

THE OFFICIAL ASE STUDY GUIDE

ASE Transit Bus Tests



National Institute for
**AUTOMOTIVE
SERVICE
EXCELLENCE**

ASE TRANSIT BUS TESTS

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Introduction

The *Official ASE Study Guide for the Transit Bus Tests* is intended to help technicians study for the ASE certification tests. The specific material about each test, included in the booklet is a useful tool for reviewing the technical knowledge that is covered in the *Transit Bus tests*. After performing a thorough review, it should be easier to select additional reference material that will assist you with the test preparation needs.

ASE voluntary certification is a means through which technicians can prove their abilities to themselves, to their employers, and to their customers. By passing ASE tests you will earn the most valuable credential available to working technicians. Because the tests are tough, you'll have the satisfaction of proving to yourself that you are among the elite in your profession. What's more, these credentials are recognized throughout the nation.

Certified technicians promote customer trust and improve the image of the industry. And trust and professionalism are the first steps to a better, more prosperous business.

ASE encourages you to take the tests and to join the "proven pros" who wear the ASE Blue Seal of Excellence®.

How Do I Become Certified?

There are eight tests in the Transit Bus certification series thus far. If you pass one or more tests, and have at least two years of hands-on working experience in transit bus repair, then you will become certified as an ASE Transit Bus Technician. If you pass H1 or H2, plus H3 through H8, and meet the work experience requirement, you will earn the certificate of Master Transit Bus Technician (Appropriate vocational training may be substituted for up to one year of work experience.)

If you fail a test, you may take it again during any scheduled test administration in which it is offered. And remember, you are the only one who will receive your tests scores; results will not be given over the phone nor will they be released to anyone without your written permission.

If you are currently certified in Diesel Engines (A9, H2, S2, or T2) and Electrical/Electronic Systems (A6, H6, S6, or T6), you are eligible to take the L2 Electronic Diesel Engine Diagnosis Specialist test.

OVERVIEW (CONTINUED)

ASE also offers certification in Automobile, Medium/Heavy Truck, Truck Equipment, School Bus, Collision Repair/Refinish, Parts Specialist, and Advanced Level specialties. Separate *Study Guides* are available.

For full information on ASE testing as well as downloadable *Study Guides*, *Registration Booklets*, and more, visit www.ase.com. You may also request *Registration Booklets* by mailing the coupon located on the back cover of this booklet or by calling ASE at 703-669-6600, ext. 400.

Who Writes the Questions?

The questions, written by service industry experts familiar with all aspects of transit bus repair, are entirely job-related. They are designed to test the skills that you need to know in servicing transit buses; theoretical knowledge is not covered.

Each question has its roots in an ASE “item-writing” workshop where service representatives from working bus technicians, technical educators, transit agency directors, and representatives from parts and equipment manufacturers meet in a workshop setting to share ideas and translate them into test questions. Each test question written by these experts must survive review by all members of the group. The questions are written to deal with practical problems of diagnosis and repair experienced by technicians in their day-to-day work.

From there, all questions are pre-tested and quality-checked on a national sample of technicians. Those questions that meet ASE standards of quality and accuracy are included in the scored sections of the tests; the “rejects” are sent back to the drawing board or discarded altogether.

Each transit bus certification test is made up of between 40 and 60 multiple-choice questions. The testing sessions are 4 hours and 15 minutes, allowing plenty of time to complete several tests.

Note: Each test could contain up to fifteen additional questions that are included for statistical purposes and will not be scored. Answers to these questions do not affect test scores, but since they are not separately identified in the test, all questions should be answered.

How Do I Prepare for the ASE Tests?

Become familiar with test content and question format: The Test Specifications in this booklet contain a summary description of the content covered by each test. The Specifications Task Lists describe the actual work performed by technicians in each specialty area. Together, these form a “blueprint” for writing and assembling the ASE tests.

Please note that each question on the test is keyed, or linked, to a particular task or set of tasks in the task list. Therefore, a review of the task lists, with an eye to judging whether you know how to perform each task listed, will provide you valuable information as you prepare for the tests.

There are five types of multiple-choice questions on the tests, each of which is included in the sample questions in this booklet. Note the different instructions for each question type.

Be sure to read each question carefully, (twice, if necessary) so that you understand exactly what is being asked. *Each question tests a specific diagnostic or repair problem and has only one correct answer.*

To summarize, we suggest the following steps be taken:

Step 1. Study the content list for each test you will attempt.

Step 2. Carefully read the task list for each area.

Step 3. Go over the sample questions to become familiar with each question type. This is very important.

Step 4. Review steps 1 through 3 and identify the skill area(s) where you need additional study.

Types of Knowledge Measured by the Tests

The types of knowledge and skills you will need to know to pass the tests are as follows:

- **Basic technical knowledge:** Tests your knowledge of what is in a system and how the system works, and what are the proper procedures and precautions to be followed in making repairs and adjustments.
- **Service or repair knowledge and skill:** Tests your understanding and ability to apply generally accepted repair procedures and precautions in assembly, disassembly, and reconditioning operations; and in making inspections and adjustments. Also tests ability to use shop manuals and precision tools of the trade.
- **Testing and diagnostic knowledge and skill:** Tests your ability to recognize problems and to use generally available measurement and testing equipment to make a diagnosis. Also tests your ability to trace the effects of a particular condition and find the cause of a particular set of symptoms.

If you are an experienced and competent technician, a careful review of this booklet, and additional brush-up on those areas in which you are weakest, is all you should need to pass the ASE tests.

Before The Tests

Try to be well-rested for the test so you will be alert and efficient. If you are taking the written versions, please bring several sharpened soft-lead (#2) pencils and an eraser with you; pencils will not be furnished at the test center. If you wish to pace yourself, bring a watch; some testing rooms may not have clocks. Finally, be sure to bring along your test center admission ticket and a current photo I.D.

OVERVIEW (CONTINUED)

At the Test Center—Some Tips

Arrive early enough to find the building and testing room. When you reach the location, wait in the assigned area until the proctor begins the test administration. He or she will instruct you in filling out the answer booklet (if taking written tests) or logging on to the computer (if taking computer-based tests).

Once testing has begun, keep track of time. Do not spend too long on any single question. Be sure to read each question carefully so that you understand exactly what is being asked. Do not mark answers in the test booklet; they must be marked on the answer booklet. Your test will not be scored if your answers are not on your answer booklet.

If a question is difficult, mark the answer that you think is correct and put a check by it in the test book. (Computer-based tests allow you to do this on screen.) Then go on to the next question. If you finish before time is up, you may go back to the questions that you checked.

It is to your advantage to answer every question. Do not leave any answers blank. Your score will be based only on the number of correct answers that you give.

Test Content and Sample Questions

The following material is designed to help technicians prepare for the ASE certification tests.

Each section begins with the Test Specifications, which will list the main categories covered on that particular test and the number of test questions and percentage of the test devoted to each topic.

The Task List describes the work activities a technician should be able to perform in each technical area covered on that test. This list was developed by working technicians and technical experts from across the country and will provide a valuable check list of what to study for the test.

These task descriptions offer detailed information to technicians preparing for the test and to persons who may be instructing technicians. The task lists may also serve as guidelines for question writers, reviewers, and test assemblers.

It should also be noted that the number of questions in each content area may not equal the number of tasks listed. Some of the tasks are complex and broad in scope and may be covered by several questions. Other tasks are simple and narrow in scope and one question may cover several tasks. The main objective in listing the tasks is to describe accurately what is done on the job, not to make each task correspond to a particular test question.

Sample questions follow. Although these same questions will not appear on actual tests, they are in the same format as actual test questions. All five types of multiple-choice questions used on the ASE tests are represented here. Note the different instructions for some questions. ■

TEST SPECIFICATIONS AND TASK LIST

COMPRESSED NATURAL GAS (CNG) ENGINES (TEST H1)

Content Area	Questions in Test	Percentage of Test
A. General Engine Diagnosis	9	18%
B. Cylinder Head and Valve Train Diagnosis and Repair	4	8%
C. Engine Block Diagnosis, Repair, and Overhaul	4	8%
D. Lubrication and Cooling Systems Diagnosis and Repair	4	8%
E. Air Induction and Exhaust Systems Diagnosis and Repair	7	14%
F. Fuel System Diagnosis and Repair	14	28%
1. High Pressure Systems (6)		
2. Low Pressure Systems (3)		
3. Fuel Controls (5)		
G. Starting and Charging System Diagnosis and Repair	4	8%
H. Ignition System Inspection Diagnosis and Repair	4	8%
Total	50	100%

A. General Engine Diagnosis (9 questions)

1. Verify the complaint, check for and retrieve fault codes, and road test vehicle; review operator service request and past maintenance documents (if available); determine further diagnosis.
2. Inspect engine assembly and engine compartment for natural gas, oil, coolant, exhaust, or other leaks; determine needed repairs.
3. Inspect engine compartment wiring harness, connectors, seals, and locks; check for proper routing and terminal/connector condition; determine needed repairs.
4. Listen for and diagnose engine noises; determine needed repairs.
5. Check engine exhaust for odor, smoke, or excessive temperatures; determine needed repairs.
6. Perform fuel supply system tests; check fuel for contamination and consumption; determine needed repairs.
7. Perform air intake system restriction and leakage tests; determine needed repairs.
8. Perform intake manifold pressure tests; determine needed repairs.

H1 TASK LIST (CONTINUED)

9. Perform exhaust backpressure and temperature tests; determine needed repairs.
10. Perform crankcase pressure test; determine needed repairs.
11. Diagnose no-cranking, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed repairs.
12. Diagnose surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems; determine needed repairs.
13. Isolate and diagnose engine related vibration problems; check engine mounts; determine needed repairs.
14. Check cooling system for temperature protection level, contamination, coolant type and level, temperature, pressure, supplemental coolant additive (SCA) concentration, filtration, and fan operation; determine needed repairs.
15. Check lubrication system for contamination, oil level, condition, temperature, pressure, filtration, and oil consumption; determine needed repairs.
16. Check, record, and clear electronic diagnostic codes; monitor electronic data; determine needed repairs.
17. Perform visual inspection for physical damage and missing, modified, or tampered components; determine needed repairs.
18. Research applicable vehicle and service information, service precautions, and technical service bulletins; determine needed actions.
19. Inspect accessory belts, drives, tensioners, and pulleys for tension and condition; determine needed repairs.
20. Perform engine compression test; determine needed repairs.

B. Cylinder Head and Valve Train Diagnosis and Repair (4 questions)

1. Remove, inspect, disassemble, and clean cylinder head assembly(s).
2. Inspect threaded holes, studs, and bolts for serviceability; service or replace as needed.
3. Measure cylinder head-to-deck thickness, and check mating surfaces for warpage and surface finish; inspect for cracks and damage; check condition of passages; inspect core and gallery plugs; service as needed.
4. Inspect valves, guides, seats, springs, retainers, rotators, locks and seals; determine serviceability and needed repairs.
5. Inspect, reinstall or replace seals and spark plug adaptors/tubes; inspect spark plug threads; service as required.
6. Inspect, reinstall or replace valve bridges (crossheads) and guides; adjust bridges (crossheads).
7. Clean components; reassemble, check, and install cylinder head assembly.
8. Inspect, measure, reinstall, or replace pushrods, rocker arms, rocker arm shafts, and supports for wear, bending, cracks, looseness, and blocked oil passages; determine needed repairs.
9. Inspect, install, and adjust cam followers.
10. Adjust valve clearances.
11. Inspect, measure, and reinstall or replace camshaft and bearings; measure and adjust endplay and backlash.

C. Engine Block Diagnosis, Repair and Overhaul (4 questions)

1. Remove, inspect, service, and reinstall pans, covers, breathers, gaskets, seals, and wear rings.
2. Disassemble, clean, and inspect engine block for cracks; check mating surfaces for damage or warpage and surface finish; check deck height; check condition of passages, core, and gallery plugs; inspect threaded holes, studs, dowel pins and bolts for serviceability; service, reinstall or replace as needed.
3. Inspect cylinder sleeve counterbore and lower bore; check bore distortion; determine needed service.
4. Inspect and measure cylinder walls or liners for wear and damage; determine needed service.
5. Replace/reinstall cylinder liners and seals; check and adjust liner heights.
6. Inspect in-block camshaft bearings for wear and damage; replace as needed.
7. Inspect, measure, reinstall or replace in-block camshaft; measure and adjust end play; inspect, reinstall or replace, and adjust cam followers (if applicable).
8. Clean and inspect crankshaft and journals for surface cracks and damage; check condition of oil passages; check passage plugs; measure journal diameters; check mounting surfaces; determine needed service.
9. Inspect, reinstall or replace main bearings; check cap fit and bearing clearances; check and correct crankshaft endplay.
10. Inspect, reinstall, and time the drive gear train (check timing sensors, gear wear and backlash of crankshaft, camshaft, balance shaft, auxiliary drive, and idler gears); service shafts, bushings, and bearings.
11. Clean, inspect, measure, reinstall or replace pistons, pins, and retainers.
12. Measure piston-to-cylinder wall clearances.
13. Check ring-to-groove clearances and end gaps; install piston rings.
14. Identify piston, connecting rod bearing, and main bearing wear patterns that indicate connecting rod and crankshaft alignment or bearing bore problems; check bearing bore and bushing condition; determine needed repairs.
15. Assemble pistons and connecting rods and install in block; check piston height; replace rod bearings and check clearances; check condition, position, and clearance of piston cooling jets (nozzles).
16. Inspect and measure crankshaft vibration damper; determine needed repairs.
17. Inspect, install, and align flywheel housing.
18. Inspect flywheel or flexplate (including ring gear) and mounting surfaces for cracks, wear, and runout; determine needed repairs.

D. Lubrication and Cooling Systems Diagnosis and Repair (4 questions)

1. Verify engine oil pressure and temperature; check operation of pressure/temperature sensors/switches, pressure gauge, and sending unit.
2. Inspect, measure, repair or replace oil pump, drives, pipes, and screens.
3. Inspect, repair or replace oil pressure regulator valve(s), by-pass valve(s), and filters.
4. Inspect, clean, test, reinstall or replace oil cooler, by-pass valve, oil thermostat, lines and hoses.
5. Inspect turbocharger lubrication and cooling system; repair or replace components as needed.

H1 TASK LIST (CONTINUED)

6. Change oil and filter; select oil type; verify oil level and condition.
7. Inspect, reinstall or replace drive belts, pulleys and tensioners; adjust drive belts and check alignment.
8. Verify coolant temperature and pressure; check operation of temperature/pressure and level sensors/switches, temperature gauge, and sending unit.
9. Inspect and replace cooling system thermostat(s), by-passes, housing(s), and seals.
10. Flush and refill cooling system; bleed air from system; recover coolant.
11. Inspect, repair or replace coolant conditioner/filter, check valves, lines, shutoff valves, and fittings.
12. Inspect, repair, or replace water pump, housing, hoses, idler pulley and drives.
13. Inspect radiator, pressure cap, and tank(s); determine needed service.
14. Inspect, repair, or replace fan hub, fan, and fan clutch; inspect mechanical, hydraulic, and electronic fan controls, fan thermostat, and fan shroud.
15. Pressure test cooling system and radiator cap; determine needed repairs.

E. Air Induction and Exhaust Systems Diagnosis and Repair (7 questions)

1. Inspect, service or replace air induction piping and clamps, air cleaner, and element; check for air restriction or contamination.
2. Inspect, test, and replace turbocharger, wastegate, actuator, and wastegate controls.
3. Inspect and replace intake manifold and gaskets; test temperature and pressure sensors; check connections.
4. Inspect, test, clean, repair or replace aftercooler or charge-air cooler, clamps, and piping system.
5. Inspect, repair or replace exhaust manifold, gaskets, piping, mufflers, insulation/heat shield and mounting hardware; inspect, replace, or repair exhaust after-treatment devices and controls.
6. Inspect, test, service, and replace O₂ sensor, EGR valve and associated controls and wiring.
7. Inspect and repair exhaust brake system.

F. Fuel System Inspection, Diagnosis and Repair (14 questions)

1. High Pressure System (6 questions)

1. Inspect fuel storage cylinders for physical damage, delamination, leaks; inspect mountings, shields, and hardware; repair or replace as required.
2. Inspect and interpret cylinder labels for cylinder compliance; determine needed action.
3. Inspect storage cylinder valves, solenoids, pressure relief device (PRD), fittings, piping, clamps, check valves, and vent tubing; repair or replace as required.
4. Inspect fuel lines, clamps and fittings, fill receptacles, 1/4 turn valve, and high pressure gauge; repair or replace as required.
5. Inspect high pressure regulator, fuel filter, and coolant lines for leaks, proper mounting or damage; repair or replace as required.
6. Service high pressure regulator, filter, coolant lines, hoses, and high pressure tubing as required.
7. Defuel and vent cylinders; remove and replace cylinders.
8. Refuel system; check for leaks.

2. Low Pressure System (3 questions)

1. Inspect low pressure filters, regulator, coolant lines, switch(es), sensor gauge, and tubing; repair or replace as required.
2. Service low pressure coolant lines, filters, gaskets, seals, and O-rings as required.

3. Fuel Controls (5 questions)

1. Inspect fuel shutoff solenoids, throttle actuator, fuel metering devices, control valves, and fuel mixer; repair or replace as required.
2. Inspect engine control module (ECM/ECU), sensors, wiring harness(es), connector(s) and other modules; repair or replace as required.

G. Starting and Charging System Diagnosis and Repair (4 questions)

1. Perform battery state-of-charge test; determine needed service.
2. Perform battery load and capacitance tests; test battery cables for shorts, opens and high resistance. Determine needed service; repair as required.
3. Charge battery using slow or fast charge method as appropriate.
4. Start vehicle using jumper cables, a booster battery, or an auxiliary power supply.
5. Inspect, clean, repair or replace batteries, battery cables, disconnects, and clamps.
6. Inspect, test, and reinstall or replace starter relays, safety switch(es), and solenoids; test engine prelude system.
7. Perform alternator amperage and voltage output tests; perform relay terminal output voltage test; perform charging circuit voltage drop tests; determine needed repairs. Perform repairs as required.
8. Perform starter current draw and circuit voltage drop tests; determine needed repairs. Perform repairs as required.

H. Ignition Systems Diagnosis and Repair (4 questions)

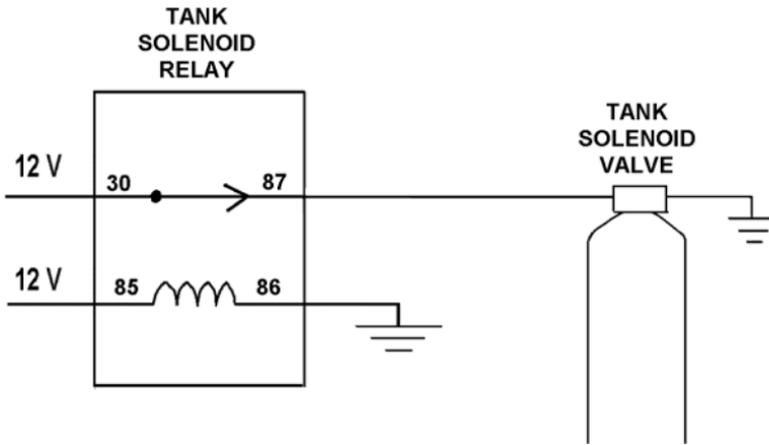
1. Diagnose ignition-related problems such as no-starting, engine misfire, poor drivability, spark knock, power loss, and poor mileage on vehicles with distributorless ignition systems; determine needed repairs.
2. Check for possible ignition system related diagnostic trouble codes (DTC); verify performance parameters.
3. Inspect, test, repair, or replace ignition primary circuit wiring and components.
4. Inspect and test spark plugs, boots, tubes and seals, and wiring; check and adjust spark plug gap.
5. Inspect, test, or replace ignition system secondary circuit wiring and components.
6. Inspect, test, and replace ignition coil(s).
7. Inspect, test, and replace ignition system pick-up sensor or triggering device.
8. Inspect, test, and replace ignition control module or controller. ■

SAMPLE QUESTIONS

COMPRESSED NATURAL GAS ENGINES (TEST H1)

Questions:

1. A replacement pressure relief device (PRD) vent tube should be made of
(A) rigid non-conductive material.
(B) flexible plastic tubing.
* (C) electrically conductive tubing.
(D) copper tubing.
2. A transit bus with NGV Type 2 fuel tanks is being inspected. There is one 6” (15.24 cm) long cut measuring 0.008” (0.203 mm) deep in the outer covering of a tank. This tank should be:
* (A) considered useable as is.
(B) rotated until the cut is on top.
(C) repaired by removing and replacing the fiber wrap.
(D) removed from service.
3. A CNG engine has a history of repeated head gasket failures.
Technician A says that low liner height could be the cause.
Technician B says that under-torqued head bolts could be the cause.
Who is right?
(A) A only
(B) B only
* (C) Both A and B
(D) Neither A nor B
4. Technician A says that the oil pressure can go too high if the oil pressure relief valve is stuck open.
Technician B says that the oil pressure can go too high if the engine is over-filled with lubricant.
Who is right?
(A) A only
(B) B only
(C) Both A and B
* (D) Neither A nor B



5. The solenoid valve on the tank shown in the above illustration is normally closed. Which of the following steps will allow the cylinder to be vented?
- (A) Disconnect the tank solenoid valve wires
 - (B) Remove the relay and install a jumper wire across terminals 86 and 87
 - * (C) Remove the relay and install a jumper wire across terminals 30 and 87
 - (D) Ground the housing of the tank solenoid valve

Question 6 is not like the ones above.

It has the word **EXCEPT**. For this question, look for the choice that could **NOT** cause the described situation. Read the entire question carefully before choosing your answer.

6. A CNG transit bus with a normal range of 350 miles stops running after 3 hours. The high-pressure fuel gauge shows 375 psi. Any of these could be the cause **EXCEPT** for a:
- (A) stuck cylinder flow control solenoid.
 - (B) defective engine ECM wiring.
 - (C) low CNG fuel cascade system pressure.
 - * (D) defective high-pressure regulator

TEST SPECIFICATIONS AND TASK LIST

DIESEL ENGINES (TEST H2)

Content Area	Questions in Test	Percentage of Test
A. General Engine Diagnosis	14	28%
B. Cylinder Head and Valve Train Diagnosis and Repair	4	8%
C. Engine Block Diagnosis, Repair, and Overhaul	4	8%
D. Lubrication and Cooling Systems Diagnosis and Repair	7	14%
E. Air Induction and Exhaust Systems Diagnosis and Repair	6	12%
F. Fuel System Diagnosis and Repair	11	22%
1. Mechanical Components (3)		
2. Electronic Components (8)		
G. Starting and Charging System Diagnosis and Repair	4	7%
Total	50	100%

A. General Engine Diagnosis (14 questions)

1. Verify the complaint, and road test vehicle; review operator service request and past maintenance documents (if available); determine further diagnosis.
2. Inspect engine assembly and engine compartment for fuel, oil, coolant, exhaust, or other leaks; determine needed repairs.
3. Inspect engine compartment wiring harness, connectors, seals, and locks; check for proper routing and terminal/connector condition; determine needed repairs.
4. Listen for and diagnose engine noises; determine needed repairs.
5. Check engine exhaust emissions, odor, smoke color, opacity (density) and quantity; determine needed repairs.
6. Perform fuel supply and fuel return system tests; check fuel for contamination, quality/type/grade, and consumption; determine needed repairs.
7. Perform air intake system restriction and leakage tests; determine needed repairs.
8. Perform intake manifold pressure tests; determine needed repairs.
9. Perform exhaust back-pressure and temperature tests; determine needed repairs.
10. Perform crankcase pressure test; determine needed repairs.
11. Diagnose no cranking, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed repairs.
12. Diagnose surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems; determine needed repairs.

13. Isolate and diagnose engine related vibration problems; check engine mounts; determine needed repairs.
14. Check cooling system for temperature protection level, contamination, coolant type and level, temperature, pressure, supplemental coolant additive (SCA) concentration, filtration, and fan operation; determine needed repairs.
15. Check lubrication system for contamination, oil level, quality, temperature, pressure, filtration, and oil consumption; determine needed repairs.
16. Check, record, and clear electronic diagnostic codes; monitor electronic data; determine needed repairs.
17. Perform visual inspection for physical damage and missing, modified, or tampered components; determine needed repairs.
18. Research applicable vehicle and service information, service precautions, and technical service bulletins; determine needed actions.

B. Cylinder Head and Valve Train Diagnosis and Repair (4 questions)

1. Remove, inspect, disassemble, and clean cylinder head assembly(s).
2. Inspect threaded holes, studs, and bolts for serviceability; service or replace as needed.
3. Measure cylinder head-to-deck thickness, and check mating surfaces for warpage and surface finish; inspect for cracks and damage; check condition of passages; inspect core and gallery plugs; service as needed.
4. Inspect valves, guides, seats, springs, retainers, rotators, locks and seals; determine serviceability and needed repairs.
5. Inspect, reinstall or replace injector sleeves and seals; pressure test to verify repair (if applicable); measure injector tip or nozzle protrusion where specified by manufacturer.
6. Inspect, reinstall or replace valve bridges (crossheads) and guides; adjust bridges (crossheads).
7. Clean components; reassemble, check, and install cylinder head assembly as specified by the manufacturer.
8. Inspect, measure, reinstall, or replace pushrods, rocker arms, rocker arm shafts, and supports for wear, bending, cracks, looseness, and blocked oil passages. Visually inspect for wear and correct routing
9. Inspect, install, and adjust cam followers.
10. Adjust valve clearances and injector settings.
11. Inspect, measure, and reinstall or replace overhead camshaft and bearings; measure and adjust endplay and backlash.

C. Engine Block Diagnosis, Repair and Overhaul (4 questions)

1. Remove, inspect, service, and reinstall pans, covers, breathers, gaskets, seals, and wear rings.
2. Disassemble, clean, and inspect engine block for cracks; check mating surfaces for damage or warpage and surface finish; check deck height; check condition of passages, core, and gallery plugs; inspect threaded holes, studs, dowel pins and bolts for serviceability; service, reinstall or replace as needed.
3. Inspect cylinder sleeve counterbore and lower bore; check bore distortion; determine needed service.

H2 TASK LIST (CONTINUED)

4. Inspect and measure cylinder walls or liners for wear and damage; determine needed service.
5. Replace/reinstall cylinder liners and seals; check and adjust liner heights.
6. Inspect in-block camshaft bearings for wear and damage; replace as needed.
7. Inspect, measure, reinstall or replace in-block camshaft; measure and adjust end play; inspect, reinstall or replace, and adjust cam followers (if applicable).
8. Clean and inspect crankshaft and journals for surface cracks and damage; check condition of oil passages; check passage plugs; measure journal diameters; check mounting surfaces; determine needed service.
9. Inspect, reinstall or replace main bearings; check cap fit and bearing clearances; check and correct crankshaft endplay.
10. Inspect, reinstall, and time the drive gear train (check timing sensors, gear wear and backlash of crankshaft, camshaft, balance shaft, auxiliary drive, and idler gears); service shafts, bushings, and bearings.
11. Clean, inspect, measure, reinstall or replace pistons, pins, and retainers.
12. Measure piston-to-cylinder wall clearances.
13. Check ring-to-groove clearances and end gaps; install piston rings.
14. Identify piston, connecting rod bearing, and main bearing wear patterns that indicate connecting rod and crankshaft alignment or bearing bore problems; check bearing bore and bushing condition; determine needed repairs.
15. Assemble pistons and connecting rods and install in block; check piston height; replace rod bearings and check clearances; check condition, position, and clearance of piston cooling jets (nozzles).
16. Inspect and measure crankshaft vibration damper; determine needed repairs.
17. Inspect, install, and align flywheel housing.
18. Inspect flywheel or flexplate (including ring gear) and mounting surfaces for cracks, wear, and runout; determine needed repairs.

D. Lubrication and Cooling Systems Diagnosis and Repair (7 questions)

1. Verify engine oil pressure and check operation of pressure sensor, pressure gauge, and sending unit.
2. Inspect, measure, repair or replace oil pump, drives, pipes, and screens.
3. Inspect, repair or replace oil pressure regulator valve(s), by-pass valve(s), and filters.
4. Inspect, clean, test, reinstall or replace oil cooler, by-pass valve, oil thermostat, lines and hoses.
5. Inspect turbocharger lubrication system; repair or replace as needed.
6. Change oil and filter, verify oil level and condition.
7. Inspect, reinstall or replace drive belts, pulleys and tensioners; adjust drive belts and check alignment.
8. Verify coolant temperature, and check operation of temperature and level sensors, temperature gauge, and sending unit.
9. Inspect and replace cooling system thermostat(s), by-passes, housing(s), and seals.
10. Flush and refill cooling system; bleed air from system; recover coolant.
11. Inspect, repair or replace coolant conditioner/filter, check valves, lines, shutoff valves, and fittings.
12. Inspect, repair, or replace water pump, housing, hoses, idler pulley and drives.
13. Inspect radiator, pressure cap, and tank(s); determine needed service.

14. Inspect, repair, or replace fan hub, fan, and fan clutch; inspect mechanical, hydraulic, and electronic fan controls, fan thermostat, and fan shroud.
15. Pressure test cooling system and radiator cap; determine needed repairs.

E. Air Induction and Exhaust Systems Diagnosis and Repair (6 questions)

1. Inspect, service or replace air induction piping, air cleaner, and element; check for air restriction or contamination.
2. Inspect, test, and replace turbocharger, wastegate, and wastegate controls.
3. Inspect and replace intake manifold and gaskets; test temperature and pressure sensors; check connections.
4. Inspect, test, clean, repair or replace aftercooler or charge-air cooler and piping system.
5. Inspect, repair or replace exhaust manifold, gaskets, piping, mufflers, insulation/heat shield and mounting hardware; inspect, replace, or repair exhaust after treatment devices
6. Inspect, repair or replace preheater/inlet air heater, starting aids, and controls.
7. Inspect, test, service, and replace EGR system components; including EGR valve, variable ratio/geometry turbocharger, cooler, piping, filter, electronic sensors, controls, system air pressure solenoids, and wiring.
8. Inspect and repair exhaust brake system.

F. Fuel System Diagnosis and Repair (11 questions)**1. Mechanical Components (3 questions)**

1. Inspect, repair or replace fuel tanks, vents, cap(s), mounts, valves, screens, crossover system, supply and return lines, and fittings.
2. Inspect, clean, test, repair or replace fuel transfer pump, lift pump, drives, screens, fuel/water separators/indicators, filters, heaters, coolers, ECM cooling plates, and mounting hardware.
3. Check fuel system for air and temperature; determine needed repairs; prime and bleed fuel system; check, repair or replace primer pump.
4. Inspect, test, repair or replace low/high pressure systems (check valves, pressure regulator valves and restrictive fittings).
5. Inspect, adjust, repair or replace mechanical engine throttle and controls.
6. Perform on-engine inspections, tests, adjustments, and time, or replace and time, distributor-type injection pumps.
7. Perform on-engine inspections, tests, and adjustments, or replace mechanical unit injectors.
8. Inspect, test, repair or replace fuel injection nozzles.
9. Inspect, adjust, repair or replace smoke limiters (air/fuel ratio controls).
10. Inspect, reinstall or replace high-pressure injection lines, fittings, seals, and mounting hardware.
11. Inspect, test, adjust, repair or replace engine fuel shut-off devices and controls, including engine protection shut-down devices, circuits and sensors.

H2 TASK LIST (CONTINUED)

2. Electronic Components (8 questions)

1. Check and record engine electronic diagnostic codes and trip/operational data; clear codes; determine needed repairs.
2. Inspect, adjust, repair or replace electronic throttle and PTO (high/low idle) control devices, circuits, and sensors.
3. Perform on-engine inspections, tests, and adjustments on hydraulic electronic unit injectors (HEUI) and electronic controls (rail pressure control).
4. Perform on-engine inspections, tests, and adjustments on electronic unit injectors (EUI) and electronic controls.
5. Inspect, test, adjust, repair or replace engine electronic fuel shut-down components, circuits, and sensors, including engine protection and automatic stop systems.
6. Inspect and test voltage, ignition, and ground circuits and connections for electrical/electronic components; determine needed repairs.
7. Inspect and replace electrical connector terminals, pins, harnesses, seals, and locks.
8. Connect diagnostic tool to vehicle/engine to access allowed service parameters; determine needed repairs.
9. Use a diagnostic tool (hand-held or PC-based, and/or break-out cable or box) to inspect and test electronic engine control system, sensors, actuators, electronic control modules (ECMs), and circuits; determine needed repairs.
10. Measure and interpret voltage, voltage drop, amperage, and resistance readings using a digital multimeter (DMM).

G. Starting and Charging System Diagnosis and Repair (4 questions)

1. Perform battery state-of-charge test; determine needed service.
2. Perform battery load and capacitance tests; determine needed service.
3. Charge battery using slow or fast charge method as appropriate.
4. Start vehicle using jumper cables, a booster battery, or an auxiliary power supply.
5. Inspect, clean, repair or replace batteries, battery cables, disconnects, and clamps.
6. Inspect, test, and reinstall or replace starter relays, safety switch(s), and solenoids.
7. Perform alternator voltage and amperage output tests; determine needed repairs.
8. Perform starter and charging circuit voltage drop tests; determine needed repairs. ■

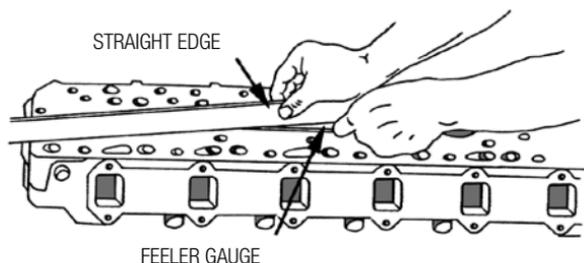
SAMPLE QUESTIONS

DIESEL ENGINES (TEST H2)

Questions:

1. An operator complains that a transit bus has excessive black smoke when started in the morning. Which of these could be the cause?
* (A) A bad fuel injector nozzle
(B) A restricted fuel filter
(C) A blocked fuel tank vent
(D) A leaking fuel return line
2. An operator complains that a transit bus will not crank. The most likely cause is:
(A) loose starter bolts.
* (B) a bad starter solenoid.
(C) a shorted starter ground cable.
(D) the gear selector was left in neutral.
3. A transit bus engine repeatedly throws off the engine accessory drive belts. Which of these is the most likely cause?
(A) Worn pulley grooves
(B) An over-tightened drive belt
(C) Loose driveline yokes
* (D) An out-of-balance crankshaft vibration damper
4. During a cold weather start-up, the oil filter ruptures, causing an oil leak. This could be caused by:
* (A) a stuck-closed oil filter bypass valve.
(B) a stuck-open oil pressure regulator valve.
(C) use of a high viscosity motor oil.
(D) excessive engine rpm at start-up.
5. A transit bus has had repeated serpentine belt failures. Which of these is the most likely cause?
(A) A stuck belt tensioner
* (B) Misaligned belt pulleys
(C) A binding idler bearing
(D) An out-of-balance fan

H2 SAMPLE QUESTIONS (CONTINUED)



6. What is the technician checking in the illustration shown above?
 - (A) Valve protrusion
 - (B) Valve recession
 - (C) Coolant nozzle recession
 - * (D) Cylinder head warpage
7. Which of these can cause a no-start condition on a HEUI engine?
 - (A) High fuel pressure
 - * (B) Low injection control pressure
 - (C) High boost pressure
 - (D) Low boost pressure
8. A diesel engine with EUI has a misfire and the check engine light is ON. Fault code "cylinder 4 current below normal" is active. This could be caused by a:
 - (A) failed engine position sensor.
 - (B) sticking #4 injector plunger.
 - * (C) broken #4 injector wire terminal.
 - (D) sticking throttle position sensor.

Question 9 is not like the ones above.

It has the word **EXCEPT**. For this question, look for the choice that could **NOT** cause the described situation. Read the entire question carefully before choosing your answer.

9. A transit bus has excessive engine oil consumption and an oil film on the back of the bus. All of these could be the cause EXCEPT:
 - (A) bad turbocharger seals.
 - * (B) a cracked cylinder liner.
 - (C) worn piston rings.
 - (D) worn valve guide seals.

TEST SPECIFICATIONS AND TASK LIST

DRIVE TRAIN (TEST H3)

Content Area	Questions in Test	Percentage of Test
A. Automatic Transmission Diagnosis and Repair	28	70%
B. Drive Shaft and Universal Joint Diagnosis and Repair	4	10%
C. Drive Axle Diagnosis and Repair	8	20%
Total	40	100%

A. Automatic Transmission Diagnosis and Repair (28 questions)

1. Diagnose noise, vibration, and shifting problems; determine needed repairs.
2. Check transmission fluid level; check dipstick calibration; diagnose fluid usage, leaks, and condition; determine needed repairs.
3. Perform transmission pressure tests; determine needed repairs.
4. Perform stall tests; determine needed repairs.
5. Perform lock-up converter system tests; determine needed repairs.
6. Diagnose mechanical control systems; determine needed repairs.
7. Replace fluid and internal/external filter(s).
8. Inspect, test, adjust, and/or replace retarder controls, valves, air lines, sensors, and components.
9. Inspect and replace external seals and gaskets.
10. Inspect, test, flush, transmission, transmission cooler and lines; inspect breathers, filters, and fittings; service as required.
11. Inspect, test, reinstall or replace vehicle speed sensor.
12. Inspect and test transmission temperature circuit for accuracy; determine needed repairs.
13. Inspect, test, diagnose, adjust, repair, or replace electrical/electronic components including the transmission control module(TCM), electronic modulators, solenoids, sensors, relays, switches, lights, fuses/breakers, wiring and connectors.
14. Inspect, replace, and align drive train mounts.
15. Remove and replace transmission; inspect flex plate.
16. Inspect engine block, flywheel housing, and transmission mating surfaces; check runout; check engine-to-transmission mounting adapters; determine needed repairs.
17. Inspect, test, repair, or replace electronic shift selectors, switches, displays and indicators, and wiring harnesses.
18. Diagnose automatic transmission and retarder problems using appropriate diagnostic tools and software, procedures, and service information/flow charts; check and record diagnostic trouble codes; clear codes; interpret digital multimeter (DMM) readings; determined needed repairs.

H3 TASK LIST (CONTINUED)

19. Diagnose automatic transmission problems caused by data link/bus interfaces with the transmission control module (TCM); identify electrical interference problems; determine needed repairs.
20. Inspect, adjust, service, repair, or replace power take-off assemblies and controls.

B. Drive Shaft and Universal Joint Diagnosis and Repair (4 questions)

1. Diagnose drive shaft and universal joint noise and vibration problems; determine cause of failure and needed repairs.
2. Inspect, service, or replace driveshaft, slip joints, yokes, drive flanges, universal joints, and vibration dampers; phase drive shaft yokes.
3. Measure drive line angles; determine needed adjustments.

C. Drive Axle Diagnosis and Repair (8 questions)

1. Diagnose rear axle drive unit noise, vibration, and overheating problems; determine needed repairs.
2. Check and repair fluid leaks; inspect and replace rear axle drive unit cover plates, gaskets, breathers, magnetic plugs, and pinion seals.
3. Check rear axle drive unit fluid level and condition; determine needed service; add proper type of lubricant.
4. Remove and replace differential carrier assembly, check ring and pinion backlash, inspect rear axle housing mating surfaces; determine needed repairs.
5. Remove, inspect, and replace axle shafts.
6. Remove and replace rear wheel hub assembly; inspect ABS tone/exciter ring and wheel speed sensor; determine needed repairs.
7. Diagnose wheel bearing noises and damage; determine needed repairs.
8. Clean, inspect, lubricate, and replace wheel bearing cones and races (cups); clean and inspect locking plates and nuts; replace seals, wear rings, and axle flange gasket; adjust rear wheel bearings.
9. Inspect, adjust, repair, or replace planetary axle assemblies including case, idler pinion, pins, gears, thrust washers, shims, seals, cover, and springs. ■

SAMPLE QUESTIONS

DRIVE TRAIN (TEST H3)

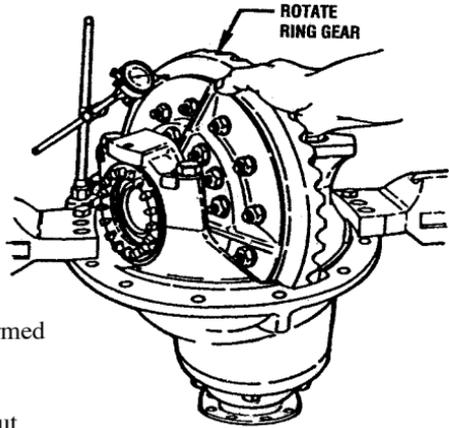
Questions:

1. A transit bus with a diesel engine and an electronic automatic transmission shifts late. Which of these is the most likely cause?
(A) An illuminated Do Not Shift light
(B) A bad retarder accumulator solenoid
* (C) A bad throttle position (TP) sensor
(D) A bad torque converter clutch (TCC) solenoid
2. An automatic transmission slips when cold, but shifts normally at operating temperature. The most likely cause is a:
(A) restricted transmission cooler.
(B) misadjusted throttle position (TP) sensor.
* (C) low fluid level.
(D) worn converter hub.
3. Which of these could cause the rear axle seals to fail repeatedly?
(A) Over-torqued wheel bearings
* (B) A restricted axle housing breather
(C) A high fluid level
(D) Incorrect fluid type
4. A transmission has no lock-up. During a pressure test, no pressure is found at the lock-up test port. This could be caused by:
(A) lock-up clutch wear.
(B) a locked stator.
* (C) a bad lock-up solenoid.
(D) a freewheeling stator.
5. A transit bus transmission is to be replaced.
Technician A says that the transmission flex plate should be inspected each time the transmission is removed.
Technician B says that the flywheel housing should be inspected each time the transmission is removed.
Who is right?
(A) A only
(B) B only
* (C) Both A and B
(D) Neither A nor B

H3 SAMPLE QUESTIONS (CONTINUED)

6. An operator reports that the transit bus won't go into gear. Technician A says that not engaging the high idle switch could be the cause. Technician B says that not stepping on the brake pedal could be the cause. Who is right?

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



7. What operation is being performed in the setup shown above?
- (A) Adjusting tooth contact
 - * (B) Checking ring gear runout
 - (C) Checking ring gear backlash
 - (D) Setting differential bearing preload
8. To most accurately check the fluid level in an automatic transmission, the technician should do all of these EXCEPT:
- (A) park the transit bus on level ground.
 - * (B) check while the fluid is cold.
 - (C) put the transmission in NEUTRAL.
 - (D) turn off the fast idle.

TEST SPECIFICATIONS AND TASK LIST

BRAKES (TEST H4)

Content Area	Questions in Test	Percentage of Test
A. Air Supply and Service Systems Diagnosis and Repair	24	48%
B. Mechanical/Foundation Brakes Diagnosis and Repair	14	28%
C. Parking Brakes Diagnosis and Repair	7	14%
D. Wheel Bearings Diagnosis and Repair	5	10%
Total	50	100%

A. Air Supply and Service Systems Diagnosis and Repair (24 questions)

1. Diagnose poor stopping, pulling, grabbing, dragging, overheating, and air leak (static and applied) problems, caused by supply and service system malfunctions; determine needed repairs.
2. Check air system build-up and recovery time; determine needed repairs.
3. Drain air reservoir tanks; check for oil, water, and foreign material; determine needed repairs.
4. Inspect, adjust, align, or replace air compressor drive gears, and couplings.
5. Inspect, repair, or replace air compressor, air intake, oil and coolant lines and fittings.
6. Inspect, test, adjust, or replace system pressure controls (governor/ relief valve), unloader assembly valves, pressure protection valves, and filters.
7. Inspect, repair, or replace air system lines, hoses, fittings, and couplings.
8. Inspect, test, clean, or replace air tank relief (pop-off) valves, one-way check valves, drain cocks, automatic drain (spitter) valves, heaters, wiring, and connectors.
9. Inspect, clean, repair, or replace air drier systems, filters, valves, heaters, wiring, and connectors.
10. Inspect, test, repair, or replace brake application (foot/treadle) valve, fittings, and mounts; check and adjust brake pedal free play.
11. Inspect, test, clean, or replace two-way (double) check valves and anti-compounding valves.
12. Inspect, test, repair, or replace stop and parking brake light circuit switches, wiring, and connectors.
13. Inspect, test, repair, or replace brake relay valve and quick-release valves.
14. Inspect, test, repair, or replace interlock system solenoid valves, regulator valves, pressure switches, and related components.
15. Inspect, test, and replace inversion/emergency (spring) brake control valve(s).

H4 TASK LIST (CONTINUED)

16. Inspect, test, repair, or replace low pressure warning devices.
17. Inspect, test, and replace air pressure sensors, gauges, lines, and fittings.
18. Inspect, test, and replace parking brake override valve.
19. Inspect, test, repair, or replace towing circuit components.
20. Perform antilock brake system and automatic traction control (ABS/ATC) warning lamp start-up test; determine needed repairs; diagnose hard fault codes/diagnostic trouble codes (DTCs) using scan tool, PC computer, or LEDs; determine needed repairs.
21. Diagnose poor stopping and lockup problems on antilock brake systems (ABS); determine needed repairs.
22. Test, adjust, or replace antilock brake system (ABS) wheel speed sensors and tone/exciter rings.
23. Test and replace antilock brake system and automatic traction control system (ABS/ATC), electronic control units (ECU) and modulator valves; test, repair, and replace wiring and connectors.
24. Verify proper operation of auxiliary (transmission retarder, driveline, exhaust, and engine) braking systems.

B. Mechanical/Foundation Brakes Diagnosis and Repair (14 questions)

1. Diagnose poor stopping, brake noise, overheating, premature wear, pulling, grabbing, or dragging complaints caused by foundation brake, slack adjuster, and brake chamber problems; determine needed repairs.
2. Perform deceleration tests on service and parking brake systems.
3. Inspect, test, adjust, repair, or replace service brake chambers, diaphragm, clamp, spring, pushrod, clevis, and mounting brackets.
4. Inspect, test, adjust, repair, or replace manual and automatic slack adjusters.
5. Inspect or replace S-cams, rollers, shafts, bushings, seals, spacers, and retainers.
6. Inspect, or replace brake spider, shields, anchor pins, bushings, and springs.
7. Inspect, clean, adjust, rebuild or replace air disc brake caliper assemblies.
8. Inspect brake shoes, linings, or pads; determine needed repairs.
9. Inspect brake drums or rotors; determine needed repairs.
10. Resurface brake drums and linings; resurface rotors.

C. Parking Brakes Diagnosis and Repair (7 questions)

1. Inspect or replace parking (spring) brake chamber; dispose of removed brake chambers in accordance with local regulations.
2. Inspect, test, or replace parking (spring) brake valves, lines, hoses, and fittings.
3. Manually release and cage parking (spring) brakes.

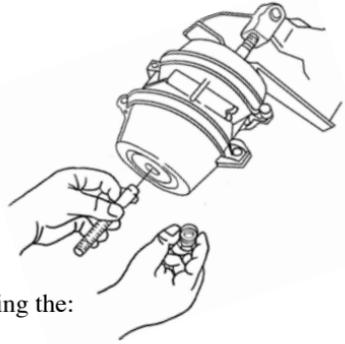
D. Wheel Bearings Diagnosis and Repair (5 questions)

1. Remove and replace axle hub and wheel assembly.
2. Clean, inspect, lubricate, or replace wheel bearing assemblies; replace seals and wear rings.
3. Adjust axle wheel bearings in accordance with manufacturer's procedures.
4. Inspect or replace extended service (sealed, close-tolerance, and unitized) bearing assemblies; perform initial installation in accordance with manufacturer's procedures.
5. Replace seals and O-rings on planetary axle assemblies; adjust axle endplay. ■

SAMPLE QUESTIONS BRAKES (TEST H4)

Questions:

1. A transit bus, with a ruptured air supply tank, is being towed from the front. The technician should:
(A) prevent the steering wheel from turning.
* (B) cage the rear air brake chambers.
(C) drain the air from the secondary tank.
(D) cage the front air brake chambers.
2. The setup at right shows the first step in:
(A) measuring chamber pushrod travel.
(B) adjusting spring brake tension.
* (C) manually releasing the spring brake.
(D) adjusting the brakes for lining wear.
3. Brake shoe-to-drum clearance, on a transit bus with cam brakes, is maintained by adjusting the:
* (A) slack adjuster.
(B) shoe anchor pins.
(C) pushrod.
(D) cam roller eccentrics.
4. The parking brakes fail to apply on a transit bus with air brakes. Technician A says that low air pressure in the spring brake chamber could be the cause. Technician B says that a ruptured spring brake diaphragm could be the cause. Who is right?
(A) A only
(B) B only
(C) Both A and B
* (D) Neither A nor B
5. The air line from the air drier to the air supply (wet) tank is being replaced. Technician A says that there should be no low spots in the line after installation. Technician B says that a smaller diameter line may be used for the replacement.
* (A) A only
(B) B only
(C) Both A and B
(D) Neither A or B



H4 SAMPLE QUESTIONS (CONTINUED)

6. A transit bus's parking brake valve button pops out immediately after being depressed.
Technician A says that this could be caused by low system air pressure.
Technician B says that this could be caused by air in the emergency chamber.
Who is right?
- * (A) A only (C) Both A and B
(B) B only (D) Neither A nor B
7. A transit bus has an uneven braking problem. Which of these could be the cause?
- (A) A binding treadle (foot) valve
(B) Low brake line air pressure
* (C) A bad brake drum
(D) A bad governor

Question 8 is not like the ones above.

This Question has the word **EXCEPT**. Look for the choice that could **NOT** cause the described situation. Read the entire question carefully before choosing your answer.

8. An air compressor is not unloading, causing the air tank safety valve to pop off. This could be caused by any of these EXCEPT:
- * (A) an obstructed intake.
(B) a restricted governor reservoir line.
(C) a bad governor.
(D) a bad unloader.

TEST SPECIFICATIONS AND TASK LIST SUSPENSION AND STEERING (TEST H5)

Content Area	Questions in Test	Percentage of Test
A.. Steering System Diagnosis and Repair	12	27%
B.. Suspension Systems Diagnosis and Repair	23	51%
1. Independent Front Suspensions (4)		
2. Straight/I Beam Axle Front Suspensions (6)		
3. Rear Suspensions (6)		
4. Air Suspension System and Controls (7)		
C. Wheel Alignment Diagnosis, Adjustment and Repair	6	13%
D. Wheels and Tires Diagnosis and Repairs	4	9%
Total	45	100%

A. Steering System Diagnosis and Repair (12 questions)

1. Diagnose steering column (tilt, telescoping, or fixed) shaft noise, looseness, and binding problems; determine needed repairs.
2. Inspect and replace steering shaft U-joint(s), slip joint(s), bearings, bushings, and seals; phase steering shaft U-joints.
3. Diagnose power steering system noises, steering binding, uneven turning effort, looseness, hard steering, overheating, fluid leakage, and fluid aeration problems; determine needed repairs.
4. Inspect power steering fluid level and condition; determine fluid type and needed service.
5. Purge air from the power steering system.
6. Perform power steering system pressure and flow tests; determine needed repairs.
7. Inspect, service, or replace power steering reservoir including filter, seals, and gaskets.
8. Inspect, adjust, align, or replace power steering pump belt(s), pulley(s), and tensioner(s).
9. Inspect power steering pump drive gear and coupling; replace as required.
10. Inspect, adjust, or repair, power steering pump, mountings, and brackets; replace as required.
11. Inspect power steering system cooler, lines, hoses, and fittings; replace as required.
12. Inspect power steering gear; replace as required.
13. Inspect and replace pitman arm; center the steering linkage.
14. Inspect, adjust/service, or replace drag link/center link, idler arm/stabilizer link, tie rods and tie rod ends; position adjusting sleeves, clamps, and retainers.

H5 TASK LIST (CONTINUED)

15. Inspect steering and Ackerman/steering arms; replace as required.
16. Check and adjust steering gear poppet/relief valves, and wheel /steering stops.
17. Diagnose problems in the articulation system electronic controls, and mechanical and hydraulic components; determine needed repairs.

B. Suspension Systems Diagnosis and Repair (23 questions)

1. Independent Front Suspensions (4 questions)

1. Diagnose front suspension system noises, looseness, body sway, and ride quality; determine needed repairs.
2. Inspect upper and lower control arms, strut rods/radius arms, bushings, shafts, and rebound/jounce bumpers on short and long arm (SLA) suspension systems; replace as required.
3. Inspect kingpins and bushings/bearings; replace as required.
4. Inspect steering knuckle/spindle assemblies; replace as required.
5. Measure and adjust ride height.
6. Inspect front suspension system air bags; replace as required.
7. Inspect stabilizer bar (sway bar) bushings, brackets, and links; replace as required.
8. Inspect shock absorbers, bushings, brackets, and mounts; replace as required.

2. Straight/I-Beam Axle Front Suspensions (6 questions)

1. Diagnose front suspension system noises, looseness, body sway, and ride quality; determine needed repairs.
2. Inspect front axle, U-bolts, and fasteners; service or replace as required.
3. Inspect kingpins, steering knuckle, bushings, locks, bearings, shims, seals, and covers; service or replace as required.
4. Inspect shock absorbers, bushings, brackets, and mounts; replace as required.
5. Measure vehicle ride height; determine needed adjustments or repairs.
6. Inspect, repair, and/or replace radius rods, lateral/torque rods, stabilizer bar (sway bar), bushings, brackets, and mounts, and air/walking beams; adjust as necessary.

3. Rear Suspensions (6 questions)

1. Diagnose suspension system noises, looseness, ride quality, and body sway problems; determine needed repairs.
2. Inspect rear axle housing, U-bolts, and fasteners; service or replace as required.
3. Inspect shock absorbers, bushings, brackets, and mounts; replace as required.
4. Measure vehicle ride height; determine needed adjustments or repairs.
5. Inspect and adjust rear axle aligning devices such as radius rods, lateral rods, torque rods, stabilizer bars, and related bushings, mounts, shims, and links; replace as required.

4. Air Suspension System and Controls (7 questions)

1. Inspect, test, or repair, air bags/air springs, mounting plates, suspension arms, and bushings; replace as required.
2. Inspect, test, adjust, or repair air suspension pressure regulator, pressure protection valve(s), height control valve(s), lines, hoses, and fittings; replace as required.
3. Inspect operation of kneeling system; perform necessary repairs.

C. Wheel Alignment Diagnosis, Adjustment, and Repair (6 questions)

1. Diagnose vehicle wandering, pulling, shimmy, and steering effort problems; determine needed adjustments or repairs.
2. Check camber; determine needed repairs.
3. Check and adjust caster; determine needed repairs.
4. Check SAI/KPI (steering axis inclination/kingpin inclination) and included angle; determine needed repairs.
5. Check and adjust toe.
6. Diagnose toe-out-on-turns (Ackerman angle) problems; determine needed repairs.
7. Check rear axle alignment (thrust line/centerline) and tracking; adjust or determine needed repairs.
8. Check and adjust axle wheel bearings.

D. Wheels and Tires Diagnosis and Repair (4 questions)

1. Diagnose tire wear patterns; determine needed repairs.
2. Inspect tires for damage; check and adjust air pressure.
3. Diagnose wheel/tire vibration and shimmy problems; determine needed repairs.
4. Inspect and replace wheels (rims), wheel spacers, studs, and nuts.
5. Measure wheel and tire runout (radial and lateral); determine needed repairs.
6. Balance wheel and tire assembly.
7. Measure tire diameter and/or circumference; match tires and rims. ■

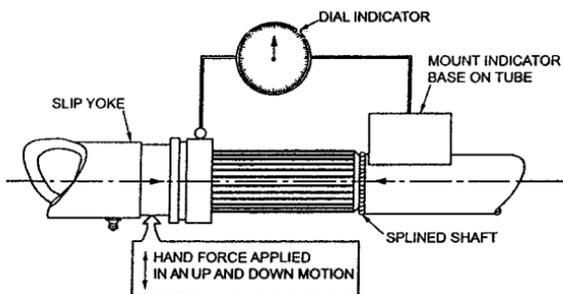
SAMPLE QUESTIONS

SUSPENSION AND STEERING (TEST H5)

Questions:

1. Technician A says that when replacing a bad front wheel bearing, both bearings and races should be replaced along with the seals.
Technician B says that when replacing a bad front wheel bearing, a front alignment should be performed.
Who is right?
* (A) A only (C) Both A and B
(B) B only (D) Neither A nor B
2. A transit bus has hard steering during sharp turns. Which of these could be the cause?
(A) Incorrect toe
(B) Too much negative caster
* (C) Misadjusted poppet/relief valves
(D) Excessive power steering system pressure
3. A transit bus is leaning to the left in the rear. This could be caused by:
(A) low pressure from the supply reservoir.
(B) low pressure at the rear accessory/suspension reservoir.
(C) a faulty pressure protection valve.
* (D) a faulty height control/leveling valve.
4. A transit bus operator reports that tight spots in the steering occur while turning the steering wheel.
Technician A says that a bad U-Joint could be the cause.
Technician B says that a worn tie rod end could be the cause.
Who is right
* (A) A only
(B) B only
(C) Both A and B
(D) Neither A nor B
5. The operator says that the transit bus lift pan contacts the road surface when going over speed bumps. Which of these could be the cause?
(A) The system air pressure is too high.
(B) The front of the bus is over-loaded.
* (C) The ride height needs to be adjusted.
(D) The shock absorbers are too short.

6. The operator could not keep the transit bus from wandering while driving at highway speeds. Technician A says that a $1/8''$ toe-in setting could be the cause. Technician B says that a worn tie-rod end could be the cause. Who is right?
- (A) A only
 * (B) B only
 (C) Both A and B
 (D) Neither A nor B



7. Which of these is being measured in the setup shown above?
- * (A) Steering shaft spline wear
 (B) Steering shaft out-of-roundness
 (C) Steering shaft diameter
 (D) Steering shaft endplay

Question 8 is not like the ones above.

This Question has the word **EXCEPT**. Look for the choice that could **NOT** cause the described situation. Read the entire question carefully before choosing your answer.

8. A transit bus has 120psi air pressure shown at the dash panel gauge, but none of the air bag/springs will inflate. All of these could be the cause EXCEPT a:
- (A) leaking pressure protection valve.
 (B) stuck double-check valve.
 (C) leaking ACC/tank drain valve.
 * (D) stuck left rear height control/leveling valve.

TEST SPECIFICATIONS AND TASK LIST

ELECTRICAL/ELECTRONIC SYSTEMS (TEST H6)

Content Area	Questions in Test	Percentage of Test
A. General Electrical Diagnosis	16	32%
B. Battery Diagnosis and Repair	5	10%
C. Starting System Diagnosis and Repair	7	14%
D. Charging System Diagnosis and Repair	7	14%
E. Lighting Systems Diagnosis and Repair	7	14%
1. Headlights, Daytime Running Lights, Parking, Clearance, Tail, Interior, and Dash Lights (4)		
2. Stoplights, Turn Signals, Hazard Light, and Backup Lights (3)		
F. Gauges and Warning Devices Diagnosis and Repair	4	8%
G. Related Systems	4	8%
Total	50	100%

A. General Electrical Diagnosis (16 questions)

1. Verify operator complaint, reproduce the condition (including intermittent problems), and/or road test vehicle; determine necessary action.
2. Check continuity in electrical/electronic circuits using appropriate test equipment.
3. Check applied voltages, circuit voltages, and voltage drops in electrical/ electronic circuits using a digital multimeter (DMM).
4. Check current flow in electrical/electronic circuits and components using an ammeter, digital multimeter (DMM), or a clamp-on ammeter.
5. Check electronic circuit waveforms using an oscilloscope or graphing multimeter (GMM); interpret readings and determine needed repairs.
6. Check resistance in electrical/electronic circuits and components using an ohmmeter or a digital multimeter (DMM).
7. Locate shorts, grounds, and opens in electrical/electronic circuits.
8. Diagnose battery drain problems with the master/key switch off.
9. Inspect and test circuit breakers, solid state current limiters, and fuses; replace as required.
10. Inspect and test spike suppression diodes/resistors and capacitors; replace as required.
11. Inspect and test relays and solenoids; replace as required.
12. Read and interpret electrical schematic diagrams and symbols.
13. Read and interpret ladder logic diagrams to diagnose electrical/electronic problems.

14. Diagnose and repair computer communication multiplex systems; determine needed repairs.
15. Using a laptop computer, establish communication with a multiplex control system. Verify that the needed ladder logic inputs are active to control an individual/specific ladder logic output.
16. Remove, replace, and adjust electrical/electronic switches, sensors, and other electrical/electronic components.
17. Use proper care and handling of electrical/electronic components.

B. Battery Diagnosis and Repair (5 questions)

1. Perform battery load and/or capacitance tests; determine needed repairs.
2. Determine battery state of charge by measuring open circuit voltage (OCV) using a digital multimeter (DMM) or perform a specific gravity test using a hydrometer.
3. Inspect, clean, and service battery, cables, terminal connections, and disconnects; replace as required.
4. Inspect, clean, and repair battery boxes, mounts, and hold downs; replace as required.
5. Charge battery/batteries, using slow or fast charge method as appropriate.
6. Jump-start a transit bus using jumper cables and a booster battery or auxiliary power supply.

C. Starting System Diagnosis and Repair (7 questions)

1. Perform starter circuit voltage drop tests; determine needed repairs.
2. Inspect and test components of the starter control circuit (master/key switch, push button and/or magnetic switch, and wires); replace as required.
3. Inspect and test starter, relays, and solenoids/switches; replace as required.
4. Remove and replace starter; inspect flywheel ring gear or flex plate.
5. Inspect, clean, repair or replace cranking circuit battery cables and connectors.
6. Differentiate between electrical, multiplex, or mechanical problems that cause a slow cranking, no cranking, extended cranking, or a cranking noise condition.

D. Charging System Diagnosis and Repair (7 questions)

1. Diagnose the cause of a no-charge, low-charge, or overcharge condition; determine needed repairs.
2. Inspect and adjust alternator drive belts/gears, pulleys, fans, mounting brackets, and tensioners; replace as required.
3. Perform charging system output tests (12 volt and 24 volt); determine needed repairs.
4. Perform charging circuit voltage drop tests; determine needed repairs.
5. Test, adjust, or replace voltage regulator.
6. Maintain, remove, and replace alternator.
7. Inspect, repair, or replace charging circuit connectors and wires.
8. Check battery equalizer output, check wiring and mounting; determine needed repairs.
9. Verify operation of charging system circuit monitor; determine needed repairs.

H6 TASK LIST (CONTINUED)

E. Lighting Systems Diagnosis and Repair (7 questions)

1. Headlights, Daytime Running Lights, Parking, Clearance, Tail, Interior, and Dash Lights (4 questions)

1. Diagnose the cause of brighter than normal, intermittent, dim, or no headlight and daytime running light (DRL) operation.
2. Test, aim, and replace headlights.
3. Test headlight and dimmer switches, wires, connectors, terminals, sockets, relays, and control components; repair or replace as required.
4. Inspect, test, and repair parking, clearance, and taillight circuit switches, bulbs, sockets, connectors, terminals, relays, wires, and light-emitting diodes (LEDs); replace as required.
5. Inspect, test, and repair dash light circuit switches, bulbs, sockets, connectors, terminals, wires, and printed circuits; replace as required.
6. Inspect, test, and repair interior and exterior light circuit switches, bulbs, sockets, connectors, terminals, ballasts/inverters, and wires; replace as required.

2. Stoplights, Turn Signals, Hazard Lights, and Backup Lights (3 questions)

1. Inspect and test stoplight circuit switches, bulbs, sockets, connectors, terminals, relays, control components, and wires; repair or replace as required.
2. Diagnose the cause of turn signal and hazard flasher light system malfunctions; determine needed repairs.
3. Inspect and test turn signal and hazard circuit flashers or other control components, switches, bulbs, sockets, connectors, terminals, relays, wires, and light-emitting diodes (LEDs); repair or replace as required.
4. Inspect, test, and adjust backup light and warning devices, circuit switches, bulbs, sockets, connectors, terminals, and wires; repair or replace as required.

F. Gauges and Warning Devices Diagnosis and Repair (4 questions)

1. Diagnose the cause of intermittent, high, low, or no gauge readings; determine needed repairs.
2. Diagnose the cause of control area network (CAN) driven gauge malfunctions; determine needed repairs.
3. Inspect, test, and adjust gauge circuit sending units, sensors, gauges, connectors, terminals, and wires; repair or replace as required.
4. Inspect and test warning device (lights and audible) circuit sending units, sensors, bulbs, audible components, sockets, connectors, terminals, wires, and printed circuits/control modules; repair or replace as required.
5. Inspect and test electronic speedometer and odometer systems; replace as required; verify proper calibration for vehicle application.

G. Related Systems (4 questions)

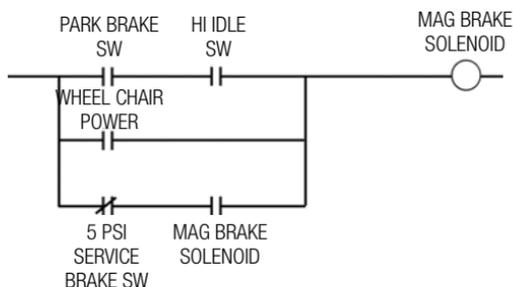
1. Inspect and test horns, horn circuit relays, switches, connectors, terminals, and wires; repair or replace as required.
2. Diagnose the cause of constant, intermittent, or no wiper operation; diagnose the cause of wiper speed control and/or park problems.
3. Inspect and test wiper motor, resistors, park switch, relays, switches, connectors, terminals, and wires; repair or replace as required.
4. Inspect and test windshield washer motor or pump/relay assembly, switches, connectors, terminals, and wires; repair or replace as required.
5. Inspect and test side view mirror motors, heater circuit grids, relays, switches, connectors, terminals, and wires; repair or replace as required.
6. Inspect and test HVAC electrical components including: A/C clutches, motors, resistors, relays, switches, controls, connectors, terminals, and wires; repair or replace as required.
7. Inspect and test engine cooling fan electrical control components; replace as required. ■

SAMPLE QUESTIONS

ELECTRICAL/ELECTRONIC SYSTEMS (TEST H6)

Questions:

1. The headlights on a transit bus work OK on low beam, but they are very dim on high beam. Which of these could be the cause?
(A) A bad headlight ground
(B) A bad ground at the master switch
(C) An overloaded circuit breaker
* (D) Corroded dimmer switch contacts
2. The operator notices battery odor while the transit bus is being driven. Which of these could be the cause?
* (A) The alternator is overcharging.
(B) The electrolyte level is low.
(C) The battery connections are loose.
(D) The alternator drive belt is slipping.
3. Technician A says that a battery equalizer ensures that both batteries charge at the same rate.
Technician B says that a battery equalizer converts 24 volts to 12 volts in a 24-volt/two-battery system.
Who is right?
(A) A only
(C) Both A and B
* (B) B only
(D) Neither A nor B
4. A transit bus's windshield wipers work sporadically.
Technician A says that an open (broken) wire could be the cause.
Technician B says that a loose wiring connection could be the cause.
Who is right?
(A) A only
(C) Both A and B
* (B) B only
(D) Neither A nor B
5. An engine will not crank when the start button is pressed, but cranks normally when the starter relay is activated. Which of these is the most likely cause?
(A) a bad starter solenoid.
* (B) an open between the start button and the relay.
(C) a bad engine ground.
(D) an open between the battery and the relay.



6. According to the ladder logic in the schematic shown above, the MAG brake solenoid will release only when the:
- (A) wheelchair power is on.
 - (B) “hi idle” is on.
 - (C) park brake is applied.
 - * (D) service brake is applied.

Questions 7 and 8 are not like the ones above.

Each of these has the word **EXCEPT**. For each question, look for the choice that could **NOT** cause the described situation. Read the entire question carefully before choosing your answer.

7. When arc welding on a transit bus, a technician should disconnect all of these EXCEPT the:
- (A) batteries.
 - (B) engine control module.
 - (C) transmission control module.
 - * (D) starter.
8. All of these could cause high starter current draw EXCEPT:
- (A) worn starter bushings.
 - * (B) a bad starter relay.
 - (C) grounded field coils.
 - (D) a grounded armature.

TEST SPECIFICATIONS AND TASK LIST

HEATING, VENTILATION, AND AIR CONDITIONING

(TEST H7)

Content Area	Questions in Test	Percentage of Test
A. Heating, Ventilation, and Air Conditioning Systems Diagnosis, Service, and Repair	7	14%
B. A/C System and Component Diagnosis, Service and Repair	22	44%
1. A/C System—General (10)		
2. Compressor and Clutch (6)		
3. Evaporator, Condenser, and Related Components (6)		
C. Heating and Engine Cooling Systems Diagnosis, Service and Repair	7	14%
D. Heating, Ventilation, and Air Conditioning Operating Systems and Related Controls Diagnosis and Repair	10	20%
1. Electrical Systems (6)		
2. Constant/Automatic Temperature Control (4)		
E. Refrigerant Recovery, Recycling, Handling, and Retrofit	4	8%
Total	50	100%

A. Heating, Ventilation, and Air Conditioning Systems Diagnosis, Service, and Repair (7 Questions)

1. Verify the need for service or repair of HVAC systems based on operating noises; determine appropriate action.
2. Verify the need of service or repair of HVAC systems based on sight, odor, and tou conditions; determine appropriate action.
3. Identify HVAC system components and refrigerant type (R-22, R-134a, R-407c); conduct performance tests; determine appropriate action.
4. Use a data reader/computer to determine fault codes and perform system tests; check and adjust system parameters; clear fault codes.

B. A/C System and Component Diagnosis, Service, and Repair (22 questions)**1. A/C System—General (10 questions)**

1. Diagnose the cause of A/C system temperature control problems; determine needed repairs.
2. Identify A/C refrigerant type; check for contamination; determine appropriate action.
3. Diagnose the cause of A/C system problems indicated by pressure gauge readings and sight glass/moisture indicator conditions (where applicable); determine needed service or repairs.
4. Diagnose the cause of A/C system problems indicated by sight, audible, odor, and touch conditions; determine needed repairs.
5. Perform A/C system leak test; determine needed repairs.
6. Evacuate A/C system using appropriate equipment.
7. Remove contaminants from the A/C system.
8. Charge A/C system with refrigerant.
9. Identify A/C system lubricant type needed for system application.

2. Compressor and Clutch (6 questions)

1. Diagnose A/C system problems that cause protection devices (pressure, thermal, and electronic) to interrupt system operation; determine needed repairs.
2. Inspect and test A/C system pressure, thermal, and electronic protection devices and connections; replace as required.
3. Inspect and adjust A/C compressor drives, belts, pulleys, and tensioners; replace as required.
4. Inspect, test, and service A/C compressor clutch components and clutch assembly; replace as required.
5. Check and correct A/C compressor lubricant level and condition.
6. Inspect, test, and replace A/C compressor.
7. Inspect and repair A/C compressor mountings and hardware; replace as required.
8. Check operation of A/C compressor unloaders; adjust as required.

3. Evaporator, Condenser, and Related Components (6 questions)

1. Adjust A/C system lubricant level after replacement of system components.
2. Inspect and repair A/C system hoses, lines, filters, fittings, and seals; replace as required.
3. Check air flow through A/C condensers and evaporators; correct as required.
4. Inspect and test A/C system condenser and mountings; replace as required.
5. Inspect receiver and filter-drier; replace as required.
6. Inspect and test refrigerant solenoid, expansion valve(s), and evaporator pressure regulators; check placement of thermal bulb (capillary tube); replace as required.
7. Inspect and test evaporator core; replace as required.
8. Inspect, clean, and repair evaporator housing and water drain; inspect and service or replace evaporator air filter.
9. Identify and inspect A/C system service valves and connections; repair as required.
10. Diagnose cause of A/C system failures which result in refrigerant loss from the high pressure relief device.

H7 TASK LIST (CONTINUED)

C. Heating and Engine Cooling Systems Diagnosis, Service, and Repair (7 questions)

1. Diagnose the cause of outlet air temperature control problems in the HVAC system; determine needed repairs.
2. Diagnose window fogging problems; determine needed repairs.
3. Perform engine cooling system tests for leaks, protection level, contamination, coolant level, temperature, and conditioner concentration; determine needed repairs.
4. Inspect engine cooling and heating system hoses, lines, and clamps; replace as required.
5. Inspect and test radiator, pressure relief devices, and coolant recovery system (surge tank); determine needed repairs.
6. Inspect water pump and drive system; determine needed repairs.
7. Inspect and test thermostats, by-passes, housings, and seals; determine needed repairs.
8. Flush and refill cooling system; bleed air from system.
9. Inspect and test fan, fan drives, controls, and fan shroud; repair or replace as required.
10. Inspect and test heating system coolant control valve(s) and manual shut-off valves; replace as required.
11. Inspect and flush driver's heater and/or defroster cores; replace as required.
12. Perform heating system tests to include coolant flow and booster pump(s) operation.
13. Inspect, test, and diagnose heater/defroster and defogger system problems; check blowers, fans, resistors, switches, relay/modules, sensors, wiring, and protection devices; repair or replace as required.
14. Inspect, test and diagnose service heating, ventilating, and defrosting control panel assemblies, cables, and linkages; repair or replace as required.
15. Inspect, test, and diagnose heating, ventilating, and defrosting control switches, hoses, and solenoid valves; repair or replace as required.
16. Inspect, test, and adjust heating, ventilating, and defrosting ducts, filters, doors, cables, linkages, hoses, and outlets; repair or replace as required.
17. Test, diagnose, and service fuel-fired auxiliary heater system.

D. Heating, Ventilation, and Air Conditioning Operating Systems and Related Controls Diagnosis and Repair (10 questions)

1. Electrical Systems (6 questions)

1. Diagnose the cause of failures in HVAC electrical control systems; determine needed repairs.
2. Inspect and test HVAC defroster blower motors, resistors, switches, relays, modules, wiring, and protection devices; repair or replace as required.
3. Inspect and test HVAC compressor clutch relays, modules, wiring, sensors, switches, diodes, and protection devices; repair or replace as required.
4. Inspect and test HVAC-related electronic engine control systems; determine needed repairs.
5. Inspect and test HVAC evaporator/heater and condenser fan motors, motor drivers (alternating current and direct current), relays, modules, switches, sensors, wiring, and protection devices; repair or replace as required.
6. Inspect and test HVAC system electrical control panel assemblies; repair or replace as required.

2. Constant/Automatic Temperature Control Systems (4 questions)

1. Diagnose constant/automatic temperature control system problems; determine needed repairs.
2. Inspect and test climate control temperature sensors; repair or replace as required.
3. Inspect, test, and adjust heater coolant valve and controls; repair or replace as required.
4. Inspect and test solenoids and switches; repair or replace as required.
5. Inspect and test constant/automatic temperature control panels; repair or replace as required.
6. Inspect and test constant/automatic temperature control microprocessor (climate control computer/programmer); repair or replace as required.
7. Connect data reader/computer to determine fault codes and perform system tests; check and adjust system parameters; clear fault codes.

E. Refrigerant Recovery, Recycling, and Handling (4 questions)

NOTE: Tasks 1 through 5 should be accomplished in accordance with published EPA and appropriate SAE “J” standards for R-22, R-134a, R-407c, and EPA approved refrigerant blends. Service must be performed by EPA certified technicians.

1. Maintain and verify correct operation of certified equipment.
2. Identify and recover A/C system refrigerant.
3. Recycle refrigerant.
4. Handle, label, and store refrigerant.
5. Test recycled refrigerant for non-condensable gases.
6. Follow federal and local laws for service procedures. ■

SAMPLE QUESTIONS

HVAC (TEST H7)

Questions:

1. High discharge pressure can be caused by:
(A) restricted evaporator coils.
* (B) an overcharged system.
(C) a defective remote bulb.
(D) compressor oil over fill.
2. A technician cannot get a transit bus A/C system to take a refrigerant charge. Which of these could be the cause?
(A) Wrong compressor clutch clearance
* (B) Suction service valve not mid-seated
(C) Compressor speed too low
(D) Excessive dirt in the system
3. Removing refrigerant from a system and storing it in a separate container is considered to be:
* (A) recovering.
(B) evacuating.
(C) reclaiming.
(D) recycling.
4. An operator says that the HVAC system is not cooling properly. Air is blowing from the vents on one side of the transit bus only. This could be caused by:
(A) an undercharged system.
* (B) one evaporator fan drive coupling is broken.
(C) the evaporator fan is turning too slowly.
(D) the compressor clutch is not engaged.
5. Repeated A/C system high pressure hose failures are most likely caused by:
(A) extended operation of A/C with a loose drive belt.
* (B) incorrect hose installation.
(C) an open inside ambient air sensor.
(D) extended operation of A/C in high humidity.
6. Both the suction-side and discharge-side pressures are above normal. This could be caused by:
(A) a stuck-closed coolant modulating valve.
(B) the compressor clutch not disengaging.
* (C) a dirty condenser core.
(D) a too slow evaporator fan speed.

7. Before being recharged, an A/C system should be evacuated to:
- (A) 29" Hg. for 2 hours.
 - (B) 30" Hg. for 30 minutes.
 - * (C) 500 to 1500 microns for 10 minutes.
 - (D) 2500 to 3000 microns for 30 minutes.
8. Reusable refrigerant cylinders must be hydrostatically tested every:
- (A) year.
 - (B) 3 years.
 - * (C) 5 years.
 - (D) 10 years.
9. An operator complains of a coolant smell while running the defroster. Which of these could be the cause?
- (A) A closed shutoff valve
 - (B) A bad defroster switch
 - * (C) A leak in the defroster core
 - (D) A leak in the evaporator core

Question 10 is not like the ones above.

It has the word **EXCEPT**. For this question, look for the choice that could **NOT** cause the described situation. Read the entire question carefully before choosing your answer.

10. A transit bus has thrown its A/C compressor drive belts for the second time. Any of these could be the cause EXCEPT:
- (A) the compressor's isolator mounts are worn out.
 - (B) the compressor and engine crankshaft pulleys are out of alignment.
 - (C) a weak automatic belt tensioner.
 - * (D) excessive air gap at the A/C clutch armature.

TEST SPECIFICATIONS AND TASK LIST

PREVENTATIVE MAINTENANCE AND INSPECTION (PMI)

(TEST H8)

Content Area	Questions in Test	Percentage of Test
A. Engine Systems	17	34%
B. Body Interior and Exterior	5	10%
C. Electrical/Electronic Systems	9	18%
D. Frame and Chassis	19	38%
Total	50	100%

A. Engine Systems (17 questions)

Engine

1. Check engine operation for unusual noises, vibration, and excessive exhaust smoke.
2. Inspect crankcase ventilation system.
3. Inspect belts, tensioners, belt guards, pulleys and alignment; check and adjust belt tension; inspect vibration damper.
4. Check engine compartment for oil, coolant, air, hydraulic fluid, and fuel leaks; check oil line routing and mounting, (Engine Off and Engine Running).
5. Inspect engine mounts for looseness and deterioration.
6. Check engine oil pressure, oil level and condition; check dipstick seal.
7. Check engine compartment wiring, harnesses, connectors, and seals for damage and proper routing; check engine compartment controls, gauges, and lighting.

Fuel System

8. Check fuel tanks and mountings, filler neck check valve mountings, lines, vents, and caps.
9. Drain water from fuel system.
10. Inspect water separator/fuel heater; replace fuel filter(s); prime and bleed fuel system.

Air Induction and Exhaust Systems

11. Inspect diesel emission control systems and components, including exhaust gas recirculation (EGR), catalytic converter, and diesel particulate filter (DPF).
12. Check engine exhaust system mountings for looseness and damage.
13. Check engine exhaust system for leaks, excessive noise, proper routing, and missing or damaged components (heat shields and guards); perform restriction/backpressure tests.
14. Check air induction system routing, piping, charge air cooler, hoses, clamps, mountings, and indicators; check for air restrictions and leaks; check operation of cold start aids.
15. Inspect turbocharger for noise and leaks; check mountings and connections; check wastegate and controls, variable geometry turbo, linkages, and hoses.
16. Service or replace air filter(s) as required.

Cooling System

17. Check operation of fan system; check for hydraulic leaks; inspect fan assembly, fan shroud, and mountings.
18. Inspect radiator and hydraulic oil cooler for air flow restrictions, leaks, and damage; check mountings.
19. Pressure test cooling system and radiator cap.
20. Inspect all coolant and hydraulic hoses for leaks, damage, and proper routing, check clamp condition and correct installation.
21. Check surge tank; check sight glass for leaks, cracks, and discoloration.
22. Identify coolant type; check coolant for contamination, supplemental additive (SCA) levels, check PH level, and freeze point protection level, service coolant filter/conditioner; check condition of shut-off valves.
23. Drain and refill cooling system; bleed air from system; recover coolant.
24. Inspect water pump for leaks and bearing play.

Lubrication System

25. Change engine oil; visually check oil for coolant or fuel contamination; inspect and clean magnetic drain plugs; torque engine oil pan drain plug to specifications.
26. Change oil filters; service centrifugal oil filter if applicable.
27. Take an engine oil sample.

B. Body Interior and Exterior (5 questions)**Instruments and Controls**

1. Inspect master control switch and start button; check operation of transmission shift selector.
2. Check operation of indicator lights, warning lights and/or alarms.
3. Check operation of instruments, gauges, and panel lighting.
4. Check operation of fast engine idle and throttle and brake interlock systems.
5. Check operation of driver's area defroster, heater, ventilation, and A/C (HVAC) controls.
6. Check operation of driver controlled auxiliary systems, i.e. doors, wheelchair lift, kneeling system, and PA system.
7. Check operation and condition of accelerator and brake pedals.

Safety Equipment

8. Check operation of horns.
9. Check condition of safety equipment including flares, reflective triangles, fire extinguisher, fire suppression system, and all required decals.
10. Inspect seat belts and wheelchair restraints.
11. Inspect wiper blades and arms.
12. Check windshield wiper and washer operation.
13. Check for required vehicle permits, registration, decals, and inspection papers.
14. Check operation of emergency exits (roof hatches, windows, door releases, and switches).
15. Check operation of entrance and exit doors, sensitive edges and touch bars: check door opening and closing speeds; check operation of brake interlocks.

H8 TASK LIST (CONTINUED)

Hardware

16. Inspect windshield glass for cracks, chips or discoloration; check sun shade/visor operation.
17. Check driver's seat condition, operation, mounting, and suspension components.
18. Check passenger seat condition, operation, and mountings.
19. Check door glass and passenger window operation, condition, and safety stops.
20. Inspect steps, flooring, stanchions, grab rails, and overhead panels.
21. Inspect mirrors, mountings, brackets, glass heaters, and motors.
22. Inspect and record interior and exterior damage.
23. Inspect and lubricate door and compartment hinges, latches, strikers, gas struts, linkages, and cables.
24. Inspect bicycle rack operation, condition, and mounting.
25. Check fare box physical condition and mounting.

Heating, Ventilation, and Air Conditioning (HVAC)

26. Inspect A/C condenser and evaporator and lines for routing, condition, and visible leaks.
27. Inspect A/C compressor and lines for routing, condition, and visible leaks; check compressor mountings; check drive belt condition, tension, and alignment.
28. Check operation of condenser and evaporator motors.
29. Check HVAC system operation.
30. Check HVAC air inlet filters and ducts; service as required.
31. Check booster pump and coolant control valves.
32. Check operation of auxiliary coolant heater system; check for leaks and damage.

C. Electrical/Electronic Systems (9 questions)

Battery and Starting Systems

1. Inspect and lubricate battery compartment and doors, trays, slides, covers, latches, and mountings.
2. Inspect battery disconnect switch, hold downs, connections, cables, and cable routing; service as required.
3. Check battery condition and record battery state of charge (open circuit voltage); check electrolyte level (if applicable).
4. Perform battery load tests.
5. Inspect starter, mounting, connections, cables, and cable routing; inspect hoses, and hose routing for air starters.
6. Engage starter; check for unusual noises, starter drag, and starting difficulty.

Charging System

7. Inspect alternator, mountings, wiring and routing.
8. Perform charging system output test (12V and 24V); determine needed repairs.
9. Check equalizer function, wiring, and mountings.

Lighting and Alarm Systems

10. Check operation and condition of interior lights.
11. Check operation and condition of exterior lights, lenses, and reflectors; check headlight alignment.

12. Inspect and check operation of exterior warning systems (backup, wheelchair, kneeling).
13. Check operation of passenger stop request light and chime.
14. Inspect and check operation of destination signs and block/route signs.
15. Use a diagnostic tool or the on-board diagnostic system to extract engine, transmission, brake monitoring, and other vehicle diagnostic systems information and codes.

D. Frame and Chassis (19 questions)**Air Brakes**

1. Check parking brake operation.
2. Check and record air governor cut-in and cutout settings (psi); check air pressure build-up time.
3. Check operation of air drier purge valve and heater; service air drier as required; check system for contamination.
4. Check air system for leaks (brakes released and applied).
5. Test single-check and double-check valves.
6. Check low air pressure warning devices and air-actuated pressure switches (brake light, retarder, etc).
7. Test emergency spring brake control valve (SR-1).
8. Measure brake interlock application pressure.
9. Perform antilock brake system (ABS) operational self-test; perform automatic traction control (ATC) operational self-test.
10. Inspect air lines, couplings, fittings, and air tanks, and mountings.
11. Check brake chambers and air lines for secure mountings, damage, and missing caging plugs.
12. Inspect and record brake lining/pad condition and thickness on all axles.
13. Inspect condition of brake drums/rotors on all axles.
14. Check operation of automatic slack adjusters on all axles; measure and record pushrod travel at each wheel end.
15. Check condition of foundation brake components and hardware on all axles.
16. Lubricate air brake system component grease fittings.

Drive Train

17. Inspect transmission case, seals, filter, retarder components, cooler, and cooler lines for cracks, leaks, and routing.
18. Inspect transmission wiring, connectors, seals, and harnesses for damage and routing.
19. Inspect transmission breather; service as required.
20. Inspect transmission mounts for looseness and deterioration.
21. Check transmission oil/fluid level and condition.
22. Inspect U-joints, slip joints, yokes, and drivelines for looseness, damage, and correct phasing.
23. Inspect axle housing for cracks and leaks.
24. Inspect axle breather; service as required.
25. Lubricate drive train grease fittings.
26. Check drive axle and planetary hubs for correct oil level.
27. Change drive axle and planetary hub oil; check and clean magnetic plug.

H8 TASK LIST (CONTINUED)

28. Change transmission oil/fluid and filters; check and clean magnetic plug, torque transmission oil pan drain plug and/or transmission filter bolts.
29. Take transmission oil/fluid sample.

Suspension and Steering Systems

30. Check steering wheel operation for free play or binding; check tilt and telescoping operations and condition.
31. Check hydraulic and/or power steering pump and hoses for leaks and mounting; check fluid level and condition.
32. Change hydraulic and/or power steering fluid and filter(s).
33. Inspect steering gear and miter box for leaks and mounting.
34. Inspect steering shaft and U-joints for condition and phasing; inspect pinch bolts, splines, Pitman arm-to-steering sector shaft, steering/Ackerman arms, drag link, tie rod ends and wheel stops.
35. Check for kingpin and thrust bearing wear.
36. Check wheel bearings for adjustment and noise.
37. Check oil level and condition of non-drive axle hubs; check for leaks.
38. Inspect suspension components (torque rods, lateral rods).
39. Inspect shock absorbers for leaks and mounting.
40. Inspect air suspension components for leaks and damage.
41. Check suspension ride height.
42. Lubricate suspension and steering system grease fittings.

Tires and Wheels

43. Inspect tires for irregular wear patterns and proper mounting.
44. Inspect tires for cuts, cracks, bulges, and sidewall damage.
45. Inspect valve caps and stems.
46. Measure and record tire tread depth; check and record tire air pressure.
47. Inspect for loose or missing lug nuts; torque lug nuts; check mounting hardware condition.
48. Inspect wheels and spacers for cracks and damage.
49. Check tire matching (diameter and tread), and valve stem positioning on dual tire installations.

Frame and Under Floor Equipment

50. Check mud flaps, skirts, and brackets.
51. Check articulation joint mounts, bushings, cylinders, switches and sensors; check articulation joint hydraulic pressures where applicable; inspect bellows/curtains for damage or tears; inspect articulation joint steering linkage and operation; torque articulation joint fasteners as required; lubricate articulation joint grease fittings.
52. Inspect frame and frame members for cracks and damage.
53. Inspect body-attaching hardware.
54. Check operation and condition of wheelchair lift/ramps, interlocks, sensitive edges, sensors, proximity switches; and hoses; check fluid level; lubricate grease fittings.
55. Check mounting security of under floor equipment.

SAMPLE QUESTIONS

PREVENTATIVE MAINTENANCE AND INSPECTION (PMI)

(TEST H8)

Questions:

1. When the driveline spline is being lubed, the PM technician should see grease coming out is the:
(A) yoke.
* (B) relief hole.
(C) seal.
(D) U-joint.
2. During a PMI, coolant is found under the vehicle and the reservoir is low. The PMI technician should:
(A) add coolant and replace the coolant reservoir cap.
* (B) pressure-test the system to find a leak.
(C) run the engine to check the cooling fan operation.
(D) run the engine at operating temperature to find a leak.
3. When performing a load test on a multiple battery system, which of these operations should the PM technician perform first?
(A) Clean the battery cables.
(B) Start the engine.
* (C) Isolate the batteries.
(D) Remove the surface charge.
4. Technician A says that if the compressor cutout pressure is too high, the air governor should be adjusted.
Technician B says that if the difference between cutout and cut-in is excessive, the air governor should be adjusted.
Who is right?
* (A) A only
(B) B only
(C) Both A and B
(D) Neither A nor B
5. During a PMI, the PM technician finds a green eye on each of the batteries. This indicates that the batteries are:
(A) serviceable at this time.
(B) bad and need to be replaced.
* (C) ready to be tested.
(D) marginal, and should be charged.

6. During a PM inspection, excessive serpentine belt wear was detected. Technician A says that improper belt adjustment could be the cause. Technician B says that misaligned pulleys could be the cause. Who is right?
- (A) A only
 - (B) B only
 - * (C) Both A and B
 - (D) Neither A nor B
7. Which air tank should be drained when testing the emergency spring brake valve?
- (A) Accessory tank
 - (B) Wet tank
 - * (C) Primary tank
 - (D) Secondary tank

Question 8 is not like the ones above.

It has the word **EXCEPT**. For this question, look for the choice that could **NOT** cause the described situation. Read the entire question carefully before choosing your answer.

8. When inspecting the wheels, the PM technician should check for all of these EXCEPT:
- (A) rust trails from the lug nuts.
 - (B) proper hand hole alignment.
 - (C) cracks radiating from the stud holes.
 - * (D) paint flaking from the rim.

INDUSTRY TRAINING

The following sources of information provide comprehensive listings of training resources available to working technicians:

Delmar Cengage Learning

P.O. Box 6904
Florence, KY 41022
1-800-487-8488
www.autoed.cengage.com
www.cengage.com/delmar

Motor Age Training for Certification

131 West First Street
Duluth, MN 55802
800-240-1968
www.motorage.com

In Canada

Thomson Learning Nelson Canada

1120 Birchmount Road
Scarborough, Ontario M1K 5G4
1-800-268-222
E-mail: inquire@nelson.com

Spanish Language Training Resources

For a listing of training providers who offer training, or training materials in Spanish go to www.ase.com; once there, enter the "Service Professionals" area and click on "Spanish Language Training Resources."

CASE: ASE Certification for Training Providers of Continuing Automotive Service Education. Visit www.natef.org/case/case_certified.cfm for periodic updates to this list.

The National Institute for Automotive Service Excellence (ASE) and its educational foundation, the National Automotive Technicians Education Foundation (NATEF), offer a voluntary certification program for institutions and organizations providing continuing automotive service education. ASE seeks to improve the quality of continuing automotive education and help automotive technicians identify appropriate training sources and activities by evaluating and certifying providers of continuing automotive service education against CASE Standards.

The CASE program differs from ASE's existing entry-level training program certification in that it addresses the training provider's process of developing and delivering training as opposed to prescribing specific program content. Elements of organization, structure and methods which appear to contribute significantly to the development and delivery of high quality automotive service education, have been identified and incorporated into the CASE Standards.

The following training providers have achieved CASE certification. Please note that * indicates a proprietary program unavailable to all technicians.

MD Publications

Undercar Digest, July Issue
Transmission Digest, September Issue
P.O. Box 2210
Springfield, MO 65801
1-800-274-7890

Motor Source Guide

Hearst Business Publishing, Inc.
645 Stewart Ave.
Garden City, NY 11530
www.motor.com

Fleet Equipment, April Issue

P.O. Box 7605
Mt. Prospect, IL 60056-7605
www.truklink.com

Recursos de Educación en Español

Para obtener acceso a la lista de proveedores de educación, ó materiales educativos en Español diríjase a www.ase.com; una ves allí, entre en la sección "Español" y prosiga al área "Lista de Educadores y Materiales Didácticos."

INDUSTRY TRAINING

3M Industrial and Transportation Business Services Training and Development

3M Center Building 225-1N-01
St. Paul, MN 55144
651-737-0141
www.3m.com/automotive

ACDelco Service Training

6200 Grand Point Dr., MC#2-316
Grand Blanc, MI 48439
800-825-5886 prompt 1
www.acdelcotechconnect.com

Affinia Under Vehicle Group

Technical Services Department
4400 Prime Parkway
McHenry, IL 60050
815-363-9000 – ask for technical
www.raybestos.com

AKZO NOBEL Coatings Inc., Car Refinishes

5555 Spalding Dr.
Norcross, GA 30092
770-242-5760
www.akzonobelcarrefinishes.net

American Automobile Association, Inc.

1000 AAA Dr.
Heathrow, FL 32746
407-444-7169 or 407-444-8041
Allan Stanley, astanley@national.aaa.com
Len Johannes, ljohnnes@national.aaa.com
www.aaa.com

***American Honda Automobile Service Training**

1919 Torrance Blvd.
Torrance, CA 90501
310-783-3557
www.honda.com

Automotive Spray Equipment Technologies (ASET)

3703 West Parkway Blvd.
Salt Lake City, UT 84120
801-964-6646
www.asetusa.com

ATech Training, Inc

12290 Chandler Dr.
PO Box 297
Walton, KY 41094
859-485-7229 ext. 109
www.atechtraining.com

BASF Automotive Refinish Division

26701 Telegraph Rd.
Southfield, MI 48034
248-304-5200
www.basfrefinish.com

BP Global Fuels Technology

150 W. Warrenville Rd.
800 Building
Naperville, IL 60563
312-729-4212
www.fuelcertification.com

Chief Automotive Systems

996 Industrial Dr.
Madison, IN 47250
800-445-9262
www.chiefautomotive.com

CARQUEST Technical Institute

4401 Atlantic Ave.
Raleigh, NC 27604
919-573-3000
www.CARQUEST.com/CTI

Collision Management Services Inc.

2040R Lord Baltimore Dr.
Baltimore, MD 21244
410-944-3383
www.ineedcms.com/Training.html

Delphi Integrated Service Solutions

5820 Delphi Dr.
Troy, MI 48098
800-545-2220
Customer Support
www.delphi-iss.com

DuPont Performance Coatings

500 Eagleview Blvd.
Exton, PA 19341
610-458-6323
www.pc.dupont.com

EAST Training Inc.

4404 Sylon Blvd.
Hainesport, NJ 08036
609-267-2223
www.easttraining.com

Federal Mogul Technical Education Centers

6565 Wells Ave.
St. Louis, MO 63133
314-977-0684
www.federal-mogul.com

Fox Valley Technical College

1825 N. Bluemound Dr.
Appleton, WI 54912
920-993-5163
www.fvtc.edu/public

***General Motors Service Technical College**

30501 Van Dyke Ave., M/C 480-204-100
Warren, MI 48090
586-947-9704
www.gmstc.com

Hunter Engineering

11250 Hunter Dr.
Bridgeton, MO 63044
314-731-0000
www.hunter.com

I-CAR (Inter-Industry Conference on Auto Collision Repair)

5125 Trillium Blvd.
Hoffman Estates, IL 60192
800-422-7872
www.i-car.com

Iwata Medea

3703 West Parkway Blvd.
West Valley City, UT 87120
801-964-6646
www.asetusa.com

Jiffy Lube International

700 Milam, Room 24038PNT
Houston, TX 77002
713-546-3957
www.jiffylube.com

Kent Automotive

6200 Oak Tree Blvd., #350
Independence, OH 44131
216-642-5973
www.kent-automotive.com

Lawson State Community College

1100 9th Ave., SW
Bessemer, AL 35022
205-929-3521
www.lawsonstate.edu

Lew Kinney & Associates On-site Welding Training and Certifications

PO Box 511, 184 State Route 314
Centerburg, OH 43011
740-625-6342

***Lexus, A Division of Toyota Motor Sales, Inc., U.S.A.**

19001 S. Western Ave.
Torrance, CA 90509
Technical Training 310-468-4958
www.lexus.com

Martin Senour Automotive Finishes

7019 Highgrove Rd.
Burr Ridge, IL 60527
630-887-7516
www.martinsenour-autopaint.com

Megatech Corporation

525 Woburn St., Suite 3
Tewksbury, MA 01876
800-767-6342 (US)
978-937-9600 (Int'l)
www.megatechcorp.com

Melior, Inc.

200 Cahaba Park Circle West
Suite 250
Birmingham, AL 35242
205-298-8300
www.melioronline.com

National Automotive Parts Association (NAPA)

2999 Circle 75 Pkwy.
Atlanta, GA 30339
800-292-NIAT (6428)
www.niat-training.com

INDUSTRY TRAINING

National Appraisal Institute

10150 Canoga Ave
Chatsworth, CA 91311
818-775-1370
www.nainstitute.com

Nationwide Training Organization

9243 Columbus Pike
Lewis Center, OH 43035
614-840-7169
www.nationwide.com

***Navistar, Inc.**

3033 Wayne Terrace
Fort Wayne, IN 46806
260-461-1951
www.navistar.com

***Nissan North America, Inc. Customer Loyalty and Training**

P.O. Box 685001
Franklin, TN 37068
615-725-8319
www.nissantechinfo.com

***Penske Truck Leasing**

Route 10 Pheasant Rd., PO Box 563
Reading, PA 19607
610-775-6479
www.gopenske.com

PPG Industries

19699 Progress Dr.
Strongsville, OH 44149
440-572-6784
www.ppg.com

Raytheon Professional Services L.L.C.

1919 Technology Dr.
Troy, MI 48083
248-837-6777
www.rps.com

Saint Gobain Abrasives

1 New Bond St.
Worcester, MA 01606
508-795-2774
www.nortonautomotive.com
www.aa.carborundumabrasives.com

SEM Products, Inc.

1685 Overview Dr.
Rock Hill, SC 29730
803-207-8231
www.semproducts.com

Sherwin-Williams Automotive Finishes Corp.

7019 Highgrove Rd.
Burr Ridge, IL 60527
630-887-7516
www.sherwin-automotive.com

Solera, Inc.

P.O. Box 151376
Altamonte Springs, FL 32715
858-724-1600
www.training.audatex.us

Specialty Products Company

4045 Specialty Place
Longmont, CO 80504
303-772-2103
www.spcalignment.com

Technical Training, Inc. (TTI)

2750 Product Dr.
Rochester Hills, MI 48309
248-853-5550 or 800-837-5222
www.ttiniao.com

***Toyota Motor Sales, USA, Inc.**

19001 S. Western Ave.
Torrance, CA 90509-2991
310-468-7171
www.toyota.com

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101 Blue Seal Dr., S.E., Suite 101
Leesburg, VA 20175

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ASE, 101 Blue Seal Dr., S.E., Suite 101, Leesburg, VA 20175
Telephone: 703-669-6600 (FAX: 703-669-6123)
Download forms 24/7 at www.ase.com!

To: _____