

Florida Department of Education  
CLUSTER CURRICULUM FRAMEWORK

**Program Title:** Advanced Automotive Technology  
**Program Type:** Job Preparatory  
**Occupational Area:** Industrial Education  
**Components:** 10 Occupational Completion Points

Grade Level PSAV  
30, 31  
Facility Code 246  
CTSO SkillsUSA  
Coop Method: Yes  
Apprenticeship: Yes

- I. **PURPOSE:** The purpose of this program is to prepare students for employment and/or specialized training in the automotive industry. The program provides specialized corporate/association job preparatory training.

This program requires a written business plan that establishes a partnership agreement between the educational institution and the automotive industry.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the Automotive industry; planning, management, finance, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

- II. **PROGRAM STRUCTURE:** The Advanced Automotive Technology Program provides for 10 Occupational Completion Points (areas of automobile specialization). This structure will allow students who successfully complete specified competencies to exit for employment or continue training.

Competencies established by the Automotive Industry plus those included in the business plan and integration of academic requirements and training in communications, leadership, human relations, employability skills and safe, efficient work practices constitute the program curriculum.

The standard length of this program: 2,250 hours.

All the NATEF tasks are assigned a priority number: P-1, P-2, or P-3. 95% of P-1 tasks will be performed; 80% of P-2 tasks; 50% of P-3 tasks. Please refer to the Task List Information in the NATEF Policies section for additional information on the requirements for instruction on tasks.

Theory instruction and hands-on performance of all the basic tasks will provide initial training for employment in the automotive service field or further training in any or all of the specialty areas. Competency in the tasks will indicate to employers that the graduate is skilled in that area.

Occupational Completion Points may be reached before the end of a program. All outcomes must be completed to receive credit for an Occupational Completion Point (OCP).

1. It is assumed that:
  - \* In all areas, appropriate theory, safety, and support instruction will be required for performing each task;
  - \* The instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks;
  - \* The student has received the necessary training to locate and use current reference and training materials from accepted industry publications.
  
2. It is assumed that:
  - \* All diagnostic and repair tasks described in this document are to be accomplished in accordance with manufacturer's recommended procedures as published.
  
3. It is assumed that:
  - \* Individual training programs being evaluated for certification should have written and detailed performance standards for each task covered and taught in the curriculum;
  - \* Learning progress of students will be monitored and evaluated against these performance standards;
  - \* A system is in place which informs all students of their individual progress through all phases of the training program.
  
4. It is assumed that:
  - \* Individual courses of study will differ across automobile technician training programs;
  - \* Development of appropriate learning delivery systems and tests which monitor student progress will be the responsibility of the individual training program.
  
5. It is assumed that:
  - \* All students will receive instruction in the storage, handling, and use of Hazardous Materials as required in Hazard Communication Title 29 Code of Federal Regulation Part 1910.1200, "Right to Know Law";
  - \* Hazardous and toxic materials will be handled, removed and recycled or disposed of according to federal, state, and local regulations.

- III. **LABORATORY ACTIVITIES:** Shop or laboratory activities are an integral part of the Advanced Automotive Technology Program. These activities provide instruction in the use of automotive service equipment, tools, materials and processes found in the automotive service industry including product specific tools and equipment.
- IV. **SPECIAL NOTES:** The program must be NATEF Master Certified and have a business plan approved by the appropriate industry affiliated organization. Instructors must be ASE Certified in all areas that they teach in addition to being certified in Engine Performance and Electrical/Electronic Systems. ASE Master Technician and Advanced Engine Performance (L1) ASE Certification is preferred. Instructors must meet the specific product certification as specified in the business plan.

Program must meet the equipment and specialty tool requirement as specified in the business plan. Must offer Federally recognized refrigerant-recycling certification training.

SkillsUSA, Inc. is the appropriate Career and Technical Student Organization (CTSO) for providing leadership training and for reinforcing specific career and technical skills. Career and Technical Student Organizations, when provided, shall be an integral part of the career and technical instructional program, and the activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, FAC. Planned and supervised instructional activities must be provided through one or more of the following: (1) directed laboratory experience (2) student projects (3) placement for experience (4) cooperative experience.

Cooperative training should be an integral part of this program. Whenever cooperative training is offered, the following are required for each student: a training plan, signed by the student, teacher, and employer, which includes instructional objectives and a list of on-the-job and in-school learning experiences; a workstation that reflects equipment, skills and tasks that are relevant to the occupation which the student has chosen as a career goal. The student must receive compensation for work performed.

In accordance with Rule 6A-10.040, FAC, the minimum basic skills grade levels required for postsecondary adult vocational students to complete this program are listed at the program level or at the occupational completion points within the program. These grade level numbers correspond to a grade equivalent score obtained on one of the state designated basic skills examinations. The level required for this Postsecondary Adult Vocational Program: Mathematics-10, Language-10, Reading-10. If a student does not meet the basic skills level required for completion from the program, remediation should be provided concurrently through Vocational Preparatory Instruction (VPI) or prior to admission in an Adult Basic Education (ABE) setting.

When a student with a disability is enrolled in a vocational class with modifications to the curriculum framework, the particular

outcomes and student performance standards which the student must master to earn credit must be specified in the student's Individual Educational Plan (IEP). Additional credits may be earned when outcomes and standards are mastered in accordance with the requirements indicated in subsequent IEPs. The job title for which the student is being trained must be designated in the IEP.

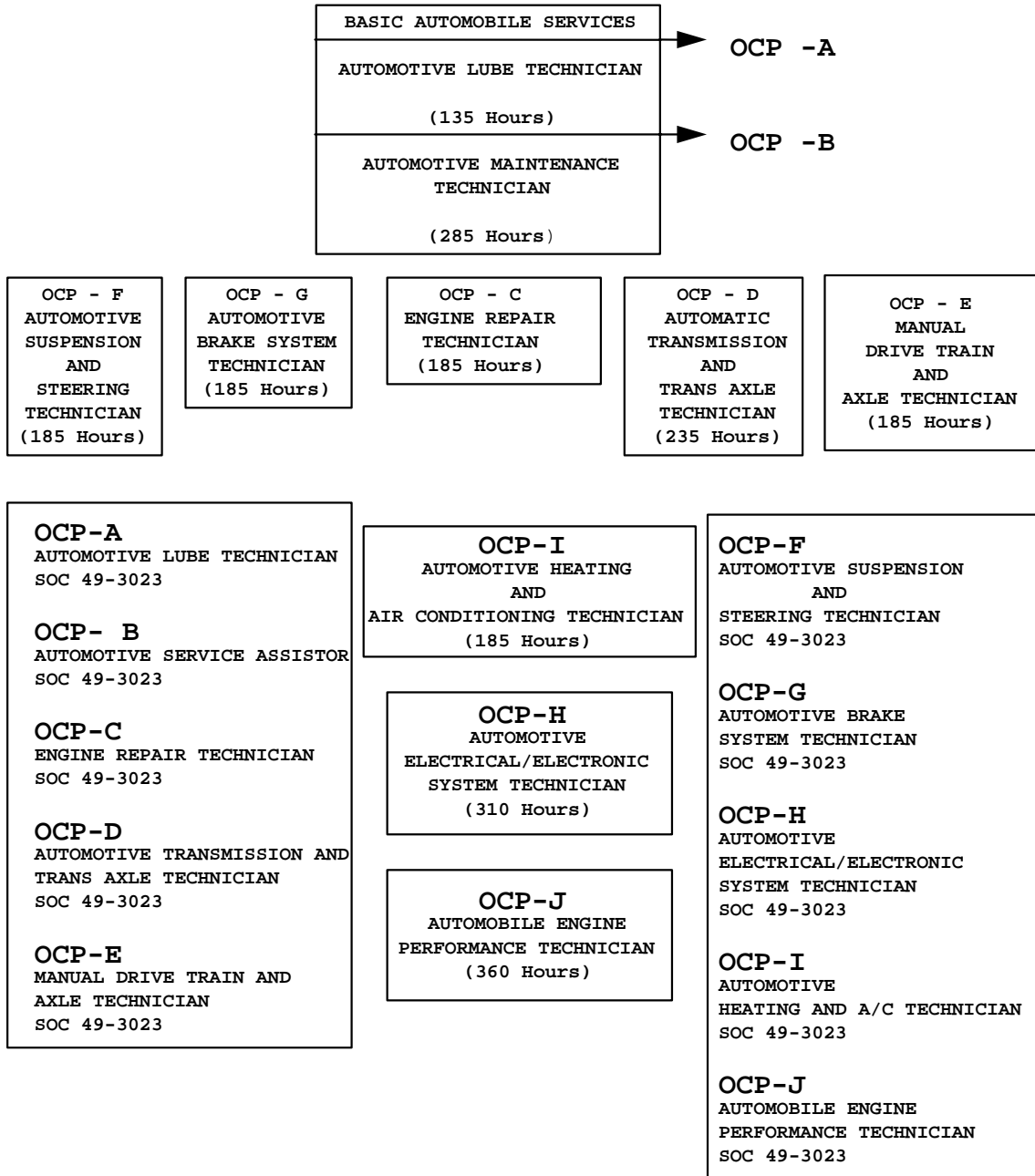
***Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Adult students with disabilities must self-identify and request such services. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.***

To be transferable statewide between institutions, this program must have been reviewed, and a "transfer value" assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific program or course articulation agreements with each other.

SCANS Competencies: Instructional strategies for this program must include methods that require students to identify, organize and use resources appropriately; to work with each other cooperatively and productively; to acquire and use information; to understand social, organizational and technological systems; and to work with a variety of tools and equipment. Instructional strategies must also incorporate the methods to improve students' personal qualities and high-order thinking skills.

The following diagram illustrates the cluster structure:

**ADVANCED AUTOTOMOTIVE TECHNOLOGY**



**Florida Department of Education  
INTENDED OUTCOMES**

	<u>PSAV</u>
<b>Program Number</b>	I470604
CIP Number	0647060406
Grade Level	30, 31
Length	2250 Hours
SOC	49-3023
Certification	AUTO IND @7 G AUTO MECH @7 G

**INTENDED OUTCOMES:** After successfully completing the appropriate course(s) for each occupational completion point of this program, the student will be able to perform the following:

**OCCUPATIONAL COMPLETION POINT - DATA CODE - A (135 Hours)**

AUTOMOTIVE LUBE TECHNICIAN - (SOC 49-3023)

- 01.0 Demonstrate proficiency in the equipment skills and safety regulations relating to the automotive industry. (01.01 - 01.16)
- 02.0 Demonstrate proficiency in appropriate math skills. (02.01 - 02.11)
- 03.0 Demonstrate proficiency in appropriate understanding of basic sciences. (03.01 - 03.04)
- 04.0 Demonstrate proficiency in employability skills. (04.01 - 04.10)
- 05.0 Demonstrate proficiency in appropriate communication skills. (05.01 - 05.04)
- 06.0 Demonstrate proficiency in understanding of entrepreneurship. (06.01 - 06.07)
- 07.0 Demonstrate proficiency in acceptable employee behavior in the automotive industry. (07.01 - 07.08)
- 08.0 Demonstrate proficiency in routine maintenance and consumer services. (08.01 - 08.40)

**OCCUPATIONAL COMPLETION POINT - DATA CODE - B (285 Hours)**

AUTOMOTIVE MAINTENANCE TECHNICIAN - (SOC 49-3023)

- 08.0 Demonstrate proficiency in routine maintenance and consumer services. (08.41 - 08.72)

**OCCUPATIONAL COMPLETION POINT - DATA CODE - C (185 Hours)**

ENGINE REPAIR TECHNICIAN - (SOC 49-3023)

- 09.0 Demonstrate proficiency in engine theory and repairs. (09.01 - 09.66)

**OCCUPATIONAL COMPLETION POINT - DATA CODE - D (235 Hours)**

AUTOMATIC TRANSMISSION AND TRANSAXLE TECHNICIAN -(SOC 49-3023)

- 10.0 Demonstrate proficiency in the operation and servicing of automatic transmission/trans-axle. (10.01 - 10.46)

**OCCUPATIONAL COMPLETION POINT - DATA CODE - E (185 Hours)**

MANUAL DRIVE TRAIN AND AXLE TECHNICIAN - (SOC 49-3023)

11.0 Demonstrate proficiency in the operation and servicing of manual drive trains and axles. (SOC 49-3023)

**OCCUPATIONAL COMPLETION POINT - DATA CODE - F (185 Hours)**

AUTOMOBILE SUSPENSION AND STEERING TECHNICIAN - (SOC 49-3023)

12.0 Demonstrate proficiency in the operation of steering and suspension systems. (12.01 - 12.67)

**OCCUPATIONAL COMPLETION POINT - DATA CODE - G (185 Hours)**

AUTOMOTIVE BRAKE SYSTEM TECHNICIAN - (SOC 49-3023)

13.0 Demonstrate proficiency in the operation and servicing of automotive brake systems. (13.01 - 13.55)

**OCCUPATIONAL COMPLETION POINT - DATA CODE - H (310 Hours)**

AUTOMOTIVE ELECTRICAL/ELECTRONIC SYSTEM TECHNICIAN - (SOC 49-3023)

14.0 Demonstrate proficiency in diagnosing/troubleshooting electrical/electronic components as related to power train. (14.01 - 14.50)

**OCCUPATIONAL COMPLETION POINT - DATA CODE - I (185 Hours)**

AUTOMOTIVE HEATING AND AIR-CONDITIONING TECHNICIAN - (SOC 49-3023)

15.0 Demonstrate proficiency in heating, air conditioning and engine cooling systems. (15.01 - 15.42)

**OCCUPATIONAL COMPLETION POINT - DATA CODE - J (360 Hours)**

AUTOMOTIVE ENGINE PERFORMANCE TECHNICIAN - (SOC 49-3023)

16.0 Demonstrate proficiency in engine performance service. (16.01 - 16.78)

Florida Department of Education  
STUDENT PERFORMANCE STANDARDS

**Program Title:** Advanced Automotive Technology  
**Postsecondary Number:** I470604

**OCCUPATIONAL COMPLETION POINT - A**  
AUTOMOTIVE LUBE TECHNICIAN

- 01.0 DEMONSTRATE PROFICIENCY IN THE EQUIPMENT SKILLS AND SAFETY REGULATIONS RELATING TO THE AUTOMOTIVE INDUSTRY--The student will be able to:
- 01.01 Apply shop safety rules, EPA and OSHA standards.
  - 01.02 Identify and use appropriate emergency first aid procedures.
  - 01.03 Identify, use and maintain hand and power tools properly.
  - 01.04 Identify and practice using appropriate precision measuring tools and torque methods.
  - 01.05 Identify and describe the proper procedure to apply and remove automotive fasteners, to include thread repair.
  - 01.06 Identify and use metric and English measurement skills.
  - 01.07 Use computer and operate keyboard.
  - 01.08 Identify automobiles according to engine location, cylinders, type of drive system, purpose, etc.
  - 01.09 Identify and describe typical automotive lubricants and lubricant properties.
  - 01.10 Interpret the Florida 'Workers Right To Know Law'.
  - 01.11 Identify and describe typical automotive seals and gaskets.
  - 01.12 Identify and use the proper procedures required for cutting tubing and double and ISO flaring.
  - 01.13 Utilize flat rate manuals, service manuals, service bulletins, parts manuals and electronic service information.
  - 01.14 Demonstrate knowledge of the Automotive Service Excellence (ASE) Certification and other applicable certifications.
  - 01.15 Describe and identify supplemental restraint systems (SRS).
  - 01.16 Disable supplemental restraint systems (SRS) in accordance with manufacturers' procedures.
- 02.0 DEMONSTRATE PROFICIENCY IN APPROPRIATE MATH SKILLS--The student will be able to:
- 02.01 Read and interpret measuring devices.
  - 02.02 Solve number word problems.
  - 02.03 Solve percentage problems.
  - 02.04 Operate a calculator.
  - 02.05 Use metric units related to auto industry.
  - 02.06 Convert inches to millimeters and millimeters to inches.
  - 02.07 Solve problems of length, area, volume and weight to include the circumference of a circle, the area of a rectangle, and the volume of a cylinder.
  - 02.08 Measure size within a specified tolerance.
  - 02.09 Add, subtract, multiply and divide using fractions, decimals, and whole numbers.
  - 02.10 Determine the correct purchase price, to include sales tax for a materials list containing a minimum of six items.
  - 02.11 Identify various types of gears and interpret the meaning of a gear ratio number.

- 03.0 DEMONSTRATE PROFICIENCY IN APPROPRIATE UNDERSTANDING OF BASIC SCIENCES--The student will be able to:
- 03.01 Understand molecular action as a result of temperature extremes, chemical reaction, and moisture content.
  - 03.02 Draw conclusions or make inferences from data.
  - 03.03 Identify health related problems which may result from exposure to work related chemicals and hazardous materials, and know the proper precautions required for handling such materials.
  - 03.04 Understand pressure measurement in terms of P.S.I., inches of mercury, and K.P.A.
- 04.0 DEMONSTRATE PROFICIENCY IN EMPLOYABILITY SKILLS--The student will be able to:
- 04.01 Identify employment requirements for an automotive career.
  - 04.02 Identify documents, which may be required when applying for a job.
  - 04.03 Complete a job application form correctly.
  - 04.04 Identify and adopt acceptable work habits.
  - 04.05 Demonstrate acceptable employee health habits; including infection control of blood born pathogens.
  - 04.06 Demonstrate appropriate telephone/communication skills.
  - 04.07 Conduct a job search.
  - 04.08 Demonstrate competence in job interview techniques.
  - 04.09 Identify or demonstrate appropriate responses to criticism from employer, supervisor or other employees.
  - 04.10 Demonstrate knowledge of how to make job changes appropriately.
- 05.0 DEMONSTRATE PROFICIENCY IN APPROPRIATE COMMUNICATION SKILLS--The student will be able to:
- 05.01 Write logical and understandable statements, or phrases, to accurately fill out forms/invoices commonly used in business and industry.
  - 05.02 Read and follow written and oral instructions.
  - 05.03 Answer and ask questions coherently and concisely.
  - 05.04 Read critically by recognizing assumptions and implications and by evaluating ideas.
- 06.0 DEMONSTRATE PROFICIENCY IN UNDERSTANDING OF ENTREPRENEURSHIP--The student will be able to:
- 06.01 Define entrepreneurship.
  - 06.02 Describe the importance of entrepreneurship to the American economy.
  - 06.03 List the advantages and disadvantages of business ownership.
  - 06.04 Identify the risks involved in ownership of business.
  - 06.05 Identify the necessary personal characteristics of a successful entrepreneur.
  - 06.06 Identify the business skills needed to operate a small business efficiently and effectively.
  - 06.07 Identify and apply communication skills used in automotive careers.

- 07.0 DEMONSTRATE PROFICIENCY IN ACCEPTABLE EMPLOYEE BEHAVIOR IN THE AUTOMOTIVE INDUSTRY--The student will be able to:
- 07.01 Explain the effects of chemical/substance abuse.
  - 07.02 Identify principles of stress management.
  - 07.03 Identify and define career opportunities in the automotive service industry.
  - 07.04 Demonstrate acceptable industry dress code.
  - 07.05 Identify and demonstrate proper customer relations skills.
  - 07.06 Identify and define payroll deductions (taxes, insurance, social security) employee benefits and pay systems.
  - 07.07 Identify principles of time management.
  - 07.08 Identify acceptable customer relations.
- 08.0 DEMONSTRATE PROFICIENCY IN THE PROFICIENCY IN ROUTINE MAINTENANCE AND CONSUMER SERVICES AKA Light Line AKA General Service Technician--The student will be able to:
- 08.01 Inspect, test head lamps, tail lamps and stop lamps. Aim headlights.
  - 08.02 Perform oil and filter change.
  - 08.03 Service transmission; perform visual inspection; replace fluids and filters.
  - 08.04 Inspect engine assembly for fuel, oil, coolant, and other leaks.
  - 08.05 Inspect manual and power steering fluid levels and condition.
  - 08.06 Check rear axle drive assembly seals and vents; check lube level.
  - 08.07 Inspect and replace power steering hoses and fittings.
  - 08.08 Lubricate suspension and steering systems.
  - 08.09 Inspect, remove, and replace shock absorbers.
  - 08.10 Remove, inspect, and service front and rear wheel bearings on non-drive axles.
  - 08.11 Inspect tires, diagnose tire wear patterns. check and adjust air pressure.
  - 08.12 Rotate tires according to manufacturer's recommendations, install wheels, torque lug nuts.
  - 08.13 Balance wheel and tire assembly (static and dynamic).
  - 08.14 Dismount, inspect, repair, and remount tire on wheel.
  - 08.15 Check master cylinder for internal and external leaks and proper operation.
  - 08.16 Inspect brake lines and fittings for leaks, dents, kinks, rust, cracks or wear; tighten loose fittings and supports.
  - 08.17 Inspect flexible brake hoses for leaks, kinks, cracks, bulging or wear; tighten loose fittings and supports.
  - 08.18 Select, handle, store, and install brake fluids to proper level.
  - 08.19 Fill master cylinder with recommended fluid and seat pads.
  - 08.20 Inspect, clean, fill, and replace battery.
  - 08.21 Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed.
  - 08.22 Start a vehicle using jumper cables using a battery auxiliary power supply.
  - 08.23 Perform slow/fast battery charge.
  - 08.24 Observe dash warning lamps during bulb check.

- 08.25 Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels and calibration decals).
- 08.26 Practice recommended precautions when handling static sensitive devices.
- 08.27 Inspect and test positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; service or replace as needed.
- 08.28 Perform product specific service procedures.
- 08.29 Reset product specific service indicator.
- 08.30 Demonstrate knowledge of manufacturer policies and procedures.
- 08.31 Identify product specific engine systems.
- 08.32 Identify product specific automatic transmission systems.
- 08.33 Identify product specific manual transmission systems.
- 08.34 Identify product specific electrical & electronic systems.
- 08.35 Identify product specific Heating & A/C systems.
- 08.36 Identify product specific steering & suspension systems.
- 08.37 Identify product specific brake systems.
- 08.38 Identify product specific audio systems.
- 08.39 Identify product specific safety systems.
- 08.40 Identify product specific accessories.

**OCCUPATIONAL COMPLETION POINT - B**

**AUTOMOTIVE MAINTENANCE TECHNICIAN**

- 08.41 Use wiring diagrams of electrical circuit problems.
- 08.42 Check electrical circuits with a test light; determine necessary action.
- 08.43 Check voltage and voltage drop in electrical circuits using a digital multimeter (DMM).
- 08.44 Check current flow in electrical/electronic circuits and components using an ammeter.
- 08.45 Check electrical circuits using jumper wires.
- 08.46 Measure and diagnose the cause(s) of abnormal key-off battery drain.
- 08.47 Inspect and test fusible links, circuit breakers, and fuses; replace as needed.
- 08.48 Perform battery capacity (load, high-rate discharge) test; determine needed service.
- 08.49 Maintain or restore electronic memory functions.
- 08.50 Perform starter current draw and circuit voltage drop test; determine necessary action.
- 08.51 Remove and replace/reinstall starter.
- 08.52 Perform charging system test.
- 08.53 Remove, inspect, and replace/reinstall alternator.
- 08.54 Demonstrate retrieving stored diagnostic trouble codes.
- 08.55 Obtain and interpret digital multimeter (DMM) readings.
- 08.56 Inspect fuel tank and fuel cap; inspect and replace fuel lines, fittings, and hoses.
- 08.57 Replace fuel filters.
- 08.58 Inspect exhaust manifold, exhaust pipes, mufflers, resonators, tail pipes, and heat shields; repair or replace as needed.
- 08.59 Adjust valves on engines with mechanical lifters.
- 08.60 Remove and replace valve cover gaskets (ASE).
- 08.61 Return cores for rebuilt and exchange items.
- 08.62 Inspect passenger restraint system, repair if needed.
- 08.63 Maintain product specific engine systems.
- 08.64 Maintain product specific automatic transmission systems.

- 08.65 Maintain product specific manual transmission systems.
- 08.66 Maintain product specific electrical & electronic systems.
- 08.67 Maintain product specific Heating & A/C systems.
- 08.68 Maintain product specific steering & suspension systems.
- 08.69 Maintain product specific brake systems.
- 08.70 Maintain product specific audio systems.
- 08.71 Maintain product specific safety systems.
- 08.72 Maintain product specific accessories.

**OCCUPATIONAL COMPLETION POINT - C**  
**ENGINE REPAIR TECHNICIAN**

09.0 DEMONSTRATE PROFICIENCY IN ENGINE THEORY AND REPAIR--The student will be able to:

- 09.01 Service product specific engine systems.
- 09.02 Interpret and verify complaint; determine necessary action. P-1
- 09.03 Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. P-2
- 09.04 Listen to engine noises; determine necessary action. P-2
- 09.05 Diagnose the cause of excessive oil consumption, unusual engine exhaust color, odor, and sound; determine necessary action. P-2
- 09.06 Perform engine vacuum tests; determine necessary action. P-1
- 09.07 Perform cylinder power balance tests; determine necessary action. P-1
- 09.08 Perform cylinder compression tests; determine necessary action. P-1
- 09.09 Perform cylinder leakage tests; determine necessary action. P-1
- 09.10 Remove engine (front-wheel drive); prepare for disassembly. P-1
- 09.11 Reinstall engine (front-wheel drive). P-1
- 09.12 Remove engine (rear-wheel drive); prepare for disassembly. P-3
- 09.13 Reinstall engine (rear-wheel drive). P-3

**CYLINDER HEAD AND VALVE TRAIN DIAGNOSIS AND REPAIR**

- 09.14 Remove cylinder head(s); inspect cylinder head(s) for cracks; check gasket surface areas for warpage and leakage; check passage condition. P-2
- 09.15 Install cylinder heads and gaskets; tighten according to manufacturer's specifications and procedures. P-2
- 09.16 Inspect and test valve springs for squareness, pressure, and free height comparison; replace as needed. P-2
- 09.17 Inspect valve spring retainers, locks, and valve grooves. P-2
- 09.18 Replace valve stem seals. P-2
- 09.19 Inspect valve guides for wear; check valve guide height and stem-to-guide clearance; recondition or replace as needed. P-2
- 09.20 Inspect valves; resurface or replace. P-3
- 09.21 Inspect valve seats; resurface or replace. P-3
- 09.22 Check valve face-to-seat contact and valve seat concentricity (run out); service seats and valves as needed. P-3
- 09.23 Check valve spring assembled height and valve stem height; service valve and spring assemblies as needed. P-3
- 09.24 Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); repair or replace. P-2
- 09.25 Inspect hydraulic or mechanical lifters; replace as needed. P-2
- 09.26 Adjust valves (mechanical or hydraulic lifters). P-1
- 09.27 Inspect and replace camshaft drives (including gear wear and backlash, sprocket and chain wear, overhead cam drive sprockets, drive belts, belt tension, and tensioners). P-2
- 09.28 Inspect camshaft for run out; measure journals and lobes for wear. P-3
- 09.29 Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action. P-3
- 09.30 Verify camshaft(s) timing according to manufacturer's specifications and procedure. P-2
- 09.31 Service product specific cam drive systems.
- 09.32 Perform product specific valve adjustments.

## ENGINE BLOCK DIAGNOSIS AND REPAIR

09.33	Inspect and replace pans, covers, gaskets, and seals.	P-3
09.34	Inspect engine block for cracks, passage condition, core and gallery plug condition, and surface warpage; determine needed repairs.	P-3
09.35	Inspect internal and external threads; repair as needed.	P-1
09.36	Remove cylinder wall ridges.	P-3
09.37	Inspect and measure cylinder walls for damage and wear; determine necessary action.	P-2
09.38	Deglaze and clean cylinder walls.	P-2
09.39	Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action.	P-3
09.40	Inspect crankshaft for surface cracks and journal damage; check oil passage condition; measure journal wear; determine necessary action.	P-3
09.41	Inspect and measure main and connecting rod bearings for damage, clearance, and end play; determine necessary action (includes the proper selections of bearings).	P-2
09.42	Identify position and bearing wear patterns that include connecting rod alignment and main bearing bore problems; inspect rod alignment and bearing bore condition.	P-3
09.43	Inspect, measure, service or replace pistons.	P-2
09.44	Inspect, measure, and install piston rings.	P-2
09.45	Inspect, repair or replace crankshaft vibration damper (harmonic balancer).	P-3
09.46	Inspect flywheel or flexplate and ring gear for cracks and wear; measure run out; determine necessary action.	P-3
09.47	Inspect, remove, and replace crankshaft pilot bearing or bushing (as applicable).	P-2
09.48	Reassemble engine components using correct gaskets and sealants.	P-2
09.49	Inspect auxiliary (balance, intermediate, idler, counterbalance or silencer) shaft(s); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time.	P-3

## LUBRICATION AND COOLING SYSTEMS DIAGNOSIS AND REPAIRS

09.50	Prime engine lubrication system.	P-1
09.51	Perform oil pressure tests; determine necessary action.	P-2
09.52	Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; replace as needed.	P-3
09.53	Perform cooling system tests (pressure, combustion leakage, and temperature); determine necessary action.	P-1
09.54	Inspect, replace, and adjust drive belts and pulleys.	P-1
09.55	Inspect and replace engine cooling and heater system hoses.	P-2
09.56	Inspect, test, and replace thermostat and housing.	P-2
09.57	Inspect coolant; drain, flush, and refill cooling system with recommended coolant and bleed air as required.	P-2
09.58	Inspect, test, remove, and replace water pump.	P-2
09.59	Inspect and test radiator, pressure cap, and coolant recovery system; remove and replace radiator.	P-2
09.60	Clean, inspect, and test fan(s) (electrical or mechanical), fan clutch, fan shroud, and air dams.	P-2
09.61	Inspect and test electrical fan control system and circuits.	P-2
09.62	Inspect auxiliary oil coolers; replace as needed.	P-3
09.63	Inspect, test, and replace oil temperature and pressure switches and sensors.	P-2
09.64	Perform oil and filter change.	P-1
09.65	Service product specific water pumps.	P-1

09.66 Service product specific belt drive & tensioner systems.

**OCCUPATIONAL COMPLETION POINT - D**

**AUTOMATIC TRANSMISSION AND TRANSAXLE TECHNICIAN**

10.0 DEMONSTRATE PROFICIENCY IN THE OPERATION AND SERVICING OF AUTOMATIC TRANSMISSION/TRANSAXLE--The student will be able to:

- 10.01 Interpret and verify driver's complaint; verify proper engine operation; determine necessary action. P-1
- 10.02 Diagnose unusual fluid usage, level, and condition problems; determine necessary action. P-1
- 10.03 Perform pressure tests; determine necessary action. P-1
- 10.04 Perform stall tests; determine necessary action. P-2
- 10.05 Perform lock-up converter system tests; determine necessary action. P-2
- 10.06 Diagnose electronic, mechanical, and vacuum control systems; determine necessary action. P-2
- 10.07 Diagnose noise and vibration problems; determine necessary action. P-3

**TRANSMISSION AND TRANSAXLE MAINTENANCE AND ADJUSTMENT**

- 10.08 Inspect, adjust or replace manual shift valve and throttle (TV) linkages or cables and check gear select indicator (as applicable). P-1
- 10.09 Service transmission; perform visual inspection; replace fluids and filters. P-1

**IN-VEHICLE TRANSMISSION AND TRANSAXLE REPAIR**

- 10.10 Inspect, adjust or replace (as applicable) vacuum modulator; inspect and repair or replace lines and hoses. P-3
- 10.11 Inspect, repair, and replace governor assembly. P-3
- 10.12 Inspect and replace external seals and gaskets. P-3
- 10.13 Inspect extension housing; replace bushing and seals. P-3
- 10.14 Inspect, leak test, flush, and replace cooler, lines, and fittings. P-1
- 10.15 Inspect and replace speedometer drive gear, driven gear, vehicle speed sensor (VSS), and retainers. P-3
- 10.16 Inspect, measure, clean, and replace valve body (includes surfaces and bores, springs, valves, sleeves, retainers, brackets, check-balls, screens, spacers, and gaskets); check/adjust valve body bolt torque. P-2
- 10.17 Inspect servo bore, piston, seals, pin, spring, and retainers; repair or replace as needed. P-3
- 10.18 Inspect accumulator bore, piston, seals, spring, and retainer; repair or replace as needed. P-3
- 10.19 Inspect, test, adjust, repair or replace transmission related electrical and electronic components (includes computers, solenoids, sensors, relays, switches, and harnesses). P-2
- 10.20 Inspect, replace, and align power train mounts. P-3
- 10.21 Inspect and replace parking pawl, shaft, spring, and retainer. P-3

**OFF-VEHICLE TRANSMISSION AND TRANSAXLE REPAIR  
(REMOVAL, DISASSEMBLY, AND REINSTALLATION)**

- 10.22 Remove and reinstall transmission and torque converter

- (rear-wheel drive). P-2
- 10.23 Remove and reinstall transmission and torque converter (rear-wheel drive). P-2
- 10.24 Disassemble, clean, and inspect transmission/transaxle. P-1
- 10.25 Assemble transmission/transaxle. P-1

**OIL PUMP AND CONVERTER**

- 10.26 Inspect converter flex plate, attaching parts, pilot and pump drive, and seal areas. P-2
- 10.27 Measure torque converter end play and check for interference check stator clutch. P-2
- 10.28 Inspect, measure, and replace oil pump housings, shafts, vanes, rotors, gears, valves, seals, and bushings. P-3
- 10.29 Check torque converter and transmission cooling system for contamination. P-1

**GEAR TRAIN, SHAFTS, BUSHINGS AND CASE**

- 10.30 Check end play or preload; determine needed service. P-2
- 10.31 Inspect, measure, and replace thrust washers and bearings. P-2
- 10.32 Inspect oil delivery seal rings, ring grooves, and sealing surface areas. P-2
- 10.33 Inspect bushings; replace as needed. P-2
- 10.34 Inspect and measure planetary gear assembly (includes sun, ring gear, thrust washers, planetary gears, and carrier assembly); replace as needed. P-2
- 10.35 Inspect cases, bores, passages, bushings, vents, and mating surfaces; replace as needed. P-2
- 10.36 Inspect transaxle drive, link chains, sprockets, gears, bearings and bushings; replace as needed. P-2
- 10.37 Inspect, measure, repair, adjust or replace transaxle final drive components. P-2
- 10.38 Inspect and reinstall parking pawl, shaft, spring, and retainer; replace as needed. P-3

**FRICITION AND REACTION UNITS**

- 10.39 Inspect clutch drum, piston, check-balls, springs, retainers, seals, and friction and pressure plates; replace as needed. P-2
- 10.40 Measure clutch pack clearance; adjust as needed. P-1
- 10.41 Air test operation of clutch and servo assemblies. P-1
- 10.42 Inspect roller and sprag clutch, races, rollers, sprags, springs, cages, and retainers; replace as needed. P-2
- 10.43 Inspect bands and drums; replace as needed. P-3
- 10.44 Achieve product specific certification requirements for automatic transmission systems.
- 10.45 Achieve product specific certification requirements for automatic transaxle systems.
- 10.46 Achieve product specific certification requirements for computer shifted transmission systems.

**OCCUPATIONAL COMPLETION POINT - E**

**MANUAL DRIVE TRAIN AND AXLE TECHNICIAN**

**11.0 DEMONSTRATE PROFICIENCY IN THE OPERATION AND ASSEMBLY OF MANUAL DRIVE TRANSMISSION/TRANSAXLE--The student will be able to:**

- 11.01 Diagnose clutch noise, binding, slippage, pulsation, and chatter problems; determine necessary action. P-1

11.02	Inspect, adjust or replace clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs.	P-1
11.03	Inspect, adjust, repair or replace hydraulic clutch slave master-cylinders, lines, and hoses.	P-1
11.04	Inspect, adjust or replace release (throw-out) bearing, lever, and pivot.	P-2
11.05	Inspect and replace clutch pressure plate assembly and clutch disc.	P-2
11.06	Inspect, remove or replace crankshaft pilot bearing or bushing (as applicable).	P-2
11.07	Inspect, repair, and service or replace flywheel and ring gear.	P-2
11.08	Inspect engine block, clutch (bell) housing, and transmission case mating surface; determine necessary action.	P-3
11.09	Measure flywheel-to-block run out and crankshaft end play; determine necessary action.	P-3
11.10	Measure clutch (bell) housing bore-to-crankshaft run out and face squareness; determine needed service.	P-3

#### **TRANSMISSION DIAGNOSIS AND REPAIR**

11.11	Diagnose transmission noise, hard shifting, jumping out of gear, and fluid leakage problems; determine necessary action.	P-1
11.12	Inspect, adjust, and replace transmission shift linkages, Brackets, bearings, cables, pivots, and levers.	P-2
11.13	Inspect, replace, and align power train mounts.	P-3
11.14	Inspect and replace transmission gaskets, seals, and sealants; Inspect sealing surfaces.	P-2
11.15	Remove and reinstall transmission.	P-2
11.16	Disassemble, clean, and reassemble transmission components.	P-2
11.17	Inspect, adjust, and reinstall transmission shift cover, forks, grommets, levers, shafts, sleeves, detent mechanisms, interlocks, and springs.	P-2
11.18	Inspect and reinstall input (clutch) shaft and bearings.	P-2
11.19	Inspect and reinstall main shaft, gears, thrust washers, bearings, and retainers.	P-2
11.20	Inspect and reinstall synchronizer hub, sleeve, keys (inserts), springs, and blocking rings.	P-2
11.21	Inspect and reinstall counter (cluster) gear, shaft, bearings, thrust washers, and retainers; check end play; adjust as needed.	P-2
11.22	Inspect and reinstall reverse idler gear, shaft, bearings, thrust washers, and retainers; check end play; adjust as needed.	P-2
11.23	Inspect and replace speedometer drive gear, driven gear, vehicle speed sensor (VSS), and retainers.	P-2
11.24	Inspect, repair, and replace extension housing and transmission case mating surfaces, bores, bushings, and vents.	P-3
11.25	Inspect lubrication devices (oil pump or slingers).	
11.26	Achieve product specific certification for manual transmission systems.	P-3

#### **TRANSAXLE DIAGNOSIS AND REPAIR**

11.27	Diagnose transaxle noise, hard shifting, jumping out of gear, and fluid leakage problem; determine necessary action.	P-1
11.28	Inspect, adjust, and reinstall transaxle shift linkages, brackets, bushings, cables, pivots, and levers.	P-3
11.29	Inspect and reinstall power train mounts.	P-3
11.30	Remove and reinstall transaxle.	P-2
11.31	Inspect and replace transaxle gaskets, seals, and sealants;	

- inspect sealing surfaces. P-2
- 11.32 Remove and replace transaxle final drive. P-3
- 11.33 Disassemble and clean transaxle final drive. P-3
- 11.34 Inspect, adjust, and reinstall transaxle shift cover, forks, levers, grommets, shafts, sleeves, detent mechanism, interlocks, and springs. P-2
- 11.35 Inspect and reinstall input (clutch) shaft and bearings. P-2
- 11.36 Inspect and reinstall output shaft, gears, thrust washers, bearings, and retainers. P-2
- 11.37 Measure end play or preload (shim or spacer selection procedure) on transaxle shafts; adjust as needed. P-2
- 11.38 Inspect and reinstall synchronizer hub, sleeve, keys (inserts), springs, and blocking rings. P-2
- 11.39 Inspect and reinstall reverse idler gear, shaft, bearings, thrust washers, and retainers. P-2
- 11.40 Inspect transaxle case, mating surfaces, bores, bushings, and vents. P-2
- 11.41 Inspect and reinstall speedometer drive gear, driven gear, vehicle speed sensor (VSS), and retainers. P-2
- 11.42 Diagnose differential assembly noise and vibration problems; determine necessary action. P-3
- 11.43 Remove, inspect, measure, adjust, and reinstall differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case assembly. P-2
- 11.44 Inspect lubrication devices (oil pump or slingers). P-3
- 11.45 Achieve product specific certification for manual transaxle systems.

**DRIVE AND HALF SHAFT UNIVERSAL AND CONSTANT-VELOCITY (CV) JOINT DIAGNOSIS AND REPAIR**

- 11.46 Diagnose constant-velocity (CV) joint noise and vibration problems; determine necessary action. P-2
- 11.47 Diagnose universal joint noise and vibration problems; determine necessary action. P-2
- 11.48 Diagnose front wheel drive (FWD) front wheel bearing noise and vibration problems; determine necessary action. P-2
- 11.49 Inspect, service, and replace shafts, yokes, boots, and universal/CV joints. P-2
- 11.50 Inspect, service, and replace shaft center support bearings. P-3
- 11.51 Check and correct shaft balance; measure shaft run out; measure and adjust driveline angles. P-3

**REAR AXLE DIAGNOSIS AND REPAIR; RING AND PINION GEARS AND DIFFERENTIAL CASE ASSEMBLY**

- 11.52 Diagnose noise and vibration problems; determine necessary action. P-2
- 11.53 Diagnose fluid leakage problems; determine necessary action. P-2
- 11.54 Inspect and replace companion flange and pinion seal; measure companion flange run out. P-2
- 11.55 Inspect ring gear and measure run out; determine necessary action. P-2
- 11.56 Remove and inspect drive pinion gear, spacers, sleeves, and bearings. P-2
- 11.57 Measure and adjust drive pinion depth. P-2
- 11.58 Measure and adjust drive pinion bearing preload. P-2
- 11.59 Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup and shim types). P-2
- 11.60 Check ring and pinion tooth contact patterns; adjust as needed. P-2

- 11.61 Disassemble, inspect, measure, and adjust or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case. P-2
- 11.62 Reassemble and reinstall differential case assembly; measure run out; determine necessary action. P-2
- 11.63 Achieve product specific certification for differentials.

**LIMITED SLIP DIFFERENTIAL**

- 11.64 Diagnose noise, slippage, and chatter problems; determine necessary action. P-3
- 11.65 Inspect and flush differential housing; refill with correct lubricant. P-3
- 11.66 Inspect and reinstall clutch (cone or plate) components. P-3
- 11.67 Measure rotating torque; determine necessary action P-3

**AXLE SHAFT**

- 11.68 Diagnose rear axle shafts, bearings, and seals for noise, vibration, and fluid leakage problems; determine necessary action. P-2
- 11.69 Inspect and replace rear axle shaft wheel studs. P-3
- 11.70 Remove and replace rear axle shafts. P-2
- 11.71 Inspect and replace rear axle shaft seals, bearings, and retainers. P-2
- 11.72 Measure rear axle flange run out and shaft end play; determine necessary action. P-2

**FOUR-WHEEL DRIVE/ALL-WHEEL DRIVE COMPONENT DIAGNOSIS AND REPAIR**

- 11.73 Diagnose noise, vibration, and unusual steering problems; determine necessary action. P-2
- 11.74 Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets. P-2
- 11.75 Remove and reinstall transfer case. P-3
- 11.76 Disassemble, service, and reassemble transfer case and components. P-3
- 11.77 Inspect, service, and replace front-wheel bearings and locking hubs. P-2
- 11.78 Check drive assembly seals and vents; check lube level. P-2
- 11.79 Inspect viscous coupling assembly. P-3
- 11.80 Achieve product specific certification for all wheel drive systems.

**OCCUPATIONAL COMPLETION POINT - F**

**AUTOMOTIVE SUSPENSION AND STEERING TECHNICIAN**

**12.0 DEMONSTRATE PROFICIENCY IN THE OPERATION OF STEERING AND SUSPENSION SYSTEMS--**  
The student will be able to:

- 12.01 Disable supplemental restraint system (SRS) in accordance with manufacturer's procedures. P-1
- 12.02 Diagnose steering column noises, looseness, and binding problems (including tilt mechanisms); determine necessary action. P-3
- 12.03 Diagnose power non-rack and pinion steering gear binding, uneven turning effort, looseness, hard steering, and fluid leakage problems; determine necessary action. P-3
- 12.04 Diagnose power rack and pinion steering gear vibration, looseness, and hard steering problems; determine necessary action. P-2

- 12.05 Inspect and replace steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel. P-2
- 12.06 Adjust manual or power non-rack and pinion worm bearing preload and sector lash. P-3
- 12.07 Remove and replace manual or power rack and pinion steering gear; inspect mounting bushings and brackets. P-2
- 12.08 Disassemble, inspect, repair, and reassemble rack and pinion steering gear. P-3
- 12.09 Adjust manual or power rack and pinion steering gear. P-3
- 12.10 Inspect and replace manual or power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots. P-2
- 12.11 Inspect manual and power steering fluid levels and condition. P-1
- 12.12 Flush, fill, and bleed power steering system. P-2
- 12.13 Diagnose power steering fluid leakage; determine necessary action. P-2
- 12.14 Inspect, replace, and adjust power steering pump belt. P-1
- 12.15 Remove, inspect, and replace power steering pump, pump mounts, pump seals, and gaskets. P-3
- 12.16 Remove, inspect, and replace power steering pump pulley; check alignment. P-3
- 12.17 Perform power steering system pressure test; determine needed repairs. P-2
- 12.18 Inspect and replace power steering hoses and fittings. P-2
- 12.19 Inspect and replace pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper. P-3
- 12.20 Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps. P-2
- 12.21 Diagnose, inspect, adjust, repair or replace components of electronically-controlled steering systems. P-3
- 12.22 Diagnose, inspect, repair or replace components of variable-assist steering systems. P-3
- 12.23 Achieve product specific certification for power assisted steering systems.
- 12.24 Achieve product specific certification for variable assisted steering systems.

**SUSPENSION SYSTEMS DIAGNOSIS AND REPAIR; FRONT SUSPENSIONS**

- 12.25 Diagnose short and long arm suspension system noises, body sway, and uneven riding height problems; determine necessary action. P-2
- 12.26 Diagnose MacPherson strut suspension system noises body sway, and uneven riding height problems; determine necessary action. P-2
- 12.27 Remove, inspect, and replace upper and lower control arms, bushings, shafts, and rebound bumpers. P-2
- 12.28 Remove, inspect, replace, and adjust strut (compression/tension) rods and bushings. P-2
- 12.29 Remove, inspect, and replace upper and lower ball joints on short and long arm suspension systems. P-2
- 12.30 Remove, inspect, and replace steering knuckle assemblies. P-2
- 12.31 Remove, inspect, and replace short and long arm suspension system coil springs and spring insulators. P-2
- 12.32 Remove, inspect, replace, and adjust suspension system torsion bars; inspect mounts. P-3
- 12.33 Remove, inspect and replace stabilizer bar bushings, brackets, and links. P-3
- 12.34 Remove, inspect ,and replace ball joints on MacPherson strut suspension systems. P-2
- 12.35 Remove, inspect, and replace MacPherson strut cartridge or assembly, strut coil spring, insulators, and upper strut

- bearing mount. P-1
- 12.36 Lubricate suspension and steering systems. P-2
- 12.37 Service product specific suspension systems.

**REAR SUSPENSIONS**

- 12.38 Remove, inspect, and replace coil springs and spring insulators. P-2
- 12.39 Remove, inspect, and replace transverse links, control arms, bushings, and mounts. P-2
- 12.40 Remove, inspect, and replace leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts. P-3
- 12.41 Remove, inspect, and replace MacPherson strut cartridge or assembly, strut coil spring, and insulators (silencers). P-2
- 12.42 Service product specific suspension systems.

**MISCELLANEOUS SERVICE**

- 12.43 Inspect, remove, and replace shock absorbers. P-2
- 12.44 Remove, inspect, and service or replace front and rear wheel bearings. P-1
- 12.45 Diagnose, inspect, adjust, repair or replace components of electronically-controlled suspension systems. P-3
- 12.46 Service product specific ride height control systems.

**WHEEL ALIGNMENT DIAGNOSIS, ADJUSTMENT, AND REPAIR**

- 12.47 Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return problems; determine necessary action. P-1
- 12.48 Measure vehicle riding height; determine necessary action. P-2
- 12.49 Check and adjust front and rear wheel camber; determine needed repairs. P-2
- 12.50 Check and adjust caster; determine necessary action. P-2
- 12.51 Check and adjust front wheel toe; adjust as needed. P-2
- 12.52 Center steering wheel. P-2
- 12.53 Check toe-out-on-turns (turning radius); determine needed repairs. P-2
- 12.54 Check SAI (steering axis inclination) and included angle; determine necessary action. P-2
- 12.55 Check and adjust rear wheel toe. P-2
- 12.56 Check rear wheel thrust angle; determine necessary action. P-2
- 12.57 Check for front wheel setback; determine necessary action. P-2
- 12.58 Check front cradle (subframe) alignment; determine needed repairs. P-3

**WHEEL AND TIRE DIAGNOSIS AND REPAIR**

- 12.59 Diagnose tire wear patterns; determine necessary action. P-1
- 12.60 Inspect tires; check and adjust air pressure. P-1
- 12.61 Diagnose wheel/tire vibration, shimmy, and noise problems; determine necessary action. P-2
- 12.62 Rotate tires according to manufacturer's recommendations. P-1
- 12.63 Measure wheel, tire, axle, and hub run out; determine needed repairs. P-2
- 12.64 Diagnose tire pull (lead) problem; determine corrective actions. P-2
- 12.65 Balance wheel and tire assembly (static and dynamic). P-1
- 12.66 Dismount, inspect, repair, and remount tire on wheel. P-2
- 12.67 Reinstall wheel; torque lug nuts. P-1

**OCCUPATIONAL COMPLETION POINT - G**  
**AUTOMOTIVE BRAKE TECHNICIAN**

**13.0 DEMONSTRATE PROFICIENCY IN THE OPERATION AND SERVICING OF AUTOMOTIVE BRAKE SYSTEM--The student will be able to:**

- |   |     |
|---|-----|
| 13.01 Measure and adjust pedal pushrod length and pedal height.   | P-3 |
| 13.02 Check master cylinder for internal and external leaks and proper operation; determine necessary action.                 | P-2 |
| 13.03 Remove, bench bleed, and replace master cylinder.   | P-2 |
| 13.04 Diagnose poor stopping, pulling or dragging caused by problems in the hydraulic system; determine necessary action.     | P-1 |
| 13.05 Inspect brake lines and fittings for leaks, dents, kinks, rust, cracks or wear; tighten loose fittings and supports.    | P-2 |
| 13.06 Inspect flexible brake hoses for leaks, kinks, cracks, bulging or wear; tighten loose fittings and supports.            | P-2 |
| 13.07 Fabricate and install brake lines (double flare and ISO types); replace hoses, fittings, and supports as needed.        | P-2 |
| 13.08 Select, handle, store, and install brake fluids to proper level.  | P-1 |
| 13.09 Inspect, test, and replace metering (hold-off), proportioning (balance), pressure differential, and combination valves. | P-2 |
| 13.10 Inspect, test, replace, and adjust height (load) sensing proportioning valve.   | P-3 |
| 13.11 Inspect, test, and replace components of brake warning light system.  | P-2 |
| 13.12 Bleed (manual, pressure, vacuum or surge) brake system; flush hydraulic system.   | P-1 |

**DRUM BRAKE DIAGNOSIS AND REPAIR**

- |   |     |
|---|-----|
| 13.13 Diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation problems; determine necessary action.   | P-1 |
| 13.14 Remove, clean (using proper safety procedures), inspect, and measure brake drums; service or replace as needed.   | P-1 |
| 13.15 Mount brake drum on lathe machine braking surface.  | P-2 |
| 13.16 Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble. | P-2 |
| 13.17 Remove and reinstall wheel cylinders.   | P-2 |
| 13.18 Pre-adjust brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings.   | P-2 |
| 13.19 Reinstall wheel, torque lug nuts, and make final checks and adjustments.  | P-1 |

**DISC BRAKE DIAGNOSIS AND REPAIR**

- |   |     |
|---|-----|
| 13.20 Diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation caused problems; determine necessary action.                | P-1 |
| 13.21 Remove caliper assembly from mountings; clean and inspect for leaks and damage to caliper housing.  | P-2 |
| 13.22 Clean and inspect caliper mounting and slides for wear and damage.  | P-2 |
| 13.23 Remove, clean, and inspect pads and retaining hardware; determine needed service.   | P-2 |
| 13.24 Disassemble and clean caliper assembly; inspect parts for wear, rust, scoring, and damage; replace seal, boot, and damaged or worn parts. | P-2 |

- 13.25 Reassemble, lubricate, and reinstall caliper, pads, and related hardware. P-2
- 13.26 Clean, inspect, and measure rotor with a dial indicator and a micrometer; follow manufacturer's recommendations in determining need to machine or replace. P-1
- 13.27 Refinish rotor according to manufacturer's recommendations. P-2
- 13.28 Adjust calipers with integrated parking brake system. P-3
- 13.29 Fill master cylinder with recommended fluid and seat pads; inspect caliper for leaks. P-1
- 13.30 Reinstall wheel, torque lug nuts, and make final checks and adjustments. P-1
- 13.31 Remove and replace rotor. P-2

**POWER ASSIST UNITS DIAGNOSIS AND REPAIR**

- 13.32 Test pedal free travel with and without engine running; check power assist operation. P-2
- 13.33 Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster. P-2
- 13.34 Inspect the vacuum-type power booster unit for vacuum leaks; inspect the check valve for proper operation; repair or replace parts as needed. P-2

**MISCELLANEOUS (WHEEL BEARINGS, PARKING BRAKES, ELECTRICAL, ETC.) DIAGNOSIS AND REPAIR**

- 13.35 Diagnose wheel bearing noises, wheel shimmy, and vibration problems; determine necessary action. P-1
- 13.36 Remove, clean, inspect, repack, and reinstall wheel bearings and replace seals; reinstall hub and adjust wheel bearings. P-1
- 13.37 Check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, and replace as needed. P-2
- 13.38 Check parking brake operation; adjust as needed. P-1
- 13.39 Check operation of parking brake indicator light system. P-2
- 13.40 Check operation of brake stop light system; adjust and service as needed. P-1
- 13.41 Replace wheel bearing and race. P-1

**ANTI-LOCK BRAKE SYSTEM**

- 13.42 Inspect, test, and service anti-lock brake system (ABS) hydraulic, electrical, and mechanical components. P-2
- 13.43 Diagnose poor stopping, wheel lock-up, abnormal pedal feel or pulsation, and noise problems caused by the anti-lock brake system (ABS); determine necessary action. P-2
- 13.44 Observe anti-lock brake system (ABS) warning light(s) at startup; determine if further diagnosis is needed. P-2
- 13.45 Diagnose anti-lock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determine necessary action. P-2
- 13.46 Depressurize high pressure components of the anti-lock brake system (ABS) following manufacturer's recommended safety procedures. P-2
- 13.47 Fill the anti-lock brake system (ABS) master cylinder with recommended fluid following manufacturer's procedures; inspect system for leaks. P-2
- 13.48 Bleed the anti-lock brake system's (ABS) front and rear hydraulic circuits following manufacturer's procedures. P-2
- 13.49 Perform a fluid pressure (hydraulic boost) diagnosis on the high pressure anti-lock brake system (ABS); determine

- necessary action. P-2
- 13.50 Remove and install anti-lock brake system (ABS) electrical/electronic/hydraulic components following manufacturer's procedures and specifications. P-3
- 13.51 Service, test, and adjust anti-lock brake system (ABS) speed sensors following manufacturer's recommended procedures. P-2
- 13.52 Diagnose anti-lock brake system (ABS) braking problems caused by vehicle modifications (tire size, curb height, final drive ratio, etc.). P-3
- 13.53 Achieve product specific certification requirements for anti-lock brake systems.
- 13.54 Service product specific anti-lock brake systems
- 13.55 Service product specific traction control systems.

**OCCUPATIONAL COMPLETION POINT - H**

**AUTOMOTIVE ELECTRICAL/ELECTRONIC SYSTEM TECHNICIAN**

**14.0 DEMONSTRATE PROFICIENCY IN DIAGNOSING/TROUBLESHOOTING ELECTRICAL/ELECTRONIC RELATED COMPONENTS--The student will be able to:**

- 14.01 Use wiring diagrams during diagnosis of electrical circuit problems. P-1
- 14.02 Check electrical circuits with a test light; determine necessary action. P-2
- 14.03 Check voltage and voltage drop in electrical/electronic circuits using a digital multimeter (DMM); determine needed repairs. P-1
- 14.04 Check current flow in electrical/electronic circuits and components using an ammeter; determine necessary action. P-1
- 14.05 Check electrical circuits using jumper wires; determine necessary action. P-2
- 14.06 Find shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action. P-1
- 14.07 Measure and diagnose the cause(s) of abnormal key-off battery drain; determine necessary action. P-1
- 14.08 Inspect and test fusible links, circuit breakers, and fuses; replace as needed. P-1
- 14.09 Inspect and test switches, connectors, relays, and wires of electrical/electronic circuits; repair or replace as needed. P-1

**BATTERY DIAGNOSIS AND SERVICE**

- 14.10 Perform battery state-of-charge test; determine needed service. P-1
- 14.11 Perform battery capacity (load, high-rate discharge) test; determine needed service. P-1
- 14.12 Maintain or restore electronic memory functions. P-2
- 14.13 Inspect, clean, fill, and replace battery. P-2
- 14.14 Perform slow/fast battery charge. P-2
- 14.15 Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed. P-1
- 14.16 Start a vehicle using jumper cables and a battery or auxiliary power supply. P-1

**STARTING SYSTEM DIAGNOSIS AND REPAIR**

- 14.17 Perform starter current draw and circuit voltage drop test; determine necessary action P-1
- 14.18 Inspect and test starter relays and solenoids; replace as needed. P-2
- 14.19 Remove and replace/reinstall starter. P-2

- 14.20 Perform starter bench tests; determine necessary action. P-2
- 14.21 Inspect, test, and repair or replace switches, connectors, and wires of starter control circuits. P-2
- 14.22 Disassemble, clean, inspect, and test starter components; replace as needed. P-3

**CHARGING SYSTEM DIAGNOSIS AND REPAIR**

- 14.23 Diagnose charging system problems that cause an undercharge, a no-charge or an overcharge condition. P-1
- 14.24 Inspect and adjust alternator drive belts; replace as needed. P-1
- 14.25 Inspect and test voltage regulator; replace as needed. P-2
- 14.26 Remove, inspect, and replace/reinstall alternator. P-2
- 14.27 Disassemble, clean, inspect, and test alternator components; replace as needed. P-3
- 14.28 Perform charging circuit voltage drop tests; determine needed repairs. P-2

**LIGHTING SYSTEMS DIAGNOSIS AND REPAIR**

- 14.29 Diagnose brighter than normal, intermittent, dim or no light operation. P-2
- 14.30 Inspect, replace, and aim headlights and bulbs. P-2
- 14.31 Inspect and diagnose incorrect turn signal or hazard light operation; repair or replace as needed. P-2

**GAUGES, WARNING DEVICES, AND DRIVER INFORMATION SYSTEMS DIAGNOSIS AND REPAIR**

- 14.32 Diagnose intermediate, high, low or no gauge readings. P-2
- 14.33 Test gauge circuit voltage regulators (limiters); replace as needed. P-3
- 14.34 Inspect and test gauges and gauge sending units; replace as needed. P-2
- 14.35 Inspect and test connectors, wires, and printed circuit boards of gauge circuits; repair or replace as needed. P-3
- 14.36 Diagnose incorrect operation of warning devices and other driver information systems. P-2
- 14.37 Diagnose intermediate, high, low or no readings on electronic instrument clusters. P-3
- 14.38 Inspect and test sensors, sending units, connectors, and wires of electronic instrument circuits; repair or replace as needed. P-3

**HORN AND WIPER/WASHER DIAGNOSIS AND REPAIR**

- 14.39 Diagnose incorrect horn operation; repair as needed. P-3
- 14.40 Diagnose incorrect wiper operation; diagnose wiper speed control and park problems; repair as needed. P-3
- 14.41 Diagnose incorrect windshield washer operation; repair as needed. P-3

**ACCESSORIES DIAGNOSIS AND REPAIR**

- 14.42 Diagnose incorrect operation of motor-driven accessory circuits; repair as needed. P-2
- 14.43 Diagnose incorrect heated glass operation; repair as needed. P-3
- 14.44 Diagnose incorrect electric door and hatch/trunk lock operation; repair as needed. P-3
- 14.45 Diagnose incorrect operation of cruise control systems; repair as needed. P-3
- 14.46 Diagnose supplemental restraint system (SRS) problems; repair

- as needed. (NOTE: Follow manufacturer's safety procedures to prevent accidental deployment.) P-3
- 14.47 Diagnose radio static and weak, intermittent, or no radio reception. P-3
- 14.48 Achieve product specific certification requirements for electrical/electronic systems.
- 14.49 Service and repair product specific electrical/electronic systems.
- 14.50 Perform product specific diagnostic procedures.

**OCCUPATIONAL COMPLETION POINT - I**

**AUTOMOTIVE HEATING AND AIR-CONDITIONING TECHNICIAN**

**15.0 DEMONSTRATE PROFICIENCY IN HEATING, AIR CONDITIONING AND ENGINE COOLING SYSTEMS--The student will be able to:**

- 15.01 Diagnose unusual operating noises in the A/C system; determine necessary action. P-2
- 15.02 Conduct a performance test of the A/C system; determine needed repairs. P-2
- 15.03 Leak test a/c system; determine necessary action. P-2
- 15.04 Inspect the condition of discharged oil. P-2
- 15.05 Select oil type; measure and add oil to the A/C system as needed. P-2

**REFRIGERATION SYSTEM COMPONENT DIAGNOSIS AND REPAIR  
COMPRESSOR AND CLUTCH**

- 15.06 Diagnose A/C system problems that cause the protection devices (pressure, thermal, and PCM) to interrupt system operation; determine necessary action. P-2
- 15.07 Inspect A/C compressor drive belts; replace and adjust as needed. P-2
- 15.08 Inspect, test, and replace A/C compressor clutch components or assembly. P-2
- 15.09 Remove and replace A/C compressor and mountings. P-2
- 15.10 Inspect and replace A/C compressor shaft seal assembly(ies). P-2

**EVAPORATOR, RECEIVER/DRIER, CONDENSER, ETC.**

- 15.11 Diagnose A/C system problems caused by too much moisture in the refrigerant; determine necessary action. P-3
- 15.12 Install A/C system filter. P-3
- 15.13 Remove and inspect A/C system mufflers, hoses, lines, fittings, o-rings, seals, and service valves; replace as needed. P-2
- 15.14 Inspect A/C condenser for air flow restrictions; service as required. P-3
- 15.15 Inspect receiver/drier or accumulator/drier; replace as needed. P-2
- 15.16 Inspect and test expansion valve or orifice (expansion) tube; replace as needed. P-2
- 15.17 Inspect evaporator housing water drain; repair as needed. P-3

**HEATING AND ENGINE COOLING SYSTEMS DIAGNOSIS AND REPAIR**

- 15.18 Diagnose temperature control problems in the heater/ventilation system; determine necessary action. P-2
- 15.19 Perform cooling system, cap, and recovery system tests (pressure, combustion leakage, and temperature); determine necessary action. P-1
- 15.20 Inspect engine cooling and heater system hoses and belts; replace as needed. P-1
- 15.21 Inspect, test, and replace thermostat and housing. P-1
- 15.22 Determine coolant condition; drain and recover. P-1
- 15.23 Flush system and refill with recommended coolant; bleed system. P-1

- 15.24 Clean, inspect, and test fan, fan clutch (electrical and mechanical), fan shroud, and air dams; replace as needed. P-2
- 15.25 Inspect and test heater control valve(s); replace as needed. P-2

**OPERATING SYSTEMS AND RELATED CONTROLS DIAGNOSIS AND REPAIRS**

- 15.26 Diagnose failures in the electrical controls of heating and A/C systems; determine necessary action. P-2
- 15.27 Inspect and test A/C-heater blower, motors, resistors, switches, relays, wiring, and protection devices; repair as needed. P-2
- 15.28 Test A/C compressor load cut-off systems; determine needed repairs. P-3

**VACUUM/MECHANICAL**

- 15.29 Diagnose failure in the vacuum and mechanical controls of the heating and A/C system; determine necessary action. P-2
- 15.30 Inspect and test A/C-heater control panel assembly; replace as needed. P-3
- 15.31 Inspect and test A/C-heater control cables and linkages adjust or replace as needed. P-3
- 15.32 Inspect and test A/C-heater vacuum control switches, hoses, diaphragms(motor), vacuum reservoir, check valve, and restrictors; replace as needed. P-3
- 15.33 Inspect and test A/C-heater ducts, doors, hoses, and outlets; replace as needed. P-3

**AUTOMATIC AND SEMI-AUTOMATIC TEMPERATURE CONTROLS**

- 15.34 Check operation of automatic and semi-automatic heating, ventilation, and air-conditioning (HVAC) control systems; determine necessary action. P-3

**REFRIGERANT RECOVERY, RECYCLING, AND HANDLING**

- 15.35 Verify correct operation and maintenance of refrigerant handling equipment. P-1
- 15.36 Identify and recover A/C system refrigerant. P-1
- 15.37 Recycle refrigerant. P-1
- 15.38 Label and store refrigerant. P-1
- 15.39 Test recycled refrigerant for non-condensable gases. P-1
- 15.40 Evaluate and charge A/C system. P-1
- 15.41 Achieve product specific certification requirements for climate control systems.
- 15.42 Service product specific climate control systems.

**OCCUPATIONAL COMPLETION POINT - J**

**AUTOMOTIVE ENGINE PERFORMANCE TECHNICIAN**

16.0 DEMONSTRATE PROFICIENCY IN ENGINE PERFORMANCE SERVICES--The student will be able to:

- 16.01 Interpret and verify complaint; determine necessary action. P-1
- 16.02 Demonstrate proficiency in use of computer-based information systems.
- 16.03 Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. P-2
- 16.04 Diagnose unusual engine noise or vibration problems; determine necessary action. P-2
- 16.05 Diagnose unusual exhaust color, odor, and sound; determine needed

- action. P-2
- 16.06 Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action. P-1
- 16.07 Perform cylinder power balance test; determine needed action. P-1
- 16.08 Perform cylinder compression test; determine needed action. P-1
- 16.09 Perform cylinder leakage test; determine needed action. P-1
- 16.10 Diagnose engine mechanical, electrical, electronic, fuel, and ignition problems with an oscilloscope and engine diagnostic equipment; determine needed action. P-1
- 16.11 Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test and obtain exhaust readings; interpret readings and determine needed action. P-1

#### **COMPUTERIZED ENGINE CONTROLS DIAGNOSIS AND REPAIR**

- 16.12 Diagnose emissions or driveability problems resulting from of computerized engine controls with no diagnostic trouble codes stored; determine necessary action. P-2
- 16.13 Retrieve and record stored diagnostic trouble codes. P-1
- 16.14 Diagnose the causes of emissions or driveability problems resulting from failure of computerized engine controls with stored diagnostic trouble codes. P-2
- 16.15 Inspect, test, adjust, and replace computerized engine control system sensors, powertrain control module (PCM), actuators, and circuits. P-2
- 16.16 Obtain and interpret digital multimeter (DMM) readings. P-1
- 16.17 Access and use electronic service information (ESI). P-3
- 16.18 Locate and interpret vehicle and major component identification numbers(VIN, vehicle certification labels and calibration decals). P-1
- 16.19 Inspect and test power and ground circuits and connections; service or replace as needed. P-1
- 16.20 Practice recommended precautions when handling static sensitive devices. P-2
- 16.21 Diagnose driveability and emissions problems resulting from failures of interrelated systems (cruise control, security alarms, torque controls, suspension controls, traction controls, torque management, A/C, automatic transmissions, and similar systems); determine necessary action. P-3
- 16.22 Achieve product specific certification requirements for diagnostic scanner.
- 16.23 Achieve product specific certification requirements for PROM reprogramming systems.
- 16.24 Perform product specific OBD II drive cycle diagnostic tests.

#### **IGNITION SYSTEM DIAGNOSIS AND REPAIR**

- 16.25 Diagnose no-starting, driveability, and emissions problems on vehicles with electronic ignition (distributorless) systems; determine necessary action. P-1
- 16.26 Diagnose no-starting, driveability, and emissions problems on vehicles with distributor ignition (DI) systems; determine needed repairs. P-1
- 16.27 Inspect and test ignition primary circuit wiring and components; repair or replace as needed. P-2
- 16.28 Inspect and test distributor; service as needed.
- 16.29 Inspect and test ignition system secondary circuit wiring and components; replace as needed. P-2
- 16.30 Inspect and test ignition coil(s); replace as needed. P-2
- 16.31 Check and adjust (where applicable) ignition system timing

- and timing advance/retard. P-1
- 16.32 Inspect and test ignition wiring harness and connectors; replace as needed. P-2
- 16.33 Inspect and test ignition system pick-up sensor or triggering devices; replace as needed. P-2
- 16.34 Inspect and test ignition control module; replace as needed. P-2
- 16.35 Achieve product specific certification requirements for specific ignition systems. P-2
- 16.36 Service product specific ignition systems.

**FUEL, AIR INDUCTION, AND EXHAUST SYSTEMS DIAGNOSIS AND REPAIR**

- 16.37 Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with carburetor-type fuel systems; determine needed action. P-3
- 16.38 Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with injection-type fuel systems; determine needed action. P-1
- 16.39 Inspect fuel tank and fuel cap; inspect and replace fuel lines, fittings, and hoses. P-2
- 16.40 Check fuel for contaminants and quality. P-2
- 16.41 Inspect and test mechanical and electrical fuel pumps and pump control systems; replace as needed. P-2
- 16.42 Replace fuel filters. P-1
- 16.43 Inspect and test fuel pressure regulation system and components. P-2
- 16.44 Inspect and test cold enrichment system components; adjust or replace as needed. P-2
- 16.45 Remove, clean, and reinstall throttle body; adjust related linkages P-2
- 16.46 Inspect and test fuel injectors; clean and replace. P-2
- 16.47 Inspect throttle body mounting plates, air induction and filtration system, intake manifold, and gaskets; clean or replace as needed. P-2
- 16.48 Check/adjust idle speed and fuel mixture where applicable. P-2
- 16.49 Remove, inspect, and test vacuum and electrical components and connections of fuel system; repair or replace as needed. P-2
- 16.50 Inspect exhaust manifold, exhaust pipes, mufflers, resonators, tail pipes, and heat shields; repair or replace as needed. P-2
- 16.51 Perform exhaust system back-pressure test; determine needed action.
- 16.52 Test the operation of turbocharger/supercharger systems; determine needed action. P-3
- 16.53 Remove, clean, inspect, and repair or replace turbocharger /supercharger system components. P-3
- 16.54 Identify the causes of turbocharger/supercharger failure; determine needed action. P-3
- 16.55 Achieve product specific certification requirements for fuel injection systems.
- 16.56 Service product specific fuel injection systems.

**EMISSIONS CONTROL SYSTEMS DIAGNOSIS AND REPAIR**

**POSITIVE CRANKCASE VENTILATION**

- 16.57 Diagnose oil leaks, emissions, and driveability problems resulting from failure of the positive crankcase ventilation (PCV)system. P-1
- 16.58 Inspect and test positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; service or replace as needed. P-2

#### **EXHAUST GAS RECIRCULATION**

- 16.59 Diagnose emissions and driveability problems caused by failure of the exhaust gas recirculation (EGR) system. P-1
- 16.60 Inspect and test valve, valve manifold, and exhaust passages of exhaust gas recirculation (EGR) systems; service or replace as needed. P-2
- 16.61 Inspect and test vacuum/pressure controls, filters, and hoses of exhaust gas recirculation (EGR) systems; service or replace as needed. P-2
- 16.62 Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; repair or replace as needed. P-2

#### **EXHAUST GAS TREATMENT**

- 16.63 Diagnose emissions and driveability problems resulting from failure of the secondary air injection and catalytic converter systems. P-2
- 16.64 Inspect and test mechanical components of secondary air injection systems; service or replace as needed. P-2
- 16.65 Inspect and test electrical/electronically-operated components and circuits of air injection systems; replace as needed. P-2
- 16.66 Inspect and test components of catalytic converter systems; replace as needed. P-2

#### **INTAKE AIR TEMPERATURE CONTROLS**

- 16.67 Diagnose emissions and driveability problems resulting from failure of the intake air temperature control systems. P-3
- 16.68 Inspect and test components of intake air temperature control systems; replace as needed. P-3

#### **EARLY FUEL EVAPORATION (INTAKE MANIFOLD TEMPERATURE) CONTROLS**

- 16.69 Diagnose emissions and driveability problems resulting from failure of early fuel evaporation control systems. P-3
- 16.70 Inspect and test components of early fuel evaporation control systems; service or replace as needed. P-3

#### **EVAPORATIVE EMISSIONS CONTROLS**

- 16.71 Diagnose emissions and driveability problems resulting from failure of evaporative emissions control system. P-2
- 16.72 Inspect and test components and hoses of evaporative emissions control system; replace as needed. P-2

#### **ENGINE RELATED SERVICE**

- 16.73 Adjust valves on engines with mechanical or hydraulic lifters P-1
- 16.74 Verify correct camshaft timing; determine needed action. P-1
- 16.75 Verify engine operating temperature; determine needed action. P-1
- 16.76 Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; service or replace as needed. P-1
- 16.77 Inspect and test thermostat, by-pass, and housing; replace as needed. P-1
- 16.78 Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; service or replace as needed. P-2

