

Standards/Measurement Criteria
Automotive Technologies
Automotive Technology - Option A
CIP No. 47.0600

***This indicates the “technical skill standards” for this program that will be assessed on the end-of-program Automotive Technologies standards assessment.**

1.0 CONDUCT A CAREER SURVEY FOR AUTOMOTIVE TECHNOLOGIES

- 1.1 Identify work activities associated with career pathways in automotive technology
- 1.2 Relate interests, skills and personal orientation to career choices
- 1.3 Explain how personal choices affect career plans
- 1.4 Develop a portfolio of career opportunity information

2.0 DEVELOP JOB SEARCH SKILLS TO OBTAIN A JOB IN THE AUTOMOTIVE INDUSTRY

- 2.1 Explain the steps in a job search
- 2.2 Identify employment opportunities
- 2.3 Critique a job application

3.0 PRACTICE EMPLOYABILITY SKILLS FOR THE AUTOMOTIVE INDUSTRY

- 3.1 Apply basic oral and written communication skills
- 3.2 Contribute to a team effort
- 3.3 Conform to a personal/professional code of ethics

4.0 CHARACTERIZE APPROPRIATE WORK HABITS FOR SUCCESSFUL EMPLOYMENT IN THE AUTOMOTIVE INDUSTRY

- 4.1 Demonstrate regular attendance and punctual arrival
- 4.2 Exhibit appropriate dress and grooming for employment in the automotive industry
- 4.3 Understand the importance of enthusiasm and confidence about work and learning new tasks
- 4.4 Plan and organize appropriate resources
- 4.5 Understand the importance of completing tasks accurately
- 4.6 Follow directions and procedures
- 4.7 Give and receive constructive feedback when appropriate
- 4.8 Develop skills to work with minimal supervision
- 4.9 Develop productive, collaborative relationships with members of a work group

5.0 PARTICIPATE IN LEADERSHIP ACTIVITIES SUCH AS THOSE SUPPORTED BY THE CAREER AND TECHNICAL STUDENT ORGANIZATION SkillsUSA

- 5.1 Determine the roles and responsibilities that leaders and members bring to an organization
- 5.2 Identify characteristics of an effective team player
- 5.3 Identify characteristics of effective teams
- 5.4 Practice techniques to involve each member of the team
- 5.5 Demonstrate team work
- 5.6 Practice effective meeting management
- 5.7 Participate in career development events
- 5.8 Practice decision-making process

6.0 EXPLORE THE LEGAL AND ETHICAL ENVIRONMENT OF THE AUTOMOTIVE INDUSTRY

- 6.1 Explain legal responsibilities of employees to comply with government laws and regulations
- 6.2 Define ethics in the business environment
- 6.3 Investigate the ethical behaviors employers expect of employees
- 6.4 Examine alternative responses to workplace situations based on personal, professional, and legal responsibilities
- 6.5 Examine workplace issues including safety, drug testing, harassment, discrimination, privacy rights, etc.
- 6.6 Examine the relationship between ethics and the law

7.0 EXPLORE ECONOMIC PRINCIPLES OF THE AUTOMOTIVE TECHNOLOGY INDUSTRY

- 7.1 Define the five management functions: planning, organizing, directing, staffing, and controlling
- 7.2 Compare management styles, including the styles related to cultural differences
- 7.3 Describe the effects of group dynamics on group decision-making and consensus building
- 7.4 Describe how global competition from auto manufacturers affects automotive technology and business in the United States

8.0 DEVELOP TECHNOLOGICAL LITERACY TO SUPPORT AUTOMOTIVE TECHNOLOGY OPERATIONS

- 8.1 Demonstrate basic usage of computers (input, storage, output)
- 8.2 Access automotive information electronically (via Internet, CD-ROM, etc.)
- 8.3 Demonstrate the use of basic Input/Output devices such as keyboards, scanners, printers and peripherals
- 8.4 Apply file and disk management techniques

9.0 APPLY PROBLEM SOLVING AND DECISION MAKING PROCESSES TO AUTOMOTIVE TECHNOLOGY

- 9.1 Apply problem-solving processes
- 9.2 Describe methods of establishing priorities
- 9.3 Prepare a work schedule plan
- 9.4 Apply strategy based diagnostics to solve common problems

10.0 APPLY MATHEMATICAL PROCESSES TO PROBLEMS IN AUTOMOTIVE TECHNOLOGY

- 10.1 Express problems in automotive technology using numeric, symbolic and/or graphic representations
- 10.2 Perform mathematical calculations in the context of automotive technology problems
- 10.3 Use technology in the solution of math-related problems

11.0 APPLY MEASUREMENT TECHNIQUES TO PROBLEMS IN AUTOMOTIVE TECHNOLOGY

- 11.1 Demonstrate knowledge of metric and English units of measurement
- 11.2 Identify common measurement tools used in automotive technology and their functions
- 11.3 Determine degree of accuracy required for a measurement task and select appropriate measurement equipment

12.0 PRACTICE SAFE WORKING PROCEDURES FOR THE AUTOMOTIVE INDUSTRY

- 12.1 Identify responsibilities of professionals in automotive technology in creating/maintaining a safe work environment
- 12.2 Explain appropriate safety precautions around common job-site hazards
- 12.3 Identify and use personal protective equipment when performing tasks
- 12.4 Explain the importance of the OSHA (Occupational Safety and Health Administration) standards, HazCom (Hazard Communication Standard) requirements and MSDS (Material Safety Data Sheets)
- 12.5 Describe safety and environmental policies and procedures

13.0 PRACTICE SAFE USE OF TOOLS AND EQUIPMENT IN AUTOMOTIVE TECHNOLOGY

- 13.1 Identify and demonstrate safe use of basic hand tools in automotive technology
- 13.2 Identify and demonstrate safe use of power tools and equipment in automotive technology
- 13.3 Practice basic procedures for safe storage and upkeep of tools
- 13.4 Identify shop equipment and use it safely

14.0 EXPLORE ELECTRICAL/ELECTRONICS TECHNOLOGY

- 14.1 Investigate the use of electronics in the automotive industry (communications, micro-technology, etc.)
- 14.2 Identify electrical/electronic components
- 14.3 Express the scientific laws related to electricity
- 14.4 Explore the functions and applications of basic electrical components (e.g., solenoid, switch, light circuit)
- 14.5 Build a simple electrical/electronic circuit with components that simulate a typical automotive circuit
- 14.6 Identify electrical symbols on an automotive wiring diagram and trace the flow of electricity through a basic circuit
- 14.7 Explain and measure voltage and resistance, and demonstrate voltage drop measurement

15.0 EXPLORE METHODS OF ENERGY APPLICATIONS

- 15.1 Explain how energy is converted to useful purposes and applied in the automotive industry
- 15.2 Investigate hydraulic power system(s)
- 15.3 Investigate mechanical power system(s)
- 15.4 Investigate alternative energy production and use

16.0 EXPLORE AUTOMOTIVE TECHNOLOGY

- 16.1 Discuss environmental issues and trends in the automotive industry
- 16.2 Examine the operation of powertrain system(s)
- 16.3 Examine the operation of suspension system(s)
- 16.4 Examine the operation of braking system(s)
- 16.5 Examine the operation of the computerized emission, body and powertrain management systems
- 16.6 Examine the operation of the exhaust system
- 16.7 Examine the operation of the electrical system
- 16.8 Perform threading and thread restoration operations
- 16.9 Perform operational checks on a vehicle
- 16.10 Examine tire technology and basic service procedures for tires
- 16.11 Demonstrate preventative maintenance procedures on a vehicle
- 16.12 Describe the basic parts and operating principles of the internal combustion engine
- 16.13 Identify common automotive fasteners (name, thread pitch, and diameter)

17.0 DEVELOP AN INDIVIDUAL CAREER PLAN FOR THE AUTOMOTIVE INDUSTRY

- 17.1 Investigate career options including entrepreneurship in the automotive field
- 17.2 Develop career goals in the automotive field based on interests, aptitudes, and research
- 17.3 Review/revise career plan/goals on annual basis
- 17.4 Manage personal and career goals
- 17.5 Describe factors that contribute to job satisfaction and success in the automotive industry

18.0 PREPARE FOR EMPLOYMENT IN THE AUTOMOTIVE INDUSTRY

- 18.1 Develop a résumé
- 18.2 Complete job application process
- 18.3 Demonstrate interviewing skills
- 18.4 Research an automotive organization as a potential employee

19.0 PARTICIPATE IN WORK-BASED LEARNING EXPERIENCES IN THE AUTOMOTIVE TECHNOLOGY INDUSTRY

- 19.1 Use technology appropriate for the job
- 19.2 Demonstrate positive work behaviors
- 19.3 Demonstrate positive interpersonal behaviors
- 19.4 Demonstrate safe and healthy work behaviors in the automotive technology environment
- 19.5 Analyze the relationship of customer service and customer satisfaction on the success of an automotive business
- 19.6 Manage customer relations in the automotive field

20.0 DEMONSTRATE ORAL COMMUNICATION SKILLS FOR THE AUTOMOTIVE INDUSTRY

- 20.1 Use questioning techniques to obtain needed information from customers
- 20.2 Interpret oral and non-verbal communications of audience
- 20.3 Demonstrate active listening during communications with automotive customers and coworkers
- 20.4 Deliver automotive related presentation incorporating both appropriate verbal and non-verbal communication techniques
- 20.5 Communicate using equitable and culturally sensitive language for a diverse audience
- 20.6 Demonstrate effective telephone technique

21.0 DEMONSTRATE WRITTEN COMMUNICATION SKILLS FOR THE AUTOMOTIVE INDUSTRY

- 21.1 Conduct formal/informal research to collect appropriate topical information
- 21.2 Organize information and develop an outline
- 21.3 Write automotive business communication using appropriate format for the situation
- 21.4 Using appropriate technology, prepare a draft document using established rules for grammar, spelling and sentence construction
- 21.5 Utilize multiple technologies for written and presentation communications

22.0 EVALUATE THE ROLE OF SMALL AUTOMOTIVE BUSINESSES IN THE ECONOMY

- 22.1 Evaluate the role of small automotive businesses on local, state, national and international economies
- 22.2 Evaluate a business plan for an automotive operation

23.0 EVALUATE LEADERSHIP STYLES APPROPRIATE FOR THE AUTOMOTIVE INDUSTRY

- 23.1 Determine personal characteristics of effective leaders in the automotive industry
- 23.2 Compare/contrast leadership and management styles in the automotive industry
- 23.3 Describe how cultural/ethnic differences affect leadership styles within a group in the automotive industry
- 23.4 Describe how cultural/ethnic differences affect interpersonal interactions/communications within a group in the automotive industry

24.0 DETERMINE APPROPRIATE TOOL CARE AND DEFINE A SAFE AUTOMOTIVE TECHNOLOGY WORK ENVIRONMENT

- 24.1 Identify visual controls (e.g., monitors, read outs)
- 24.2 Apply applicable electrical, mechanical, hydraulic, hazardous waste and pneumatic safety rules and procedures
- 24.3 Use preventative maintenance checklists
- 24.4 Practice clean and orderly work habits
- 24.5 Identify and use appropriate hand tools
- 24.6 Perform lockout and tag out

25.0 PROCESS WORK ORDERS FOR AUTOMOTIVE SERVICE AND/OR REPAIR

- 25.1 Interpret specifications or drawings
- 25.2 Record accurate and truthful data
- 25.3 Demonstrate record keeping on work order and job ticket with estimated time and cost for jobs, and order parts
- 25.4 Obtain appropriate repair information from service information
- 25.5 Interpret a written work order and determine appropriate order for task performance

26.0 PARTICIPATE IN LEADERSHIP ACTIVITIES SUCH AS THOSE SUPPORTED BY CAREER AND TECHNICAL STUDENT ORGANIZATION SkillsUSA

- 26.1 Determine the roles and responsibilities that leaders and members bring to an organization
- 26.2 Identify characteristics of an effective team player
- 26.3 Identify characteristics of effective teams
- 26.4 Practice techniques to involve each member of the team
- 26.5 Demonstrate team work
- 26.6 Practice effective meeting management
- 26.7 Participate in career development events
- 26.8 Practice decision-making process

The measurement criteria attached to the following standards represent the National Automotive Technicians Education Foundation (NATEF) Task List Priority Items. These tasks (measurement criteria) will need to be taught to your students in order for them to successfully pass the **four** Automotive Service Excellence (ASE) tests.” For additional information, go to the website: www.natef.org.

***27.AEVALUATE PERFORMANCE AND IMPLEMENT BRAKE REPAIR**

(General Brake Systems Diagnosis)

- 27.1a Identify and interpret brake system concern; determine necessary action. P-1
- 27.2a Research applicable vehicle and service information, such as brake system operation, vehicle service history, service precautions, and technical service bulletins. P-1
- 27.3a Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals). P-1

(Hydraulic System Diagnosis and Repair)

- 27.4a Diagnose pressure concerns in the brake system using hydraulic principles (Paschal’s Law). P-1
- 27.5a Measure brake pedal height; determine necessary action. P-2
- 27.6a Check master cylinder for internal and external leaks and proper operation; determine necessary action. P-2
- 27.7a Remove, bench bleed, and reinstall master cylinder. P-1
- 27.8a Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action. P-1
- 27.9a Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports; determine necessary action. P-2
- 27.10a Fabricate and/or install brake lines (double flare and ISO types); replace hoses, fittings, and supports as needed. P-2
- 27.11a Select, handle, store, and fill brake fluids to proper level. P-1
- 27.12a Inspect, test, and/or replace metering (hold-off), proportioning (balance), pressure differential, and combination valves. P-2
- 27.13a Inspect, test, and adjust height (load) sensing proportioning valve. P-3
- 27.14a Inspect, test, and/or replace components of brake warning light system. P-3
- 27.15a Bleed (manual, pressure, vacuum or surge) brake system. P-1
- 27.16a Flush hydraulic system. P-3

(Drum Brake Diagnosis and Repair)

- 27.17a Diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action. P-1
- 27.18a Remove, clean (using proper safety procedures), inspect, and measure brake drums; determine necessary action. P-1
- 27.19a Refinish brake drum. P-1

- 27.20a 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-1
- 27.21a Remove, inspect, and install wheel cylinders. P-2
- 27.22a Pre-adjust brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings. P-1
- 27.23a Install wheel, torque lug nuts, and make final checks and adjustments. P-1
- (Disc Brake Diagnosis and Repair)**
- 27.24a Diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action. P-1
- 27.25a Remove caliper assembly from mountings; clean and inspect for leaks and damage to caliper housing; determine necessary action. P-1
- 27.26a Clean and inspect caliper mounting and slides for wear and damage; determine necessary action. P-1
- 27.27a Remove, clean, and inspect pads and retaining hardware; determine necessary action. P-1
- 27.28a Disassemble and clean caliper assembly; inspect parts for wear, rust, scoring, and damage; replace seal, boot, and damaged or worn parts. P-2
- 27.29a Reassemble, lubricate, and reinstall caliper, pads, and related hardware; seat pads, and inspect for leaks. P-1
- 27.30a 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
- 27.31a Remove and reinstall rotor. P-1
- 27.32a Refinish rotor on and off vehicle. P-1
- 27.33a Adjust calipers equipped with an integrated parking brake system. P-3
- 27.34a Install wheel, torque lug nuts, and make final checks and adjustments. P-1
- (Power Assist Units Diagnosis and Repair)**
- 27.35a Test pedal free travel with and without engine running; check power assist operation. P-2
- 27.36a Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster. P-2
- 27.37a Inspect the vacuum-type power booster unit for vacuum leaks; inspect the check valve for proper operation; determine necessary action. P-2
- 27.38a Inspect and test hydraulically assisted power brake systems for leaks and proper operation; determine necessary action. P-3
- 27.39a Measure and adjust master cylinder pushrod length. P-3
- (Miscellaneous (Wheel Bearings, Parking Brakes, Electrical, Etc.) Diagnosis and Repair)**
- 27.40a Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action. P-1
- 27.41a Remove, clean, inspect, repack, and install wheel bearings and replace seals; install hub and adjust wheel bearings. P-1
- 27.42a Check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, or replace as needed. P-2

- 27.43a Check parking brake operation; determine necessary action. P-1
- 27.44a Check operation of parking brake indicator light system. P-3
- 27.45a Check operation of brake stop light system; determine necessary action. P-1
- 27.46a Replace wheel bearing and race. P-1
- 27.47a Inspect and replace wheel studs. P-1
- 27.48a Remove and reinstall sealed wheel bearing assembly. P-2
- (Antilock Brake and Traction Control Systems)**
- 27.49a Identify and inspect antilock brake system (ABS) components; determine necessary action. P-1
- 27.50a Diagnose poor stopping, wheel lock-up, abnormal pedal feel or pulsation, and noise concerns caused by the antilock brake system (ABS); determine necessary action. P-2
- 27.51a Diagnose antilock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determine necessary action. P-1
- 27.52a Depressurize high-pressure components of the antilock brake system (ABS). P-3
- 27.53a Bleed the antilock brake system's (ABS) front and rear hydraulic circuits. P-2
- 27.54a Remove and install antilock brake system (ABS) electrical/electronic and hydraulic components. P-3
- 27.55a Test, diagnose and service ABS speed sensors, toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data). P-1
- 27.56a Diagnose antilock brake system (ABS) braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.). P-3
- 27.57a Identify traction control/vehicle stability control system components. P-3

***28.AEVALUATE AND IMPLEMENT REPAIRS TO ELECTRICAL/ELECTRONIC SYSTEMS**

(General Electrical System Diagnosis)

- 28.1a Identify and interpret electrical/electronic system concern; determine necessary action. P-1
- 28.2a Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins. P-1
- 28.3a Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals). P-1
- 28.4a Diagnose electrical/electronic integrity for series, parallel and series-parallel circuits using principles of electricity (Ohm's Law). P-1
- 28.5a Use wiring diagrams during diagnosis of electrical circuit problems. P- 1
- 28.6a Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems. P-1

- 28.7a Check electrical circuits with a test light; determine necessary action. P-2
- 28.8a Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action. P-1
- 28.9a Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action. P-1
- 28.10a Check continuity and measure resistance in electrical/electronic circuits and components using an ohmmeter; determine necessary action. P-1
- 28.11a Check electrical circuits using fused jumper wires; determine necessary action. P-2
- 28.12a Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action. P-1
- 28.13a Measure and diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action. P-1
- 28.14a Inspect and test fusible links, circuit breakers, and fuses; determine necessary action. P-1
- 28.15a Inspect and test switches, connectors, relays, solid state devices, and wires of electrical/electronic circuits; perform necessary action. P-1
- 28.16a Remove and replace terminal end from connector. P-1
- 28.17a Repair connectors and terminal ends. P-1
- 28.18a Repair wiring harnesses and connectors (including CAN/BUS systems). P-1
- 28.19a Perform solder repair of electrical wiring. P-1
- 28.20a Identify location of hybrid vehicle high voltage circuit disconnect (service plug) location and safety procedures. P-3
- (Battery Diagnosis and Service)**
- 28.21a Perform battery state-of-charge test; determine necessary action. P-1
- 28.22a Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action. P-1
- 28.23a Maintain or restore electronic memory functions. P-1
- 28.24a Inspect, clean, fill, and replace battery. P-2
- 28.25a Perform slow/fast battery charge. P-2
- 28.26a Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed. P-1
- 28.27a Start a vehicle using jumper cables and a battery or auxiliary power supply. P-1
- 28.28a Identify high voltage circuits of electric or hybrid electric vehicles and related safety precautions. P-3
- 28.29a Identify electronic modules, security systems and/or radios that require reinitialization or code entry following battery disconnect. P-2
- 28.30a Identify hybrid vehicle auxiliary (12v) battery service, repair and test procedures. P-3
- (Starting System Diagnosis and Repair)**
- 28.31a Perform starter current draw tests; determine necessary action. P-1
- 28.32a Perform starter circuit voltage drop tests; determine necessary action. P-1

- 28.33a Inspect and test starter relays and solenoids; determine necessary action.
P-2
- 28.34a Remove and install starter in a vehicle. P-1
- 28.35a Inspect and test switches, connectors, and wires of starter control circuits;
perform necessary action. P-2
- 28.36a Differentiate between electrical and engine mechanical problems that
cause a slow-crank or no-crank condition. P-2
- (Charging System Diagnosis and Repair)**
- 28.37a Perform charging system output test; determine necessary action. P-1
- 28.38a Diagnose charging system for the cause of undercharge, no-charge, and
overcharge conditions. P-1
- 28.39a Inspect, adjust, or replace generator, alternator. P-2
- 28.40a Remove, inspect, and install generator (alternator). P-1
- 28.41a Perform charging circuit voltage drop tests; determine necessary action.
P-1
- (Lighting Systems Diagnosis and Repair)**
- 28.42a Diagnose the cause of brighter than normal, intermittent, dim, or no light
operation; determine necessary action. P-1
- 28.43a Inspect, replace, and aim headlights and bulbs. P-2
- 28.44a Inspect and diagnose incorrect turn signal or hazard light operation;
perform necessary action P-2
- 28.45a Identify system voltage and safety precautions associated with high
intensity discharge headlights. P-3
- (Gauges, Warning Devices, and Driver Information Systems Diagnosis and
Repair)**
- 28.46a Inspect and test gauges and gauge sending units for cause of intermittent,
high, low, or no gauge readings; determine necessary action. P-1
- 28.47a Inspect and test connectors, wires, and printed circuit boards of gauge
circuits; determine necessary action. P-3
- 28.48a Diagnose the cause of incorrect operation of warning devices and other
driver information systems; determine necessary action. P-1
- 28.49a Inspect and test sensors, connectors, and wires of electronic instrument
circuits; determine necessary action. P-2
- (Horn and Wiper/Washer Diagnosis and Repair)**
- 28.50a Diagnose incorrect horn operation; perform necessary action. P-2
- 28.51a Diagnose incorrect wiper operation; diagnose wiper speed control and
park problems; perform necessary action. P-2
- 28.52a Diagnose incorrect washer operation; perform necessary action. P-2
- (Accessories Diagnosis and Repair)**
- 28.53a Diagnose incorrect operation of motor-driven accessory circuits;
determine necessary action. P-2
- 28.54a Diagnose incorrect heated glass, mirror and seat operation; determine
necessary action. P-2
- 28.55a Diagnose incorrect electric lock operation; determine necessary action.
P-2

- 28.56a Diagnose incorrect operation of cruise control systems; determine necessary action. P-3
- 28.57a Diagnose supplemental restraint system (SRS) concerns; determine necessary action. (Note: Follow manufacturer's safety procedures to prevent accidental deployment.) P-1
- 28.58a Disarm and enable the airbag system for vehicle service. P-1
- 28.59a Diagnose radio static and weak, intermittent, or no radio reception; determine necessary action. P-3
- 28.60a Remove and reinstall door panel. P-1
- 28.61a Diagnose body electronic system circuits using a scan tool; determine necessary action. P-2
- 28.62a Check for module communication (including CAN/BUS systems) errors using a scan tool. P-3
- 28.63a Diagnose the cause of false, intermittent, or no operation of anti-theft system. P-2

***29.APERFORM REPAIRS TO STEERING AND SUSPENSION SYSTEMS**

(General Suspension and Steering Systems Diagnosis)

- 29.1a Identify and interpret suspension and steering concern; determine necessary action. P-1
- 29.2a Research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins. P-1
- 29.3a Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals). P-1

(Steering Systems Diagnosis and Repair)

- 29.4a Disable and enable supplemental restraint system (SRS). P-1
- 29.5a Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring). P-1
- 29.6a Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action. P-2
- 29.7a Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and fluid leakage concerns; determine necessary action. P-3
- 29.8a Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and fluid leakage concerns; determine necessary action. P-3
- 29.9a Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action. P-2
- 29.10a Adjust manual power non-rack and pinion worm bearing preload and sector lash. P-3
- 29.11a Remove and replace manual or power rack and pinion steering gear; inspect mounting bushings and brackets. P-1
- 29.12a Inspect and replace manual or power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots. P-1
- 29.13a Determine proper steering fluid type; inspect power steering fluid levels and condition. P-1
- 29.14a Flush, fill, and bleed power steering system. P-2
- 29.15a Diagnose power steering fluid leakage; determine necessary action. P-2
- 29.16a Remove, inspect, replace, and adjust power steering pump belt. P-1
- 29.17a Remove and reinstall power steering pump. P-3
- 29.18a Remove and reinstall power steering pump pulley; check pulley and belt alignment. P-3
- 29.19a Inspect and replace power steering hoses and fittings. P-2
- 29.20a Inspect and replace pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper. P-2
- 29.21a Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps. P-1
- 29.22a Test and diagnose components of electronically controlled steering systems using a scan tool; determine necessary action. P-3

- 29.23a Inspect and test non-hydraulic electric power assist steering. P-3
- 29.24a Identify hybrid vehicle power steering system electrical circuits, service and safety precautions. P-3
- (Suspension Systems Diagnosis and Repair) (Front Suspension)**
- 29.25a Diagnose short and long arm suspension system noises, body sway, and uneven riding height concerns; determine necessary action. P-1
- 29.26a Diagnose strut suspension system noises, body sway, and uneven riding height concerns; determine necessary action. P-1
- 29.27a Remove, inspect, and install upper and lower control arms, bushings, shafts, and rebound bumpers. P-3
- 29.28a Remove, inspect and install strut rods (compression/tension) and bushings. P-2
- 29.29a Remove, inspect, and install upper and/or lower ball joints. P-1
- 29.30a Remove, inspect, and install steering knuckle assemblies. P-2
- 29.31a Remove, inspect, and install short and long arm suspension system coil springs and spring insulators. P-3
- 29.32a Remove, inspect, install, and adjust suspension system torsion bars; inspect mounts. P-3
- 29.33a Remove, inspect, and install stabilizer bar bushings, brackets, and links. P-2
- 29.34a Remove, inspect, and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount. P-1
- 29.35a Lubricate suspension and steering systems. P-2
- (Rear Suspension)**
- 29.36a Remove, inspect, and install coil springs and spring insulators. P-2
- 29.37a Remove, inspect, and install transverse links, control arms, bushings, and mounts. P-2
- 29.38a Remove, inspect, and install strut cartridge or assembly, strut coil spring, and insulators (silencers). P-2
- 29.39a Inspect, remove, and replace shock absorbers. P-1
- 29.40a Remove, inspect, and service or replace front and rear wheel bearings. P-1
- 29.41a Test and diagnose components of electronically controlled suspension systems using a scan tool; determine necessary action. P-3
- (Wheel Alignment Diagnosis, Adjustment, and Repair)**
- 29.42a Differentiate between steering and suspension concerns using principles of steering geometry (caster, camber, toe, etc). P-1
- 29.43a Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary action. P-1
- 29.44a Perform prealignment inspection; perform necessary action. P-1
- 29.45a Measure vehicle riding height; determine necessary action. P-1
- 29.46a Check and adjust front and rear wheel camber; perform necessary action. P-1
- 29.47a Check and adjust caster; perform necessary action. P-1

- 29.48a Check and adjust front wheel toe; adjust as needed and center steering wheel. P-1
- 29.49a Check toe-out-on-turns (turning radius); determine necessary action. P-2
- 29.50a Check SAI (steering axis inclination) and included angle; determine necessary action. P-2
- 29.51a Check and adjust rear wheel toe. P-1
- 29.52a Check rear wheel thrust angle; determine necessary action. P-1
- 29.53a Check for front wheel setback; determine necessary action. P-2
- 29.54a Check front cradle (subframe) alignment; determine necessary action. P-3
- (Wheel and Tire Diagnosis and Repair)**
- 29.55a Diagnose tire wear patterns; determine necessary action. P-1
- 29.56a Inspect tires; check and adjust air pressure. P-1
- 29.57a Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action. P-2
- 29.58a Rotate tires according to manufacturer's recommendations. P-1
- 29.59a Measure wheel, tire, axle, and hub runout; determine necessary action. P-2
- 29.60a Diagnose tire pull (lead) problem; determine necessary action. P-2
- 29.61a Balance wheel and tire assembly (static and dynamic). P-1
- 29.62a Dismount, inspect, repair, and remount tire on wheel. P-2
- 29.63a Dismount, inspect, and remount tire on wheel equipped with tire pressure sensor. P-3
- 29.64a Reinstall wheel; torque lug nuts. P-1
- 29.65a Inspect tire and wheel assembly for air loss; perform necessary action. P-1
- 29.66a Repair tire using internal patch. P-1
- 29.67a Inspect, diagnose, and calibrate tire pressure monitoring system. P-3

***30.AIMPLEMENT GENERAL ENGINE PERFORMANCE DIAGNOSIS AND REPAIR**

(General Engine Diagnosis)

- 30.1a Identify and interpret engine performance concern; determine necessary action. P-1
- 30.2a Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins. P-1
- 30.3a Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals). P-1
- 30.4a Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. P-2
- 30.5a Diagnose abnormal engine noise or vibration concerns; determine necessary action. P-2
- 30.6a Diagnose abnormal exhaust color, odor, and sound; determine necessary action. P-2
- 30.7a Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action. P-1
- 30.8a Perform cylinder power balance test; determine necessary action. P-1
- 30.9a Perform cylinder cranking compression tests; determine necessary action. P-1
- 30.10a Perform engine running compression test; determine necessary action. P-2
- 30.11a Perform cylinder leakage test; determine necessary action. P-1
- 30.12a Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns with an oscilloscope and/or engine diagnostic equipment; determine necessary action. P-1
- 30.13a Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action. P-1
- 30.14a Verify engine operating temperature; determine necessary action. P-1
- 30.15a Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action. P-1
- 30.16a Verify correct camshaft timing. P-2

(Computerized Engine Controls Diagnosis and Repair)

- 30.17a Retrieve and record stored OBD I diagnostic trouble codes; clear codes. P-3
- 30.18a Retrieve and record stored OBD II diagnostic trouble codes; clear codes when applicable. P-1
- 30.19a Diagnose the causes of emissions or driveability concerns resulting from malfunctions in the computerized engine control system with stored diagnostic trouble codes. P-1
- 30.20a Diagnose emissions or driveability concerns resulting from malfunctions in the computerized engine control system with no stored diagnostic trouble codes; determine necessary action. P-1

- 30.21a Check for module communication (including CAN/BUS systems) errors using a scan tool. P-2
- 30.22a Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action. P-1
- 30.23a Obtain and interpret scan tool data. P-1
- 30.24a Access and use service information to perform step-by-step diagnosis. P-1
- 30.25a Diagnose driveability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM-installed accessories, or similar systems); determine necessary action. P-3
- 30.26a Perform active tests of actuators using scan tool; determine necessary action. P-1

(Ignition System Diagnosis and Repair)

- 30.27a Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns on vehicles with electronic ignition (distributorless) systems; determine necessary action. P-1
- 30.28a Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns on vehicles with distributor ignition (DI) systems; determine necessary action. P-1
- 30.29a Inspect and test ignition primary circuit wiring and solid state components; perform necessary action. P-2
- 30.30a Inspect, test and service distributor. P-3
- 30.31a Inspect and test ignition system secondary circuit wiring and components; perform necessary action. P-2
- 30.32a Inspect and test ignition coil(s); perform necessary action. P-1
- 30.33a Check and adjust ignition system timing and timing advance/retard (where applicable). P-3
- 30.34a Inspect and test ignition system pick-up sensor or triggering devices; perform necessary action P-1

(Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair)

- 30.35a 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 necessary action. P-1
- 30.36a Check fuel for contaminants and quality; determine necessary action. P-3
- 30.37a Inspect and test fuel pumps and pump control systems for pressure, regulation and volume; perform necessary action. P-1
- 30.38a Replace fuel filters. P-1
- 30.39a Inspect and test cold enrichment system and components; perform necessary action. P-3
- 30.40a Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air. P-2
- 30.41a Inspect and test fuel injectors. P-1

- 30.42a Check idle speed. P-2
- 30.43a Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action. P-2
- 30.44a Perform exhaust system back-pressure test; determine necessary action. P-1
- 30.45a Test the operation of turbocharger/supercharger systems; determine necessary action P-3

(Emissions Control Systems Diagnosis and Repair) Positive Crankcase Ventilation)

- 30.46a Diagnose oil leaks, emissions, and driveability problems resulting from malfunctions in the positive crankcase ventilation (PCV) system; determine necessary action. P-2
- 30.47a Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action. P-2

(Exhaust Gas Recirculation)

- 30.48a Diagnose emissions and driveability problems caused by malfunctions in the exhaust gas recirculation (EGR) system; determine necessary action. P-1
- 30.49a Inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action. P-1
- 30.50a Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action. P-2

(Exhaust Gas Treatment)

- 30.51a Diagnose emissions and driveability problems resulting from malfunctions in the secondary air injection and catalytic converter systems; determine necessary action. P-2
- 30.52a Inspect and test mechanical components of secondary air injection systems; perform necessary action. P-3
- 30.53a Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action. P-3
- 30.54a Inspect and test catalytic converter performance. P-1

(Evaporative Emissions Controls)

- 30.55a Diagnose emissions and driveability problems resulting from malfunctions in the evaporative emissions control system; determine necessary action. P-1
- 30.56a Inspect and test components and hoses of evaporative emissions control system; perform necessary action. P-2
- 30.57a Interpret evaporative emission related diagnostic trouble codes (DTCs); determine necessary action. P-1

(Engine Related Service)

- 30.58a Adjust valves on engines with mechanical or hydraulic lifters. P-1
- 30.59a Remove and replace timing belt; verify correct camshaft timing. P-1
- 30.60a Remove and replace thermostat. P-1

- 30.61a Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action. P-1
- 30.62a Perform common fastener and thread repairs to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert. P-1
- 30.63a Perform oil and filter change. P-1
- 30.64a Identify hybrid vehicle internal combustion engine service precautions.
P-3