warnings, cautions, procedures, and notes.
2. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.
3. Identify suspension and steering system components and configurations.

► **Steering Column**

4. Check steering wheel for free play, binding, and proper centering; inspect and service steering shaft U-joint(s), slip joint(s), bearings, bushings, and seals; phase steering shaft.
5. Check operation of tilt and telescoping steering column.
6. Check cab mounting.

► **Steering Pump and Gear**

7. Check power steering pump (belt- and gear-driven) and steering gear operation, mountings, lines, and hoses; check fluid level and condition; service filter; inspect system for leaks.
8. Flush and refill power steering system; purge air from system.

► **Steering Linkage**

9. Inspect tie rod ends, ball joints, pivot pins, pitman arms, idler arms, and other steering linkage components; lubricate as needed.

► **Suspension Systems**

10. Inspect shock absorbers, bushings, brackets, and mounts; determine needed action.
11. Inspect leaf springs, center bolts, clips, pins, bushings, shackles, U-bolts, insulators, brackets, and mounts; determine needed action.
12. Inspect axle and axle aligning devices such as: radius rods, track bars, stabilizer bars, and torque arms; inspect related bushings, mounts, and shims.

13. Inspect tandem suspension equalizer components.
14. Inspect and test air suspension pressure regulator and height control valves, lines, hoses, and fittings; check and record ride height.
15. Inspect coil springs, air springs, mounting plates, springs, suspension arms, and bushings.

► **Wheel Alignment**

16. Demonstrate understanding of alignment angles.

► **Hydraulics**

17. Determine vehicle identification information and utilize to identify applicable technical manual warnings, cautions, and notes; determine proper fluid type per vehicle.
18. Understand theory and operation of hydraulic systems; perform a hydraulic pressure and flow check.
19. Identify hydraulic system components; locate filtration system components; service filters and breathers.
20. Check fluid level and condition; determine needed action.
21. Inspect hoses and connections for leaks, proper routing, and proper protection; determine needed action.

► **Frame and Coupling Devices**

22. Inspect, service, and/or adjust fifth wheel, pivot pins, bushings, locking mechanisms, mounting hardware, air lines, and fittings.
23. Inspect frame and frame members for cracks, breaks, corrosion, distortion, elongated holes, looseness, and damage.
24. Inspect frame hangers, brackets, and cross members.
25. Inspect pintle hook and mounting.

E. Electrical/Electronic Systems (12 questions)

► **General**

1. Determine vehicle identification information and utilize to identify applicable technical manual warnings, cautions, procedures, and notes.
2. Research vehicle service information, including vehicle service history, service precautions, and technical service bulletins.
3. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).
4. Demonstrate proper use of test equipment when measuring source voltage, voltage drop (including grounds), current flow, continuity, and resistance.
5. Demonstrate knowledge of the causes and effects of shorts, grounds, opens, and resistance problems in electrical/electronic circuits.
6. Use wiring diagrams to trace electrical/electronic circuits.
7. Measure parasitic (master power OFF) battery drain.
8. Demonstrate knowledge of the function, operation, and testing of circuit breakers, relays, solenoids, diodes, switches, and fuses.
9. Inspect, repair, and/or replace connectors, seals, terminal ends, and wiring; verify proper routing and securement.

10. Use appropriate maintenance support device (MSD) and procedures to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings.
11. Identify electrical/electronic system components and configuration.

▶ **Battery System**

12. Identify battery type and system configuration.
13. Perform battery open circuit voltage test; perform battery capacitance (CCA), determine needed action.
14. Inspect battery, battery cables, connectors, battery boxes, mounts, and hold-downs; determine needed action.
15. Charge battery using appropriate method for battery type.
16. Jump-start vehicle using NATO cables or an appropriate auxiliary power supply.

▶ **Starting System**

17. Identify and understand operation of the starter.
18. Inspect cables, wires, and connectors in the starting circuit.

▶ **Charging System**

19. Identify and understand operation of the generator (alternator).
20. Check instrument panel-mounted voltmeters and/or indicator lamps.
21. Inspect generator (alternator) drive belt condition; check pulleys and tensioners for wear; check fans and mounting brackets; verify proper belt alignment.
22. Inspect cables, wires, and connectors in the charging circuit.
23. Perform charging system voltage output tests.

▶ **Lighting Systems**

24. Inspect for brighter-than-normal, intermittent, dim, or no-light operation; determine needed action.
25. Test, replace, and aim headlights.
26. Inspect cables, wires, and connectors in lighting systems.
27. Inspect truck-to-trailer multi-wire connectors.

▶ **Instrument Cluster and Driver Information Systems**

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

F. Heating, Ventilation, and Air Conditioning (HVAC) (4 questions)

▶ **General**

1. Determine vehicle identification information and utilize to identify applicable technical manual warnings, cautions, procedures, and notes.
2. Research vehicle HVAC information, including refrigerant capacity/oil type; follow all EPA 609 and Technical Manual requirements.
3. Identify heating, ventilation, and air conditioning (HVAC) components and configuration; understand HVAC refrigerant cycle.
4. Use appropriate maintenance service devices (MSD) and procedures to diagnose problems; interpret digital multimeter (DMM) readings.

► **Refrigeration System Components**

5. Inspect A/C compressor drive belts, pulleys, and tensioners; verify proper belt alignment.
6. Check A/C system operation including system pressures using proper diagnostic equipment (Recovery/Recycling Machine); visually inspect A/C components for signs of leaks.
7. Inspect A/C evaporator and condenser for airflow restrictions; determine needed action.

► **Heating, Ventilation, and Engine Cooling Systems**

8. Inspect engine cooling system and heating system hoses, clamps, pipes, and core; determine needed action.
9. Inspect HVAC system-heater ducts, doors, hoses, cabin filters, and outlets; determine needed action.
10. Identify the source of HVAC system odors.

► **Operating Systems and Related Controls**

11. Verify blower motor operation; confirm proper air distribution; confirm proper temperature control; determine needed action.

G. Cab (4 questions)

► **General**

1. Determine vehicle identification information and utilize to identify applicable technical manual warnings, cautions, procedures, and notes.
2. Use appropriate maintenance support devices (MSD) and procedures to diagnose problems; check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings.

► **Instruments and Controls**

3. Check operation of master power and ignition switches; check operation of indicator lights, warning lights, and/or alarms; check instruments; record oil pressure and system voltage.
4. Check operation of all accessories.

► **Safety Equipment**

5. Test operation of horns (electric and air) and all exterior lights; test warning device operation (reverse, air pressure, etc.); check condition of safety triangles, fire extinguisher, and all required decals; inspect seat belts; inspect condition of wiper blades, arms, and linkages; determine needed action.

► **Hardware**

6. Test operation of windshield wipers and washer; inspect windshield glass for cracks, discoloration, and delamination; check sun visor; check seat condition, operation, and mounting; check door glass and window operation; verify operation of door and combat locks; inspect steps and grab handles; inspect mirrors, mountings, brackets, and glass; determine needed action.
7. Identify any physical body damage.
8. Service all cab lubrication points; inspect and lubricate door and hood hinges, latches, strikers, safety latches, linkages, and cables.
9. Inspect cab mountings, hinges, latches, linkages, and ride height; determine needed action.
10. Inspect quarter fender, mud flaps, and brackets; determine needed action.

Sample Questions for MILITARY FUNDAMENTALS TEST (MIL1)

1. A tactical wheeled vehicle is being diagnosed for poor heater performance. This could be caused by a:
 - > (A) stuck-open thermostat.
 - (B) stuck-closed thermostat.
 - (C) internally restricted radiator.
 - (D) failed radiator cap.

 2. The serpentine drive belt of a tactical wheeled vehicle (TWV) continues to come off during operation. Which of these could be the cause?
 - > (A) A damaged alternator pulley
 - (B) A glazed serpentine belt
 - (C) An overcharging alternator
 - (D) A dragging starter assembly

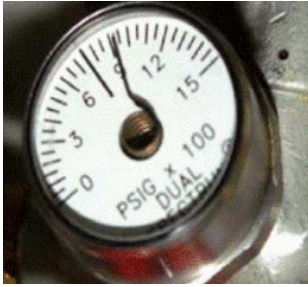
 3. A tactical wheeled vehicle equipped with a 13-psi coolant pressure cap is being pressure tested for a coolant leak.

Technician A says that the coolant system should be drained before the pressure is applied.

Technician B says that the coolant system should be pressurized to 15 psi.

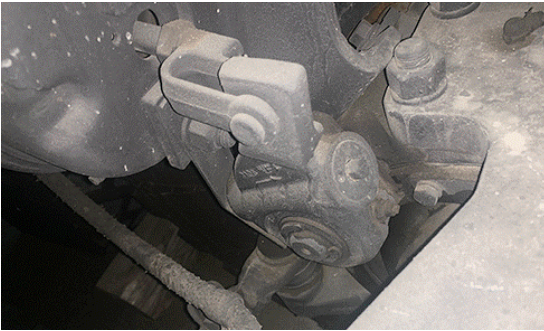
Who is right?

(A) A only	(C) Both A and B
(B) B only	> (D) Neither A nor B
-



4. The pressure gauge shown indicates a pressure of:

- (A) 9 psi.
- (B) 90 psi.
- > (C) 900 psi.
- (D) 9000 psi.



5. The image shown is:

- (A) a hydraulic brake adjuster.
- (B) an air ride suspension component.
- > (C) an air brake slack adjuster.
- (D) a power steering component.



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