

Automobile: ASE Entry-level Technician

Test Specifications and Task Lists NATEF Standards

This document contains the task list and test specifications the eight individual tests listed below. Each exam corresponds to a specific technical area in the 2018 NATEF Automobile Standards for program accreditation.

The task lists are simply listings of the tasks involved in the process of diagnosing and repairing problems in the various vehicle systems. The tasks may also be thought of as competencies. Each question found in the tests is keyed to one of these tasks. The tasks are organized into content categories, and these content categories, along with the number of questions included in each category, comprise the test specifications. Every form of the exams will be built to meet these specifications.

Students preparing for the ASE Entry-level Technician exams should review the entire tasks list and note areas where further preparation may be needed. It also helps students to consider how many questions will be included on the exams in each content area.

These tests may include additional questions for statistical evaluation. These extra questions will not count for or against the final score. Since the extra questions are not identified, test candidates should answer every question to the best of their ability.

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ENGINE REPAIR

Content Area	Questions
A. General: Engine Diagnosis; Removal and Reinstallation	10
B. Cylinder Head and Valve Train D&R	10
C. Engine Block Assembly D&R	7
D. Lubrication and Cooling Systems D&R	13
<i>Required to Pass: 22 of 40</i>	40

Effective August 1, 2018, this individual test is based on the Engine Repair tasks of the 2018 NATEF MAST Automobile Program Standards and is intended for those students who have completed a course of study that corresponds with that level of instruction.

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- ER-A.0 A. General: Engine Diagnosis; Removal and Reinstallation (R & R)
- ER-A.1 Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
- ER-A.2 Research vehicle service information including fluid type, internal engine operation, vehicle service history, service precautions, and technical service bulletins.
- ER-A.3 Verify operation of the instrument panel engine warning indicators.
- ER-A.4 Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
- ER-A.5 Install engine covers using gaskets, seals, and sealers as required.
- ER-A.6 Verify engine mechanical timing.
- ER-A.7 Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert.
- ER-A.8 Inspect, remove and replace engine mounts.
- ER-A.9 Identify service precautions related to service of the internal combustion engine of a hybrid vehicle.
- ER-10 Remove and reinstall engine in an OBD or newer vehicle; reconnect all attaching components and restore the vehicle to running condition.
- ER-B.0 B. Cylinder Head and Valve Train Diagnosis and Repair
- ER-B.1 Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specification and procedure.
- ER-B.2 Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.
- ER-B.3 Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action.
- ER-B.4 Adjust valves (mechanical or hydraulic lifters).
- ER-B.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.

- ER-B.6 Establish camshaft position sensor indexing.
- ER-B.7 Inspect valve springs for squareness and free height comparison; determine necessary action.
- ER-B.8 Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action.
- ER-B.9 Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action.
- ER-B.10 Inspect valves and valve seats; determine necessary action.
- ER-B.11 Check valve spring assembled height and valve stem height; determine necessary action.
- ER-B.12 Inspect valve lifters; determine necessary action.
- ER-B.13 Inspect and/or measure camshaft for runout, journal wear and lobe wear.
- ER-B.14 Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action.

- ER-C.0 C. Engine Block Assembly Diagnosis and Repair
- ER-C.1 Remove, inspect, and/or replace crankshaft vibration damper (harmonic balancer).
- ER-C.2 Disassemble engine block; clean and prepare components for inspection and reassembly.
- ER-C.3 Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action.
- ER-C.4 Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action.
- ER-C.5 Deglaze and clean cylinder walls.
- ER-C.6 Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action.
- ER-C.7 Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action.
- ER-C.8 Inspect main and connecting rod bearings for damage and wear; determine necessary action.
- ER-C.9 Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action.
- ER-C.10 Inspect and measure piston skirts and ring lands; determine necessary action.
- ER-C.11 Determine piston-to-bore clearance.
- ER-C.12 Inspect, measure, and install piston rings.
- ER-C.13 Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance and/or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time.
- ER-C.14 Assemble engine block.

- ER-D.0 D. Lubrication and Cooling Systems Diagnosis and Repair
- ER-D.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 necessary action.
- ER-D.2 Identify causes of engine overheating.
- ER-D.3 Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.
- ER-D.4 Inspect and/or test coolant; drain and recover coolant; flush and refill cooling system with proper fluid type per manufacturer specification; bleed air as required.
- ER-D.5 Inspect, remove, and replace water pump.

- ER-D.6 Remove and replace radiator.
- ER-D.7 Remove, inspect, and replace thermostat and gasket/seal.
- ER-D.8 Inspect and test fan(s) (electrical or mechanical), fan clutch, fan shroud, and air dams.
- ER-D.9 Perform oil pressure tests; determine necessary action.
- ER-D.10 Perform engine oil and filter change; use proper fluid type per manufacturer specification.
- ER-D.11 Inspect auxiliary coolers; determine necessary action.
- ER-D.12 Inspect, test, and replace oil temperature and pressure switches and sensors.
- ER-D.13 Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action.

AUTOMATIC TRANSMISSION AND TRANSAXLE

Content Area	Questions
A. General: Transmission and Transaxle Diagnosis	18
B. In-Vehicle Transmission/Transaxle Maintenance and Repair	10
C. Off-Vehicle Transmission and Transaxle Repair	12
<i>Required to Pass: 22 of 40</i>	40

Effective August 1, 2018, this individual test is based on the Automatic Transmission and Transaxle tasks of the 2018 NATEF MAST Automobile Program Standards and is intended for those students who have completed a course of study that corresponds with that level of instruction.

This test may include additional questions for statistical evaluation. These extra questions will not count for or against the final score. Since the extra questions are not identified, test candidates should answer every question to the best of their ability.

- AT-A.0 A. General: Transmission and Transaxle Diagnosis
- AT-A.1 Identify and interpret transmission/transaxle concern, differentiate between engine performance and transmission/transaxle concerns; determine necessary action.
- AT-A.2 Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.
- AT-A.3 Diagnose fluid loss and condition concerns; determine necessary action.
- AT-A.4 Check fluid level in a transmission or a transaxle equipped with a dip-stick.
- AT-A.5 Check fluid level in a transmission or a transaxle not equipped with a dip-stick.
- AT-A.6 Perform pressure tests (including transmissions/transaxles equipped with electronic pressure control); determine necessary action.
- AT-A.7 Diagnose noise and vibration concerns; determine necessary action.
- AT-A.8 Perform stall test; determine necessary action.
- AT-A.9 Perform lock-up converter system tests; determine necessary action.
- AT-A.10 Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.
- AT-A.11 Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information.
- AT-A.12 Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law).
- AT-B.0 B. In-Vehicle Transmission/Transaxle Maintenance and Repair
- AT-B.1 Inspect, adjust, and/or replace external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch.
- AT-B.2 Inspect for leakage; replace external seals, gaskets, and bushings.
- AT-B.3 Inspect, test, adjust, repair, and/or replace electrical/electronic components and circuits including computers, solenoids, sensors, relays, terminals, connectors, switches, and harnesses; perform demonstrated understanding of the relearn procedure.
- AT-B.4 Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification.
- AT-B.5 Inspect, replace and align powertrain mounts.
- AT-C.0 C. Off-Vehicle Transmission and Transaxle Repair

- AT-C.1 Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mounting surfaces.
- AT-C.3 Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore.
- AT-C.4 Describe the operational characteristics of a continuously variable transmission (CVT).
- AT-C.5 Describe the operational characteristics of a hybrid vehicle drive train.
- AT-C.6 Disassemble, clean, and inspect transmission/transaxle.
Inspect, measure, clean, and replace valve body (includes surfaces, bores, springs, valves, switches, solenoids, sleeves, retainers, brackets, check valves/balls, screens, spacers, and gaskets).
- AT-C.7 Inspect servo and accumulator bores, pistons, seals, pins, springs, and retainers; determine necessary action.
- AT-C.8 Assemble transmission/transaxle.
- AT-C.9 Inspect, measure, and reseal oil pump assembly and components.
- AT-C.10 Measure transmission/transaxle end play and/or preload; determine necessary action.
- AT-C.11 Inspect, measure, and/or replace thrust washers and bearings.
- AT-C.12 Inspect oil delivery circuits, including seal rings, ring grooves, and sealing surface areas, feed pipes, orifices, and check valves/balls.
- AT-C.13 Inspect bushings; determine necessary action.
- AT-C.14 Inspect and measure planetary gear assembly components; determine necessary action.
- AT-C.15 Inspect case bores, passages, bushings, vents, and mating surfaces; determine necessary action.
- AT-C.16 Diagnose and inspect transaxle drive, link chains, sprockets, gears, bearings, and bushings; perform necessary action.
- AT-C.17 Inspect measure, repair, adjust or replace transaxle final drive components.
- AT-C.18 Inspect clutch drum, piston, check-balls, springs, retainers, seals, friction and pressure plates, and bands; determine necessary action.
- AT-C.19 Measure clutch pack clearance; determine necessary action.
- AT-C.20 Air test operation of clutch and servo assemblies.
- AT-C.21 Inspect one way clutches, races, rollers, sprags, springs, cages, retainers; determine necessary action.
- AT-C.22

MANUAL DRIVE TRAIN AND AXLES

Content Area	Questions
A. General: Drive Train Diagnosis	5
B. Clutch Diagnosis and Repair	7
C. Transmission/Transaxle Diagnosis and Repair	8
D. Drive Shaft and Half Shaft, Universal and CV Joint	6
E. Drive Axle Diagnosis and Repair	9
F. Four-wheel Drive/All-wheel Drive Component D&R	5
<i>Required to Pass: 21 of 40</i>	40

Effective August 1, 2018, this individual test is based on the Manual Drive Train and Axles tasks of the 2018 NATEF MAST Automobile Program Standards and is intended for those students who have completed a course of study that corresponds with that level of instruction.

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MD-A.0	A. General: Drive Train Diagnosis
MD-A.1	Identify and interpret drive train concerns; determine necessary action.
MD-A.2	Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.
MD-A.3	Check fluid condition; check for leaks; determine necessary action.
MD-A.4	Drain and refill manual transmission/transaxle and final drive unit; use proper fluid type per manufacturer specification.
MD-B.0	B. Clutch Diagnosis and Repair
MD-B.1	Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action.
MD-B.2	Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform necessary action.
MD-B.3	Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing/ linkage, and pilot bearing/bushing (as applicable).
MD-B.4	Bleed clutch hydraulic system.
MD-B.5	Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification.
MD-B.6	Inspect flywheel and ring gear for wear, cracks, and discoloration; determine necessary action.
MD-B.7	Measure flywheel runout and crankshaft end play; determine necessary action.
MD-B.8	Describe the operation and service of a system that uses a dual mass flywheel.
MD-C.0	C. Transmission/Transaxle Diagnosis and Repair
MD-C.1	Inspect, adjust, lubricate, and reinstall shift linkages, brackets, bushings, cables, pivots, and levers.
MD-C.2	Describe the operational characteristics of an electronically-controlled manual transmission/transaxle.
MD-C.3	Diagnose noise concerns through the application of transmission/transaxle power flow principles.

MD-C.4	Diagnose hard shifting and jumping out of gear concerns; determine necessary action.
MD-C.5	Diagnose transaxle final drive assembly noise and vibration concerns; determine necessary action.
MD-C.6	Disassemble, inspect clean, and reassemble internal transmission/transaxle components.
MD-D.0	D. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair (Front, Rear, All wheel drive, 4-wheel drive)
MD-D.1	Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action.
MD-D.2	Diagnose universal joint noise and vibration concerns; perform necessary action.
MD-D.3	Inspect, remove, and/or replace bearings, hubs, and seals.
MD-D.4	Inspect, service, and/or replace shafts, yokes, boots, and universal/CV joints.
MD-D.5	Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles.
	E. Drive Axle Diagnosis and Repair
MD-E.1.0	E.1 Ring and Pinion Gears and Differential Case Assembly
MD-E.1.1	Clean and inspect differential case; check for leaks; inspect housing vent.
MD-E.1.2	Check and adjust differential case fluid level; use proper fluid type per manufacturer specification.
MD-E.1.3	Drain and refill differential case; use proper fluid type per manufacturer specifications.
MD-E.1.4	Diagnose noise and vibration concerns; determine necessary action.
MD-E.1.5	Inspect and replace companion flange and/or pinion seal; measure companion flange runout.
MD-E.1.6	Inspect ring gear and measure runout; determine necessary action.
MD-E.1.7	Remove, inspect, and/or reinstall drive pinion and ring gear, spacers, sleeves, and bearings.
MD-E.1.8	Measure and adjust drive pinion depth.
MD-E.1.9	Measure and adjust drive pinion bearing preload.
MD-E.1.10	Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types).
MD-E.1.11	Check ring and pinion tooth contact patterns; perform necessary action.
MD-E.1.12	Disassemble, inspect, measure, adjust, and/or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case.
MD-E.1.13	Reassemble and reinstall differential case assembly; measure runout; determine necessary action.
MD-E.2.0	E.2 Limited Slip Differential
MD-E.2.1	Diagnose noise, slippage, and chatter concerns; determine necessary action.
MD-E.2.2	Measure rotating torque; determine necessary action.
MD-E.3.0	E.3 Drive Axles

SUSPENSION AND STEERING

Content Area	Questions
A. General: Suspension and Steering Systems	3
B. Steering Systems Diagnosis and Repair	8
C. Suspension Systems Diagnosis and Repair	8
D. Related Suspension and Steering Service	4
E. Wheel Alignment Diagnosis, Adjustment, and Repair	10
F. Wheels and Tires Diagnosis and Repair	7
<i>Required to Pass: 20 of 40</i>	40

Effective August 1, 2018, this individual test is based on the Suspension and Steering tasks of the 2018 NATEF MAST Automobile Program Standards and is intended for those students who have completed a course of study that corresponds with that level of instruction.

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- SS-A.2 Identify and interpret suspension and steering system concerns; determine necessary action.
- SS-B.0 B. Steering Systems Diagnosis and Repair
- SS-B.1 Disable and enable supplemental restraint system (SRS); verify indicator lamp operation.
- SS-B.2 Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).
- SS-B.3 Diagnose steering column noises, looseness, and binding concerns (including tilt/telescoping mechanisms); determine necessary action.
- SS-B.4 Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action.
- SS-B.5 Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action.
- SS-B.6 Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action.
- SS-B.7 Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets.
- SS-B.8 Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots; replace as needed.
- SS-B.9 Inspect power steering fluid level and condition.
- SS-B.10 Flush, fill, and bleed power steering system; use proper fluid type per manufacturer specification.
- SS-B.11 Inspect for power steering fluid leakage; determine necessary action.
- SS-B.12 Remove, inspect, replace, and/or adjust power steering pump drive belt.
- SS-B.13 Remove and reinstall power steering pump.
- SS-B.14 Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.
- SS-B.15 Inspect, remove and/or replace power steering hoses and fittings.
- SS-B.16 Inspect, remove and/or replace pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper.
- SS-B.17 Inspect, replace, and/or adjust tie rod ends (sockets), tie rod sleeves, and clamps.

- SS-B.18 Inspect, test and diagnose electrically assisted power steering systems (including using a scan tool); determine necessary action.
- SS-B.19 Identify hybrid vehicle power steering system electrical circuits and safety precautions.
- SS-B.20 Test power steering system pressure; determine necessary action.
- SS-C.0 C. Suspension Systems Diagnosis and Repair
- SS-C.1 Diagnose short and long arm suspension system noises, body sway, and uneven ride height concerns; determine necessary action.
- SS-C.2 Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine necessary action.
- SS-C.3 Inspect, remove, and/or replace upper and lower control arms, bushings, shafts, and rebound bumpers.
- SS-C.4 Inspect, remove, and/or replace strut rods and bushings.
- SS-C.5 Inspect, remove, and/or replace upper and/or lower ball joints (with or without wear indicators).
- SS-C.6 Inspect, remove, and/or replace steering knuckle assemblies.
- SS-C.7 Inspect, remove and/or replace short and long arm suspension system coil springs and spring insulators.
- SS-C.8 Inspect, remove, and/or replace torsion bars and mounts
- SS-C.9 Inspect, remove, and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links.
- SS-C.10 Inspect, remove, and/or replace strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.
- SS-C.11 Inspect, remove, and/or replace track bar, strut rods/radius arms, and related mounts and bushings.
- SS-C.12 Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts.
- SS-D.0 D. Related Suspension and Steering Service
- SS-D.1 Inspect, remove, and/or replace shock absorbers; inspect mounts and bushings.
- SS-D.2 Remove, inspect, service and/or replace front and rear wheel bearings.
- SS-D.3 Describe the function of steering and suspension control systems and components, (i.e. active suspension, and stability control).
- SS-E.0 E. Wheel Alignment Diagnosis, Adjustment, and Repair
- SS-E.1 Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary action.
- SS-E.2 Perform pre-alignment inspection; measure vehicle ride height; determine necessary action.
- SS-E.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.
- SS-E.4 Check toe-out-on-turns (turning radius); determine necessary action.
- SS-E.5 Check Steering Axis Inclination (SAI) and included angle; determine necessary action.
- SS-E.6 Check rear wheel thrust angle; determine necessary action.
- SS-E.7 Check for front wheel setback; determine necessary action.
- SS-E.8 Check front and/or rear cradle (subframe) alignment; determine necessary action.
- SS-E.9 Reset steering angle sensor.
- SS-F.0 F. Wheels and Tires Diagnosis and Repair
- SS-F.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.
- SS-F.2 Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action.
- SS-F.3 Rotate tires according to manufacturer's recommendations including vehicles equipped with Tire Pressure Monitoring Systems (TPMS)

- SS-F.4 Measure wheel, tire, axle flange, and hub runout; determine necessary action.
- SS-F.5 Diagnose tire pull problems; determine necessary action.
- SS-F.6 Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly.
- SS-F.7 Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor.
- SS-F.8 Inspect tire and wheel assembly for air loss; perform necessary action.
- SS-F.9 Repair tire following vehicle manufacturer approved procedure.
- SS-F.10 Identify tire pressure monitoring system (indirect and direct), calibrate system; verify operation of instrument panel lamps.
- SS-F.11 Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system; including relearn procedure

BRAKES

Content Area	Questions
A. General: Brake Systems Diagnosis	4
B. Hydraulic System Diagnosis and Repair	8
C. Drum Brake Diagnosis and Repair	5
D. Disc Brake Diagnosis and Repair	8
E. Power-Assist Units Diagnosis and Repair	3
F. Miscellaneous (Wheel Bearings, Parking Brakes, Electrical)	5
G. Electronic Brake Control Systems: ABS, TCS and ESC, D&R	7
<i>Required to Pass: 21 of 40</i>	40

Effective August 1, 2018, this individual test is based on the Brakes tasks of the 2018 NATEF MAST Automobile Program Standards and is intended for those students who have completed a course of study that corresponds with that level of instruction.

This test may include additional questions for statistical evaluation. These extra questions will not count for or against the final score. Since the extra questions are not identified, test candidates should answer every question to the best of their ability.

- BR-A.0 A. General: Brake Systems Diagnosis
- BR-A.1 Identify and interpret brake system concerns; determine necessary action.
- BR-A.2 Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.
- BR-A.3 Describe procedure for performing a road test to check brake system operation; including an anti-lock brake system (ABS).
- BR-A.4 Install wheel and torque lug nuts.
- BR-B.0 B. Hydraulic System Diagnosis and Repair
- BR-B.1 Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law).
- BR-B.2 Measure brake pedal height, travel, and free play (as applicable); determine necessary action.
- BR-B.3 Check master cylinder for internal/external leaks and proper operation; determine necessary action.
- BR-B.4 Remove, bench bleed, and reinstall master cylinder.
- BR-B.5 Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action.
- BR-B.6 Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear; for loose fittings/supports; determine necessary action.
- BR-B.7 Replace brake lines, hoses, fittings, and supports.
- BR-B.8 Fabricate brake lines using proper material and flaring procedures (double flare and ISO types).
- BR-B.9 Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification.
- BR-B.10 Inspect, test, and/or replace components of brake warning light system.
- BR-B.11 Identify components of hydraulic brake warning light system.
- BR-B.12 Bleed and/or flush brake system.
- BR-B.13 Test brake fluid for contamination.
- BR-C.0 C. Drum Brake Diagnosis and Repair
- BR-C.1 Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action.

- BR-C.2 Remove, clean, and inspect brake drum; measure brake drum diameter; determine necessary action.
- BR-C.3 Refinish brake drum and measure final drum diameter; compare with specification.
- BR-C.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.
- BR-C.5 Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.
- BR-C.6 Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments.
- BR-D.0 D. Disc Brake Diagnosis and Repair
- BR-D.1 Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine necessary action.
- BR-D.2 Remove and clean caliper assembly; inspect for leaks and damage/wear; determine necessary action.
- BR-D.3 Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine necessary action.
- BR-D.4 Remove, inspect, and/or replace brake pads and retaining hardware; determine necessary action.
- BR-D.5 Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads and inspect for leaks.
- BR-D.6 Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine necessary action.
- BR-D.7 Remove and reinstall/replace rotor.
- BR-D.8 Refinish rotor on vehicle; measure final rotor thickness and compare with specification.
- BR-D.9 Refinish rotor off vehicle; measure final rotor thickness and compare with specification.
- BR-D.10 Retract and re-adjust caliper piston on an integrated parking brake system.
- BR-D.11 Check brake pad wear indicator; determine necessary action.
- BR-D.12 Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations.
- BR-E.0 E. Power-Assist Units Diagnosis and Repair
- BR-E.1 Check brake pedal travel with, and without, engine running to verify proper power booster operation.
- BR-E.2 Identify components of the brake power assist system (vacuum and hydraulic); check vacuum supply (manifold or auxiliary pump) to vacuum type power booster.
- BR-E.3 Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine necessary action.
- BR-E.4 Inspect and test hydraulically-assisted power brake system for leaks and proper operation; determine necessary action.
- BR-E.5 Measure and adjust master cylinder pushrod length.
- BR-F.0 F. Miscellaneous (Wheel Bearings, Parking Brakes, Electrical, Etc.) Diagnosis and Repair
- BR-F.1 Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action.
- BR-F.2 Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings.
- BR-F.3 Check parking system and components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed.
- BR-F.4 Check parking brake operation and parking brake indicator light system operation; determine necessary action.
- BR-F.5 Check operation of brake stop light system.
- BR-F.6 Replace wheel bearing and race.
- BR-F.7 Remove and reinstall sealed wheel bearing assembly.
- BR-F.8 Inspect and replace wheel studs.

- BR-G.0 G. Electronic Brake Control Systems: Antilock Brake Systems (ABS), Traction Control System (TCS), and Electronic Stability Control Systems (ESC) Diagnosis and Repair
- BR-G.1 Identify and inspect electronic brake control system components (ABS, TCS, ECS); determine necessary action.
- BR-G.2 Describe the operation of a regenerative braking system.
- BR-G.3 Diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system; determine necessary action.
- BR-G.4 Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine necessary action.
- BR-G.5 Depressurize high-pressure components of an electronic brake control system.
- BR-G.6 Bleed the electronic brake control system hydraulic circuits.
- BR-G.7 Test, diagnose, and service electronic brake control system speed sensors (digital and analog), toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to
- BR-G.8 Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.).

ELECTRICAL/ELECTRONIC SYSTEMS

Content Areas	Questions
A. General: Electrical System Diagnosis	11
B. Battery Diagnosis and Service	5
C. Starting System Diagnosis and Repair	5
D. Charging System Diagnosis and Repair	5
E. Lighting Systems Diagnosis and Repair	4
F. Instrument Cluster and Driver Information Systems D&R	3
G. Body Electrical Systems Diagnosis and Repair	7
<i>Required to Pass: 20 of 40</i>	40

Effective August 1, 2018, this individual test is based on the Electrical/Electronic Systems tasks of the 2018 NATEF MAST Automobile Program Standards and is intended for those students who have completed a course of study that corresponds with that level of instruction.

This test may include additional questions for statistical evaluation. These extra questions will not count for or against the final score. Since the extra questions are not identified, test candidates should answer every question to the best of their ability.

- EE-A.0 A. General: Electrical System Diagnosis
- EE-A.1 Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.
- EE-A.2 Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).
- EE-A.3 Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow and resistance.
- EE-A.4 Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.
- EE-A.5 Demonstrate proper use of a test light on an electrical circuit.
- EE-A.6 Check operation of electrical circuits fused jumper wires.
- EE-A.7 Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems.
- EE-A.8 Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action.
- EE-A.9 Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.
- EE-A.10 Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; determine necessary action.
- EE-A.11 Inspect, test, repair, and/or replace components, connectors, terminals, harnesses, and wiring in electrical/electronic systems (including solder repairs)
- EE-A.12 Check electrical/electronic circuit waveforms; interpret readings and determine needed repairs.
- EE-A.13 Repair Data BUS wiring harness.
- EE-B.0 B. Battery Diagnosis and Service
- EE-B.1 Perform battery state-of-charge test; determine necessary action.
- EE-B.2 Confirm proper battery capacity for vehicle application; perform battery capacity and load test; determine necessary action
- EE-B.3 Maintain or restore electronic memory functions.

- EE-B.4 Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps, and hold-downs.
- EE-B.5 Perform slow/fast battery charge according to manufacturer's recommendations.
- EE-B.6 Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply.
- EE-B.7 Identify safety precautions for high voltage systems on hybrid, hybrid electric, and diesel vehicles.
- EE-B.8 Identify electrical/electronic modules, security systems, radios, and other accessories that require re-initialization or code entry after reconnecting vehicle battery.
- EE-B.9 Identify hybrid vehicle auxiliary (12v) battery service, repair, and test procedures.
- EE-C.0 C. Starting System Diagnosis and Repair
- EE-C.1 Perform starter current draw tests; determine necessary action.
- EE-C.2 Perform starter circuit voltage drop tests; determine necessary action.
- EE-C.3 Inspect and test starter relays and solenoids; determine necessary action.
- EE-C.4 Remove and install starter in a vehicle.
- EE-C.5 Inspect and test switches, connectors, and wires of starter control circuits; determine necessary action.
- EE-C.6 Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition.
- EE-C.7 Demonstrate knowledge of an automatic idle-stop/start-stop system.
- EE-D.0 D. Charging System Diagnosis and Repair
- EE-D.1 Perform charging system output test; determine necessary action.
- EE-D.2 Diagnose (troubleshoot) charging system for causes of undercharge, no-charge, or overcharge conditions.
- EE-D.3 Inspect, adjust, and/or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment.
- EE-D.4 Remove, inspect, and/or replace generator (alternator).
- EE-D.5 Perform charging circuit voltage drop tests; determine necessary action.
- EE-E.0 E. Lighting Systems Diagnosis and Repair
- EE-E.1 Diagnose (troubleshoot) the causes of brighter-than-normal, intermittent, dim, or no light operation; determine necessary action.
- EE-E.2 Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed.
- EE-E.3 Aim headlights.
- EE-E.4 Identify system voltage and safety precautions associated with high-intensity discharge headlights.
- EE-F.0 F. Instrument Cluster and Driver Information Systems Diagnosis and Repair
- EE-F.1 Inspect and test gauges and gauge sending units for causes of abnormal readings; determine necessary action
- EE-F.2 Diagnose (troubleshoot) the causes of incorrect operation of warning devices and other driver information systems; determine necessary action.
- EE-F.3 Reset maintenance indicators as required.
- EE-G.0 G. Body Electrical Systems Diagnosis and Repair
- EE-G.1 Diagnose 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.
- EE-G.2 Diagnose operation of security/anti-theft systems and related circuits (such as: theft deterrent, door locks, remote keyless entry, remote start, and starter/fuel disable); determine needed repairs.

- EE-G.3 Diagnose operation of entertainment and related circuits (such as: radio, DVD, remote CD changer, navigation, amplifiers, speakers, antennas, and voice-activated accessories); determine needed repairs.
- EE-G.4 Diagnose operation of safety systems and related circuits (such as: horn, airbags, seat belt pre-tensioners, occupancy classification, wipers, washers, speed control/collision avoidance, heads- up display, park assist, and back-up camera); determine needed repairs.
- EE-G.5 Diagnose body electronic systems circuits using a scan tool; check for module communication errors (DATA BUS systems); determine necessary action.
- EE-G.6 Describe the process for software transfer, software updates, or re-programming of electronic modules.

HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

Content Areas	Questions
Heating and A/C	
A. General: A/C System Diagnosis and Repair	11
B. Refrigeration System Component Diagnosis and Repair	9
C. Heating, Ventilation, and Engine Cooling Systems D&R	4
D. Operating Systems and Related Controls Diagnosis and Repair	11
E. Refrigerant Recovery, Recycling, and Handling	5
<i>Required to Pass: 20 of 40</i>	40

Effective August 1, 2018, this individual test is based on the Heating, Ventilation and Air Conditioning tasks of the 2018 NATEF MAST Automobile Program Standards and is intended for those students who have completed a course of study that corresponds with that level of instruction.

This test may include additional questions for statistical evaluation. These extra questions will not count for or against the final score. Since the extra questions are not identified, test candidates should answer every question to the best of their ability.

- AC-A.0 A. General: A/C System Diagnosis and Repair
- AC-A.1 Identify and interpret heating and air-conditioning problems; determine necessary action.
- AC-A.2 Research vehicle service information including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins.
- AC-A.3 Performance test A/C system; identify problems.
- AC-A.4 Identify abnormal operating noises in the A/C system; determine necessary action.
- AC-A.5 Identify refrigerant type; select and connect proper gauge set/test equipment; record temperature and pressure readings.
- AC-A.6 Leak test A/C system; determine necessary action.
- AC-A.7 Inspect condition of refrigerant oil removed from A/C system; determine necessary action.
- AC-A.8 Determine recommended oil and oil capacity for system application.
- AC-A.9 Using a scan tool, observe and record related HVAC data and trouble codes.
- AC-B.0 B. Refrigeration System Component Diagnosis and Repair
- AC-B.1 Inspect, remove, and/or replace A/C compressor drive belts, pulleys, tensioners and visually inspect A/C components for signs of leaks; determine necessary action.
- AC-B.2 Inspect, test, service and/or replace A/C compressor clutch components and/or assembly; check compressor clutch air gap; adjust as needed.
- AC-B.3 Remove, inspect, and/or reinstall A/C compressor and mountings; determine recommended oil type and quantity.
- AC-B.4 Identify hybrid vehicle A/C system electrical circuits and service/safety precautions.
- AC-B.5 Determine need for an additional A/C system filter; perform necessary action.
- AC-B.6 Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform necessary action.
- AC-B.7 Inspect for proper A/C condenser airflow; determine necessary action.
- AC-B.8 Remove, inspect, and replace receiver/drier or accumulator/drier; determine recommended oil type and quantity.
- AC-B.9 Remove, inspect, and install expansion valve or orifice (expansion) tube.
- AC-B.10 Inspect evaporator housing water drain; perform necessary action.

- AC-B.11 Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and PCM) to interrupt system operation; determine necessary action.
- AC-B.12 Determine procedure to remove and reinstall evaporator; determine required oil type and quantity.
- AC-B.13 Remove, inspect, and reinstall condenser; determine required oil type and quantity.
- AC-C.0 C. Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair
- AC-C.1 Inspect engine cooling and heater systems hoses and pipes; perform necessary action.
- AC-C.2 Inspect and test heater control valve(s); perform necessary action.
- AC-C.3 Diagnose temperature control problems in the heater/ventilation system; determine necessary action.
- AC-C.4 Determine procedure to remove, inspect, and/or replace heater core.
- AC-D.0 D. Operating Systems and Related Controls Diagnosis and Repair
- AC-D.1 Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; perform necessary action.
- AC-D.2 Diagnose A/C compressor clutch control systems; determine necessary action.
- AC-D.3 Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action.
- AC-D.4 Inspect and test HVAC system control panel assembly; determine necessary action.
- AC-D.5 Inspect and test HVAC system control cables, motors, and linkages; perform necessary action.
- AC-D.6 Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; perform necessary action.
- AC-D.7 Identify the source of HVAC system odors.
- AC-D.8 Check operation of automatic or semi-automatic heating, ventilation, and air-conditioning (HVAC) control systems; determine necessary action.
- AC-E.0 E. Refrigerant Recovery, Recycling, and Handling
- AC-E.1 Perform correct use and maintenance of refrigerant handling equipment according to equipment manufacturer's standards.
- AC-E.2 Identify A/C system refrigerant; test for sealants; recover, evacuate, and charge A/C system; add refrigerant oil as required.
- AC-E.3 Recycle, label, and store refrigerant.

ENGINE PERFORMANCE

Content Areas	Questions
A. General: Engine Diagnosis	10
B. Computerized Controls Diagnosis and Repair	11
C. Ignition System Diagnosis and Repair	6
D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair	7
E. Emissions Control Systems Diagnosis and Repair	6
<i>Required to Pass: 21 of 40</i>	40

Effective August 1, 2018, this individual test is based on the Engine Performance tasks of the 2018 NATEF MAST Automobile Program Standards and is intended for those students who have completed a course of study that corresponds with that level of instruction.

This test may include additional questions for statistical evaluation. These extra questions will not count for or against the final score. Since the extra questions are not identified, test candidates should answer every question to the best of their ability.

- EP-A.0 A. General: Engine Diagnosis
- EP-A.1 Identify and interpret engine performance concerns; determine necessary action.
- EP-A.2 Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.
- EP-A.3 Diagnose abnormal engine noises or vibration concerns; determine necessary action.
- EP-A.4 Diagnose the cause of excessive oil consumption, coolant consumption, unusual exhaust color, odor, and sound; determine necessary action.
- EP-A.5 Perform engine absolute manifold pressure tests (vacuum/boost); determine necessary action.
- EP-A.6 Perform cylinder power balance test; determine necessary action.
- EP-A.7 Perform cylinder cranking and running compression tests; determine necessary action.
- EP-A.8 Perform cylinder leakage test; determine necessary action.
- EP-A.9 Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action.
- EP-A.10 Verify engine operating temperature; determine necessary action.
- EP-A.11 Verify correct camshaft timing including Variable Valve Timing systems (VVT).
- EP-B.0 B. Computerized Controls Diagnosis and Repair
- EP-B.1 Retrieve and record Diagnostic Trouble Codes (DTC), OBD monitor status, and freeze frame data; clear codes when applicable.
- EP-B.2 Access and use service information to perform step-by-step (troubleshooting) diagnosis.
- EP-B.3 Perform active tests of actuators using a scan tool; determine necessary action.
- EP-B.4 Describe the use of OBD monitors for repair verification.
- EP-B.5 Diagnose the causes of emissions or drivability concerns with stored or active diagnostic trouble codes; obtain, graph, and interpret scan tool data.
- EP-B.6 Diagnose emissions or drivability concerns without stored diagnostic trouble codes; determine necessary action.
- EP-B.7 Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action.

- EP-B.8 Diagnose drivability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, (HVAC), automatic transmissions, non-OEM installed accessories, or similar systems); determine necessary action.
- EP-C.0 C. Ignition System Diagnosis and Repair
- EP-C.1 Diagnose (troubleshoot) ignition system related problems such as no-starting, hard starting, engine misfire, poor drivability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action.
- EP-C.2 Inspect and test crankshaft and camshaft position sensor(s); perform necessary action.
- EP-C.3 Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram/initialize as necessary.
- EP-C.4 Remove and replace spark plugs; inspect secondary ignition components for wear and damage.
- EP-D.0 D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair
- EP-D.1 Diagnose (troubleshoot) hot or cold no-starting, hard starting, poor drivability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems; determine necessary action.
- EP-D.2 Check fuel for contaminants; determine necessary action.
- EP-D.3 Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action.
- EP-D.4 Replace fuel filter(s) when applicable.
- EP-D.5 Inspect, service, or replace air filters, filter housings, and intake duct work.
- EP-D.6 Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.
- EP-D.7 Inspect, test, and/or replace fuel injectors.
- EP-D.8 Verify idle control operation.
- EP-D.9 Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; perform necessary action.
- EP-D.10 Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine necessary action.
- EP-D.11 Perform exhaust system back-pressure test; determine necessary action.
- EP-D.12 Check and refill diesel exhaust fluid (DEF).
- EP-D.13 Test the operation of turbocharger/supercharger systems; determine necessary action.
- EP-E.0 E. Emissions Control Systems Diagnosis and Repair
- EP-E.1 Diagnose oil leaks, emissions, and drivability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action.
- EP-E.2 Inspect, test, service, and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; perform necessary action.
- EP-E.3 Diagnose emissions and drivability concerns caused by the exhaust gas recirculation (EGR) system; inspect, test, service and/or replace electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems including tubing, exhaust passages, vacuum/pressure controls, filters and hoses; determine necessary action.
- EP-E.4 Diagnose emissions and drivability concerns caused by the secondary air injection system; components and circuits of air injection systems; inspect, test, repair, and/or replace electrical/electronically-operated components and circuits of air injection systems; determine necessary action.
- EP-E.5 Diagnose emissions and drivability concerns caused by the evaporative emissions control (EVAP) system; determine necessary action.

- EP-E.6 Diagnose emission and drivability concerns caused by catalytic converter system; determine necessary action.
- EP-E.7 Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action.