



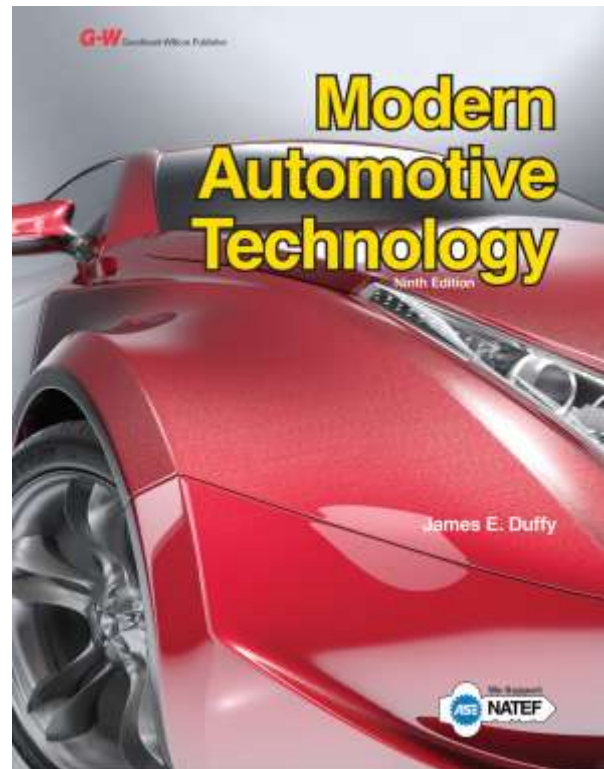
Correlation of
***Modern Automotive Technology*, by Duffy**
(Goodheart-Willcox Publisher ©2017)
 to

NATEF Automobile Service Technology (AST) Task List Correlation Chart

The following chart correlates the *Modern Automotive Technology* Shop Manual (©2017) to the 2017 NATEF Automobile Service Technology (AST) Task List.

The correlation below lists the tasks, priority levels, and the corresponding page numbers from the *Modern Automotive Technology* Shop Manual for the Automobile Service Technology Task List.

For more information on NATEF standards, including additional information on the ASE Industry Education Alliance, please visit <http://www.asealliance.org/>.



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.

Task Number and Description	Priority	Job #s
I. ENGINE REPAIR		
A. General: Engine Diagnosis; Removal and Reinstallation (R & R)		
1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.	P-1	2

Task Number and Description	Priority	Job #s
2. Research applicable vehicle and service information, including fluid type, internal engine operation, vehicle service history, service precautions, and technical service bulletins.	P-1	2
3. Verify operation of the instrument panel engine warning indicators.	P-1	11, 138, 139, 140, 141
4. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed action.	P-1	7
5. Install engine covers using gaskets, seals, and sealers as required.	P-1	3, 4, 27, 28, 34
6. Verify engine mechanical timing.	P-1	24, 28
7. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads with thread insert.	P-2	15
8. Inspect, remove, and/or replace engine mounts.	P-2	37, 38
9. Identify service precautions related to service of the internal combustion engine of a hybrid vehicle.	P-2	12, 13
I. 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	13, 28
2. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.	P-1	3, 20
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	21
4. Adjust valves (mechanical or hydraulic lifters).	P-1	25
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	24, 28
6. Establish camshaft position sensor indexing.	P-1	28
I. ENGINE REPAIR		
C. Engine Block Assembly Diagnosis and Repair		
1. Remove, inspect, and/or replace crankshaft vibration damper (harmonic balancer).	P-2	13, 19, 29

Task Number and Description	Priority	Job #s
I. 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	31
2. Identify causes of engine overheating.	P-1	8, 9, 10, 31
3. Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.	P-1	31, 33
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	13, 32
5. Inspect, remove, and replace water pump.	P-2	31, 34
6. Remove and replace radiator.	P-2	35
7. Remove, inspect, and replace thermostat and gasket/seal.	P-1	36
8. Inspect and test fan(s), fan clutch (electrical or mechanical), fan shroud, and air dams; determine needed action.	P-1	31
9. Perform oil pressure tests; determine needed action.	P-1	10
10. Perform engine oil and filter change; use proper fluid type per manufacturer specification.	P-1	2, 6
11. Inspect auxiliary coolers; determine needed action.	P-3	31
12. Inspect, test, and replace oil temperature and pressure switches and sensors.	P-2	139, 141

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.

Task Number and Description	Priority	Job #s
II. AUTOMATIC TRANSMISSION AND TRANSAXLE		
A. General: Transmission and Transaxle Diagnosis		
1. Identify and interpret transmission/transaxle concerns, differentiate between engine performance and transmission/transaxle concerns; determine needed action.	P-1	39
2. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.	P-1	2

Task Number and Description	Priority	Job #s
3. Diagnose fluid loss and condition concerns; determine needed action.	P-1	7, 39, 44, 65
4. Check fluid level and condition in a transmission or a transaxle equipped with a dipstick.	P-1	39, 44
5. Check fluid level and condition in a transmission or a transaxle not equipped with a dipstick.	P-1	39, 44
6. Perform a stall test; determine needed action.	P-2	39
7. Perform lock-up converter system tests; determine needed action.	P-3	39
8. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.	P-1	39
9. Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's law).	P-2	40
10. Demonstrate knowledge of pressure test including transmissions/transaxles equipped with electronic pressure control.	P-3	40
11. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information.	P-2	39, 48, 161
II. 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	39, 45
2. Inspect for leakage; replace external seals, gaskets, and bushings.	P-2	3, 4
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 procedures.	P-1	48, 161
4. Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification.	P-1	2, 44
5. Inspect, replace, and align power train mounts.	P-2	37, 38
II. 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	50, 51, 58, 59
2. Inspect, leak test, flush, and/or replace transmission/transaxle oil cooler, lines, and fittings.	P-1	46

Task Number and Description	Priority	Job #s
3. Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore.	P-2	50, 51, 52, 53, 55
4. Describe the operational characteristics of a continuously variable transmission (CVT).	P-3	39
5. Describe the operational characteristics of a hybrid vehicle drive train.	P-3	39

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.

Task Number and Description	Priority	Job #s
III. MANUAL DRIVE TRAIN AND AXLES		
A. General: Drive Train Diagnosis		
1. Identify and interpret drive train concerns; determine needed action.	P-1	60
2. Research vehicle and service information including fluid type, vehicle service history, service precautions, and technical service bulletins.	P-1	2
3. Check fluid condition; check for leaks; determine needed action.	P-1	60, 65
4. Drain and refill manual transmission/transaxle and final drive unit; use proper fluid type per manufacturer specification.	P-1	2, 77, 78, 79, 80, 86, 89
III. MANUAL DRIVE TRAIN AND AXLES		
B. Clutch Diagnosis and Repair		
1. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action.	P-1	71
2. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushing pivots, and springs; determine needed action.	P-1	71, 72
3. Inspect and/or replace clutch pressure plate assembly clutch disc, release (throw-out) bearing, linkage, and pilot bearing bushing (as applicable).	P-1	75
4. Bleed clutch hydraulic system.	P-1	73
5. Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification.	P-1	2, 71, 73

Task Number and Description	Priority	Job #s
6. Inspect flywheel and ring gear for wear and cracks; determine needed action.	P-1	75
7. Measure flywheel runout and crankshaft end play; determine needed action.	P-2	75
8. Describe the operation and service of a system that uses a dual mass flywheel.	P-3	—
III. 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	64, 78, 80
2. Describe the operational characteristics of an electronically controlled manual transmission/transaxle.	P-2	69
III. 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	67, 68
2. Diagnose universal joint noise and vibration concerns; determine needed action.	P-2	61, 62, 63, 66
3. Inspect, remove, and/or replace bearings, hubs, and seals.	P-1	68, 83
4. Inspect, service, and/or replace shaft yokes, boots, and universal/CV joints.	P-1	66, 67
5. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles.	P-2	61, 62, 63
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	7, 65, 87
2. Check and adjust differential case fluid level; use proper fluid type per manufacturer specification.	P-1	2, 60
3. Drain and refill differential case; use proper fluid type per manufacturer specification.	P-1	2, 86, 89
4. Inspect and replace companion flange and/or pinion seal; measure companion flange runout.	P-2	66, 87, 88
E.2 Drive Axles		
1. Inspect and replace drive axle wheel studs.	P-1	108
2. Remove and replace drive axle shafts.	P-1	67, 84, 85
3. Inspect and replace drive axle shaft seals, bearings, and retainers.	P-2	67, 84, 85

Task Number and Description	Priority	Job #s
4. Measure drive axle flange runout and shaft end play; determine needed action.	P-2	84
III. 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	83
2. Inspect locking hubs; determine needed action.	P-3	67, 68, 83, 92
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	2, 65, 81, 82, 83
4. Identify concerns related to variations in the tire circumference and/or final drive ratios.	P-2	81

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.

Task Number and Description	Priority	Job #s
IV. 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	2
2. Identify and interpret suspension and steering system concerns; determine needed action.	P-2	90, 93, 97, 101, 102, 104
IV. SUSPENSION AND STEERING		
B. Steering Systems Diagnosis and Repair		
1. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation.	P-1	94, 138, 141, 147
2. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).	P-1	94, 147
3. Diagnose steering column noises, looseness, and binding concerns (including tilt/telescoping mechanisms); determine needed action.	P-2	90, 93
4. Diagnose power steering gear (non-rack-and-pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.	P-2	90, 97

Task Number and Description	Priority	Job #s
5. Diagnose power steering gear (rack-and-pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.	P-2	90, 97
6. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; determine needed action.	P-2	93, 94
7. Remove and replace rack-and-pinion steering gear; inspect mounting bushings and brackets.	P-2	95
8. Inspect rack-and-pinion steering gear; inspect inner tie rod ends (sockets) and bellow boots; replace as needed.	P-1	95
9. Inspect power steering fluid level and condition.	P-1	91, 97
10. Flush, fill, and bleed power steering system; use proper fluid type per manufacturer specification.	P-2	2, 97
11. Inspect for power steering fluid leakage; determine needed action.	P-1	97
12. Remove, inspect, replace, and/or adjust power steering pump drive belt.	P-1	33, 97
13. Remove and reinstall power steering pump.	P-2	97
14. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.	P-2	97
15. Inspect, remove, and/or replace power steering hoses and fittings.	P-2	90, 97
16. Inspect, remove, and/or replace Pitman arm, relay (center link/intermediate) rod, idler arm, mountings, and steering linkage damper.	P-2	90, 94, 96
17. Inspect, replace, and/or adjust tie rod ends (sockets), tie rod sleeves, and clamps.	P-1	90, 95, 96
18. Identify hybrid vehicle power steering system electrical circuits and safety precautions.	P-2	93
19. Inspect electric power steering assist system.	P-3	97
IV. 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	90
2. Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine needed action.	P-1	90
3. Inspect, remove, and/or replace upper and lower control arms, bushings, shafts, and rebound bumpers.	P-3	90, 99
4. Inspect, remove, and/or replace strut rods and bushings.	P-3	90, 98

Task Number and Description	Priority	Job #s
5. Inspect, remove, and/or replace upper and/or lower ball joints (with or without wear indicators).	P-2	90, 99
6. Inspect, remove, and/or replace steering knuckle assemblies.	P-3	90
7. Inspect, remove, and/or replace short and long arm suspension system coil springs and spring insulators.	P-3	90, 100
8. Inspect, remove, and/or replace torsion bars and mounts.	P-3	90
9. Inspect, remove, and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links.	P-3	90, 98
10. Inspect, remove, and/or replace strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.	P-3	90, 101
11. Inspect, remove, and/or replace track bar, strut rods/radius arms, and related mounts and bushings.	P-3	90, 96, 98, 99
12. Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts.	P-1	90, 101
IV. SUSPENSION AND STEERING		
D. Related Suspension and Steering Service		
1. Inspect, remove, and/or replace shock absorbers; inspect mounts and bushings.	P-1	90, 102
2. Remove, inspect, service, and/or replace front and rear wheel bearings.	P-1	5, 83, 92
3. Describe the functions of suspension and steering control systems and components, (i.e. active suspension and stability control).	P-3	90
IV. 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	103
2. Perform prealignment inspection; measure vehicle ride height; determine needed action.	P-1	90, 103
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	103
4. Check toe-out-on-turns (turning radius); determine needed action.	P-1	103
5. Check steering axis inclination (SAI) and included angle; determine needed action.	P-2	103

Task Number and Description	Priority	Job #s
6. Check rear wheel thrust angle; determine needed action.	P-1	103
7. Check for front wheel setback; determine needed action.	P-2	103
8. Check front and/or rear cradle (subframe) alignment; determine needed action.	P-3	103
9. Reset steering angle sensor.	P-2	103
IV. 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	81, 104
2. Diagnose wheel/tire vibration, shimmy, and noise; determine needed action.	P-2	103, 104, 106
3. Rotate tires according to manufacturer's recommendation including vehicles equipped with tire pressure monitoring systems (TPMS).	P-1	106
4. Measure wheel, tire, axle flange, and hub runout; determine needed action.	P-2	84, 104
5. Diagnose tire pull problems; determine needed action.	P-1	103
6. Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly.	P-1	105, 106
7. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor.	P-1	105, 106
8. Inspect tire and wheel assembly for air loss; determine needed action.	P-1	104
9. Repair tire following vehicle manufacturer approved procedure.	P-1	2, 105
10. Identify indirect and direct tire pressure monitoring systems (TPMS); calibrate system; verify operation of instrument panel lamps.	P-1	105
11. Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system (TPMS) including relearn procedure.	P-1	105, 161

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.

Task Number and Description	Priority	Job #s
V. BRAKES		
A. General: Brake System Diagnosis		
1. Identify and interpret brake system concerns; determine needed action.	P-1	107
2. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.	P-1	2
3. Describe procedure for performing a road test to check brake system operation including an anti-lock brake system (ABS).	P-1	107
4. Install wheel and torque lug nuts.	P-1	105, 116, 118
V. BRAKES		
B. Hydraulic System Diagnosis and Repair		
1. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's law).	P-1	107, 111
2. Measure brake pedal height, travel, and free play (as applicable); determine needed action.	P-1	107
3. Check master cylinder for internal/external leaks and proper operation; determine needed action.	P-1	107
4. Remove, bench bleed, and reinstall master cylinder.	P-1	113
5. Diagnose poor stopping, pulling, or dragging concerns caused by malfunctions in the hydraulic system; determine needed action.	P-3	111
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	107, 111
7. Replace brake lines, hoses, fittings, and supports.	P-2	112
8. Fabricate brake lines using proper material and flaring procedures (double flare and ISO types).	P-2	112
9. Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification.	P-1	2, 113, 115
10. Inspect, test, and/or replace components of brake warning light system.	P-3	111, 112, 136, 138, 141
11. Identify components of hydraulic brake warning light system.	P-2	111, 112, 136, 138
12. Bleed and/or flush brake system.	P-1	115

Task Number and Description	Priority	Job #s
13. Test brake fluid for contamination.	P-1	115
V. 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	107
2. Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability.	P-1	107, 116
3. Refinish brake drum and measure final drum diameter; compare with specification.	P-1	117
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	116
5. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.	P-2	116
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	116
V. BRAKES		
D. Disc Brake Diagnosis and Repair		
1. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action.	P-1	107
2. Remove and clean caliper assembly; inspect for leaks, damage, and wear; determine needed action.	P-1	107, 118
3. Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine needed action.	P-1	118
4. Remove, inspect, and/or replace brake pads and retaining hardware; determine needed action.	P-1	118
5. Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads; inspect for leaks.	P-1	118
6. Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action.	P-1	118
7. Remove and reinstall/replace rotor.	P-1	118
8. Refinish rotor on a vehicle; measure final rotor thickness and compare with specification.	P-1	120
9. Refinish rotor off vehicle; measure final rotor thickness and compare with specification.	P-1	120
10. Retract and re-adjust caliper piston on an integrated parking brake.	P-2	110
11. Check brake pad wear indicator; determine needed action.	P-1	118

Task Number and Description	Priority	Job #s
12. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations.	P-1	118
V. 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	114
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	114
3. Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine needed action.	P-1	114
4. Inspect and test hydraulically assisted power brake system for leaks and proper operation.	P-3	114
5. Measure and adjust master cylinder pushrod length.	P-3	114
V. 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	109
2. Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings.	P-2	5, 109
3. Check parking brake system components for wear, binding, and corrosion; clean, lubricate, adjust, and/or replace as needed.	P-1	110
4. Check parking brake operation and parking brake indicator light system operation; determine needed action.	P-1	110
5. Check operation of brake stop light system.	P-1	136
6. Replace wheel bearing and race.	P-3	5, 109
7. Inspect and replace wheel studs.	P-1	108
8. Remove, reinstall, and/or replace sealed wheel bearing assembly.	P-1	109
V. 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	121
2. Describe the operation of a regenerative braking system.	P-3	111

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.

Task Number and Description	Priority	Job #s
VI. 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	2
2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's law).	P-1	136
3. Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), and current flow resistance.	P-1	130, 136, 142
4. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.	P-1	130, 138, 142
5. Demonstrate proper use of a test light on an electrical circuit.	P-1	130, 136
6. Use fused jumper wires to check operation of electrical circuits.	P-1	125, 138
7. Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems.	P-1	130, 136, 138
8. Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine needed action.	P-1	125
9. Inspect and test fusible links, circuit breakers, and fuses; determine needed action.	P-1	125, 130, 138, 139
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	126, 130, 132, 142
VI. ELECTRICAL/ELECTRONIC SYSTEMS		
B. Battery Diagnosis Service		
1. Perform battery state-of-charge test; determine needed action.	P-1	127
2. Confirm proper battery capacity for vehicle application; perform battery capacity and load test; determine needed action.	P-1	127
3. Maintain or restore electronic memory functions.	P-1	125, 128
4. Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps, and hold-downs.	P-1	127, 128
5. Perform slow/fast battery charge according to manufacturer's recommendations.	P-1	128

Task Number and Description	Priority	Job #s
6. Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply.	P-1	129
7. Identify safety precautions for high voltage systems on electric, hybrid-electric, and diesel vehicles.	P-2	126
8. Identify electrical/electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery.	P-1	128
9. Identify hybrid vehicle auxiliary (12V) battery service, repair, and test procedures.	P-2	127, 128
VI. ELECTRICAL/ELECTRONIC SYSTEMS		
C. Starting System Diagnosis and Repair		
1. Perform starter current draw test; determine needed action.	P-1	130
2. Perform starter circuit voltage drop tests; determine needed action.	P-1	130
3. Inspect and test starter relays and solenoids; determine needed action.	P-2	130, 131
4. Remove and install starter in a vehicle.	P-1	133
5. Inspect and test switches, connectors, and wires of starter control circuits; determine needed action.	P-2	130, 132
6. Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition.	P-2	130
7. Demonstrate knowledge of automatic idle-stop/start-stop system.	P-2	—
VI. ELECTRICAL/ELECTRONIC SYSTEMS		
D. Charging System Diagnosis and Repair		
1. Perform charging system output test; determine needed action.	P-1	134
2. Diagnose (troubleshoot) charging system for causes of undercharge, no-charge, or overcharge conditions.	P-1	134
3. Inspect, adjust, and/or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment.	P-1	33, 134
4. Remove, inspect, and/or replace generator (alternator).	P-1	134, 135
5. Perform charging circuit voltage drop tests; determine needed action.	P-1	134
VI. 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	136

Task Number and Description	Priority	Job #s
2. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed.	P-1	136
3. Aim headlights.	P-2	137
4. Identify system voltage and safety precautions associated with high-intensity discharge headlights.	P-2	137
VI. 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	139, 140
2. Diagnose (troubleshoot) the causes of incorrect operation of warning devices and other driver information systems; determine needed action.	P-2	138, 139, 140, 141
3. Reset maintenance indicators as required.	P-2	136, 138, 141
VI. ELECTRICAL/ELECTRONIC SYSTEMS		
G. Body Electrical Systems Diagnosis and Repair		
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, moonroof, sunroof, sunshade, remote keyless entry, voice activation, steering wheel controls, back-up camera, park assist, cruise control, and auto-dimming headlamps); determine needed repairs.	P-3	126, 144, 145, 150, 151
2. Describe operations 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-3	94, 126, 132, 144, 150, 151
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-3	126, 146
4. Describe operation of safety systems and related circuits (such as: horns, 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-3	48, 64, 94, 126, 142, 143, 147, 148
5. Describe body electronic systems circuits using a scan tool; check for module.	P-3	149, 150
6. Describe the process for software transfer, software updates, or reprogramming.	P-3	48, 150, 161

HEATING AND AIR CONDITIONING (HVAC)

For every task in Heating 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.

Task Number and Description	Priority	Job #s
VII. HEATING AND AIR CONDITIONING (HVAC)		
A. General: A/C System Diagnosis and Repair		
1. Identify and interpret heating and air conditioning problems; determine needed action.	P-1	152
2. Research vehicle service information including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins.	P-1	2, 152, 153, 154, 157
3. Performance test A/C system; identify problems.	P-1	152, 153
4. Identify abnormal operating noises in the A/C system; determine needed action.	P-2	152
5. Identify refrigerant type; select and connect proper gauge set/test equipment; record temperature and pressure readings.	P-1	152, 153
6. Leak test A/C system; determine needed action.	P-1	152
7. Inspect condition of refrigerant oil removed from A/C system; determine needed action.	P-2	155
8. Determine recommended oil and oil capacity for system application.	P-1	155
9. Using a scan tool, observe and record related HVAC data and trouble codes.	P-3	11
VII. HEATING 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	33, 152, 155
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	152, 155
3. Remove, inspect, and reinstall A/C compressor and mountings; determine recommended oil type and quantity.	P-2	155
4. Identify hybrid vehicle A/C system electrical circuits and service/safety precautions.	P-2	152
5. Determine need for additional A/C system filter; determine needed action.	P-3	159

Task Number and Description	Priority	Job #s
6. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; determine needed action.	P-2	152, 156
7. Inspect for proper A/C condenser airflow; determine needed action.	P-1	152
8. Remove, inspect, and reinstall receiver/drier or accumulator/drier; determine recommended oil type and quantity.	P-2	155, 156
9. Remove, inspect, and install expansion valve or orifice (expansion) tube.	P-1	156
10. Inspect evaporator housing water drain; determine needed action.	P-1	152
11. Determine procedure to remove and reinstall evaporator; determine required oil type and quantity.	P-2	156
VII. HEATING AND AIR CONDITIONING (HVAC)		
C. Heating, Ventilation, and Engine Cooling System Diagnosis and Repair		
1. Inspect engine cooling and heater systems hoses and pipes; determine needed action.	P-1	31, 33, 158
2. Inspect and test heater control valve(s); determine needed action.	P-2	158
3. Determine procedure to remove, inspect, reinstall, and/or replace heater core.	P-2	158
VII. HEATING AND AIR CONDITIONING (HVAC)		
D. Operating Systems and Related Control Diagnosis and Repair		
1. Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action.	P-1	152, 159
2. Diagnose HVAC system clutch control systems; determine needed action.	P-2	152
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	153
4. Inspect and test HVAC system control panel assembly; determine needed action.	P-2	153
5. Inspect and test HVAC system control cables, motors, and linkages; determine needed action.	P-3	153
6. Inspect HVAC system ducts, doors, houses, cabin filters, and outlets; determine needed action.	P-1	159
7. Identify the source of HVAC system odors.	P-2	152
8. Check the operation of automatic or semiautomatic HVAC control systems; determine needed action.	P-2	153

Task Number and Description	Priority	Job #s
VII. HEATING 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	154, 157
2. Identify A/C system refrigerant; test for sealants; recover, evacuate, and charge A/C system; add refrigerant oil as required.	P-1	152, 154
3. Recycle, label, and store refrigerant.	P-1	154, 157

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.

Task Number and Description	Priority	Job #s
VIII. ENGINE PERFORMANCE		
A. General: Engine Diagnosis		
1. Identify and interpret engine performance concerns; determine needed action.	P-1	160
2. Research vehicle service information, including vehicle service history, service precautions, and technical service bulletins.	P-1	2
3. Diagnose abnormal engine noises or vibration concerns; determine needed action.	P-3	163
4. Diagnose the cause of excessive oil consumption, coolant consumption, unusual exhaust color, odor, and sound; determine needed action.	P-2	173
5. Perform engine absolute manifold pressure test (vacuum/boost); determine needed action.	P-1	8
6. Perform cylinder power balance test; determine needed action.	P-2	8
7. Perform cylinder cranking and running compression tests; determine needed action.	P-1	9
8. Perform cylinder leakage test; determine needed action.	P-1	9
9. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine needed action.	P-2	8, 9, 10, 130, 134, 160, 164, 167, 170
10. Verify engine operating temperature; determine needed action.	P-1	31
11. Verify correct camshaft timing including variable valve timing (VVT) systems.	P-1	24, 28

Task Number and Description	Priority	Job #s
VIII. 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	11, 161
2. Access and use service information to perform step-by-step (troubleshooting) diagnosis.	P-1	2
3. Perform active tests of actuators using a scan tool; determine needed action.	P-2	170, 178
4. Describe the use of OBD monitors for repair verification.	P-1	161
VIII. 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	160, 161, 164, 165
2. Inspect and test crankshaft and camshaft position sensor(s); determine needed action.	P-1	28, 29, 165
3. Inspect, test, and/or replace ignition control module and powertrain/engine control module; reprogram/initialize as needed.	P-3	165
4. Remove and replace spark plugs; inspect secondary ignition components for wear and damage.	P-1	164, 165
VIII. ENGINE PERFORMANCE		
D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair		
1. Check fuel for contaminants; determine needed action.	P-2	166
2. Inspect and test fuel pump(s) and pump control system for pressure, regulation, and volume; determine needed action.	P-1	167
3. Replace fuel filter(s) where applicable.	P-2	167
4. Inspect, service, or replace air filters, filter housings, and intake duct work.	P-1	168
5. Inspect throttle body, air induction system, intake manifold, and gaskets for vacuum leaks and/or unmetered air.	P-2	168
6. Inspect, test, and/or replace fuel injectors.	P-2	168, 170
7. Verify idle control operation.	P-1	169
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	173, 174, 177
9. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields.	P-1	173, 174, 177

Task Number and Description	Priority	Job #s
10. Perform exhaust system back-pressure test; determine needed action.	P-2	173
11. Check and refill diesel exhaust fluid (DEF).	P-2	173
VIII. ENGINE PERFORMANCE		
E. Emissions Control Systems Diagnosis and Repair		
1. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilations (PCV) system; determine needed action.	P-3	160, 178
2. Inspect, test, service, and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; determine needed action.	P-2	178
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	126, 160, 161, 175, 176
4. Inspect and test electrical/electronically operated components and circuits of secondary air injection systems; determine needed action.	P-3	176
5. Diagnose emissions and driveability concerns caused by the catalytic converter system; determine needed action.	P-1	177
6. Inspect and test components and hoses of evaporative emissions control (EVAP) system; determine needed action.	P-1	178
7. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine needed action.	P-2	11, 160, 177, 178

REQUIRED SUPPLEMENTAL TASKS

Task Number and Description	Job #s
Shop and Personal Safety	
1. Identify general shop safety rules and procedures.	1
2. Utilize safe procedures for handling of tools and equipment.	1
3. Identify and use the proper placement of floor jacks and jack stands.	1
4. Identify and use the proper procedures for safe lift operation.	1
5. Utilize proper ventilation procedures for working with the lab/shop area.	1
6. Identify marked safety areas.	1
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate the knowledge of the procedures for using fire extinguishers and other fire safety equipment.	1

Task Number and Description	Job #s
8. Identify the location and use of eyewash stations.	1
9. Identify the location of the posted evacuation routes.	1
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.	1
11. Identify and wear appropriate clothing for lab/shop activities.	1
12. Secure hair and jewelry for lab/shop activities.	1
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high-voltage circuits.	1
14. Demonstrate the awareness of safety aspects of high-voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.).	1, 137
15. Locate and demonstrate knowledge of material safety data sheets (MSDS).	1, 2
Tools and Equipment	
1. Identify tools and their use in automotive applications.	1, 11
2. Identify standard and metric designation.	2, 28, 31, 40, 172
3. Demonstrate safe handling and use of appropriate tools.	1
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment.	1
5. Demonstrate proper use of precision measuring tools (i.e., micrometer, dial-indicator, dial-caliper).	16, 18, 21, 27
Preparing Vehicle for Service	
1. Identify information needed and the service requested on a repair order.	2
2. Identify purpose and demonstrate proper use of fender covers, mats.	6
3. Demonstrate the three C's (concern, cause, correction).	160
4. Review vehicle service history.	2
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service, history, cause, and correction.	2
Preparing Vehicle for Customer	
1. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.)	6