

ASE PROGRAM CERTIFICATION STANDARDS
FOR
AUTOMOBILE TECHNICIAN TRAINING PROGRAMS

Administered By:

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TASK LIST AND ASSUMPTIONS

The NATEF task list was reviewed and updated in February 2017. A national committee was assembled in Alpharetta, Georgia to review the standards used in the automobile certification program. The committee consisted of individuals representing the major automobile manufacturers, automobile repair shop owners and technicians, automobile instructors and trainers, and automobile equipment and parts suppliers.

The committee reviewed the standards, task list, tools and equipment list, program hours, and instructor qualifications. The committee also had the most current National Institute for Automotive Service Excellence (ASE) automobile task lists for reference purposes.

All the tasks are assigned a priority number: P-1 _____, P-2 _____, or P-3. Please refer to the Task List Information in the Policies section for additional information on the requirements for instruction on tasks. ***NOTE: For programs certifying under the General Service Technician Program, there is a separate task list. Please refer to the General Service Technician Program Section of this manual.***

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

1. It is assumed that:

- *in all areas, appropriate theory, safety, and support instruction will be required for performing each task;
- *the instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks;
- *the student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources;
- *in all areas, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the “Three C’s” (concern, cause and correction) as a format to communicate this information.

2. It is assumed that:

- *all diagnostic and repair tasks described in this document are to be accomplished in accordance with manufacturer's recommended procedures and safety precautions as published.

3. It is assumed that:

- *individual training programs being evaluated for certification should have written and detailed performance standards for each task covered and taught in the curriculum;
- *the learning progress of students will be monitored and evaluated against these performance standards;
- *a system is in place that informs all students of their individual progress through all phases of the training program.

4. It is assumed that:

- *individual courses of study will differ across automobile technician training programs;
- *development of appropriate learning delivery systems and tests which monitor student progress will be the responsibility of the individual training program.

5. It is assumed that:

*all students will receive instruction in the storage, handling, and use of Hazardous Materials as required in Hazard Communication Title 29, Code of Federal Regulation Part 1910.1200, 'Right to Know Law', and state and local requirements;

***hazardous and toxic materials will be handled, removed and recycled or disposed of according to federal, state, and local regulations.**

Rating Scale

4 – Skilled -- can perform job independently

3 – Moderately Skilled – can do job with some supervision

2 – Limited Skill – requires instruction and supervision

1 – No Exposure – no experience or knowledge in this area

DEFINITIONS – TECHNICAL TERMS

ADJUST - To bring components to specified operational settings.

ALIGN - To bring to precise alignment or relative position of components.

ANALYZE - To examine the relationship of components of an operation.

ASSEMBLE (REASSEMBLE) - To fit together the components of a device.

BALANCE - To establish correct linear, rotational or weight relationship.

BLEED - To remove air from a closed system.

CAN – Controller Area Network. CAN is a network protocol (SAE J2284/ISO 15765-4) used to interconnect a network of electronic control modules. Some manufacturers began implementing CAN with model year 2003. By model year 2008, the California Air Resources Board (CARB) requires the use of CAN on all vehicles.

CHARGE - To bring to "full" state, e.g., battery or air conditioning system.

CHECK - To verify condition by performing an operational or comparative examination.

CLEAN - To rid component of extraneous matter for the purpose of reconditioning, repairing, measuring or reassembling.

CONCENTRICITY - A comparison of the center point between circular measurements in relation to each other.

CONDUCTANCE TEST – A battery test used to evaluate the condition of the battery. The conductance test equipment applies a known AC voltage with a given frequency across the battery and measures the resulting current flow. The tester uses this information to evaluate the relative health of the battery as compared to the battery rating (e.g. its CCA).

DEGLAZE – To restore correct surface finish.

DETERMINE - To establish the procedure to be used to affect the necessary repair.

DETERMINE NECESSARY ACTION – Indicates that the diagnostic routine(s) is the primary emphasis of a task. The student is required to perform the diagnostic steps and communicate the diagnostic outcomes and corrective actions required addressing the concern or problem. The training program determines the communication method (worksheet, test, verbal communication, or other means deemed appropriate) and whether the corrective procedures for these tasks are actually performed.

DIAGNOSE - To locate the root cause or nature of a problem by using the specified procedure.

DISASSEMBLE - To separate a component's parts as a preparation for cleaning, inspection or service.

DISCHARGE - To empty a storage device or system.

EVACUATE - To remove air, fluid or vapor from a closed system by use of a vacuum pump.

FLUSH - To use a fluid to clean an internal system.

HIGH VOLTAGE – Voltages of 50 volts and higher.

HONE - To restore or resize a bore by using rotating cutting stones.

JUMP START - To use an auxiliary power supply, e.g., battery, battery charger, etc. to assist a battery to crank an engine.

LOCATE – Determine or establish a specific spot or area.

MEASURE - To compare existing dimensions to specified dimensions by the use of calibrated instruments and gauges.

ON-BOARD DIAGNOSTICS (OBD) - A diagnostic system contained in the Powertrain Control Module (PCM), which monitors computer inputs and outputs for failures.

OBD II is an industry-standard, second generation OBD system that monitors emissions control systems for degradation as well as failures.

PARASITIC DRAW - Electrical loads which are still present when the circuit is turned OFF.

PERFORM - To accomplish a procedure in accordance with established methods and standards.

PERFORM NECESSARY ACTION – Indicates that the student is to perform the diagnostic routine(s) and perform the corrective action item. Where various scenarios (conditions or situations) are presented in a single task, at least one of the scenarios must be accomplished.

PURGE - To eliminate an undesired air or fluid from a closed system.

REMOVE - To disconnect and separate a component from a system.

REPAIR - To restore a malfunctioning component or system to operating condition.

REPLACE - To exchange a component with a new or rebuilt component; to reinstall a component.

RESURFACE – To restore correct finish.

SERVICE - To perform a specified procedure when called for in the owner's or service manual.

TEST - To verify condition through the use of meters, gauges or instruments.

TORQUE - To tighten a fastener to specified degree or tightness (in a given order or pattern if multiple fasteners are involved on a single component).

VERIFY - To establish that a problem exists after hearing the customer's complaint and performing a preliminary diagnosis.

VOLTAGE DROP - A reduction in voltage (electrical pressure) caused by the resistance in a component or circuit.

AUTOMOTIVE INTRODUCTION

For every task in Automotive Introduction, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

I. AUTOMOTIVE INTRODUCTION A. GENERAL AUTOMOTIVE WORKPLACE

Rating Scale
4 - Skilled -- can perform job independently
3 - Moderately Skilled – can do job with some supervision
2 - Limited Skill – requires instruction and supervision
1 - No Exposure – no experience or knowledge in this area

1. Know the meaning and purpose of OSHA.	P-1 4 3 2 1
2. Use and understand an MSDS.	P-1 4 3 2 1
3. Understand hazardous waste procedures.	P-1 4 3 2 1
4. Demonstrate the proper usage of fire extinguishers.	P-1 4 3 2 1
5. Demonstrate understanding for emergency procedures.	P-1 4 3 2 1
6. Demonstrate general knowledge of basic first aid and CPR procedures.	P-1 4 3 2 1
7. Exhibit proper personal safety habits.	P-1 4 3 2 1
8. Demonstrate proper equipment defect warning procedures.	P-1 4 3 2 1
9. Properly clean tools and equipment.	P-1 4 3 2 1
I 0. Demonstrate understanding of workplace security procedures.	P-1 4 3 2 1

I. AUTOMOTIVE INTRODUCTION**B. TOOLS AND EQUIPMENT**

1. Proper hand tool usage.	P-1 4 3 2 1
2. Proper use of a floor jack.	P-1 4 3 2 1
3. Demonstrate use of automotive lifts.	P-1 4 3 2 1
4. Properly use an engine hoist.	P-1 4 3 2 1
5. Use a torque wrench and a torque angle gauge.	P-1 4 3 2 1
6. Adjust and use a oxyacetylene torch.	P-1 4 3 2 1
7. Use a lubrication gun.	P-1 4 3 2 1
8. Properly use an air drill.	P-1 4 3 2 1
9. Demonstrate the proper use of an impact wrench.	P-1 4 3 2 1
10. Use an air chisel.	P-1 4 3 2 1
11. Safely use an air blow gun.	P-1 4 3 2 1
12. Proper usage of an electric drill.	P-1 4 3 2 1
13. Demonstrate proper and safe usage of an angle grinder.	P-1 4 3 2 1

14. Safely use a bench grinder.	P-1 4 3 2 1
15. Use a gear puller.	P-1 4 3 2 1
16. Use a screw extractor.	P-1 4 3 2 1
17. Proper use and maintenance of standard and metric micrometers.	P-1 4 3 2 1
18. Set up and read a dial indicator.	P-1 4 3 2 1
19. Use a feeler gauge.	P-1 4 3 2 1
20. Check tire pressure using a tire pressure gauge.	P-1 4 3 2 1
21. Measure and identify fasteners.	P-1 4 3 2 1
22. Repair internal and external threads.	P-1 4 3 2 1
23. Remove a stud.	P-1 4 3 2 1
24. Use a vacuum gauge.	P-1 4 3 2 1

I. AUTOMOTIVE INTRODUCTION**C. VEHICLE MAINTENANCE**

1. Identify powertrain configurations.	P-1 4 3 2 1
2. Identify chassis configurations.	P-1 4 3 2 1
3. Identify axle configurations.	P-1 4 3 2 1
4. Locate vehicle information.	P-1 4 3 2 1
5. Measure vehicle wheelbase.	P-1 4 3 2 1
6. Locate and decode a VIN.	P-1 4 3 2 1
7. Use a vehicle owner's manual.	P-1 4 3 2 1
8. Demonstrate the usage of repair information from shop manuals, repair manuals, and computerized service systems.	P-1 4 3 2 1
9. Use a parts manual.	P-1 4 3 2 1
10. Use a labor guide.	P-1 4 3 2 1
11. Complete a work order to contain pertinent information.	P-1 4 3 2 1
12. Check engine oil.	P-1 4 3 2 1
13. Check engine oil.	P-1 4 3 2 1

14. Check and adjust transmission fluid.	P-1 4 3 2 1
15. Check and adjust brake fluid.	P-1 4 3 2 1
16. Check and adjust differential/transaxle fluid.	P-1 4 3 2 1
17. Check and adjust coolant levels.	P-1 4 3 2 1
18. Check and adjust windshield washer fluid.	P-1 4 3 2 1
19. Check peripheral electrical systems.	P-1 4 3 2 1
20. Check and replace wiper blades.	P-1 4 3 2 1
21. Check and adjust tire pressures.	P-1 4 3 2 1
22. Check seat belt operation.	P-1 4 3 2 1

AUTOMOTIVE INTRODUCTION TASKS

P-1	56
Total:	56

ENGINE REPAIR

For every task in Engine Repair, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

II. ENGINE REPAIR

A. General: Engine Diagnosis; Removal and Reinstallation (R & R)

<u>Rating Scale</u>
4 - Skilled -- can perform job independently
3 - Moderately Skilled – can do job with some supervision
2 - Limited Skill – requires instruction and supervision
1 - No Exposure – no experience or knowledge in this area

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.	P-1 4 3 2 1
2. Research applicable vehicle and service information, including fluid type, internal engine operation, vehicle service history, service precautions, and technical service bulletins.	P-1 4 3 2 1
3. Verify operation of the instrument panel engine warning indicators.	P-1 4 3 2 1
4. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed action.	P-1 4 3 2 1
5. Install engine covers using gaskets, seals, and sealers as required.	P-1 4 3 2 1
6. Verify engine mechanical timing.	P-1 4 3 2 1
7. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert.	P-1 4 3 2 1
8. Inspect, remove, and/or replace engine mounts.	P-2 4 3 2 1
9. Identify service precautions related to service of the internal combustion engine of a hybrid vehicle.	P-2 4 3 2 1

II. ENGINE REPAIR

B. Cylinder Head and Valve Train Diagnosis and Repair

1. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specification and procedure.	P-1 4 3 2 1
2. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.	P-1 4 3 2 1
3. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine needed action.	P-2 4 3 2 1
4. Adjust valves (mechanical or hydraulic lifters).	P-1 4 3 2 1
5. 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.	P-1 4 3 2 1
6. Establish camshaft position sensor indexing.	P-1 4 3 2 1

II. ENGINE REPAIR**C. Engine Block Assembly Diagnosis and Repair**

1. Remove, inspect, and/or replace crankshaft vibration damper (harmonic balancer).	P-2 4 3 2 1
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II. ENGINE REPAIR

D. Lubrication and Cooling Systems Diagnosis and Repair

1. 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.	P-1 4 3 2 1
2. Identify causes of engine overheating.	P-1 4 3 2 1
3. Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.	P-1 4 3 2 1
4. Inspect and test coolant; drain and recover coolant; flush and refill cooling system; use proper fluid type per manufacturer specification; bleed air as required.	P-1 4 3 2 1
5. Inspect, remove, and replace water pump.	P-2 4 3 2 1
6. Remove and replace radiator.	P-2 4 3 2 1
7. Remove, inspect, and replace thermostat and gasket/seal.	P-1 4 3 2 1
8. Inspect and test fan(s), fan clutch (electrical or mechanical), fan shroud, and air dams; determine needed action.	P-1 4 3 2 1
9. Perform oil pressure tests; determine needed action.	P-1 4 3 2 1
10. Perform engine oil and filter change; use proper fluid type per manufacturer specification.	P-1 4 3 2 1
11. Inspect auxiliary coolers; determine needed action.	P-3 4 3 2 1
12. Inspect, test, and replace oil temperature and pressure switches and sensors.	P-2 4 3 2 1

ENGINE REPAIR TASKS

P-1	20
P-2	7
P-3	2
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Total:	29

AUTOMATIC TRANSMISSION AND TRANSAXLE

For every task in Automatic Transmission and Transaxle, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

III. AUTOMATIC TRANSMISSION AND TRANSAXLE

A. General: Transmission and Transaxle Diagnosis

Rating Scale

- 4 - Skilled -- can perform job independently
- 3 - Moderately Skilled – can do job with some supervision
- 2 - Limited Skill – requires instruction and supervision
- 1 - No Exposure – no experience or knowledge in this area

1. Identify and interpret transmission/transaxle concerns, differentiate between engine performance and transmission/transaxle concerns; determine needed action.	P-1 4 3 2 1
2. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.	P-1 4 3 2 1
3. Diagnose fluid loss and condition concerns; determine needed action.	P-1 4 3 2 1
4. Check fluid level and condition in a transmission or a transaxle equipped with a dip-stick.	P-1 4 3 2 1
5. Check fluid level and condition in a transmission or a transaxle not equipped with a dip-stick.	P-1 4 3 2 1
6. Perform stall test; determine needed action.	P-2 4 3 2 1
7. Perform lock-up converter system tests; determine needed action.	P-3 4 3 2 1
8. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.	P-1 4 3 2 1
9. Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law).	P-2 4 3 2 1

10. Demonstrate knowledge of pressure test including transmissions/transaxles equipped with electronic pressure control.	P-3 4 3 2 1
11. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information.	P-2 4 3 2 1

III. AUTOMATIC TRANSMISSION AND TRANSAXLE

B. In-Vehicle Transmission/Transaxle Maintenance and Repair

1. Inspect, adjust, and/or replace external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch.	P-1 4 3 2 1
2. Inspect for leakage; replace external seals, gaskets, and bushings.	P-2 4 3 2 1
3. Inspect, test, adjust, repair, and/or replace electrical/electronic components and circuits including computers, solenoids, sensors, relays, terminals, connectors, switches, and harnesses; demonstrate understanding of relearn procedure.	P-1 4 3 2 1
4. Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification.	P-1 4 3 2 1
5. Inspect, replace and align power train mounts.	P-2 4 3 2 1

III. AUTOMATIC TRANSMISSION AND TRANSAXLE

C. Off-Vehicle Transmission and Transaxle Repair

1. Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mating surfaces.	P-2 4 3 2 1
2. Inspect, leak test, flush, and/or replace transmission/transaxle oil cooler, lines, and fittings.	P-1 4 3 2 1
3. Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore.	P-2 4 3 2 1
4. Describe the operational characteristics of a continuously variable transmission (CVT).	P-3 4 3 2 1
5. Describe the operational characteristics of a hybrid vehicle drive train.	P-3 4 3 2 1

AUTOMATIC TRANSMISSION AND TRANSAXLE TASKS

P-1	10
P-2	6
P-3	4
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Total:	20

MANUAL DRIVE TRAIN AND AXLES

For every task in Manual Drive Train and Axles, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

IV. MANUAL DRIVE TRAIN AND AXLES

A. General: Drive Train Diagnosis

Rating Scale

- 4 - Skilled -- can perform job independently
- 3 - Moderately Skilled – can do job with some supervision
- 2 - Limited Skill – requires instruction and supervision
- 1 - No Exposure – no experience or knowledge in this area

1. Identify and interpret drive train concerns; determine needed action.	P-1	4	3	2	1
2. Research vehicle and service information including fluid type, vehicle service history, service precautions, and technical service bulletins.	P-1	4	3	2	1
3. Check fluid condition; check for leaks; determine needed action.	P-1	4	3	2	1
4. Drain and refill manual transmission/transaxle and final drive unit; use proper fluid type per manufacturer specification.	P-1	4	3	2	1

IV. MANUAL DRIVE TRAIN AND AXLES

B. Clutch Diagnosis and Repair

1. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action.	P-1 4 3 2 1
2. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; determine needed action.	P-1 4 3 2 1
3. Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing, linkage, and pilot bearing/bushing (as applicable).	P-1 4 3 2 1
4. Bleed clutch hydraulic system.	P-1 4 3 2 1
5. Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification.	P-1 4 3 2 1
6. Inspect flywheel and ring gear for wear and cracks; determine needed action.	P-1 4 3 2 1
7. Measure flywheel runout and crankshaft end play; determine needed action.	P-2 4 3 2 1
8. Describe the operation and service of a system that uses a dual mass flywheel.	P-3 4 3 2 1

IV. MANUAL DRIVE TRAIN AND AXLES C.**Transmission/Transaxle Diagnosis and Repair**

1. Inspect, adjust, lubricate, and/or replace shift linkages, brackets, bushings, cables, pivots, and levers.	P-2 4 3 2 1
2. Describe the operational characteristics of an electronically-controlled manual transmission/transaxle.	P-2 4 3 2 1

IV. MANUAL DRIVE TRAIN AND AXLES

D. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair (Front, Rear, All-wheel, Four-wheel drive)

1. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine needed action.	P-1 4 3 2 1
2. Diagnose universal joint noise and vibration concerns; determine needed action.	P-2 4 3 2 1
3. Inspect, remove, and/or replace bearings, hubs, and seals.	P-1 4 3 2 1
4. Inspect, service, and/or replace shafts, yokes, boots, and universal/CV joints.	P-1 4 3 2 1
5. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles.	P-2 4 3 2 1

III. MANUAL DRIVE TRAIN AND AXLES

E. Drive Axle Diagnosis and Repair

E.1 Ring and Pinion Gears and Differential Case Assembly

1. Clean and inspect differential case; check for leaks; inspect housing vent.	P-1 4 3 2 1
2. Check and adjust differential case fluid level; use proper fluid type per manufacturer specification.	P-1 4 3 2 1
3. Drain and refill differential case; using proper fluid type per manufacturer specification,	P-1 4 3 2 1
4. Inspect and replace companion flange and/or pinion seal; measure companion flange runout.	P-2 4 3 2 1

E.2 Drive Axles

1. Inspect and replace drive axle wheel studs.	P-1 4 3 2 1
2. Remove and replace drive axle shafts.	P-1 4 3 2 1
3. Inspect and replace drive axle shaft seals, bearings, and retainers.	P-2 4 3 2 1
4. Measure drive axle flange runout and shaft end play; determine needed action.	P-2 4 3 2 1

IV. MANUAL DRIVE TRAIN AND AXLES

F. Four-wheel Drive/All-wheel Drive Component Diagnosis and Repair

1. Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets.	P-3 4 3 2 1
2. Inspect locking hubs; determine needed action(s).	P-3 4 3 2 1
3. Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification.	P-3 4 3 2 1
4. Identify concerns related to variations in tire circumference and/or final drive ratios.	P-2 4 3 2 1

MANUAL DRIVE TRAIN AND AXLES TASKS

P-1	18
P-2	9
P-3	4
Total:	31

SUSPENSION AND STEERING

For every task in Suspension and Steering, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

Rating Scale

- 4 - Skilled -- can perform job independently
- 3 - Moderately Skilled – can do job with some supervision
- 2 - Limited Skill – requires instruction and supervision
- 1 - No Exposure – no experience or knowledge in this area

V. SUSPENSION AND STEERING

A. General: Suspension and Steering Systems

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.	P-1 4 3 2 1
2. Identify and interpret suspension and steering system concerns; determine needed action.	P-2 4 3 2 1

V. SUSPENSION AND STEERING

B. Steering Systems Diagnosis and Repair

1. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation.	P-1 4 3 2 1
2. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).	P-1 4 3 2 1
3. Diagnose steering column noises, looseness, and binding concerns (including tilt/telescoping mechanisms); determine needed action.	P-2 4 3 2 1
4. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.	P-2 4 3 2 1
5. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.	P-2 4 3 2 1
6. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; determine needed action.	P-2 4 3 2 1
7. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets.	P-2 4 3 2 1
8. Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots; replace as needed.	P-1 4 3 2 1
9. Inspect power steering fluid level and condition.	P-1 4 3 2 1
10. Flush, fill, and bleed power steering system; using proper fluid type per manufacturer specification.	P-2 4 3 2 1
11. Inspect for power steering fluid leakage; determine needed action.	P-1 4 3 2 1

12. Remove, inspect, replace, and/or adjust power steering pump drive belt.	P-1 4 3 2 1
13. Remove and reinstall power steering pump.	P-2 4 3 2 1
14. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.	P-2 4 3 2 1
15. Inspect, remove, and/or replace power steering hoses and fittings.	P-2 4 3 2 1
16. Inspect, remove, and/or replace pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper.	P-2 4 3 2 1
17. Inspect, replace, and/or adjust tie rod ends (sockets), tie rod sleeves, and clamps.	P-1 4 3 2 1
18. Identify hybrid vehicle power steering system electrical circuits and safety precautions.	P-2 4 3 2 1
19. Inspect electric power steering assist system.	P-3 4 3 2 1

V. SUSPENSION AND STEERING

C. Suspension Systems Diagnosis and Repair

1. Diagnose short and long arm suspension system noises, body sway, and uneven ride height concerns; determine needed action.	P-1 4 3 2 1
2. Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine needed action.	P-1 4 3 2 1
3. Inspect, remove and/or replace upper and lower control arms, bushings, shafts, and rebound bumpers.	P-3 4 3 2 1
4. Inspect, remove and/or replace strut rods and bushings.	P-3 4 3 2 1
5. Inspect, remove and/or replace upper and/or lower ball joints (with or without wear indicators).	P-2 4 3 2 1
6. Inspect, remove and/or replace steering knuckle assemblies.	P-3 4 3 2 1
7. Inspect, remove and/or replace short and long arm suspension system coil springs and spring insulators.	P-3 4 3 2 1
8. Inspect, remove and/or replace torsion bars and mounts.	P-3 4 3 2 1
9. Inspect, remove and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links.	P-3 4 3 2 1
10. Inspect, remove and/or replace strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.	P-3 4 3 2 1
11. Inspect, remove and/or replace track bar, strut rods/radius arms, and related mounts and bushings.	P-3 4 3 2 1
12. Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts.	P-1 4 3 2 1

V. SUSPENSION AND STEERING

D. Related Suspension and Steering Service

1. Inspect, remove, and/or replace shock absorbers; inspect mounts and bushings.	P-1 4 3 2 1
2. Remove, inspect, service, and/or replace front and rear wheel bearings.	P-1 4 3 2 1
3. Describe the function of suspension and steering control systems and components, (i.e. active suspension and stability control).	P-3 4 3 2 1

V. SUSPENSION AND STEERING

E. Wheel Alignment Diagnosis, Adjustment, and Repair

1. Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine needed action.	P-1 4 3 2 1
2. Perform prealignment inspection; measure vehicle ride height; determine needed action.	P-1 4 3 2 1
3. Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front and rear wheel caster, camber; and toe as required; center steering wheel.	P-1 4 3 2 1
4. Check toe-out-on-turns (turning radius); determine needed action.	P-2 4 3 2 1
5. Check steering axis inclination (SAI) and included angle; determine needed action.	P-2 4 3 2 1
6. Check rear wheel thrust angle; determine needed action.	P-1 4 3 2 1
7. Check for front wheel setback; determine needed action.	P-2 4 3 2 1
8. Check front and/or rear cradle (subframe) alignment; determine needed action.	P-3 4 3 2 1
9. Reset steering angle sensor	P-2 4 3 2 1

V. SUSPENSION AND STEERING

F. Wheels and Tires Diagnosis and Repair

1. Inspect tire condition; identify tire wear patterns; check for correct, tire size, application (load and speed ratings), and air pressure as listed on the tire information placard/label.	P-1 4 3 2 1
2. Diagnose wheel/tire vibration, shimmy, and noise; determine needed action.	P-2 4 3 2 1
3. Rotate tires according to manufacturer's recommendation including vehicles equipped with tire pressure monitoring system (TPMS).	P-1 4 3 2 1
4. Measure wheel, tire, axle flange, and hub runout; determine needed action.	P-2 4 3 2 1
5. Diagnose tire pull problems; determine needed action.	P-1 4 3 2 1
6. Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly.	P-1 4 3 2 1
7. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor.	P-1 4 3 2 1
8. Inspect tire and wheel assembly for air loss; determine needed action.	P-1 4 3 2 1
9. Repair tire following vehicle manufacturer approved procedure.	P-1 4 3 2 1
10. Identify indirect and direct tire pressure monitoring systems (TPMS); calibrate system; verify operation of instrument panel lamps.	P-1 4 3 2 1
11. Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system (TPMS) including relearn procedure.	P-1 4 3 2 1

SUSPENSION AND STEERING TASKS

P-1	26
P-2	19
P-3	11
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Total:	56

BRAKES

For every task in Brakes, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

Rating Scale

- 4 - Skilled -- can perform job independently
- 3 - Moderately Skilled – can do job with some supervision
- 2 - Limited Skill – requires instruction and supervision
- 1 - No Exposure – no experience or knowledge in this area

VI. BRAKES

A. General: Brake Systems Diagnosis

1. Identify and interpret brake system concerns; determine needed action.	P-1 4 3 2 1
2. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.	P-1 4 3 2 1
3. Describe procedure for performing a road test to check brake system operation including an anti-lock brake system (ABS).	P-1 4 3 2 1
4. Install wheel and torque lug nuts.	P-1 4 3 2 1

VI. BRAKES**B. Hydraulic System Diagnosis and Repair**

1. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law).	P-1 4 3 2 1
2. Measure brake pedal height, travel, and free play (as applicable); determine needed action.	P-1 4 3 2 1
3. Check master cylinder for internal/external leaks and proper operation; determine needed action.	P-1 4 3 2 1
4. Remove, bench bleed, and reinstall master cylinder.	P-1 4 3 2 1
5. Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine needed action.	P-3 4 3 2 1
6. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, and loose fittings/supports; determine needed action.	P-1 4 3 2 1
7. Replace brake lines, hoses, fittings, and supports.	P-2 4 3 2 1
8. Fabricate brake lines using proper material and flaring procedures (double flare and ISO types).	P-2 4 3 2 1
9. Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification.	P-1 4 3 2 1
10. Inspect, test, and/or replace components of brake warning light system.	P-3 4 3 2 1
11. Identify components of hydraulic brake warning light system.	P-2 4 3 2 1
12. Bleed and/or flush brake system.	P-1 4 3 2 1
13. Test brake fluid for contamination.	P-1 4 3 2 1

VI. BRAKES

C. Drum Brake Diagnosis and Repair

1. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine needed action.	P-1 4 3 2 1
2. Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability.	P-1 4 3 2 1
3. Refinish brake drum and measure final drum diameter; compare with specification.	P-1 4 3 2 1
4. 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.	P-1 4 3 2 1
5. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.	P-2 4 3 2 1
6. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments.	P-1 4 3 2 1

VI. BRAKES**D. Disc Brake Diagnosis and Repair**

1. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action.	P-1 4 3 2 1
2. Remove and clean caliper assembly; inspect for leaks, damage, and wear; determine needed action.	P-1 4 3 2 1
3. Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine needed action.	P-1 4 3 2 1
4. Remove, inspect, and/or replace brake pads and retaining hardware; determine needed action.	P-1 4 3 2 1
5. Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads; inspect for leaks.	P-1 4 3 2 1
6. Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action.	P-1 4 3 2 1
7. Remove and reinstall/replace rotor.	P-1 4 3 2 1
8. Refinish rotor on vehicle; measure final rotor thickness and compare with specification.	P-1 4 3 2 1
9. Refinish rotor off vehicle; measure final rotor thickness and compare with specification.	P-1 4 3 2 1
10. Retract and re-adjust caliper piston on an integrated parking brake system.	P-2 4 3 2 1
11. Check brake pad wear indicator; determine needed action.	P-1 4 3 2 1
12. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations.	P-1 4 3 2 1

VI. BRAKES**E. Power-Assist Units Diagnosis and Repair**

1. Check brake pedal travel with and without engine running to verify proper power booster operation.	P-2 4 3 2 1
2. Identify components of the brake power assist system (vacuum and hydraulic); check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster.	P-1 4 3 2 1
3. Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine needed action.	P-1 4 3 2 1
4. Inspect and test hydraulically-assisted power brake system for leaks and proper operation; determine needed action.	P-3 4 3 2 1
5. Measure and adjust master cylinder pushrod length.	P-3 4 3 2 1

VI. BRAKES**F. Related Systems (i.e. Wheel Bearings, Parking Brakes, Electrical) Diagnosis and Repair**

1. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine needed action.	P-2 4 3 2 1
2. Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings.	P-2 4 3 2 1
3. Check parking brake system components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed.	P-1 4 3 2 1
4. Check parking brake operation and parking brake indicator light system operation; determine needed action.	P-1 4 3 2 1
5. Check operation of brake stop light system.	P-1 4 3 2 1
6. Replace wheel bearing and race.	P-3 4 3 2 1
7. Inspect and replace wheel studs.	P-1 4 3 2 1
8. Remove, reinstall, and/or replace sealed wheel bearing assembly.	P-1 4 3 2 1

VI. BRAKES**G. Electronic Brake Control Systems: Antilock Brake (ABS), Traction Control (TCS) and Electronic Stability Control (ESC) Systems Diagnosis and Repair**

1. Identify and inspect electronic brake control system components (ABS, TCS, ESC); determine needed action.	P-1 4 3 2 1
2. Describe the operation of a regenerative braking system.	P-3 4 3 2 1

BRAKES TASKS

P-1 36

P-2 8

P-3 6

50

ELECTRICAL/ELECTRONIC SYSTEMS

For every task in Electrical/Electronic Systems, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

Rating Scale

- 4 - Skilled -- can perform job independently
- 3 - Moderately Skilled – can do job with some supervision
- 2 - Limited Skill – requires instruction and supervision
- 1 - No Exposure – no experience or knowledge in this area

VII. ELECTRICAL/ELECTRONIC SYSTEMS

A. General: Electrical System Diagnosis

1. Research applicable vehicle and service information including vehicle service history, service precautions, and technical service bulletins.	P-1 4 3 2 1
2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).	P-1 4 3 2 1
3. Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow and resistance.	P-1 4 3 2 1
4. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.	P-1 4 3 2 1
5. Demonstrate proper use of a test light on an electrical circuit.	P-1 4 3 2 1
6. Use fused jumper wires to check operation of electrical circuits.	P-1 4 3 2 1
7. Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems.	P-1 4 3 2 1
8. Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine needed action.	P-1 4 3 2 1
9. Inspect and test fusible links, circuit breakers, and fuses; determine needed action.	P-1 4 3 2 1

10. Inspect, test, repair, and/or replace components, connectors, terminals, harnesses, and wiring in electrical/electronic systems (including solder repairs); determine needed action.	P-1 4 3 2 1
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VII. ELECTRICAL/ELECTRONIC SYSTEMS

B. Battery Diagnosis and Service

1. Perform battery state-of-charge test; determine needed action.	P-1 4 3 2 1
2. Confirm proper battery capacity for vehicle application; perform battery capacity and load test; determine needed action.	P-1 4 3 2 1
3. Maintain or restore electronic memory functions.	P-1 4 3 2 1
4. Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps, and hold-downs.	P-1 4 3 2 1
5. Perform slow/fast battery charge according to manufacturer's recommendations.	P-1 4 3 2 1
6. Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply.	P-1 4 3 2 1
7. Identify safety precautions for high voltage systems on electric, hybrid-electric, and diesel vehicles.	P-2 4 3 2 1
8. Identify electrical/electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery.	P-1 4 3 2 1
9. Identify hybrid vehicle auxiliary (12v) battery service, repair, and test procedures.	P-2 4 3 2 1

VII. ELECTRICAL/ELECTRONIC SYSTEMS

C. Starting System Diagnosis and Repair

1. Perform starter current draw tests; determine needed action.	P-1 4 3 2 1
2. Perform starter circuit voltage drop tests; determine needed action.	P-1 4 3 2 1
3. Inspect and test starter relays and solenoids; determine needed action.	P-2 4 3 2 1
4. Remove and install starter in a vehicle.	P-1 4 3 2 1
5. Inspect and test switches, connectors, and wires of starter control circuits; determine needed action.	P-2 4 3 2 1
6. Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition.	P-2 4 3 2 1
7. Demonstrate knowledge of automatic idle-stop/start-stop system.	P-2 4 3 2 1

VII. ELECTRICAL/ELECTRONIC SYSTEMS

D. Charging System Diagnosis and Repair

1. Perform charging system output test; determine needed action.	P-1 4 3 2 1
2. Diagnose (troubleshoot) charging system for causes of undercharge, no-charge, or overcharge conditions.	P-1 4 3 2 1
3. Inspect, adjust, and/or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment.	P-1 4 3 2 1
4. Remove, inspect, and/or replace generator (alternator).	P-1 4 3 2 1
5. Perform charging circuit voltage drop tests; determine needed action.	P-1 4 3 2 1

VII. ELECTRICAL/ELECTRONIC SYSTEMS

E. Lighting Systems Diagnosis and Repair

1. Diagnose (troubleshoot) the causes of brighter-than-normal, intermittent, dim, or no light operation; determine needed action.	P-1 4 3 2 1
2. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed.	P-1 4 3 2 1
3. Aim headlights.	P-2 4 3 2 1
4. Identify system voltage and safety precautions associated with high-intensity discharge headlights.	P-2 4 3 2 1

VII. ELECTRICAL/ELECTRONIC SYSTEMS

F. Instrument Cluster and Driver Information Systems Diagnosis and Repair

1. Inspect and test gauges and gauge sending units for causes of abnormal readings; determine needed action.	P-2 4 3 2 1
2. Diagnose (troubleshoot) the causes of incorrect operation of warning devices and other driver information systems; determine needed action.	P-2 4 3 2 1
3. Reset maintenance indicators as required.	P-2 4 3 2 1

VII. ELECTRICAL/ELECTRONIC SYSTEMS

G. Body Electrical Systems Diagnosis and Repair

<p>1. Describe operation of comfort and convenience accessories and related circuits (such as: power window, power seats, pedal height, power locks, truck locks, remote start, moon roof, sun roof, sun shade, remote keyless entry, voice activation, steering wheel controls, back-up camera, park assist, cruise control, and auto dimming headlamps); determine needed repairs.</p>	<p>P-3</p> <p>4 3 2 1</p>
<p>2. Describe 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 repairs.</p>	<p>P-3</p> <p>4 3 2 1</p>
<p>3. Describe operation of entertainment and related circuits (such as: radio, DVD, remote CD changer, navigation, amplifiers, speakers, antennas, and voice-activated accessories); determine needed repairs.</p>	<p>P-3</p> <p>4 3 2 1</p>
<p>4. Describe 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, park assist, and back-up camera); determine needed repairs.</p>	<p>P-3</p> <p>4 3 2 1</p>
<p>5. Describe body electronic systems circuits using a scan tool; check for module communication errors (data bus systems); determine needed action.</p>	<p>P-3</p> <p>4 3 2 1</p>
<p>6. Describe the process for software transfer, software updates, or reprogramming of electronic modules.</p>	<p>P-3</p> <p>4 3 2 1</p>

ELECTRICAL/ELECTRONIC SYSTEMS TASKS

P-1	29
P-2	11
P-3	6
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Total:	46

HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

For every task in Heating, Ventilation, and Air Conditioning (HVAC), the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

VIII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

A. General: A/C System Diagnosis and Repair

Rating Scale

- 4 - Skilled -- can perform job independently
- 3 - Moderately Skilled – can do job with some supervision
- 2 - Limited Skill – requires instruction and supervision
- 1 - No Exposure – no experience or knowledge in this area

1. Identify and interpret heating and air conditioning problems; determine needed action.	P-1 4 3 2 1
2. Research vehicle service information including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins.	P-1 4 3 2 1
3. Performance test A/C system; identify problems.	P-1 4 3 2 1
4. Identify abnormal operating noises in the A/C system; determine needed action.	P-2 4 3 2 1
5. Identify refrigerant type; select and connect proper gauge set/test equipment; record temperature and pressure readings.	P-1 4 3 2 1
6. Leak test A/C system; determine needed action.	P-1 4 3 2 1
7. Inspect condition of refrigerant oil removed from A/C system; determine needed action.	P-2 4 3 2 1
8. Determine recommended oil and oil capacity for system application.	P-1 4 3 2 1
9. Using a scan tool, observe and record related HVAC data and trouble codes.	P-3 4 3 2 1

VIII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

B. Refrigeration System Component Diagnosis and Repair

1. Inspect, remove, and/or replace A/C compressor drive belts, pulleys, and tensioners; visually inspect A/C components for signs of leaks; determine needed action.	P-1 4 3 2 1
2. Inspect, test, service, and/or replace A/C compressor clutch components and/or assembly; check compressor clutch air gap; adjust as needed.	P-2 4 3 2 1
3. Remove, inspect, and reinstall A/C compressor and mountings; determine recommended oil type and quantity.	P-2 4 3 2 1
4. Identify hybrid vehicle A/C system electrical circuits and service/safety precautions.	P-2 4 3 2 1
5. Determine need for an additional A/C system filter; determine needed action.	P-3 4 3 2 1
6. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; determine needed action.	P-2 4 3 2 1
7. Inspect for proper A/C condenser airflow; determine needed action.	P-1 4 3 2 1
8. Remove, inspect, and reinstall receiver/drier or accumulator/drier; determine recommended oil type and quantity.	P-2 4 3 2 1
9. Remove, inspect, and install expansion valve or orifice (expansion) tube.	P-1 4 3 2 1
10. Inspect evaporator housing water drain; determine needed action.	P-1 4 3 2 1
11. Determine procedure to remove and reinstall evaporator; determine required oil type and quantity.	P-2 4 3 2 1

VIII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

C. Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair

1. Inspect engine cooling and heater systems hoses and pipes; determine needed action.	P-1 4 3 2 1
2. Inspect and test heater control valve(s); determine needed action.	P-2 4 3 2 1
3. Determine procedure to remove, inspect, reinstall, and/or replace heater core.	P-2 4 3 2 1

VIII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

D. Operating Systems and Related Controls Diagnosis and Repair

1. Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action.	P-1 4 3 2 1
2. Diagnose HVAC system clutch control systems; determine needed action.	P-2 4 3 2 1
3. Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the heating, ventilation, and A/C (HVAC) system; determine needed action.	P-2 4 3 2 1
4. Inspect and test HVAC system control panel assembly; determine needed action.	P-3 4 3 2 1
5. Inspect and test HVAC system control cables, motors, and linkages; determine needed action.	P-3 4 3 2 1
6. Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; determine needed action.	P-1 4 3 2 1
7. Identify the source of HVAC system odors.	P-2 4 3 2 1
8. Check operation of automatic or semi-automatic HVAC control systems; determine needed action.	P-2 4 3 2 1

VIII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**E. Refrigerant Recovery, Recycling, and Handling**

1. Perform correct use and maintenance of refrigerant handling equipment according to equipment manufacturer's standards.	P-1 4 3 2 1
2. Identify A/C system refrigerant; test for sealants; recover, evacuate, and charge A/C system; add refrigerant oil as required.	P-1 4 3 2 1
3. Recycle, label, and store refrigerant.	P-1 4 3 2 1

HEATING, VENTILATION, AND AIR CONDITIONING (HVAC) TASKS

P-1	16
P-2	14
P-3	4
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	34

ENGINE PERFORMANCE

For every task in Engine Performance the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

Rating Scale

- 4 - Skilled -- can perform job independently
- 3 - Moderately Skilled – can do job with some supervision
- 2 - Limited Skill – requires instruction and supervision
- 1 - No Exposure – no experience or knowledge in this area

IX. ENGINE PERFORMANCE

A. General: Engine Diagnosis

1. Identify and interpret engine performance concerns; determine needed action.	P-1 4 3 2 1
2. Research vehicle service information, including vehicle service history, service precautions, and technical service bulletins.	P-1 4 3 2 1
3. Diagnose abnormal engine noises or vibration concerns; determine needed action.	P-3 4 3 2 1
4. Diagnose the cause of excessive oil consumption coolant consumption, unusual exhaust color, odor, and sound; determine needed action.	P-2 4 3 2 1
5. Perform engine absolute manifold pressure tests (vacuum/boost); determine needed action.	P-1 4 3 2 1
6. Perform cylinder power balance test; determine needed action.	P-2 4 3 2 1
7. Perform cylinder cranking and running compression tests; determine needed action.	P-1 4 3 2 1
8. Perform cylinder leakage test; determine needed action.	P-1 4 3 2 1

9. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine needed action.	P-2 4 3 2 1
10. Verify engine operating temperature; determine needed action.	P-1 4 3 2 1
11. Verify correct camshaft timing including variable valve timing (VVT) systems.	P-1 4 3 2 1

IX. ENGINE PERFORMANCE**B. Computerized Controls Diagnosis and Repair**

1. Retrieve and record diagnostic trouble codes (DTC), OBD monitor status, and freeze frame data; clear codes when applicable.	P-1 4 3 2 1
2. Access and use service information to perform step-by-step (troubleshooting) diagnosis.	P-1 4 3 2 1
3. Perform active tests of actuators using a scan tool; determine needed action.	P-2 4 3 2 1
4. Describe the use of OBD monitors for repair verification.	P-1 4 3 2 1

IX. ENGINE PERFORMANCE

C. Ignition System Diagnosis and Repair

1. Diagnose (troubleshoot) 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.	P-2 4 3 2 1
2. Inspect and test crankshaft and camshaft position sensor(s); determine needed action.	P-1 4 3 2 1
3. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram/initialize as needed.	P-3 4 3 2 1
4. Remove and replace spark plugs; inspect secondary ignition components for wear and damage.	P-1 4 3 2 1

IX. ENGINE PERFORMANCE**D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair**

1. Check fuel for contaminants; determine needed action.	P-2 4 3 2 1
2. Inspect and test fuel pump(s) and pump control system for pressure, regulation, and volume; determine needed action.	P-1 4 3 2 1
3. Replace fuel filter(s) where applicable.	P-2 4 3 2 1
4. Inspect, service, or replace air filters, filter housings, and intake duct work.	P-1 4 3 2 1
5. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.	P-2 4 3 2 1
6. Inspect, test and/or replace fuel injectors.	P-2 4 3 2 1
7. Verify idle control operation.	P-1 4 3 2 1
8. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; determine needed action.	P-1 4 3 2 1
9. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine needed action.	P-1 4 3 2 1
10. Perform exhaust system back-pressure test; determine needed action.	P-2 4 3 2 1
11. Check and refill diesel exhaust fluid (DEF).	P-2 4 3 2 1

IX. ENGINE PERFORMANCE

E. Emissions Control Systems Diagnosis and Repair

1. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine needed action.	P-3 4 3 2 1
2. Inspect, test, service and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; determine needed action.	P-2 4 3 2 1
3. 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.	P-3 4 3 2 1
4. Inspect and test electrical/electronically-operated components and circuits of secondary air injection systems; determine needed action.	P-3 4 3 2 1
5. Diagnose emissions and driveability concerns caused by the catalytic converter system; determine needed action.	P-3 4 3 2 1
6. Inspect and test components and hoses of the evaporative emissions control (EVAP) system; determine needed action.	P-1 4 3 2 1
7. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine needed action.	P-2 4 3 2 1

ENGINE PERFORMANCE TASKS

P-1	19
P-2	13
P-3	6
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	38

GRAND TOTAL TASKS

P-1	173
P-2	90
P-3	47

REQUIRED SUPPLEMENTAL TASKS 43

353

REQUIRED SUPPLEMENTAL TASKS

Shop and Personal Safety

1. Identify general shop safety rules and procedures.
2. Utilize safe procedures for handling of tools and equipment.
3. Identify and use proper placement of floor jacks and jack stands.
4. Identify and use proper procedures for safe lift operation.
5. Utilize proper ventilation procedures for working within the lab/shop area.
6. Identify marked safety areas.
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.
8. Identify the location and use of eye wash stations.
9. Identify the location of the posted evacuation routes.
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.
11. Identify and wear appropriate clothing for lab/shop activities.

Tools and Equipment

1. Identify tools and their usage in automotive applications.
2. Identify standard and metric designation.
3. Demonstrate safe handling and use of appropriate tools.
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment.
5. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dial-caliper).

Preparing Vehicle for Service

1. Identify information needed and the service requested on a repair order.
2. Identify purpose and demonstrate proper use of fender covers, mats.
3. Demonstrate use of the three C's (concern, cause, and correction).
4. Review vehicle service history.
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.

Preparing Vehicle for Customer

1. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.).

Task List Priority Item Totals (by area)

<p>I. Introduction</p> <p>P-1 _____ = 56</p>
<p>II. Engine Repair</p> <p>P-1 _____ = 20 P-2 _____ = 7 P-3 _____ = 2</p>
<p>III. Automatic Transmission and Transaxle</p> <p>P-1 _____ = 10 P-2 _____ = 6 P-3 _____ = 4</p>
<p>IV. Manual Drive Train and Axles</p> <p>P-1 _____ = 18 P-2 _____ = 9 P-3 _____ = 4</p>
<p>V. Suspension and Steering</p> <p>P-1 _____ = 26 P-2 _____ = 19 P-3 _____ = 11</p>

<p>VI. Brakes</p> <p>P-1 _____ = 36 P-2 _____ = 8 P-3 _____ = 6</p>
<p>VII. Electrical / Electronic Systems</p> <p>P-1 _____ = 29 P-2 _____ = 11 P-3 _____ = 6</p>
<p>VIII. Heating and Air Conditioning</p> <p>P-1 _____ = 16 P-2 _____ = 14 P-3 _____ = 4</p>
<p>IX. Engine Performance</p> <p>P-1 _____ = 19 P-2 _____ = 13 P-3 _____ = 6</p>

APPLIED ACADEMICS AND WORKPLACE SKILLS

The following Applied Academic Skills general statements were developed in cooperation with the Vocational-Technical Education Consortium of States (V-TECS). The process involved using the NATEF task list and the Basic/Essential Skills Taxonomy developed at Arizona State University by Dr. Lester Snyder.

Committee meetings were held in the following four cities: Atlanta, Georgia; Boston, Massachusetts; Cincinnati, Ohio; and Phoenix, Arizona. At each of the meetings, ASE Certified Master Automobile technicians were used as experts in the automotive service industry. V-TECS used experts in three academic areas (language arts, mathematics, and science) to help the committees understand the specific definitions of the concepts used in the taxonomy.

The committees were asked to identify the academic skills required to perform each task listed in the eight automobile areas. Their responses were recorded using the Basic/Essential Skills Taxonomy codes and were put into a database. After all the meetings were completed, a composite or unduplicated list of the codes was generated for language arts, mathematics, and science. Specific statements related to the use of the academic skill in the automotive industry were then written. A matrix was built to show the relationship between the composite list and each of the eight automobile areas. The general statements included in this manual were developed from the specific statements. Several crosschecks and reviews were conducted to ensure the accuracy of the statement and the relationship to the NATEF task list.

The Workplace Skills List was generated by having the committees identify the workplace skills from the V-TECS/ILLINOIS WORKPLACE SKILLS LIST that are important for employment as an automobile technician.

** Please download the Applied Academics and Workplace Skills for Automobile Technicians book from the NATEF website or contact the office to order a copy. This book includes the unduplicated list of applied academic skills in all eight automobile areas, complete with statements of their use by automobile technicians; the matrix; the definitions of the Basic/Essential Skills codes; the general narrative statements; the Workplace Skills List; and the NATEF Task List.

The information in the book will provide a common vocabulary for instructors and administrators to use in achieving academic and vocational skill standards. This information can be used by programs to document the academic skills taught in automotive technical classes. The examples for teaching an academic concept in an applied context will also be useful for schools when planning, designing, or writing curricula. **

LANGUAGE ARTS & COMMUNICATIONS RELATED ACADEMIC SKILLS
for all
NATEF Automobile Technician Task Lists

The automobile technician must be proficient in the following Language Arts and Communications related academic skills that are embedded in the occupation. Using these skills the technician must be able to:

- Request, collect, comprehend, evaluate, and apply oral and written information gathered from customers, associates, and supervisors regarding problem symptoms and potential solutions to problems.
- Identify the purpose for all written and oral communication and then choose the most effective strategies for listening, reading, speaking, and writing to facilitate the communication process.
- Adapt a reading strategy for all written materials, e.g. customer's notes, service manuals, shop manuals, technical bulletins, etc., relevant to problem identification, diagnosis, solution, and repair.
- Attend to verbal and nonverbal cues in discussions with customers, supervisors, and associates to verify, identify, and solve problems.
- Use study habits and techniques, i.e. previewing, scanning, skimming, taking notes, etc., when reviewing publications (shop manuals, references, databases, operator's manuals, and text resources) for problem solving, diagnosis, and repair.
- Use prior knowledge learned from solving similar problems to diagnose and repair specific problems.
- Write clear, concise, complete, and grammatically accurate sentences and paragraphs.
- Write warranty reports and work orders to include information regarding problem resolution and the results of the work performed for the customer or manufacturer.
- Comprehend and apply industry definitions and specifications to diagnose and solve problems in all automotive systems and components.
- Follow all oral/written directions that relate to the task or system under study.
- Comprehend and use problem-solving techniques and decision trees that are contained in service manuals to determine cause-and-effect relationships.
- Scan service manuals and databases to locate specific information for problem-solving purposes.
- Use the service manual to identify the manufacturer's specifications for system parameters, operation, and potential malfunctions.
- Interpret charts, tables, or graphs to determine the manufacturer's specifications for system operation to identify out-of-tolerance systems and subsystems.
- Supply clarifying information to customers, associates, parts supplier, and supervisors.

MATHEMATICS RELATED ACADEMIC SKILLS
for all
NATEF Automobile Technician Task Lists

The automobile technician must be proficient in the following mathematics-related academic skills that are embedded in the occupation. Given these skills the technician must be able to:

- Determine the proper sequence of arithmetic operations to arrive at a solution that can be compared to other specifications when comparing system measurements to the manufacturer's specifications.
- Add two or more whole numbers, fractions, or decimals to determine component conformance of multiple measurements with the manufacturer's specifications.
- Subtract whole numbers, fractions, or decimals to arrive at a difference for comparison with the manufacturer's specifications.
- Divide decimals to determine measurement conformance with the manufacturer's specifications.
- Convert variables presented orally to a mathematical form that provides for an algebraic solution.
- Estimate the results of basic arithmetic operations, and accurately round up or down depending on the appropriate rule for the situation.
- Analyze and solve problems requiring the use of fractions, decimals, ratios, or percentages by a direct or indirect variation of the numerical elements of the problem.
- Determine the irrelevant and/or missing data needed to solve a problem.
- Determine and interpret place value (tenths, hundredths, thousandths) when conducting precision measurements.
- Use Centigrade or Fahrenheit measurement scales to determine the existing temperature of substances such as a coolant or lubricant.
- Use English and metric volume measurement techniques to determine the volume of a system, component, or cylinder.
- Use conventional symbols (E for voltage, etc.) to solve circuit parameter calculations using formulas such as Ohm's Law, $E=IR$.
- Understand that if the described problem has certain conditions (symptoms), then a limited number of solutions to the problem apply.
- Understand the relationship between the frequency of the occurrence of a problem (symptom) and the probability of accurately predicting the problem.
- Calculate the average (mean) of several measurements to determine the variance from the manufacturer's specifications.
- Use English and metric angle and distance measurements and techniques to determine angle variances from the manufacturer's specifications.

- Solve problems that involve determining the relative proportion of desired versus undesired ingredients or elements of a mixture, and determine if that proportion is within the manufacturer's specifications.
- Comprehend and use standards defined by each manufacturer for the system being analyzed.
- Convert test readings that are in decimal or fraction form to a ratio or percent for comparison with the manufacturer's specifications for the sub-system.
- Know when to use an estimated performance value versus an exact value, basing the decision on the system being analyzed or repaired.
- Visually perceive the geometric relationship of systems and sub-systems that require alignment.
- Construct or interpret a chart, table, graph, or symbol that depicts a range of performance characteristics that can be used for comparing various system operational conditions.
- Use measurement devices to determine the parallelism or perpendicularity of chassis, suspension, and other vehicle systems requiring geometric alignment.
- Use formulas to indirectly confirm systems that are outside of the manufacturer's specifications.
- Verify that the relationship between parallel lines and angles concurs with the manufacturer's specifications when diagnosing a system's malfunction.
- Visually formulate a belt (e.g., suspension/drive) angle and verify conformance to the manufacturer's specified angle.
- Measure timed or sequenced operating parameters to determine conformance with the manufacturer's specifications.
- Use English and metric scales to determine the conformance of components to the manufacturer's specified weight.
- Determine the degree of conformance to the manufacturer's specifications for length, volume, and other appropriate measurements in the English and/or metric system.
- Distinguish the congruence of the measured tolerances with those specified by the manufacturer.
- Measure and/or test with tools designed for English or metric measurements, then convert the result to the manufacturer's system used for specifying the correct measurement or tolerance.
- Compute mentally whether the observed measurement is out of tolerance when comparing the observed measurement to the manufacturer's specifications.
- Solve problems that involve determining whether the proportion of the existing volume compares to the manufacturer's specifications and is within the recommended tolerance.
- Distinguish whether a measurement or tolerance is equal or not equal to the manufacturer's specifications.

SCIENCE RELATED ACADEMIC SKILLS
for all
NATEF Automobile Technician Task Lists

The automobile technician must be proficient in the following science-related academic skills that are imbedded in the occupation. Using these skills the technician must be able to:

- Analyze and evaluate waste products from the repair task and dispose of the parts, residue, or trash according to applicable federal, state, and local rules and regulations.
- Follow all safety regulations and procedures while performing any task.
- Use the information provided in service manuals, charts, tables, or graphs to determine the manufacturer's specifications for system(s) operation(s) and the appropriate repair/replacement procedure.
- Develop a hypothesis regarding the cause of the problem and test the hypothesis to determine the solution to the problem.
 1. identify the problem
 2. gather information
 3. develop hypothesis
 4. take action
 5. check results
- Convert measurements taken using the English or metric system to specifications stated in terms of either system.
- Explain and demonstrate an understanding of the chemical reaction that occurs in an automobile regarding the combustion of fuels, catalytic converters, and contamination when introduced into systems.
- Explain the purpose of additives in lubricants.
- Demonstrate an understanding of the kinetic and potential energy relationships that occur in valve systems, ignition systems, and other stored energy systems, such as springs and fuels, and determine efficiency.
- Demonstrate an understanding of the role of balanced and unbalanced forces on linear and rotating vehicle assemblies.
- Explain the relationship of centrifugal/centripetal force to the failure of rotating systems.
- Explain the ignition characteristics of fuels resulting from varying levels of fractional distillation.
- Demonstrate an understanding of how fuel characteristics affect combustion in an automotive engine.
- Demonstrate an understanding of the effect of heat on automotive systems.
- Explain the concept of heat transfer in terms of conduction, convection, and radiation in automotive systems.

- Demonstrate an understanding of the expansion and contraction of system parts as a result of heat generated during use and the cooling of the system when not in operation.
- Demonstrate an understanding of the effect that adding heat will cause in a state of matter, such as solid to liquid to gas.
- Explain the role of insulation in maintaining stable temperatures.
- Demonstrate an understanding of refraction in fiber optic systems.
- Explain that dyes added to lubricants fluoresce in ultraviolet light and provide a process for determining the source of leakage.
- Demonstrate an understanding of the process of acceleration and deceleration as a function of weight and available power.
- Demonstrate an understanding of the reaction of fluid to the motion of a valve or piston.
- Demonstrate an understanding of the circular motion of a vehicle as it relates to such events as toe-out on turns and tracking.
- Demonstrate an understanding of the types of vibrations caused by out-of-balance or excessively worn systems.
- Explain to a customer how sound can be amplified due to resonant cavities and other physical characteristics of the vehicle.
- Explain and demonstrate an understanding of how sound generated in one place in the body and engine can be carried to other parts of the engine through metal and other materials.
- Explain the need for sound deadening and vibration damping materials to control the level of sound in the passenger compartment.
- Demonstrate an understanding of the relationship of the perceived intensity to the decibel level of a noise.
- Explain the relationship of the frequency of the sound to a normal or abnormally operating system.
- Explain and demonstrate an understanding of the role of listening to sounds as part of the trouble-shooting process.
- Explain that the presence of overtones may indicate changes in the vibrations of various systems.
- Demonstrate an understanding of the relationship of barometric pressure to engine performance (horsepower).
- Explain the relationship of engine torque to vehicle performance.
- Explain how levers and pulleys can be used to increase an applied force or distance.

- Identify the effect of the pH of a solution on chemical changes in a system.
- Identify the characteristics that define a system that is operating within the manufacturer's specifications.
- Use precision measuring devices to determine if wear and adjustments are within the manufacturer's specifications, and to assure that repair or replacement parts meet the manufacturer's specifications.
- Use tension gauges, such as a torque wrench, to measure the force or tension required to tighten connections to the manufacturer's specifications.
- Use a scale to measure component weight to balance rotating systems.
- Use pressure measuring tools to determine pressures in hydraulic or pneumatic systems and compare to the manufacturer's specifications.
- Use direct and indirect methods to measure system temperatures and then convert to Fahrenheit/Centigrade as required.
- Use direct and indirect methods to measure time and compare the results to the manufacturer's specifications.
- Use direct and indirect methods to measure the volume of liquids in a system and compare to the manufacturer's specifications.
- Use computer databases for information retrieval and input devices to process information for customers, billing purposes, warranty work, and other record-keeping purposes.
- Explain how an applied force at one location can be transmitted via fluid pressure to provide a force at a remote location.
- Explain catalytic converter principles which modify emission gases at the atomic level to provide a low level of HC, CO, and NO_x in the final exhaust.
- Explain the role that friction plays in acceleration and deceleration of objects as illustrated by transmitting motion to a part not physically connected to the powered part.
- Explain to the customer the need for lubrication of adjacent parts to minimize friction as a result of movement at the junction of the parts.
- Explain the necessity of knowing that the hardness of a metal determines, in part, its function and location in the automobile.
- Explain the dynamic control properties of a hydraulic system.
- Explain the surface processes that occur on system seals due to the absorption of the contained materials.
- Demonstrate an understanding of how the deterioration in an engine's performance can be caused by a chemical reaction that occurs in a liquid that has been contaminated.
- Demonstrate an understanding of how torque relates to force and angular acceleration.

- Demonstrate an understanding of how cams, pulleys, and levers are used to multiply force or transfer directions of force.
- Explain how rotational motion is changed to linear motion and the need for balance in rotating systems.
- Demonstrate an understanding of how variances in flow rate in airflow sensors or cooling systems can effect engine performance.

Electrical/Tolerances

- Explain and demonstrate an understanding of the properties of electricity that impact the lighting, engine management, and other electrical systems in the vehicle.
- Demonstrate an understanding of the characteristics of a quality electrical ground and explain the problems associated with an inadequate electrical circuit ground.
- Explain voltage and current flow in series and parallel circuits.
- Demonstrate an understanding of the processes used to locate a short circuit in the electrical/electronic system.
- Demonstrate an understanding of the role of the alternator in maintaining battery and system voltage.
- Demonstrate an understanding of the role of solar panels in maintaining battery voltage and operating selected accessories.
- Explain and demonstrate an understanding of the ignition coil's role in generating the high voltages required to fire the sparkplug.
- Demonstrate an understanding of the correct procedure used to measure the electrical parameters of voltage, current, resistance, or power.
- Explain and demonstrate an understanding of the role of a fuse or fusible link as a protective device in an electrical or electronic circuit.
- Explain and demonstrate an understanding of the use of Ohm's Law in verifying circuit parameters (resistance, voltage, amperage).
- Explain and demonstrate an understanding of the relationship of resistance to heat, voltage drop, and circuit parameters.
- Explain and demonstrate an understanding of system voltage generation, uses, and characteristics.
- Demonstrate an understanding of the ion transfer process that occurs in an automotive battery.
- Explain the conductivity problems in a circuit when connectors corrode due to electrochemical reactions.
- Explain the relationship between electrical current in a conductor and the magnetic field produced in a coil such as the starter solenoid.
- Explain the ability of a coil to increase battery voltage to the level required to fire a spark plug.
- Explain the effect of magnetic fields on unshielded circuits in selected control modules.
- Explain the need for a specific gravity test of battery electrolyte to determine charge.
- Use precision electrical test equipment to measure current, voltage, resistance, continuity, and/or power.

- Demonstrate an understanding of the role of capacitance in timer circuits, such as RC timers or MAP sensors, where the changing manifold pressure causes two metal discs to act like a capacitor by sending varying voltage to the electronic engine control system.
- Demonstrate an understanding of the capacity of semiconductor devices to modify rapidly engine operation parameters depending on multiple inputs from engine operational sensors.
- Explain how the movement of a conductor in a magnetic field can generate electricity.
- Demonstrate an understanding of the role of mechanical transducers in sending electrical control signals to modify system operating characteristics.
- Demonstrate an understanding of the purpose of photocells and measurement processes relative to determining output.

WORKPLACE SKILLS

IDENTIFIED AS BEING IMPORTANT BY THE NATEF AUTOMOTIVE TECHNICIANS RELATED ACADEMIC SKILLS COMMITTEE FROM THE V-TECS/ILLINOIS WORKPLACE SKILLS LIST.

A. DEVELOPING AN EMPLOYMENT PLAN

1. Match interests to employment area.
2. Match aptitudes to employment area.
3. Identify short-term work goals.
4. Match attitudes to a job area.
5. Match physical capabilities to a job area.
6. Demonstrate a drug-free status.

B. SEEKING AND APPLYING FOR EMPLOYMENT OPPORTUNITIES

1. Identify steps in applying for a job.
2. Locate employment opportunities.
3. Identify job requirements.
4. Identify conditions for employment.
5. Evaluate job opportunities.
6. Prepare a resume.
7. Write job application letter.
8. Complete job application form.
9. Prepare for job interview.
10. Dress for job interview.

C. ACCEPTING EMPLOYMENT

1. Apply for social security number.
2. Complete state and federal tax forms.
3. Complete employees withholding allowance certificate form W-4.

D. COMMUNICATING ON THE JOB

1. Communicate orally with others.
2. Ask questions about task.
3. Follow written and oral directions.
4. Prepare written communication.
5. Interpret the use of body language.
6. Use telephone etiquette.

E. INTERPRETING THE ECONOMICS OF WORK

1. Describe responsibilities of an employee.
2. Describe responsibilities of employer or management.
3. Investigate opportunities and options for business ownership.

F. MAINTAINING PROFESSIONALISM

1. Participate in employment orientation.
2. Treat people with respect.
3. Exhibit positive behavior.
4. Comply with organizational expectations.
5. Comply with company dress and appearance standards.
6. Use job-related terminology.
7. Participate in meetings in a positive and constructive manner.
8. Assess business image and products/services.

G. ADAPTING/COPING WITH CHANGE

1. Identify the elements of the job transition.
2. Exhibit ability to handle stress.
3. Recognize need to change or quit a job.
4. Write a letter of resignation.
5. Clarify purposes and goals.
6. Evaluate options.
7. Estimate results of implemented options.
8. Recognize impact of technological changes on tasks and people.

H. MAINTAINING INTERPERSONAL RELATIONSHIPS

1. Respond to praise or criticism.
2. Select and implement a solution to a problem.
3. Follow conservation/environmental practices and policies.
4. Use and maintain proper tools and equipment.
5. Maintain regular attendance.
6. Practice time management.
7. Display initiative.
8. Display a positive attitude.
9. Identify style of leadership used in teamwork.
10. Complete a team task.

TOOLS AND EQUIPMENT

Local employer needs and the availability of funds are key factors for determining each program's structure and operation. The NATEF Standards recognize that not all programs have the same needs, nor do all programs teach 100 % of the NATEF tasks. Therefore, the basic philosophy for the tools and equipment requirement is as follows: *for all tasks which are taught in the program, the training should be as thorough as possible with the tools and equipment necessary for those tasks.* In other words, if a program does not teach a particular task, the tool from the tool list associated with that task is not required (unless of course it is required for a task that is taught in another area). ***NOTE: For programs certifying under the General Service Technician Program, there is a separate Tools & Equipment List. Please refer to the General Service Technician Program section in this manual.***

The NATEF tool lists are organized into three basic categories: *Hand Tools*, *General Lab/Shop Equipment*, and *Specialty Tools and Equipment*. The specialty tools section is further separated into the eight NATEF task categories. When referring to the tools and equipment list, please note the following:

1. The organization of the tool list is not intended to dictate how a program organizes its tool crib or student tool sets (i.e., which tools should be in a student set, if utilized, and which should be in the tool crib or shop area).
2. Quantities for each tool or piece of equipment are determined by the program needs; however, sufficient quantities to provide quality instruction should be on hand.
3. For *Specialty Tools and Equipment*, the program need only have those tools for the areas being certified.
4. Programs may meet the equipment requirements by borrowing special equipment or providing for off-site instruction (e.g., in a dealership or independent repair shop). Use of borrowed or off-site equipment *must* be appropriately documented.
5. No specific brand names for tools and equipment are specified or required.
6. Although the NATEF Standards recommend that programs encourage their students to begin to build their own individual tools sets prior to entry into the industry, there is no requirement to do so. **NOTE:** Industry surveys indicate that most (90%) employers require that a candidate for employment provide his/her own basic hand tool set in order to be hired as an entry-level automobile technician.