APTA STANDARDS DEVELOPMENT PROGRAM
RECOMMENDED PRACTICE
American Public Transportation Association
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APTA BTS-BMT-RP-005-10, Rev. 1
Published: October 1, 2010
First Revision: October 6, 2016
APTA Bus Maintenance Training Working Group

Training Syllabus to Instruct/Prepare for the ASE Transit Bus Diesel Engines Test

Abstract: This *Recommended Practice* provides guidelines for establishing a standardized bus maintenance training program related to the ASE certification program syllabus for the diesel engines used in transit buses and coaches.

Keywords: Automotive Service Excellence (ASE) H2, bus, certification, diesel engines, training, transit

Summary: This *Recommended Practice* allows users to instruct/prepare transit bus technicians and mechanics for the Automotive Service Excellence (ASE) H2 Transit Bus Diesel Engines Test and to evaluate, develop or enhance current training programs for the diagnosis, repair and maintenance of transit bus diesel engines systems. Individual operating agencies should modify these guidelines to accommodate their specific equipment and mode of operation.

Scope and purpose: This *Recommended Practice* reflects the consensus of the APTA Bus Standards Program members in conjunction with transit labor organizations, including ATU and TWU, on the subject material, manuals, textbooks, test equipment, methods and procedures that have provided the best performance record based on the experiences of those present and participating in meetings of the program task forces and working groups. APTA recommends the use of this document by organizations that have a training department or conduct training for the maintenance of transit buses, organizations that contract with others for transit bus maintenance training, and organizations that influence how training for transit bus maintenance is conducted.

Table of Contents

List of Figures and Tables

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Training Syllabus to Instruct/Prepare for the ASE Transit Bus Diesel Engines Test

1. Learning environment

For best application of this *Recommended Practice*, a combination of classroom lectures, mentoring, practical training and practice tests should be included in the training program.

2. Computer skills

Basic computer skills are now a standard for transit bus technicians. Basic skills and knowledge in the operation of a computer in a Microsoft Windows environment are essential.

3. Course descriptions and objectives

The learning objectives listed below have been developed through a labor-management committee of subject matter experts (SMEs). The Learning Objective Levels represent 100 (introductory), 200 (intermediate) and 300 (advanced) levels. Within each level, the learning objectives are organized in the recommended order of instruction. When a transit bus mechanic demonstrates proficiency in the learning objectives, he or she should be capable of attaining ASE Transit Bus Technician Certification.

- **Modules A1, A2 and A3: General Engine Diagnosis 101, 201, 301:** The objective of these courses is to familiarize the employee with the basics of general engine diagnosis, including inspection, testing, diagnosis, troubleshooting, repairs and component replacement to restore the engine to OEM specifications.
- **Modules B1, B2 and B3: Cylinder Head and Valve Train 101, 201, 301:** The objective of these courses is to familiarize the employee with all aspects of cylinder heads and valve trains, including inspection, cleaning, replacement and repairing of all related components to restore the cylinder head and valve train to OEM specifications.
- **Modules C1, C2 and C3: Engine Block 101, 201, 301:** The object of these courses is to familiarize the employee with all aspects of engine block diagnosis, including disassembly, assembly, component identification, testing, inspection, troubleshooting, diagnosis and repairs in order to restore the engine block to OEM specifications.

4. Exam requirements

The minimum acceptable grade to pass the course and all practical tests is 75 percent. Students must pass written tests with a minimum grade of 80 percent.

5. ASE test content summary

TABLE 1

Specifications for Transit Bus Diesel Engines Test

Content Area	Questions in Test	Percent 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 1. Mechanical Components (3) 2. Electronic components (8)	11	22%
G. Starting and Charging System Diagnosis and Repair	4	7%
Total	**50**	**100%**

References

National Institute for Automotive Service Excellence (ASE) website. http://www.ase.com/

Abbreviations and acronyms

ASE Automotive Service Excellence
ATU Amalgamated Transit Union
DCA diesel coolant additive
DMM digital multimeter
ECM electronic control module
ECU electronic control unit
EDSI Educational Data Systems, Inc.
EGR exhaust gas recirculation
EUI electronic unit injectors
FMVSS Federal Motor Vehicle Safety Standards
HEUI hydraulic electronic unit injectors
KBI Kold-Ban International
MSDS Material Safety Data Sheet
NATSA North American Transit Service Association
OEM original equipment manufacturer
OJT on-the-job training
PM preventive maintenance
PPE personal protective equipment
SCA supplemental coolant additive
TWU Transport Workers Union

Document history

Document Version	Working Group Vote	Public Comment/ Technical Oversight	CEO Approval	Policy & Planning Approval	Publish Date
First published					October 1, 2010
First revision	June 1, 2016	July 7, 2016	Sept. 6, 2016	Sept. 30, 2016	October 6, 2016
Second revision					

Appendix A: Transit bus engine learning objectives

101 SAFETY	
Learning Objectives	**ASE Task Reference**
Demonstrate proper use of personal protective equipment (PPE)	B1
Explain safety procedures used while working with engines and related systems	G3

101 THEORY & UNDERSTANDING	
Learning Objectives	**ASE Task Reference**
Describe transit agency engine service procedures	A18
Demonstrate basic computer knowledge	A1
Identify basic vehicle components (vehicle familiarization)	F1(1)
Demonstrate familiarization with engines and engine equipment	A2
Identify engine type and subsystem components	A17
Identify fluid types (oils, coolants, etc.) and explain viscosity	A2
Explain the difference between types of lubricants	A15
Explain the difference between types of coolants	A14
Describe differences and applications of distributor and inline-type injection pumps and mechanical unit injectors	F1(678)
Describe manufacturer's engine test procedures	G7, G8
Demonstrate basic knowledge of starting and charging systems	A11
Demonstrate basic knowledge of air and electric start systems	A11
Locate fuel system components on engine	D2
Identify vendor publications (service bulletins, manual updates, etc.) used during maintenance	A18
Demonstrate the proper use of material safety data sheet (MSDS) for understanding chemical safety	B1
Describe differences between sensor and sending unit	D7
Describe the function of rigging and lifting equipment	B1
Describe the importance of a clean work environment	B1
Describe the importance of cleaning parts and equipment prior to disassembly or removal	B1
Demonstrate uses of manufacturer's specification	F1(4)

101 TOOL USAGE	
Learning Objectives	**ASE Task Reference**
Identify common gauges	A6, A10, A14, A15
Demonstrate use of fuel gauge, vacuum gauge, pressure gauge/mercury manometer	A1, A7, A8, F1(1)
Demonstrate use of air pressure gauges	E7
Use air pressure gauges to check supply to knock-off cylinders	F1(12)
Demonstrate use of hydrometer and/or refractometer	A14
Explain use of Ph strips for testing coolant	A14
Identify proper diagnostic equipment and demonstrate use	A16
Demonstrate the proper use of hand tools	B1
Demonstrate the proper use of a straight edge	B3
Demonstrate proper use of feeler gauges	B3, B6, B10, B11, E7, F1(10)
Demonstrate the proper use of torque wrench	B7, F1(11)
Demonstrate the proper use of dial indicator	B7, B11, E7, F1(678)
Check belt tension with the correct tool	D6, D11
Identify manufacturer-provided tools	F1(11)

101 PROCEDURES, INSPECTIONS & TESTING	
Learning Objectives	**ASE Task Reference**
Perform general engine inspection	A17
Understand and demonstrate visual inspection of engine and components	B8, F1(1), F1(2), F1(5)
Use mechanical fasteners properly	B2
Demonstrate the proper use of sealants	B3
Demonstrate the proper use of torque specs	B3
Use thread lubricant properly	B10, F1(10)
Clean components in preparation for reassembly	C1
Clean sealing surfaces and remove residual gaskets and seals	C1
Clean bolt holes and fastener threads	B7
Check lines and hoses for chaffing, damage, etc.	D4, D10
Check hose between drain and block for damage	D5
Check oil supply hose	D5
Identify location of thermostats (oil and water)	D8
Handle coolant and chemicals properly (environmental)	D9
Change coolant conditioner or additive package	D10
Check for proper torque on clamps	D10
Check pulley-to-belt surface for wear and clear debris	D11
Inspect clamps and hoses on water pumps	D11
Inspect shroud for damage	D12

Learning Objectives	ASE Task Reference
Inspect radiator fins for damage and corrosion	D12
Inspect freeze plug	D12
Inspect radiator to ensure it is free of blockages	D12
Inspect surge tank, lines, hoses and mounting surfaces	D12
Check condition of fan blades	D13
Check condition of fan shroud	D13
Ensure mounting surfaces are not cracked or broken	D13
Check for damage on cap seal and mounting seal	D14
Check for proper intake boot alignment and clamping (torque)	E1
Check seal between intake housing and engine compartment	E1
Look for corrosion on air cleaner housing	E1
Check for proper torque on V-band clamp	E2
Inspect turbo waste gate and rubber hose for holes, damage and clamping	E2
Check for damage on charge air cooler	E4
Inspect charge air cooler mounting brackets for damage	E4
Look for corrosion and dirty or damaged fins on charge air cooler	E4
Check hose clamps on air piping	E5
Check pressure relief, short cycling (listening)	F1(1)
Visual inspection of fuel system	F1(11)
Follow manufacturer’s engine maintenance procedures	F2(3)
Follow manufacturer’s specs for fuel pressure	F2(5)

101 PROCEDURES, INSPECTIONS & TESTING (ELECTRICAL-ELECTRONICS)	
Learning Objectives	**ASE Task Reference**
Visually inspect engine solenoids, sensors, etc.	F1(12), F2(6)
Visual inspection of engine wiring	F2(2)
Demonstrate repair procedures for Metri-Pack, Deutsch, Weather Pack or other manufacturers and describe the connector differences	F2(8)
Name the various wire repair procedures, line splicing, etc.	F2(8)
Explain digital multimeter (DMM) functions; properly use multimeter	F2(2), F2 (4), F2(11)
Explain multimeter manufacturer safety procedures	F2(11)
Describe the difference between series and parallel battery arrangements	G2
Explain battery load test procedure	G2
Determine voltage of batteries; set charger to proper voltage	G3
Follow proper battery hookup sequence to prevent sparks	G4
Define system voltage and polarity	G4
Check for damaged wiring and proper mounting	G6
Describe battery charging procedures	G3

102 THEORY & UNDERSTANDING	
Learning Objectives	**ASE Task Reference**
Describe exhaust back pressure test procedures and equipment	A9
Explain how to use manufacturer's specification table to determine normal range of back pressure	A9
Explain how to use manufacturer's specification table to determine normal range of crankcase pressure	A10
Use manufacturer's specifications to determine which coolant to use	A14
Use manufacturer's specifications to determine which lubricant to use	A15
Refer to manufacturer's specifications and bulletins	A18
Describe thread pitch and fastener grades	B2
Describe the importance of adhering to fastener replacement specs	B2
Explain fastener torque sequences and torque turn procedure for cylinder heads	B7
Explain lubrication, oil pump operating pressure and relief valve operation	D3

102 TOOL USAGE	
Learning Objectives	**ASE Task Reference**
Proper use of diagnostic equipment to determine if air in fuel supply system	A12
Use pressure gauge to check specific pressure	D1
Check pulley alignment with straight edge	D6
Using monometer, check for air restriction	E1

102 PROCEDURES, INSPECTIONS & TESTING	
Learning Objectives	**ASE Task Reference**
Follow manufacturer's procedures for inspecting and testing cylinder head and valve train	B5
Follow manufacturer's specs and/or use vendor tools for installation of engine components	B9
Following manufacturer's procedures, place engine in proper position for removal and installation of engine components	B10
Check operation of sending unit	D1
Identify damaged mechanical fasteners, studs and threaded holes	B2
Inspect pipes for cracks and O-ring damage	D2
Check sealing and mounting surfaces for damage to oil cooler	D4
Ensure crankcase breather is operating properly	D5
Adjust/reinstall drive belts and drive belt pulleys	D7
Inspect mounting surfaces on coolant filter housing for debris, nicks, etc.	D11
Pressure-test cooling system	D7, D14
Bleed air from cooling system	D9
Change coolant line	D10
Check inlet and outlet coolant temperatures	D12
Ensure pressure release valve works	D12
Test pressure release cap	D12
Ensure pressure relief is in place and working properly	D14
Ensure specified pressure is not exceeded for that system	D14
Ensure proper rotation and orientation of cooling fan	D13
Inspect and replace mounting bushings on cooling fan brackets	D13
Check for chaffing or holes in induction pipe and rubber boots; ensure boots remain pliable	E1
Inspect waste gate linkage for movement and retainers	E2
Check intake manifold for leaks, cracks and missing or loose bolts	E3
Check hoses for holes and clamps (loose, damaged and correct)	E4
Pressure-test charge air cooler and piping	E4
Check for V-band clamp condition	E5
Inspect for cracks on flange exhaust manifold surfaces	E5
Inspect for exhaust manifold leaks and cracks	E5
Use DMM to test electric pumps, heaters, etc.	F1(2)
Check oil return lines	F1(3)
Use external pump/fuel source to check fuel system	F1(3)
Make mechanical connections, follow installation instructions for engine throttle and controls	F1(5)
Visual inspection of fuel system linkages	F1(10)
Apply manufacturer's procedures and tools when diagnosing and repairing fuel system	F1(6,7,8)
Make manufacturer-recommended adjustments to fuel system components	F2(6)
Use DMM to check circuits and sensors	F2(6)

Learning Objectives	ASE Task Reference
Use DMM to test voltage; perform voltage drop tests	F2(7)
Visually inspect circuits	F2(7)
Using wire terminal crimping tools	F2(8)
Use connector installation and removal tools (pin removers, etc.)	F2(8)
Apply basic electrical knowledge to electrical components, perform tests and interpret readings	F2(11)
Perform state-of-charge test	G1
Safely load-test a battery	G2
Determine which charging methods to utilize	G3
Check battery cables for corrosion, wear and crimping	G5
Inspect battery holes, cracks, leaks, bulged housing	G5
Test batteries for low electrolytes	G5
Check relays for arcing or melting housings	G6
Perform full field tests (or carbon pile load test) as specified	G7
Proper use of DMM clamp-on amps probe (high current)	G7
Use high current ammeter (1000-amp capacity)	G8

103 PROCEDURES, INSPECTIONS & TESTING

Learning Objectives	ASE Task Reference

201 THEORY & UNDERSTANDING

Learning Objectives	ASE Task Reference
Demonstrate familiarization with failure report system	A1
Perform road test procedures	A1
Describe EGR theory and application	E7
Describe SAE J1708 and J1939 networking protocols	A16
Describe engine electronic control system	A12
Describe function and operation of vibration dampeners	A13
Explain effects of low or high fuel pressure on engine performance	F2(5)
Identify correct calibration and vehicle specifications using service manual	F2(9)

201 TOOL USAGE	
Learning Objectives	**ASE Task Reference**
Demonstrate proper use of belt tension gauge	B4
Demonstrate proper use of cylinder head pressure test equipment	B5
Demonstrate proper use of micrometers (spring height, bridge guides, etc.)	B4, B6
Properly use injector sleeve tools (various vendor-provided tools)	B5
Properly use code reader, laptop, manufacturer diagnostic software as necessary	A11, E7, F1(2), F2 (1), F2(2), F2(3), F2(4), F2(5), F2(7), F2(9)
Use DMM to check wiring harness	B8
Use proper tools to install seals	D8
Demonstrate proper use of pin tools	F1(10)
Use test kit to check coolant and ensure additive package levels	D10
Use listening tools to detect noises and harmonics	A4

201 PROCEDURES, INSPECTIONS & TESTING	
Learning Objectives	**ASE Task Reference**
Identify damaged connectors and wires	A3
Demonstrate use of basic schematics and troubleshooting charts	A3, A11, A12, A16, F2(7)
Listen and detect normal and abnormal operating sounds	A4
Check for air inlet restriction	A5
Exhaust back-pressure test	A5
Recognize normal vs. abnormal emissions characteristics	A5
Determine if smoke source is from oil, fuel or coolant	A5
Determine if fuel return rate is within specifications	A6
Examine fuel for contamination	A6
Perform air intake system leak test under pressure	A7, A8
Determine possible causes of engine no start	A11
Inspect and repair engine mount system	A13
Pressure-test coolant system	A14
Examine coolant for contamination	A14
Describe engine protection systems	A14, A15
Pressure-test lube system	A15
Check wiring from ECU to sensor	D1
Inspect thermostat for proper operation	D8
Check idler pulley bearings	D11
Inspect drive gear for damage	D11
Inspect lubrication and cooling systems for damage	D11

Learning Objectives	ASE Task Reference
Inspect inside of charge air cooler for oil contamination and coking	E4
Demonstrate knowledge of winterization procedures	E6
Check fuel system for air with proper manufacturer's procedure	F1(3)

202 THEORY & UNDERSTANDING

Learning Objectives	ASE Task Reference
Explain engine electronic control systems and sensor operation	A11, A16
Describe conditions that would activate engine protection systems	A12
Describe conditions that would cause abnormal engine/drivetrain vibrations	A13
Describe the interface between the engine and bus manufacturer specific devices (e.g., fire suppression)	F2(6)

202 TOOL USAGE

Learning Objectives	ASE Task Reference
Use micrometer for rocker arm shafts, bushings	B8
Use dial indicator for injector tip/nozzle protrusion	B5
Check end play with dial indicator, correct if necessary to proper specification	C9, C10
Check flywheel runout with dial indicator	C18
Demonstrate the proper use of gear removal and installation tools	C10
Check for wear on oil pump using feeler gauge and straight edge	D2
Use other specialized fuel system test equipment	F1(9)
Use DMM to check circuits and sensors	F1(12)
Properly use code reader, laptop and manufacturer diagnostic software as necessary	A12, A16, F2(1)
Properly use injector height gauges	F2(4)

202 PROCEDURES, INSPECTIONS & TESTING	
Learning Objectives	**ASE Task Reference**
Pressure testing of engine and subsystems	A2
Determine possible causes of exhaust temperature outside of normal ranges	A9
Troubleshoot cooling fan control operation	A14, A15
Examine for contaminated lubricating oil	A15
Measure valve spring height, stems and guides	B4
Remove injector sleeve	B5
Check and set preload on tapered roller bearing	C10
Follow proper reinstall procedure for drive gear train to ensure correct timing	C10
Measure vibration damper for runout	C16
Ensure proper torque sequence when installing head	C18
Use both electronic diagnostic and manual methods to verify oil pressure	D1
Verify engine oil pressure and check operation of pressure sensor	D1
Measure valve spring height and tension	D3
Check oil bypass valve and seat for damage	D4
Ensure correct orientation of oil cooler	D4
Replace bearings on pulleys and tensioners	D6
Use both electronic diagnostic and manual methods to check coolant	D7
Build replacement lines (fittings, hose types, crimping)	D10
Check for bearing wear on pulleys and tensioners	D11
Check for gear clearance (gear lash)	D11
Perform flow test	D12
Ensure fan is engaging at proper temperature	D13
Check fan speed	D13
Check mechanical and electronic fan controls	D13
Determine that waste gate operates at proper boost pressure	E2
Electronically check turbo boost pressure in engine	E2
Inspect turbo for wear in shaft, damaged or missing fins, damaged housing and leaking seals	E2
Check pressure and temperature electronically to determine if they are within specifications	E3
Check for exhaust back-pressure readings to determine if they are within specifications	E5
Determine whether to replace nozzle or whole injector	F1(9)
Read and interpret fuel pressure specification using the service manual	F2(10)
Use data from software to begin troubleshooting	F2(10)
Perform voltage drop tests on ground and power side	G7, G8
Test starting and charging systems using voltage drop test	G8
Perform starter amp draw test	A11

203 PROCEDURES, INSPECTIONS & TESTING	
Learning Objectives	**ASE Task Reference**
Examine coolant for diesel coolant additive (DCA) level and chemical makeup	A14
Clean and inspect all fastener threaded holes for broken screws or thread damage; service and repair as needed	C2
Inspect all dowel pins and holes for damage; service and replace as needed	C2

301 THEORY & UNDERSTANDING	
Learning Objectives	**ASE Task Reference**
Describe operation of variable ratio/geometry turbo chargers	E7

301 TROUBLESHOOTING, INSPECTIONS & TESTING	
Learning Objectives	**ASE Task Reference**
Troubleshoot engine performance issues and causes	A1, A2
Troubleshoot engine electrical systems	A3
Troubleshoot noise origin	A4
Troubleshoot excessive smoke	A5
Troubleshoot fuel system	A6
Diagnose engine air induction restrictions	A7
Troubleshoot high intake restriction	A7
Troubleshoot air intake system	A8
Troubleshoot high exhaust back-pressure	A9
Troubleshoot excessive crank case pressure	A10
Troubleshoot a no-start problem	A11
Troubleshoot electronic and fuel controls	A12
Diagnose engine air induction leaks	A7
Diagnose engine exhaust restrictions	A9
Troubleshoot vibrations	A13
Troubleshoot cooling system	A14
Troubleshoot fan clutch	A14
Troubleshoot surge tank system	A14
Troubleshoot water pump	A14
Troubleshoot filters	A14, A15
Troubleshoot hoses	A14, A15
Troubleshoot lubrication system	A15
Troubleshoot oil cooling system	A15
Troubleshoot oil pump	A15
Troubleshoot visual damage of engine and subsystem components	A17
Determine if valves should be replaced or repaired	B4

Learning Objectives	ASE Task Reference
Install and adjust camshaft followers	C7
Inspect gears for serviceability and determine if gears can be reused	C10
Diagnose temperature switch on the block	E6

302 TROUBLESHOOTING, INSPECTIONS & TESTING

Learning Objectives	ASE Task Reference
Evaluate engine diagnostic test results	A12
Troubleshoot high and low oil pressure readings	A15
Troubleshoot high oil consumption	A15
Interpret oil analysis results	A15
interpret engine diagnostic codes to determine needed repairs	A16
Perform fuel pressure test; inspect cylinder head and perform necessary repairs	B5
Inspect all mating surfaces for alignment and damage	C2
Install in-block camshaft bearings	C7
Install in-block camshaft; measure and adjust end play	C7
Determine acceptable wear on bearing; identify potential contamination in oil	C9
Troubleshoot electrical components of fan control between fan and ECU/OEM interface	D13
Diagnose ether injection system (KBI)	E6
Diagnose the preheater and electronic control of preheater (ECU)	E6
Determine if a sensor or actuator is giving bad readings	F2(10)
Use mechanical gauges to double-check electronic readings	F2(10)

303 TROUBLESHOOTING, INSPECTIONS & TESTING

Learning Objectives	ASE Task Reference
Troubleshoot electronic controls	A15
Troubleshoot source of contaminated lubricants	A15
Troubleshoot electronic diagnostics	A16

304 ENGINE REBUILDING

Learning Objectives	ASE Task Reference
Remove oil pan, cover and breathers	C1
Use Plastigauge to check bearing clearance	C9, B11
Inspect oil pickup screen for cracks, holes and clogs	D2
Secure oil pickup screen properly	D2
Use a proper assembly lube as per manufacturer for engine rebuild	B11
Inspect removed engine gaskets or seals for evidence of proper sealing	C1
Secure applicable fasteners in accordance with manufacturer’s specification	C1
Inspect breathers for blockage or contaminants	C1

Learning Objectives	ASE Task Reference
Clean engine block, removing all scale, carbon and other deposits	C2
Check oil passage in connecting rod; ensure free flow	C11
Rotate crank by hand to ensure no binding during engine rebuild	C14
Inspect ring gear for damaged teeth	C18
Inspect for surface wear on block where O-ring seats	D2
Install engine block components	C1
Secure seals to components and prepare for installation	C1
Use proper tools to avoid spreading rings	C13
Use feeler gauge to ensure proper clearance of end gap on piston rings	C13
Utilize proper disassembly procedures	B1
Measure deck-to-deck thickness	B3
Visual inspection for cracks, damage, passages, core	B3
Check and replace seals	B4
Visually inspect cam followers	B9
Inspect removed wear rings for proper sealing	C1
Disassemble bare block of all core plugs, galley plugs, fittings, nozzles, bearing caps, bearings and seals	C2
Install oil passage plugs	C8
Remove any oil passage plugs; clean oil passages	C8
Properly install bearings and races	C10
Check for stretched bolts and damaged threads	C11
Properly install piston rings	C11
Check for proper position of oil cooling jets	C15
Ensure oil cooling jets are free of debris	C15
Inspect vibration damper for damage and fluid leaks	C16
Align flex plate properly	C18
Check bolt holes for elongation	C18
Inspect flywheel	C18
Visually determine wear on oil pump	D2
Ensure relief valve and regulator are in correct place	D3
Measure distance for spring installation on oil pressure regulator valve	D3
Inspect machined sealing surfaces for flatness, straightness and irregular conditions	C1
Clean and inspect galley passages for blockage, restrictions and obstructions	C2
Inspect engine block for cracks and erosion	C2
Inspect galley plug sealing surfaces for damage; install plugs and fittings	C2
Ensure main bearing caps installed in proper sequence and orientation	C9
Inspect bearing journals and cam lobes for damage or excessive wear	C10
Check bushing bore	C11

Learning Objectives	ASE Task Reference
Install and properly orient pistons, connecting rods and crankshaft	C11
Determine proper piston-to-cylinder-bore clearance	C14
Check deck height on cylinder liner	C15
Install piston rings in proper sequence with ring gaps staggered and oriented (top and/or bottom) correctly	D13
Inspect cylinder walls for wear and damage if block is not equipped with cylinder liners	C4
Install cylinder liners if equipped with seals, while adjusting liner height to manufacturer's specifications	C5
Check clearance between piston and wall	C12
Check cylinder wall for taper and out-of-round	C12
Check block for deck height and deck surface for flatness, warp age and finish; service as needed	C2
Install main caps and check line bore for alignment; service as needed	C2
Inspect cylinder sleeve counter bore and lower bore for distortion, taper and sealing surface; service as needed if block has cylinder liners	C3
Inspect in-block camshaft bearing bore surface for damage and dimensions/specifications; service as needed	C6
Check thrust bearing surface for wear and dimension; service as needed	C8
Clean and inspect crankshaft for cracks and damage using Magnaflux or other approved method	C8
Measure journal diameters for out-of-round and wear; service as needed	C8
Check that con rods are not bent or twisted	C11
Check for cracks in rods if being reused	C11
Check block to ensure line bore is correct	C14
Install and align flywheel housing	C17
Perform runout check; ensure concentricity to face of flywheel	C17
Demonstrate understanding of manufacturer's calibration procedures and authority to change or calibrate	F2(9)

400 MANUFACTURER SPECIFIC

Learning Objectives	ASE Task Reference
Perform manufacturer-specified tests	E7
Use manufacturer-provided specialty tools	F1(5)

Appendix B: ASE transit bus diesel engines task list

A. General engine diagnosis

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-with 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

1. Remove, inspect, disassemble and clean cylinder head assembly or assemblies.
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

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

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), bypass valve(s) and filters.
4. Inspect, clean, test, reinstall or replace oil cooler, bypass 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), bypasses, 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

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

1. Mechanical components

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 shutoff devices and controls, including engine protection shutdown devices, circuits and sensors.

2. Electronic components

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 shutdown 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 (handheld or PC-based, and/or breakout 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

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(es) 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.

Appendix C: Sample curriculum

Diesel Engines—Module A1
General Engine Diagnosis 101

Goal: Participants should understand the basics of diesel engine components and operation.

Objectives:
Upon completion of this course, participants should be able to:

- demonstrate safe use of hand tools and related equipment;
- demonstrate familiarization with operation of engine and engine components;
- demonstrate understanding of systems and subsystems;
- identify and inspect engine components of engine assembly and engine compartments; and
- locate fuel system components on engine.

Job tasks/learning objectives/OJT checklist:
OJT checklists may be used with the learning objectives listed under these sections of Appendix A:

1. 101 Tool Usage and Diagnostics
2. 101 Procedures, Inspections & Testing
3. 101 Theory & Understanding
4. 101 Procedures, Inspections & Testing (for Electrical-Electronics)

Course description: Participants will receive instruction in which a qualified instructor will go over the basics of diesel engine components and operation, including component identification and concepts of inspection, safety issues, and applicable tool and equipment usage. Participants should leave the class with an understanding of engine operation, identification and some general inspection techniques.

Recommended class size: 8:1

Prerequisites (previous module and/or demonstrated experience):

Delivery method (e.g., lecture, hands-on, online, lab): Hands-on and classroom

Course duration: 4 hours

Target audience: All new and existing mechanics

Classroom equipment and supplies: Notepads, pens/pencils, flip chart or whiteboard (and markers), chart markers, classroom, laptop, projector, highlighters, note cards and name cards

Course materials, training aids and references: Student workbook, manuals, PowerPoint, handouts and homework assignments

Instructor:

Course developer: EDSI

Subject matter experts: Contact APTA.

Revision dates: 9/10/2010

Follow-up: Most recent revision should be sent to committee for feedback.

Instructor and course evaluation: Local course evaluation sheets should be used if present.

Diesel Engines—Module A2

General Engine Diagnosis 201

Goal: Participants should understand basic troubleshooting techniques for diesel engines through an enhanced understanding of theory and proper operation.

Objectives:
Upon completion of this course, participants should be able to:

- explain the use of test procedures and equipment to determine lubricants and coolants;
- explain basic troubleshooting techniques used with engine diagnostics;
- identify defective components; and
- identify probable causes of failure.

Job tasks/learning objectives/OJT checklist:
OJT checklists may be used with the learning objectives listed under these sections of Appendix A:

1. 102 Theory & Understanding
2. 102 Procedures, Inspections & Testing
3. 201 Procedures, Inspections & Testing
4. 102, 201 and 301 Procedures, Inspections & Testing

Course description: Participants will receive instruction from a qualified instructor regarding basic troubleshooting and preventive maintenance procedures for identification of worn/defective components and probable causes of failure. This component will be instructor-led with hands-on demonstration of components and procedures.

Recommended class size: 8:1

Prerequisites (previous module and/or demonstrated experience): Participants should have taken General Engine Diagnosis 101 or have equivalent experience.

Delivery method (e.g., lecture, hands-on, online, lab): Hands-on and classroom

Course duration: 4 hours

Target audience: Anyone successfully completing General Engine Diagnosis 101 or demonstrating equivalent knowledge/experience

Classroom equipment and supplies: Notepads, pens/pencils, flip chart or whiteboard (and markers), classroom, laptop, projector, highlighters, note cards and name cards

Course materials, training aids and references: Student workbook, manuals, PowerPoint, handouts and homework assignments

Instructor:

Course developer: EDSI

Subject matter experts: Contact APTA.

Revision dates: 9/10/2010

Follow-up: Most recent revision should be sent to committee for feedback.

Instructor and course evaluation: Local course evaluation sheets should be used if present.

Diesel Engines—Module A3

General Engine Diagnosis 301

Goal: Participants should be able to perform all necessary actions required to restore the diesel engine to OEM specifications.

Objectives:

Upon completion of this course, participants should be able to:

- demonstrate advanced troubleshooting/diagnostic procedures;
- inspect and apply electrical knowledge to test;
- check, install and adjust components;
- perform maintenance on fuel supply and fuel return system; and
- research applicable service manuals to meet OEM specifications.

Job tasks/learning objectives/OJT checklist:

OJT checklists may be used with the learning objectives listed under these sections of Appendix A:

1. 201 Procedures, Inspections & Testing – 202 Theory & Understanding
2. 101 and 201 Procedures, Inspections & Testing
3. 101 and 201 Procedures, Inspections & Testing
4. 201 Procedures, Inspections & Testing
5. 101 and 201 Theory & Understanding

Course description: Participants will be led by a qualified instructor through the process of restoring a diesel engine to OEM specifications. This includes instructor demonstrations and participant practice. This portion is highly interactive and should employ hands-on learning activities.

Recommended class size: 8:1

Prerequisites (previous module and/or demonstrated experience): Participants should have taken General Engine Diagnosis 201 *or* have equivalent experience.

Delivery method (e.g., lecture, hands-on, online, lab): Hands-on and classroom

Course duration: 4 hours

Target audience: Anyone successfully completing General Engine Diagnosis 201 or demonstrating equivalent knowledge/experience

Classroom equipment and supplies: Notepads, pens/pencils, flip chart or whiteboard (and markers), classroom, laptop, projector, highlighters, note cards and name cards

Course materials, training aids and references: Student workbook, manuals, PowerPoint, handouts and homework assignments

Instructor:

Course developer: EDSI

Subject matter experts: Contact APTA.

Revision dates: 9/10/2010

Follow-up: Most recent revision should be sent to committee for feedback.

Instructor and course evaluation: Local course evaluation sheets should be used if present.

Diesel Engines—Module B1

Cylinder Head and Valve Train 101

Goal: Participants should possess a basic understanding of transit bus cylinder head and valve train system components and operation.

Objectives:
Upon completion of this course, participants should be able to:

- demonstrate safe use of hand tools and related equipment;
- demonstrate a familiarization with all aspects of cylinder heads and valve train;
- identify cylinder head assembly and related components;
- demonstrate a basic understanding of principles of operation; and
- demonstrate an understanding of OEM specifications.

Job tasks/learning objectives/OJT checklist
OJT checklists may be used with the learning objectives listed under these sections of Appendix A:

1. 101 Safety – 101 Theory & Understanding – 101 & 102 Procedures, Inspections & Testing
2. 101 Theory & Understanding – 101 Procedures, Inspections & Testing
3. 101 and 102 Procedures, Inspections & Testing
4. 102 Theory & Understanding
5. 101 Procedures, Inspections & Testing (includes Electrical-Electronic) – 102 Theory & Understanding

Course description: Participants will receive classroom instruction in which a qualified instructor will go over aspects of cylinder heads and valve train system, components and operation. The course will cover basic safety issues using applicable tools and equipment and their proper use. Participants will acquire a basic understanding of how these systems operate and how their components are relevant to operation.

Recommended class size: 8:1

Prerequisites (previous module and/or demonstrated experience):

Delivery method (e.g., lecture, hands-on, online, lab): Hands-on and classroom

Course duration: 4 hours

Target audience: All new and existing mechanics

Classroom equipment and supplies: Notepads, pens/pencils, flip chart or whiteboard (and markers), classroom, laptop, projector, highlighters, note cards and name cards

Course materials, training aids and references: Student workbook, manuals, PowerPoint, handouts and homework assignments

Instructor:

Course developer: EDSI

Subject matter experts: Contact APTA.

Revision dates: 9/10/2010

Follow-up: Most recent revision should be sent to committee for feedback.

Instructor and course evaluation: Local course evaluation sheets should be used if present.

Diesel Engines—Module B2

Cylinder Head and Valve Train 201

Goal: Participants should understand basic troubleshooting techniques for a transit bus cylinder head and valve train systems through an enhanced understanding of theory and proper operation.

Objectives:
Upon completion of this course, participants should be able to:

- explain the proper function and relationship of the cylinder head and valve train system;
- explain basic troubleshooting procedures for the cylinder head and valve train system;
- explain basic preventive maintenance (PM) procedures;
- identify defective/worn components; and
- identify probable causes of failure.

Job tasks/learning objectives/OJT checklist:
OJT checklists may be used with the learning objectives listed under these sections of Appendix A:

1. 102 Theory & Understanding
2. 102 Procedures, Inspections & Testing
3. 201 Procedures, Inspections & Testing
4. 201 Theory & Understanding
5. 202 Procedures, Inspections & Testing

Course description: Participants will receive instruction from a qualified instructor regarding basic troubleshooting and preventive maintenance procedures for cylinder head and valve train systems, including the identification of defective/worn components and probable causes of failure. This section will be instructor-led with hands-on demonstration of components and procedures.

Recommended class size: 8:1

Prerequisites (previous module and/or demonstrated experience): Participants should have taken Cylinder Head and Valve Train 101 or have equivalent experience.

Delivery method (e.g., lecture, hands-on, online, lab): Hands-on and classroom

Course duration: 4 hours

Target audience: Anyone successfully completing Cylinder Head and Valve Train 101 or demonstrating equivalent knowledge/experience

Classroom equipment and supplies: Notepads, pens/pencils, flip chart or whiteboard (and markers), classroom, laptop, projector, highlighters, note cards and name cards

Course materials, training aids and references: Student workbook, manuals, PowerPoint, handouts and homework assignments

Instructor:

Course developer: EDSI

Subject matter experts: Contact APTA.

Revision dates: 9/10/2010

Follow-up: Most recent revision should be sent to committee for feedback.

Instructor and course evaluation: Local course evaluation sheets should be used if present.

Diesel Engines—Module B3

Cylinder head and Valve Train 301

Goal: Participants should be able to perform all necessary actions required to restore the cylinder head and valve train to OEM specifications.

Objectives:
Upon completion of this course, participants should be able to:

- demonstrate advanced troubleshooting/inspection procedures;
- test, remove, replace and adjust components;
- perform preventive maintenance (PM) on cylinder heads and valve train systems;
- repair and rebuild components; and
- conduct tests, and inspect and take required measurements.

Job tasks/learning objectives/OJT checklist:
OJT checklists may be used with the learning objectives listed under these sections of Appendix A:

1. 301 Troubleshooting, Inspections & Testing
2. 302 Troubleshooting, Inspections & Testing
3. 201 Procedures, Inspections & Testing
4. 202 Procedures, Inspections & Testing

Course description: Participants will be led by a qualified instructor through the process of restoring the cylinder head and valve train to OEM specifications. This includes instructor demonstrations and participant practice. This portion is highly interactive and should employ hands-on learning activities.

Recommended class size: 4:1

Prerequisites (previous module and/or demonstrated experience): Participants should have taken Cylinder Head and Valve Train 201 or have equivalent experience.

Delivery method (e.g., lecture, hands-on, online, lab): Hands-on and classroom

Course duration: 8 hours

Target audience: Anyone successfully completing Cylinder Head and Valve Train 201 or demonstrating equivalent knowledge/experience

Classroom equipment and supplies: Notepads, pens/pencils, flip chart or whiteboard (and markers), classroom, laptop, projector, highlighters, note cards and name cards

Course materials, training aids and references: Student workbook, manuals, PowerPoint, handouts and homework assignments

Instructor:

Course developer: EDSI

Subject matter experts: Contact APTA.

Revision dates: 9/10/2010

Follow-up: Most recent revision should be sent to committee for feedback.

Instructor and course evaluation: Local course evaluation sheets should be used if present.

Diesel Engines—Module C1

Engine Block 101

Goal: Participants should possess a basic understanding of engine block system components and operation.

Objectives:
Upon completion of this course, participants should be able to:

- demonstrate safe use of hand tools and related equipment;
- understand how to work safely with engine block system components;
- identify engine block system components;
- demonstrate a basic understanding of principles of operation; and
- demonstrate a basic understanding of a transit bus engine block system.

Job tasks/learning objectives/OJT checklist:
OJT checklists may be used with the learning objectives listed under these sections of Appendix A:

1. 101 Tool Usage
2. , 102Tool Usage
3. 201 Tool Usage
4. 101 Procedures, Inspections & Testing
5. 102 Procedures, Inspections & Testing

Course description: Participants will receive classroom instruction in which a qualified instructor will go over the basics of understanding the engine block system components and its operation. Participants will become familiar with aspects of engine block diagnosis and repairs in order to restore an engine block to OEM specifications.

Recommended class size: 8:1

Prerequisites (previous module and/or demonstrated experience):

Delivery method (e.g., lecture, hands-on, online, lab): Hands-on and classroom

Course duration: 8 hours

Target audience: All new and existing mechanics

Classroom equipment and supplies: Notepads, pens/pencils, flip chart or whiteboard (and markers), classroom, laptop, projector, highlighters, note cards and name cards

Course materials, training aids and references: Student workbook, manuals, PowerPoint, handouts and homework assignments

Instructor:

Course developer: EDSI

Subject matter experts: Contact APTA.

Revision dates: 9/10/2010

Follow-up: Most recent revision should be sent to committee for feedback.

Instructor and course evaluation: Local course evaluation sheets should be used if present.

Diesel Engines—Module C2

Engine Block 201

Goal: Participants should possess a basic understanding of engine block system components and operation.

Objectives:

Upon completion of this course, participants should be able to:

- remove, inspect and disassemble engine block assemblies;
- inspect engine block for damage and condition of components;
- reinstall and replace components as needed;
- inspect camshaft, crankshaft, main bearings and the drive gear train;
- clean, inspect, measure and replace pistons, pins and retainers;
- identify problems with crankshaft connecting rods, bearings and determine needed repairs;
- complete all assemblies needed to restore engine block to OEM specifications; and
- inspect flywheel and mounting surfaces for cracks and wear and determine needed repairs.

Job tasks/learning objectives/OJT checklist:

OJT checklists may be used with the learning objectives listed under these sections of Appendix A:

1. 103 Procedures, Inspections & Testing
2. 201 Procedures, Inspections & Testing – 202 Theory & Understanding
3. 202 Procedures, Inspections & Testing – 203 Procedures, Inspections & Testing
4. 202 Procedures, Inspections & Testing – 203 Procedures, Inspections & Testing
5. 301 Troubleshooting, Inspections & Testing
6. 301 and 302 Troubleshooting, Inspections & Testing
7. 303 Troubleshooting, Inspections & Testing

Course description: Participants should understand all aspects of diagnostics and basic troubleshooting procedures for transit bus engine block systems, including inspection, testing, diagnosis and repair of engine block components.

Recommended class size: 8:1

Prerequisites (previous module and/or demonstrated experience): Participants should have taken Engine Block 101 or have equivalent experience.

Delivery method (e.g., lecture, hands-on, online, lab): Hands-on and classroom

Course duration: 8 hours

Target audience: Anyone successfully completing Engine Block 101 or demonstrating equivalent knowledge/experience

Classroom equipment and supplies: Notepads, pens/pencils, flip chart or whiteboard (and markers), classroom, laptop, projector, highlighters, note cards and name cards

Course materials, training aids and references: Student workbook, manuals, PowerPoint, handouts and homework assignments

Instructor:

Course developer: EDSI

Subject matter experts: Contact APTA.

Revision dates: 9/10/2010

Follow-up: Most recent revision should be sent to committee for feedback.

Instructor and course evaluation: Local course evaluation sheets should be used if present.

Diesel Engine—Module C3

Engine Block 301

Goal: Participants should be able to perform all necessary actions required to restore the engine block to OEM specifications.

Objectives:

Upon completion of this course, participants should be able to:

- perform advanced troubleshooting techniques on engine block components;
- diagnose and troubleshoot engine exhaust systems;
- interpret engine diagnostic codes to determine needed repairs;
- diagnose injection system (KBI);
- troubleshoot electronic components and controls;
- demonstrate understanding of manufacturer's calibration procedures; and
- perform manufacturer-specified tests.

Job tasks/learning objectives/OJT checklist:

OJT checklists may be used with the learning objectives listed under these sections of Appendix A:

1. 301 Troubleshooting, Inspections & Testing
2. 302 Troubleshooting, Inspections & Testing
3. 303 Troubleshooting, Inspections & Testing
4. 400 Manufacturer Specific

Course description: Participants should be able to perform all necessary actions required to restore the engine block to OEM specifications. This includes possessing knowledge of all advanced theories and ability to perform all applicable testing, troubleshooting, inspection and diagnosis.

Recommended class size: 4:1

Prerequisites (previous module and/or demonstrated experience): Participants should have taken Engine Block 201 or have equivalent experience.

Delivery method (e.g., lecture, hands-on, online, lab): Hands-on and classroom

Course duration: 8 hours

Target audience: Anyone successfully completing Engine Block 201 or demonstrating equivalent knowledge/experience

Classroom equipment and supplies: Notepads, pens/pencils, flip chart or whiteboard (and markers), classroom, laptop, projector, highlighters, note cards and name cards

Course materials, training aids and references: Student workbook, manuals, PowerPoint, handouts and homework assignments

Instructor:

Course developer: EDSI

Subject matter experts: Contact APTA.

Revision dates: 9/10/2010

Follow-up: Most recent revision should be sent to committee for feedback.

Instructor and course evaluation: Local course evaluation sheets should be used if present.

