

**GREAT PLAINS TECHNOLOGY CENTER  
COURSE OF STUDY**

**Career Cluster:** Transportation, Distribution and Logistics (TR)

**Career Pathway:** Automotive Service

**Local Program:** Automotive Service Technician (ASE Compliant) (TR0080025)

**Program Hours:** Secondary Students: 1000 Hours  
Adult Students: 1000 Hours

<b><u>Instructors:</u></b>	<b>Name</b>	<b>Office</b>	<b>E-Mail</b>
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**Academic Credit:** Secondary Students: 3 high school credits per year  
Adult Students: Transcript

**Prerequisites:** None

**Program Description:**

According to the most recent ASE Automotive Service Technician standards, students in this program will cover the skills necessary to become an entry-level technician. Students will concentrate on courses in introduction, brakes, steering & suspension, electrical / electronics, engine performance, heating & air conditioning, engine repair, automatic transmission, and manual drive train and axles. They will learn how to diagnose and complete brake service, perform vehicle steering and suspension alignment, as well as electrical theory, electrical/ electronic diagnostics. Students will cover engine performance diagnostics and techniques for repair using a variety of diagnostic equipment. This program includes automotive heating, air conditioning and the student will learn how to evacuate and recharge air- conditioning systems using the proper refrigerant, as well as diagnostics of the heat and A/C system. Students will use advanced diagnostic and repair equipment to troubleshoot complex automotive systems. This program is intended to provide courses closely aligned with ASE hours and tasks. ASE certification is recommended and industry recognized.

**Program Goals:**

Students enrolled in this program will be given the opportunity to develop the skills and attitudes needed to successfully enter the Automotive Service field according to their personal choice, ability, and resourcefulness.

Upon achieving the goals of this program, students will:

- Become competent in the fundamental skills of the occupation.
- Become qualified for further related education and/or entry into the job market.
- Develop the ability to work with limited or no supervision.
- Accept and abide by the rules and regulations established by the school and/or place of employment.

**Related Career Opportunities:**

- Automotive Service Technician
- Lube/Quick Lane Technician
- Shop Foreman
- Service Advisor
- Parts Salesperson

**Program Objectives:**

After successful completion of this program, the student will be able to:

- Demonstrate skills necessary for employment as an Entry Level Automotive Service Technician.
- Utilize basic automotive hand tools and shop equipment in a safe manner.
- Diagnose, test, troubleshoot, and repair basic automotive systems according to National Institute for Automotive Service Excellence Standards.

**Program Course Sequence:**

- HS Student and Part-time Adult (Year One): Course Sequence I
- HS Student and Part-time Adult (Year Two): Course Sequence II
- Full-time Adults (Year One): Course Sequence I and II

**DESCRIPTION OF COURSES  
SEQUENCE I**

<u>Course #</u>	<u>Course Name</u>	<u>HST</u>	<u>HSL</u>	<u>ADT</u>	<u>ADL</u>
<b>TI01609</b>	<b>Fundamentals of Automotive Service</b>	<b>35</b>	<b>10</b>	<b>35</b>	<b>10</b>
<p>This course covers occupational health and safety and tools and equipment identification, usage and operation. The student will receive instruction in the storage, handling, and use of Hazardous Materials. The student will learn to write work orders and warranty reports. The student will learn about the history, current state and future of the automotive service industry. This course will cover dealership and independent operations. The student will learn vehicle identification and how to look up service information using several different sources. The student will learn vehicle maintenance, which will include fluid level checks and adjustments, peripheral electrical system checks and tire inspection and air pressure adjustment. In this course the student will learn basic measuring instruments used in vehicle service and diagnosis, as well as communication skills used throughout the automotive service industry.</p>					
<b>TI01740</b>	<b>Automotive Engine Repair</b>	<b>50</b>	<b>60</b>	<b>50</b>	<b>60</b>
<p>In accordance with the most recent ASE Automobile Service Technology task list, in this course the student will learn common fastener and thread repair to include broken bolt removal, restoration of internal and external threads and proper use of a thread insert. The student will learn to inspect the engine assembly for fuel, oil, coolant and other leaks and determine necessary action. The student will also verify proper operation of instrument panel and warning lamps. The student will identify hybrid vehicle service precautions. Also, in this course are engine oil service and engine accessory drive belt inspection and service as well as inspection of auxiliary coolers and determine necessary action. The student will learn to perform in general engine vacuum tests and general cylinder tests and to determine necessary action. The student will learn proper installation procedures of gaskets and seals on pans and covers using correct sealers and gaskets. The student will also learn to perform oil pressure tests, as well as to test and replace thermostats, water pumps, radiators and fan clutches. The student will also learn to inspect, test and replace oil and water sending units and switches. The student will also learn to inspect and determine action needed for pushrods, rocker arms, rocker arm pivots and shafts as well as valve adjustments. Also covered in this course will be cylinder head and valve train component removal and reinstallation as well as inspection including casting cracks, gaskets and bolts, lifters and camshafts as well as drive gears and timing belts/chains.</p>					

**TI01737 Automotive Steering & Suspension 45 50 45 50**

In accordance with the most recent ASE Automobile Service Technology task list, the student will learn about the steering and suspension components and quick checks for these components. Student will cover inspection, diagnosis and repair of shocks and struts. Also covered will be mounting and repair of tires and balancing of tire and wheel assembly as well as tire pressure monitoring system (TPMS) diagnosis and service. This course includes various steering system diagnosis and repair or replacement operations, including the power steering pump, tie rod ends, pitman arms, relay rods, steering dampeners, power and manual steering racks and steering gears. This course will also cover electric power-assisted steering systems and inspection thereof. Also covered will be front and rear suspension systems diagnosis and repair, including inspecting and replacement of components. Students will also learn to perform wheel alignments and how to diagnose wheel alignment issues as well as diagnosis and repair steering columns, and how to disable and enable the Supplemental Restraint System (SRS).

**TI01719 Automotive Brakes 45 50 45 50**

In accordance with most recent ASE Automobile Service Technology task list, this course covers braking system components, checking and adjusting brake fluids, checking wheel cylinders and adjusting parking brakes. The student will learn to check and replace brake pads, as well as to check and replace brake linings. The student will learn to diagnose and repair drum and disc brake systems. Also covered will be diagnosing and repairing the entire hydraulic brake system, which will include the master cylinder, lines and proportioning valves and stop light operation. The student will learn to diagnose and repair power assist units. Finally this course will cover diagnosis and service of wheel bearings, to include how to replace bearings and races, as well as clean, repack and adjust wheel bearings. The student will learn to identify and inspect brake, traction, and stability control components and determine necessary action. Also covered will be the description of a regenerative braking system.

**TI01741 Automotive Heating and Air Conditioning 30 40 30 40**

In accordance with the most recent ASE Automobile Service Technology task list, this course covers the proper use and maintenance of refrigerant handling equipment. This course covers the automotive heating systems, air conditioning systems, parts identification and function, and system operations. Also in this course the student will cover the refrigerants used in air conditioning systems and identification thereof as well as evacuate and recharge air-conditioning systems using the proper refrigerant. Temperature control components and proper operation of automatic as well as semi-automatic systems will also be identified. The student will learn to inspect heater ducts, doors, hoses, cabin filters and outlets and perform necessary action. The student will learn about the cooling system components, identifying coolant type, checking and adjusting coolant levels as well as checking and replacing coolant hoses. The student will learn to evaluate and determine necessary action for compressor and clutch assemblies, and how to perform the replacement of these parts. The student will learn to perform component replacement, such as the receiver drier, expansion valve, orifice tube, hose assemblies and o-rings. The student will learn to troubleshoot heating and air-conditioning systems operation and how to evaluate climate control systems. This course covers mechanical, electrical and vacuum controls. The student will also learn to diagnose air conditioning system failure concerns, such as the protection device interrupt system, temperature control problems, climate control systems, electrical controls for heating and ventilation, load cut-off systems and other climate control malfunctions as well as A/C system odors. Furthermore, the student will be required to identify hybrid vehicle A/C system electrical circuits and service/safety precautions.

**TI01743 Automotive Manual Drivetrain and Axles 35 45 35 45**

In accordance with the most recent ASE Automobile Service Technology task list, students in this course will identify and interpret drive train concerns and determine necessary action. The student will check fluid condition, check for leaks, drain and refill manual transmission/transaxle and final drive unit. The student will diagnose clutch noise, binding, slippage, pulsation, chatter and determine proper corrective action. Also, the student will inspect all shift linkage and clutch control components including pedal

linkage, cables, automatic adjusters, brackets and bushings, pivots, springs, and determine necessary action. The student will check fluid level of clutch master cylinder and bleed hydraulic system. The student will inspect flywheel for wear and cracks, measure flywheel runout and crankshaft endplay and determine necessary action. The student will explain characteristics of an electronically-controlled manual transmission/transaxle. The student will diagnose CV joint and U-joint noise and vibration concerns, determine and perform necessary action. The student will inspect, service and replace front wheel drive (FWD) bearings, hubs seals, shafts, yokes, boots, CV joints as well as check shaft balance, phasing, measure shaft runout, measure and adjust driveline angles. The student will clean and inspect differential housing and housing vent, check for leaks, drain, refill and adjust differential housing fluid level. The student will inspect and replace companion flange, pinion seal and measure companion flange runout. The student will inspect and replace drive axle wheel studs, drive axle shafts, seals, bearings and retainers as well as measure axle flange runout and shaft endplay and determine necessary action. The student will inspect, adjust and repair mechanical, electrical and vacuum shifting controls, bushings, mounts, levers and brackets as well as inspect front wheel bearings and locking hubs on a four-wheel/all-wheel drive vehicle. The student will also identify concerns related to variations in tire circumference and/or final drive ratios.

**TI00802 Workforce Staging I** **5 0 5 0**  
 This course is designed to be delivered as an integrated component within the courses taken by the individual student. The course is designed for the development of leadership, personal development and employability skills.

<b>Sequence I Subtotal Hours:</b>	<b>Theory</b>	<b>Lab</b>	<b>Total</b>
High School Student:	245	255	500
Adult Student:	245	255	500

**DESCRIPTION OF COURSES  
SEQUENCE II**

<u>Course #</u>	<u>Course Name</u>	<u>HST</u>	<u>HSL</u>	<u>ADT</u>	<u>ADL</u>
<b>TI01738</b>	<b>Automotive Electrical &amp; Electronics</b>	<b>100</b>	<b>130</b>	<b>100</b>	<b>130</b>
<p>In accordance with the most recent ASE Automobile Service Technology task list, the student will learn battery testing and maintenance. This course will cover electrical theory and Digital Volt Ohm Meter (DVOM) operation. The student will learn basic system checks using a DVOM. Students will learn soldering techniques for wiring and other connections. Also, the student will study general electrical system diagnosis. The student will learn to check voltage drop on circuits, locate shorts, test grounds, test relays and circuit breakers and then determine necessary action. The student will learn to diagnose and repair starting systems, charging systems as well as horn and windshield wiper systems. The student will also learn to diagnose and repair lighting circuits, sockets and controllers. Also covered in this course will be gauges, warning devices, drivers information system and sending units for gauges. The student will cover diagnosing and repairing various accessory circuits. This course will cover the Supplemental Restraint Systems (SRS) service as well as safety procedures to prevent accidental deployment. Students will also check for module communication errors, including the Controller Area Network (CAN) with the use of a scan tool.</p>					

**TI01739 Automotive Engine Performance 85 100 85 100**

In accordance with the most recent ASE Automobile Service Technology task list, the student will learn to perform basic engine tune-up operations, such as checking and changing spark plugs, checking emission system, checking and servicing of PVC system. The student will learn about the fuel system components, checking and changing the fuel and air filters, inspection and testing of fuel injectors, verification of idle control operation as well as checking and refilling diesel exhaust fluid (DEF). The student will learn to perform diagnostic techniques and determine necessary action from cylinder leakage tests, compression test and power balance tests. In this course the student will learn to retrieve and record diagnostic codes, OBD monitor status, freeze frame data and clear DTC's when applicable. In ignition systems diagnosis and repair the student will learn about no-start, drivability and emission concerns on vehicles with electronic ignition systems. The student will learn to test and/or replace ignition control module, power train/engine control module and reprogram as necessary, inspect/test crankshaft and camshaft position sensor(s). In this course the student will test fuel pressure regulation systems, inspect the exhaust system, perform exhaust back-pressure test and determine necessary action as well as test the electrical components of the fuel system. In the emission system this course covers the exhaust gas recirculation (EGR) system, evaporative emissions control system. The student will learn to perform diagnosis using gas analyzer, and engine diagnostic equipment. The student will learn to diagnose the cause of emissions or drivability problems resulting from failure of computerized engine controls, power control module (PCM) and interrelated systems. This course also covers diagnostic and repair action for no-start situations, engine misfire, stalling, poor mileage, flooding and hesitation on vehicles with injection type fuel systems. The student will learn to inspect and test the operation of turbochargers and superchargers and determine necessary action. The student will cover drivability problems resulting from exhaust gas recirculation (EGR) failure, catalytic converter systems as well as failure of the evaporative control system. Student will learn to check for module communication errors using a scan tool on CAN/BUS systems.

**TI01742 Automotive Automatic Transmission and Transaxle 40 40 40 40**

In accordance with the most recent ASE Automobile Service Technology task list, students in this course will learn about the components of the automatic transmission. The student will learn to drain and replace automatic transmission fluid, check and adjust fluid levels on a transmission/transaxle with and without a dipstick. The student will learn to identify and interpret transmission/transaxle concerns and differentiate from an engine performance concern and determine necessary action. The student will perform pressure tests and diagnose pressure concerns using hydraulic principles (Pascal's law). Also the student will diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven and held member (power flow) principles. The student will also perform stall test and lock-up converter system tests and determine necessary action. The student will inspect, adjust and replace external manual valve linkage, transmission range sensor/switch as well as inspect for fluid loss and replace external seals, gaskets and bushings. Also covered in this course are off-vehicle transmission/transaxle repairs including removal and re-installation of torque converter, inspect engine core/freeze plugs, rear crankshaft seal, alignment dowels and mating surfaces. The student will inspect, leak test and flush cooler lines and fittings. The student will describe operational characteristics of continuously variable transmission (CVT) and hybrid vehicle drivetrain

**C00000 Workforce Staging II 5 0 5 0**

This course is designed to be delivered as an integrated component within the courses taken by the individual student. The course is designed for the development of leadership, personal development and employability skills.

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<b>Sequence II Subtotal Hours:</b>	<b>Theory</b>	<b>Lab</b>	<b>Total</b>
High School Student:	230	270	500
Adult Student:	230	270	500

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<b>Program Total:</b>	<b>Theory</b>	<b>Lab</b>	<b>Total</b>
High School Student:	475	525	1000
Adult Student:	475	525	1000

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**Evaluation Policy:**

**Employability Grades (100 points per week; 50% of final grade)**

The employability skills grade is based on 20 points per day (which may include: attitude, attendance, safety, punctuality, cooperation, participation, clean-up, class preparation, school/classroom rules, and time management). Points will be deducted if these responsibilities are not met at the instructor's discretion. Students will be allowed to make up unearned employability points for **excused** absences only. Full credit will be given for assignments/tests that have been made up (see Student Handbook).

**Performance Grades (25% of final grade)**

- Live projects
- Homework
- Written Assignments

**Test Grades (25% of final grade)**

- Test grades will be based on a 100-point scale.
- Test grades include written and/or skills tests.
- A test will be given for each unit of instruction.
- Tests are to be taken as a unit is completed.
- Tests must be completed within allotted time.

**Final Grade (9 Weeks Period)**

9-weeks grade will be calculated by averaging grades in each category and summing each category according to their assigned weight. Progress reports will be sent to home schools at six and twelve-week intervals each semester as required or requested. Grades are accessible on-line at <http://sonisweb.greatplains.edu/studsect.cfm>

**Grading Scale:**

The grading scale as adopted by the Board of Education is as follows:

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|--------------|------------------------------------------|
| A = 90 – 100 | F = Below 60                             |
| B = 80 – 89  | W = Withdrawn                            |
| C = 70 – 79  | I = Incomplete                           |
| D = 60 – 69  | N = No Grade (Refer to Student Handbook) |

### **Make-Up Work Policy:**

**All Make-Up Work Is The Responsibility Of The Student.** Make-up work will be handled as specified in the Student Handbook. Please be sure to read and understand all student policies, especially make-up of assignments, tests and employability due to absences. Students should always arrange for any make-up work with the instructor as per the Student Handbook. Students should keep track of his or her progress and grades.

### **Attendance Policy:**

For specific information related to attendance and tardiness refer to the Student Handbook. Students should keep a written record of their absences and tardiness.

### **Course Requirements and Expectations:**

The general course requirements and expectations include:

- Teaching methods consist of lecture, on-line and “hands on” projects.
- The student must demonstrate the ability to apply safety to all aspects of the auto service field.

### **Student Behavior Includes:**

- Safety glasses **must** be worn at all times when in the shop area
- Uniform shirts **must** be worn at all times.
- Name badges **must** be worn at all times.
- Follow all rules and regulations of Great Plains Technology Center.

***NOTE: For additional information or questions regarding the GPTC School policies and procedures, please refer to the Student Handbook and/or the Instructor.***

### **Industry Alignments:**

- National Institute for Automotive Service Excellence (ASE)
- Automotive Youth Education System (AYES)
- National Automotive Technicians Education Foundation (ASE)

### **Certification Outcomes:**

**Tier 1** – Certifications Recognized, Administered and/or Endorsed by Industry

- ASE: Entry-Level Automobile: Automatic Transmission and Transaxle (2207)
- ASE: Entry-Level Automobile: Automobile Service Technology (2210)
- ASE: Entry-Level Automobile: Brakes (2201)
- ASE: Entry-Level Automobile: Electrical/Electronic Systems (2204)
- ASE: Entry-Level Automobile: Engine Performance (2202)
- ASE: Entry-Level Automobile: Engine Repair (2206)
- ASE: Entry-Level Automobile: Heating and Air Conditioning (2209)
- ASE: Entry-Level Automobile: Maintenance and Light Repair (2064)
- ASE: Entry-Level Automobile: Suspension and Steering (2203)

**Tier 2** – Certifications Endorsed by Industry Organizations

- ODCTE: Automatic Transmission/Transaxle Technician (2101)
- ODCTE: Brakes Technician (2102)
- ODCTE: Electrical/Electronics System Technician (2103)

- ODCTE: Engine Performance Technician (2104)
- ODCTE: Heating & Air Conditioning Technician (2105)
- ODCTE: Suspension & Steering Technician (2106)

**CIP Code and SOC Code Crosswalk:**

- CIP Code – 47.0604
- SOC Code – 49-3023.00

**OCAS program codes:**

- 9906 – Automotive Service Technology (first year)
- 9907 – Automotive Service Technology (second year)

**Instructional Materials and Supplies:**

*Students are not required to purchase textbooks or supplemental materials.*

**eLearning Curriculum:**

CDX online. *CDXsite.com*. Jones & Bartlett Learning LLC., Web. <https://www2.jblearning.com/my-account/login>



**Automobile Service Technology (AST)  
(840 Hours)**

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**I. ENGINE REPAIR**

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**A. General**

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1. Research vehicle service information such as fluid type, internal combustion engine operation, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).

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2. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.

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3. Verify operation of the instrument panel engine warning indicators.

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4. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed action.

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5. Install engine covers using gaskets, seals, and sealers as required.

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6. Verify engine mechanical timing.

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7. Inspect, remove, and/or replace engine mounts.

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8. Identify service precautions related to service of the internal combustion engine of a hybrid electric vehicle.

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**I. ENGINE REPAIR**

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**B. Cylinder Head and Valve Train**

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1. Identify cylinder head and valve train components and configurations.

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2. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specification and procedure.

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3. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.

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4. Inspect valve actuating mechanisms for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine needed action.

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5. Adjust valves (mechanical or hydraulic lifters).

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6. Inspect and replace camshaft and drive belt/chain; includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and valve timing components; verify correct camshaft timing.

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**I. ENGINE REPAIR**

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**C. Engine Block Assembly**

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1. Identify engine block assembly components and configurations.

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2. Remove, inspect, and/or replace crankshaft vibration damper (harmonic balancer).

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**I. ENGINE REPAIR**

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**D. Lubrication and Cooling Systems**

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1. Identify lubrication and cooling system components and configurations.

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2. Perform engine oil and filter change; use proper fluid type per manufacturer specification; reset maintenance reminder as required.

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3. Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, heater core, and galley plugs; determine needed action.

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4. Identify causes of engine overheating.

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5. Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.

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6. Inspect and test coolant; drain and recover coolant; flush and/or refill cooling system; use proper fluid type per manufacturer specification; bleed air as required.

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7. Inspect, remove, and replace water pump.

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8. Remove, inspect, and replace thermostat and gasket/seal.

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9. Remove and replace radiator.

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10. Inspect and test fan(s), fan clutch (electrical or mechanical), fan shroud, and air dams; determine needed action.

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11. Perform oil pressure tests; determine needed action.

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12. Inspect auxiliary coolers; determine needed action.

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13. Inspect, test, and/or replace oil temperature and pressure switches and sensors.

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**ER Tasks - AST**

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**Automobile Service Technology (AST)  
840 Hours**

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**II. AUTOMATIC TRANSMISSION AND TRANSAXLE**

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**A. General**

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1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).

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2. Identify automatic transmission and transaxle components and configurations.

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3. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.

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4. Inspect transmission fluid condition; check fluid level; inspect for leaks on transmission or transaxle equipped with a dipstick.

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5. Inspect transmission fluid condition; check fluid level; inspect for leaks on transmission or transaxle not equipped with a dipstick.

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6. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.

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7. Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law).

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8. Identify and interpret transmission/transaxle concerns, differentiate between engine performance and transmission/transaxle concerns; determine needed action.

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9. Diagnose fluid loss and condition concerns; determine needed action.

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10. Perform stall test; determine needed action.

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11. Perform lock-up converter system tests; determine needed action.

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12. Perform pressure tests on transmissions/transaxles equipped with electronic pressure control; determine needed action

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13. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information.

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## **II. AUTOMATIC TRANSMISSION AND TRANSAXLE**

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### **B. In-Vehicle Transmission/Transaxle**

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1. Inspect, adjust, and/or replace external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch.

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2. Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification.

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3. Perform relearn procedures.

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4. Inspect, replace and/or align power train mounts.

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5. Inspect for leakage; replace external seals, gaskets, and bushings.

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6. Inspect, test, adjust, repair, and/or replace electrical/electronic components and circuits.

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## **II. AUTOMATIC TRANSMISSION AND TRANSAXLE**

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### **C. Off-Vehicle Transmission and Transaxle**

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1. Describe the operational characteristics of a continuously variable transmission (CVT).

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2. Describe the operational characteristics of a hybrid vehicle drive train.

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3. Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mating surfaces.

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4. Inspect, leak test, flush, and/or replace transmission/transaxle oil cooler, lines, and fittings.

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5. Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore.

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### **AT Tasks - AST**

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#### **Automobile Service Technology (AST) 840 Hours**

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## **III. MANUAL DRIVE TRAIN AND AXLES**

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### **A. General**

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1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).

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2. Identify manual drive train and axles components and configurations.

3. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.

4. Check fluid condition; check for leaks; determine needed action.

5. Drain and refill manual transmission/transaxle; use proper fluid type per manufacturer specification.

6. Diagnose drive train concerns; determine needed action.

### **III. MANUAL DRIVE TRAIN AND AXLES**

#### **B. Clutch**

1. Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification.

2. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action.

3. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; determine needed action.

4. Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing, linkage, and pilot bearing/bushing (as applicable).

5. Bleed clutch hydraulic system.

6. Inspect flywheel and ring gear for wear and cracks, and discoloration; determine needed action.

7. Measure flywheel runout and crankshaft end play; determine needed action.

8. Describe the operation and service of a system that uses a dual mass flywheel.

### **III. MANUAL DRIVE TRAIN AND AXLES**

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**C. Transmission/Transaxle**

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1. Describe the operational characteristics of an electronically controlled manual transmission/transaxle.

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2. Inspect, adjust, lubricate, and/or replace shift linkages, brackets, bushings, cables, pivots, and levers.

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**III. MANUAL DRIVE TRAIN AND AXLES**

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**D. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joints (Front, Rear, All-wheel, Four-wheel Drive)**

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1. Inspect and/or remove/replace bearings, hubs, and seals.

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2. Inspect and/or service/replace shafts, yokes, boots, and universal/CV joints.

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3. Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification.

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4. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine needed action.

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5. Diagnose universal joint noise and vibration concerns; determine needed action.

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6. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles; determine needed action.

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**III. MANUAL DRIVE TRAIN AND AXLES**

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**E. Differential and Drive Axles**

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**E.1 Ring and Pinion Gears and Differential Housing Assembly**

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1. Inspect differential housing; check for leaks; inspect housing vent.

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2. Check and adjust differential housing fluid level; use proper fluid type per manufacturer specification.

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3. Drain and refill differential housing; using proper fluid type per manufacturer specification.

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4. Inspect and replace companion flange and/or pinion seal; measure companion flange runout.

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5. Demonstrate knowledge of drive pinion and ring gear service and set up including depth, preload, backlash and gear tooth contact.

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**E.2 Drive Axles**

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1. Inspect and replace drive axle wheel studs.

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2. Remove and replace drive axle shafts.

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3. Inspect and replace drive axle shaft seals, bearings, and retainers.

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4. Measure drive axle flange runout and shaft end play; determine needed action.

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**III. MANUAL DRIVE TRAIN AND AXLES**

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**F. Four-wheel Drive/All-wheel Drive**

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1. Identify concerns related to variations in tire circumference and/or final drive ratios.

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2. Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets.

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3. Inspect axle locking mechanisms; determine needed action(s).

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4. Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification.

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**MD  
Tasks -  
AST**

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**Automobile Service Technology (AST)**  
**840 Hours**

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**IV. SUSPENSION AND STEERING**

---

**A. General**

---

1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).

---

2. Identify suspension and steering system components and configurations.

---

3 Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.

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4. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation.

---

5. Identify and interpret suspension and steering system concerns; determine needed action.

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**IV. SUSPENSION AND STEERING**

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**B. Steering Systems**

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1. Inspect rack and pinion steering gear tie rod ends (sockets) and bellows boots; repair or replace as needed.

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2. Inspect power steering fluid level and condition.

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3. Drain and replace power steering system fluid; use proper fluid type per manufacturer specification.

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4. Inspect for power steering fluid leakage; determine needed action.

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5. Remove, inspect, replace, and/or adjust power steering pump drive belt.

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6. Inspect, remove, and/or replace power steering hoses and fittings.

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7. Inspect, remove, and/or replace pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper.

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8. Inspect, replace, and/or adjust tie rod ends (sockets), tie rod sleeves, and clamps (non-rack and pinion).

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9. Inspect and test electric power steering system; determine needed action.

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10. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).

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11. Diagnose steering column noises, looseness, and binding concerns (including tilt/telescoping mechanisms); determine needed action.

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12. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.

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13. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.

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14. Inspect steering shaft universal joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; determine needed action.

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15. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets.

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16. Remove and reinstall power steering pump.

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17. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.

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## **IV. SUSPENSION AND STEERING**

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### **C. Suspension Systems**

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1. Inspect, remove, and/or replace upper and/or lower control arms, bushings, and shafts.

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2. Inspect and replace rebound/jounce bumpers.

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3. Inspect, remove, and/or replace track bar, strut rods/radius arms, and related mounts and bushings.

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4. Inspect, remove, and/or replace upper and/or lower ball joints (with or without wear indicators).

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5. Inspect, remove, and/or replace suspension system coil springs and spring insulators.

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6. Inspect, remove, and/or replace torsion bars and mounts.

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7. Inspect, remove, and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links.

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8. Inspect, remove, and/or replace strut assembly, strut coil spring, insulators, and upper strut bearing mount.

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9. Inspect, remove, and/or replace components of suspension systems (Coil, Leaf, and Torsion).

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10. Inspect, remove, and/or replace components of electronically controlled suspension systems.

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11. Inspect, remove, and/or replace steering knuckle assemblies.

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12. Diagnose suspension system noises, body sway, and uneven ride height concerns; determine needed action.

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#### **IV. SUSPENSION AND STEERING**

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##### **D. Related Suspension and Steering Service**

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1. Inspect, remove, and/or replace shock absorbers; inspect mounts and bushings.

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2. Inspect, service, and/or replace front and rear wheel bearings.

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3. Describe the function of electronically controlled suspension and steering systems and components, (i.e., active suspension and stability control).

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#### **IV. SUSPENSION AND STEERING**

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**E. Wheel Alignment**

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1. Perform pre-alignment inspection; measure vehicle ride height; determine needed action.

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2. Describe four-wheel alignment angles (camber, caster, and toe) and effects on vehicle handling/tire wear.

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3. Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front caster, front and rear camber, and toe as required; center steering wheel.

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4. Check toe-out-on-turns (turning radius); determine needed action.

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5. Check steering axis inclination (SAI) and included angle; determine needed action.

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6. Check rear wheel thrust angle; determine needed action.

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7. Check for front wheel setback; determine needed action.

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8. Identify front and/or rear cradle (subframe) misalignment; determine needed action.

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9. Reset steering angle sensor.

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10. Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine needed action.

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**IV. SUSPENSION AND STEERING**

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**F. Wheels and Tires**

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1. Inspect tire condition/age; identify tire wear patterns; check for correct tire size, application (service-class, load, and speed ratings), and air pressure as listed on the tire information placard/label.

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2. Rotate tires according to manufacturer's recommendation including vehicles equipped with tire pressure monitoring system (TPMS).

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3. Dismount, inspect, and remount tire on wheel (with/without TPMS); balance wheel and tire assembly.

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4. Inspect tire and wheel assembly for air loss; determine needed action.

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5. Repair tire following tire manufacturer approved procedure.

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6. Identify indirect and direct tire pressure monitoring systems (TPMS); calibrate/relearn system; verify operation of instrument panel lamps.

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7. Demonstrate knowledge of steps required to remove and replace sensors (per OEM/sensor manufacturer) in a tire pressure monitoring system (TPMS).

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8. Perform Road Force balance/match mounting.

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9. Diagnose wheel/tire vibration, shimmy, and noise; determine needed action.

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10. Measure wheel, tire, axle flange, and hub runout; determine needed action.

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11. Diagnose tire pull problems; determine needed action.

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**SS Tasks - AST**

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**Automobile Service Technology (AST)  
840 Hours**

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**V. BRAKES**

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**A. General**

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1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).

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2. Identify brake system components and configurations.

3. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.

4. Describe procedure for performing a road test to check brake system operation, including an anti-lock brake system (ABS)

5. Install wheel and torque lug nuts.

6. Identify and interpret brake system concerns; determine needed action.

## **V. BRAKES**

### **B. Hydraulic System**

1. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law).

2. Measure brake pedal height, travel, and free play (as applicable); determine needed action.

3. Check master cylinder for internal/external leaks and proper operation; determine needed action.

4. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, and loose fittings/supports; determine needed action.

5. Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification.

6. Identify components of hydraulic brake warning light system.

7. Bleed and/or replace fluid in the brake system.

8. Test brake fluid for contamination.

9. Remove, bench bleed, and reinstall master cylinder.

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10. Diagnose poor stopping, pulling, or dragging concerns caused by malfunctions in the hydraulic system; determine needed action.

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11. Replace brake lines, hoses, fittings, and supports.

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12. Fabricate brake lines using proper material and flaring procedures.

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13. Inspect, test, and/or replace components of brake warning light system.

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## **V. BRAKES**

### **C. Drum Brakes**

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1. Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability.

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2. Refinish brake drum and measure final drum diameter; compare with specification.

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3. Remove, clean, inspect, and/or replace brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.

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4. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.

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5. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments.

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6. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pedal pulsation concerns; determine needed action.

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## **V. BRAKES**

### **D. Disc Brakes**

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1. Remove and clean caliper assembly; inspect for leaks, damage, and wear; determine needed action.

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2. Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine needed action

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3. Remove, inspect, and/or replace brake pads and retaining hardware; determine needed action.

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4. Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads against rotor; inspect for leaks.

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5. Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action.

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6. Remove and reinstall/replace rotor.

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7. Refinish rotor on vehicle; measure final rotor thickness and compare with specification.

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8. Refinish rotor off vehicle; measure final rotor thickness and compare with specification.

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9. Retract and re-adjust caliper piston on an integrated parking brake system.

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10. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendation.

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11. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action.

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## **V. BRAKES**

### **E. Power-Assist Units**

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1. Check brake pedal travel with and without engine running to verify proper power booster operation.

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2. Identify components of the brake power assist system (vacuum/ hydraulic/electric).

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3. Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster; determine needed action.

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4. Inspect and test hydraulically assisted power brake system for leaks and proper operation; determine needed action.

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## **V. BRAKES**

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### **F. Related Systems (i.e., Wheel Bearings, Parking Brakes, Electrical)**

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1. Remove, clean, inspect, repack/replace, and install wheel bearings; remove and install bearing races; replace seals; install hub and adjust bearings.

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2. Check parking brake system components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed.

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3. Check parking brake operation (including electric parking brakes); check parking brake indicator light system operation; determine needed action.

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4. Check operation of brake stop light system.

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5. Inspect and replace wheel studs.

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6. Remove, reinstall, and/or replace sealed wheel bearing assembly.

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7. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine needed action.

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## **V. BRAKES**

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### **G. Electronic Brake Control Systems: Antilock Brake (ABS), Traction Control (TCS) and Electronic Stability Control (ESC) Sys**

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1. Identify and inspect electronic brake control system components and describe function (ABS, TCS, ESC); determine needed action.

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2. Describe the operation of a regenerative braking system.

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3. Bleed the electronic brake control system hydraulic circuits.

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**BR Tasks - AST**

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**Automobile Service Technology (AST)  
840 Hours**

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**VI. ELECTRICAL/ELECTRONIC SYSTEMS**

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**A. General**

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1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).

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2. Identify electrical/electronic system components and configurations.

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3. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.

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4. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).

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5. Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds) current flow and resistance.

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6. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.

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7. Describe types of test lights; use appropriate test light to check operation of electrical circuits as directed per service information.

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8. Use fused jumper wires to check operation of electrical circuits per service information.

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9. Use wiring diagrams during the diagnosis of electrical/electronic circuit problems.

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10. Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine needed action.

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11. Inspect and test fusible links, circuit breakers, and fuses; determine needed action

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12. Inspect, test, repair, and/or replace components, connectors, terminals, harnesses, and wiring in electrical/electronic systems (including solder repairs); determine needed action.

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13. Test and measure circuit using an oscilloscope and/or graphing multimeter (GMM); interpret results; determine needed action.

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## **VI. ELECTRICAL/ELECTRONIC SYSTEMS**

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### **B. Batteries (Conventional 12-volt)**

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1. Perform battery state-of-charge test; determine needed action.

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2. Confirm proper battery capacity, size, type, and application for vehicle; perform battery capacity and load test; determine needed action.

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3. Maintain or restore electronic memory functions as recommended by manufacturer.

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4. Inspect and clean battery; fill battery cells (if applicable); check battery cables, connectors, clamps, and hold-downs.

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5. Perform battery charging according to manufacturer's recommendations.

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6. Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply.

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7. Identify electrical/electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery.

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## **VI. ELECTRICAL/ELECTRONIC SYSTEMS**

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### **C. Starting System**

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1. Perform starter current draw test; determine needed action.

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2. Perform starter circuit voltage drop tests; determine needed action.

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3. Inspect and test starter relays and solenoids; determine needed action.

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4. Remove and install starter in a vehicle.

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5. Inspect and test switches, connectors, and wires of starter control circuits; determine needed action.

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6. Demonstrate knowledge of automatic idle-stop/start-stop system.

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7. Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition.

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8. Diagnose a no-crank condition using a wiring diagram and test equipment; determine needed action.

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## **VI. ELECTRICAL/ELECTRONIC SYSTEMS**

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### **D. Charging System**

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1. Perform charging system output test; determine needed action.

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2. Inspect, adjust, and/or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment; determine needed action.

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3. Remove, inspect, and/or replace generator (alternator); determine needed action.

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4. Perform charging circuit voltage drop tests; determine needed action.

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5. Diagnose charging system for causes of undercharge, no-charge, or overcharge conditions; determine needed action.

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## **VI. ELECTRICAL/ELECTRONIC SYSTEMS**

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### **E. Lighting Systems**

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1. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); determine needed action.

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2. Aim headlights.

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3. Diagnose the causes of brighter-than-normal, intermittent, dim, or no light operation; determine needed action.

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**VI. ELECTRICAL/ELECTRONIC SYSTEMS**

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**F. Instrument Cluster and Driver Information Systems**

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1. Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators as required.

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2. Inspect and test gauges and gauge sending units for causes of abnormal readings; determine needed action.

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3. Diagnose the causes of incorrect operation of warning devices and other driver information systems; determine needed action.

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**VI. ELECTRICAL/ELECTRONIC SYSTEMS**

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**G. Body Electrical Systems**

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1. Diagnose vehicle comfort, convenience, access, safety, and related systems operation; determine needed action.

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2. Remove and reinstall door panel.

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3. Diagnose operation of security/anti-theft systems and related circuits (such as: theft deterrent, door locks, remote keyless entry, remote start, and starter/fuel disable); determine needed action.

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4. Describe disabling and enabling procedures for supplemental restraint system (SRS); verify indicator lamp operation.

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5. Verify windshield wiper and washer operation; replace wiper blades.

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6. Diagnose operation of entertainment and related circuits (such as: radio, DVD, remote CD changer, navigation, amplifiers, speakers, antennas, and voice-activated accessories); determine needed action.

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7. Diagnose operation of safety systems and related circuits (such as: horn, airbags, seat belt pretensioners, occupancy classification, wipers, washers, speed control/collision avoidance, heads-up display, parking assist, and back-up camera); determine needed action.

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8. Diagnose body electronic system circuits using a scan tool; check for module communication errors (data communication bus systems); determine needed action.

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9. Describe the process for software transfer, software updates, or reprogramming of electronic modules.

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### **EE Tasks - AST**

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### **Automobile Service Technology (AST)**

**840 Hours**

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### **VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**

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#### **A. General**

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1. Research vehicle service information, including refrigerant/oil/fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).

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2. Identify heating, ventilation, and air conditioning (HVAC) components and configurations.

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3. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed

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4. Perform A/C system performance test; interpret results; determine needed action

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5. Identify abnormal operating noises in the A/C system; determine needed action.

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6. Leak test A/C system; determine needed action.

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7. Identify and interpret heating and air conditioning problems; determine needed action.

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8. Identify refrigerant type; test for sealant; select and connect proper gauge set/test equipment; record temperature and pressure readings.

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9. Inspect condition/quantity of refrigerant oil removed from A/C system; determine needed action.

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10. Determine recommended oil and oil capacity for system application and component(s) replacement.

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## **VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**

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### **B. Refrigeration System Components**

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1. Inspect, remove, and/or replace A/C compressor drive belts, pulleys, and tensioners; determine needed action.

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2. Inspect for proper A/C condenser airflow; determine needed action.

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3. Inspect evaporator housing condensation drain; determine needed action.

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4. Inspect, test, and/or service A/C compressor clutch components and/or assembly; determine needed action.

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5. Remove, inspect, and reinstall, and/or replace A/C compressor and mountings; determine recommended oil type and quantity.

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6. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; determine needed action.

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7. Remove, inspect, and reinstall replace receiver/drier or accumulator/drier; determine recommended oil type and quantity.

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8. Remove, inspect, and install expansion valve or orifice (expansion) tube.

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9. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and/or control module) to interrupt system operation; determine needed action.

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10. Determine procedure to remove and reinstall evaporator; determine required oil type and quantity.

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11. Remove, inspect, reinstall, and/or replace condenser; determine required oil type and quantity.

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**VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**

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**C. Heating, Ventilation, and Engine Cooling Systems**

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1. Inspect engine cooling and heater systems hoses and pipes; determine needed action.

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2. Inspect and test heater control valve(s); determine needed action.

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3. Diagnose temperature control problems in the HVAC system related to the engine cooling system, including electric heating; determine needed action.

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4. Determine procedure to remove, inspect, reinstall, and/or replace heater core; properly refill system

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**VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**

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**D. Operating Systems and Related Controls**

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1. Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; determine needed action.

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2. Identify the source of HVAC system odors.

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3. Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action.

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4. Diagnose A/C compressor control systems; determine needed action.

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5. Diagnose malfunctions in the vacuum, mechanical, and/or electrical components and controls of the HVAC system; determine needed action.

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6. Inspect, test, remove and/or replace HVAC system control panel; determine needed action

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7. Check operation of automatic HVAC control systems; determine needed action.

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**VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**

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**E. Refrigerant Recovery, Recycling, and Handling**

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1. Demonstrate awareness of the need to recover, recycle, and handle refrigerants using proper equipment and procedures.

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2. Use and maintain refrigerant handling equipment according to equipment manufacturer's standards.

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3. Identify A/C system refrigerant; test for sealants; recover, evacuate, and charge A/C system; add refrigerant oil as required.

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4. Recycle, label, and store refrigerant.

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**HA Tasks - AST**

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**Automobile Service Technology (AST)****840 Hours**

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**VIII. ENGINE PERFORMANCE**

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**A. General**

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1. Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).

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2. Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.

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3. Verify proper engine cooling system operation; determine needed action.

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4. Verify correct camshaft timing including engines equipped with variable valve timing (VVT) systems; determine needed action.

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5. Identify and interpret engine performance concerns; determine needed action.

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6. Diagnose abnormal engine noises or vibration concerns; determine needed action.

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7. Diagnose the cause of excessive oil consumption, coolant consumption, unusual exhaust color, odor, and sound; determine needed action.

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8. Perform engine manifold pressure tests (vacuum/boost); determine needed action.

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9. Perform cylinder power balance test; determine needed action.

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10. Perform cylinder cranking and running compression tests; determine needed action.

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11. Perform cylinder leakage test; determine needed action.

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12. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine needed action.

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## **VIII. ENGINE PERFORMANCE**

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### **B. Computerized Controls**

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1. Identify computerized control system components and configurations.

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2. Access and use service information to perform step-by-step (troubleshooting) diagnosis.

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3. Perform active tests of actuators using a scan tool; determine needed action.

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4. Describe the use of OBD monitors for repair verification.

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5. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM), digital storage oscilloscope (DSO), and/or scan tool; determine needed action.

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6. Describe the process for reprogramming or recalibrating the powertrain/engine control module (PCM/ECM).

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**VIII. ENGINE PERFORMANCE**

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**C. Ignition System**

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1. Identify ignition system components and configurations.

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2. Remove and replace spark plugs; inspect secondary ignition components for wear and damage; determine needed action.

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3. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine needed action.

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4. Inspect and test crankshaft and camshaft position sensor(s); determine needed action.

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5. Inspect, test, and/or replace ignition control module and/or powertrain/engine control module; reprogram/initialize as needed.

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**VIII. ENGINE PERFORMANCE**

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**D. Fuel, Air Induction, and Exhaust Systems**

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1. Identify fuel, air induction, and exhaust system components and configurations.

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2. Replace fuel filter(s) where applicable.

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3. Inspect, service, or replace air filters, filter housings, and intake duct work.

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4. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; determine needed action.

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5. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine needed action.

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6. Check and refill diesel exhaust fluid (DEF).

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7. Check fuel for quality, composition, and contamination; determine needed action.

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8. Inspect and test fuel pump(s) and pump control system for pressure, regulation, and volume; determine needed action.

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9. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air

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10. Inspect, test, and/or replace fuel injectors on low- and high-pressure systems.

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11. Verify proper idle speed; determine needed action.

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12. Perform exhaust system back-pressure test; determine needed action.

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## **VIII. ENGINE PERFORMANCE**

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### **E. Emissions Control Systems**

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1. Identify emission control system components and configurations.

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2. Inspect, test, service, and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; determine needed action.

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3. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine needed action.

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4. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; inspect, test, service and/or replace electrical/electronic sensors, controls, wiring, tubing, exhaust passages, vacuum/pressure controls, filters, and hoses of exhaust gas recirculation (EGR) system; determine needed action.

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5. Inspect and test electrical/electronically operated components and circuits of secondary air injection systems; determine needed action.

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6. Diagnose emissions and driveability concerns caused by catalytic converter system; determine needed action.

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7. Diagnose emissions and driveability concerns caused by the evaporative emissions control (EVAP) system; determine needed action.

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8. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine needed action.

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**EP  
Tasks -  
AST**

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