Competencies

**NOTE:** For all tasks in this Apprenticeship program, the following requirements must be strictly enforced:

1. Read and follow the vehicle manufacturer's most current service procedures and safety guidelines.
2. 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 manufacturer recommendations as well as local, state, and federal safety and environmental regulations.

|  |  |  |
| --- | --- | --- |
| **INDEX #** | **TASK** | **A. ICE ENGINE REPAIR** |
| 1 | A.1 | Research vehicle service information such as fluid type, internal combustion engine operation, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS); perform software updates as needed per manufacturer requirements. |
| 2 | A.2 | Retrieve and record on-board diagnostics, diagnostic trouble codes (DTCs), TCs, monitor status, and freeze frame data; clear codes and data when directed. |
| 3 | A.3 | Verify operation of the instrument panel engine warning indicators. |
| 4 | A.4 | Check fluid levels using manufacturer procedures and specifications. |
| 5 | A.5 | Inspect engine assembly for fuel, oil, coolant, and other leaks; identify the cause and repair as required. |
| 6 | A.6 | Demonstrate knowledge of the process for verifying engine mechanical timing. |
| 7 | A.7 | Identify cylinder head and valve train components and configurations. |
| 8 | A.8 | Identify engine block assembly components and configurations. |
| 9 | A.9 | Demonstrate knowledge of lubrication and cooling system components and configurations. |
| 10 | A.10 | Perform engine oil and filter change; use proper fluid type and amount per manufacturer specification; reset maintenance reminder as required. |
| 11 | A.11 | Perform cooling system pressure and dye tests on ICE cooling systems to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant reservoir/recovery tank, heater core, and galley plugs. |
| 12 | A.12 | Identify causes of engine overheating and repair as needed. |
| 13 | A.13 | Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. |
| 14 | A.14 | Inspect and test coolant; drain and recover coolant; flush and/or refill cooling system; use proper fluid type per manufacturer specification; bleed air as required. |
| 15 | A.15 | Demonstrate knowledge of different types of water/coolant pumps (belt driven, chain driven, and electric). |
| 16 | A.16 | Remove, inspect, and replace thermostat and gasket/seal. |
| **INDEX** | **TASK** | **B. AUTOMATIC TRANSMISSION AND TRANSAXLE** |
| 17 | B.1 | Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and/or vehicles equipped with advanced driver assistance systems (ADAS); perform software updates as needed per manufacturer requirements. |
| 18 | B.2 | Identify automatic transmission and transaxle components and configurations, including torque converter automatic transmission, dual-clutch transmission (DCT), continuously variable transmission (CVT), and xEV drive. |
| 19 | B.3 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed. |
| 20 | B.4 | Inspect for leaks and check transmission fluid condition and fluid level on transmissions or transaxles with or without a dipstick. |
| 21 | B.5 | Inspect transmission external control devices, including transmission range sensor/switch, and/or park/neutral position switch. |
| 22 | B.6 | Drain and replace fluid and filter(s) per manufacturer guidelines; use proper fluid type per manufacturer specification. |
| 23 | B.7 | Demonstrate knowledge of the process for replacing the transmission or transaxle. |
| 24 | B.8 | Perform relearn procedures as required. |
| 25 | B.9 | Inspect, replace and/or align power train mounts. |
| 26 | B.10 | Describe the operational characteristics of a continuously variable transmission (CVT). |
| 27 | B.11 | Describe the operational characteristics of a hybrid vehicle drive train. |
| 28 | B.12 | Describe the operational characteristics of dual-clutch transmission (DCT). |
| **INDEX** | **TASK** | **C. MANUAL DRIVE TRAIN AND AXLES** |
| 29 | C.1 | Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS); perform software updates as needed per manufacturer requirements. |
| 30 | C.2 | Identify manual drive train, xEV drive train, and axle components and configurations. |
| 31 | C.3 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed. |
| 32 | C.4 | Check fluid condition and level; check for leaks. |
| 33 | C.5 | Drain and refill manual transmission/transaxle/xEV gearbox; use proper fluid type per manufacturer specification. |
| 34 | C.6 | Demonstrate knowledge of procedures to check and adjust clutch hydraulic system. |
| 35 | C.7 | Inspect and/or remove/replace bearings, hubs, and seals. |
| 36 | C.8 | Inspect and/or service/replace shafts, yokes, boots, and universal/CV joints. |
| 37 | C.9 | Inspect differential housing; check for leaks; inspect housing vent. |
| 38 | C.10 | Check and adjust differential housing fluid level using proper fluid type per manufacturer specification. |
| 39 | C.11 | Drain and refill differential housing using proper fluid type per manufacturer specification. |
| 40 | C.12 | Inspect and replace drive axle wheel studs. |
| 41 | C.13 | Demonstrate knowledge of concerns caused by variations in tire circumference and/or final drive ratios. |
| 42 | C.14 | Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification. |
| **INDEX** | **TASK** | **D. SUSPENSION AND STEERING** |
| 43 | D.1 | Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS); perform software updates as needed per manufacturer requirements. |
| 44 | D.2 | Identify suspension and steering system components and configurations. |
| 45 | D.3 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed. |
| 46 | D.4 | Disable, enable, and properly handle supplemental restraint system (SRS)/airbag system components during vehicle service following manufacturer procedures. |
| 47 | D.5 | Inspect rack and pinion steering gear, tie rod ends (sockets), and bellows boots. |
| 48 | D.6 | Inspect power steering hydraulic components and adjust fluid level as needed. |
| 49 | D.7 | Flush/exchange power steering system fluid; use proper fluid type per manufacturer specification. |
| 50 | D.8 | Inspect for power steering fluid leakage and repair or replace components as needed. |
| 51 | D.9 | Remove, inspect, replace, and/or adjust power steering pump drive belt. |
| 52 | D.10 | Inspect pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper; replace as needed. |
| 53 | D.11 | Inspect tie rod ends (sockets), tie rod sleeves, and clamps (non-rack and pinion); replace as needed. |
| 54 | D.12 | Demonstrate knowledge of electric power steering system operation. |
| 55 | D.13 | Inspect upper and/or lower control arms, bushings, and shafts; replace as needed. |
| 56 | D.14 | Inspect rebound/jounce bumpers; replace as needed. |
| 57 | D.15 | Inspect track bar, strut rods/radius arms, and related mounts and bushings; replace as needed. |
| 58 | D.16 | Inspect upper and/or lower ball joints (with or without wear indicators); replace as needed. |
| 59 | D.17 | Inspect suspension system coil springs and spring insulators; replace as needed. |
| 60 | D.18 | Inspect torsion bars and mounts; replace as needed. |
| 61 | D.19 | Inspect front/rear stabilizer bar (sway bar) bushings, brackets, and links; replace as needed. |
| 62 | D.20 | Inspect strut assembly, strut coil spring, insulators, and upper strut bearing mount; replace as needed. |
| 63 | D.21 | Inspect components of rear suspension systems (coil, leaf, and torsion beam); replace as needed. |
| 64 | D.22 | Inspect shock absorbers and mounts and bushings; replace as needed. |
| 65 | D.23 | Inspect front and rear wheel bearings; replace as needed. |
| 66 | D.24 | Demonstrate knowledge of electronically controlled suspension and steering systems and components, (i.e., active suspension and stability control). |
| 67 | D.25 | Inspect components of electronically controlled suspension systems; replace as needed. |
| 68 | D.26 | Demonstrate knowledge of advanced driver assistance systems (ADAS) and components, such as adaptive cruise control, blind spot detection, automatic emergency braking, lane keeping assistance, etc. |
| 69 | D.27 | Determine the need to recalibrate a vehicle's advanced driver assistance systems (ADAS) after repairs or adjustments. |
| 70 | D.28 | Perform pre-alignment inspection, place vehicle in service mode as required; measure vehicle ride height. |
| 71 | D.29 | Describe four-wheel alignment angles (camber, caster, toe, setback, and thrust angle) and effects on vehicle handling\tire wear. |
| 72 | D.30 | Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front caster, front and rear camber, and toe as required; center steering wheel. |
| 73 | D.31 | Reset steering angle sensor. |
| 74 | D.32 | Inspect tire condition/age; identify tire wear patterns; check for correct tire size, application (service-class, load, and speed ratings), and air pressure as listed on the tire information placard/label. |
| 75 | D.33 | Rotate tires according to manufacturer recommendations including vehicles equipped with tire pressure monitoring systems (TPMS). |
| 76 | D.34 | Dismount, inspect, and remount tire on wheel (with/without tire pressure monitoring systems); balance wheel and tire assembly. |
| 77 | D.35 | Demonstrate knowledge of the proper use of and concerns related to directional tires and staggered tire sizes. |
| 78 | D.36 | Inspect tire and wheel assembly for air loss; determine needed action. |
| 79 | D.37 | Repair tire following tire manufacturer approved procedure. |
| 80 | D.38 | Identify indirect and direct tire pressure monitoring systems (TPMS); calibrate/relearn system as required; verify operation of instrument panel lamps. |
| 81 | D.39 | Remove and replace sensors (per OEM/sensor manufacturer) in a tire pressure monitoring system (TPMS). |
| 82 | D.40 | Perform road force balance/match mounting. |
| **INDEX** | **TASK** | **E. BRAKES** |
| 83 | E.1 | Research vehicle service information such as fluid type, system design (hydraulic, electronic, etc.), vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS); perform software updates as needed per manufacturers requirements. |
| 84 | E.2 | Identify brake system components and configurations. |
| 85 | E.3 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed. |
| 86 | E.4 | Research requirements and place a vehicle in service mode before servicing the brake system, as required. |
| 87 | E.5 | Perform calibration/recalibration, initialization, or relearn procedures as required. |
| 88 | E.6 | Perform a road test to check brake system operation, including an anti-lock brake system (ABS). |
| 89 | E.7 | Demonstrate knowledge of hydraulic principles. |
| 90 | E.8 | Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, and loose fittings/supports; repair or replace according to manufacturer specifications. |
| 91 | E.9 | Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification. |
| 92 | E.10 | Bleed, exchange, and/or flush fluid in the brake system as needed. |
| 93 | E.11 | Test brake fluid for contamination. |
| 94 | E.12 | Identify components of brake warning light system and verify proper operation. |
| 95 | E.13 | Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability. |
| 96 | E.14 | Refinish brake drum as required and measure final drum diameter; compare with specification. |
| 97 | E.15 | 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. |
| 98 | E.16 | Inspect wheel cylinders for leaks and proper operation; remove and replace as needed. |
| 99 | E.17 | Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments. |
| 100 | E.18 | Remove and clean caliper assembly; inspect for leaks, damage, and wear. |
| 101 | E.19 | Inspect caliper mounting and slides/pins for proper operation, wear, and damage. |
| 102 | E.20 | Remove, inspect, and/or replace brake pads and retaining hardware. |
| 103 | E.21 | Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads against rotor; ensure proper brake pedal height following brake service; inspect for leaks. |
| 104 | E.22 | Demonstrate knowledge of processes to clean and inspect rotor and mounting surface, measure rotor thickness, thickness variation, and lateral runout. |
| 105 | E.23 | Remove and reinstall/replace rotor. |
| 106 | E.24 | Refinish rotor **on** vehicle; measure final rotor thickness and compare with specification. |
| 107 | E.25 | Refinish rotor **off** vehicle; measure final rotor thickness and compare with specification. |
| 108 | E.26 | Retract and re-adjust caliper piston on an integrated parking brake system. |
| 109 | E.27 | Test drive vehicle following brake system service and burnish/break-in replacement brake pads according to manufacturer recommendation. |
| 110 | E.28 | Identify components and verify proper operation of the brake power assist system (vacuum/hydraulic/electric). |
| 111 | E.29 | Describe the procedures to remove, clean, inspect, repack/replace, and install wheel bearings; remove and install bearing races; replace seals; install hub and adjust bearings; perform these services as needed. |
| 112 | E.30 | Check parking brake system components for proper operation; clean, lubricate, adjust and/or replace as needed. |
| 113 | E.31 | Check operation of brake stop light system and repair as needed. |
| 114 | E.32 | Inspect and replace wheel studs/wheel fasteners. |
| 115 | E.33 | Identify electronic brake control system components and describe function (anti-lock brake system (ABS), traction control system (TCS), electronic stability control system(ESC)). |
| 116 | E.34 | Describe the operation of a regenerative braking system. |
| **INDEX** | **TASK** | **F. ELECTRICAL/ELECTRONIC SYSTEMS (LOW VOLTAGE)** |
| 117 | F.1 | Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS); perform software updates as needed per manufacturers requirements. |
| 118 | F.2 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed. |
| 119 | F.3 | Measure key-off battery drain (parasitic draw) according to manufacturer specification. |
| 120 | F.4 | Inspect and test circuit protection devices, including fusible links, circuit breakers, fuses, etc. |
| 121 | F.5 | Repair and/or replace connectors, terminal ends, and wiring of electrical/electronic systems (including solder repair according to manufacturer specifications). |
| 122 | F.6 | Identify specified electrical/electronic system components and configurations. |
| 123 | F.7 | Demonstrate proper use of a digital multimeter (DMM) and interpret results when measuring source voltage, voltage drop (including grounds), current flow, and resistance. |
| 124 | F.8 | Demonstrate knowledge of the causes and effects of shorts, grounds, opens, and resistance problems in electrical/electronic circuits. |
| 125 | F.9 | Describe precautions related to the use of test lights. |
| 126 | F.10 | Demonstrate knowledge of wiring diagrams, symbols, and components; use wiring diagrams to trace electrical/electronic circuits. |
| 127 | F.11 | Confirm proper battery capacity, size, type, and application for vehicle; perform battery/starting/charging system performance test as recommended by manufacturer. |
| 128 | F.12 | Maintain or restore electronic memory functions as recommended by manufacturer. |
| 129 | F.13 | Inspect and clean battery; check battery cables, connectors, clamps, and hold-downs. |
| 130 | F.14 | Perform battery charging according to manufacturer recommendations. |
| 131 | F.15 | Jump-start vehicle usinga booster battery or an auxiliary power supply according to manufacturer recommendations. |
| 132 | F.16 | Identify and perform reinitialization as required on electrical/electronic modules, security systems, radios, and other accessories after reconnecting vehicle battery; meet manufacturer specifications |
| 133 | F.17 | Perform starting and charging circuit voltage drop tests. |
| 134 | F.18 | Inspect and test starter relays. |
| 135 | F.19 | Remove and install starter in a vehicle. |
| 136 | F.20 | Inspect and test components of starter control circuits. |
| 137 | F.21 | Verify proper operation of an automatic idle-stop/start-stop system that uses a low-voltage starter to restart the engine. |
| 138 | F.22 | Inspect, adjust, and replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment. |
| 139 | F.23 | Remove, inspect, and replace generator (alternator). |
| 140 | F.24 | Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed. |
| 141 | F.25 | Demonstrate knowledge of active headlamp technologies and aim headlights according to manufacturer procedures. |
| 142 | F.26 | Verify proper operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators as required. |
| 143 | F.27 | Demonstrate knowledge of vehicle comfort, convenience, access, safety, and related systems operations. |
| 144 | F.28 | Remove and reinstall door panel. |
| 145 | F.29 | Verify proper operation of keyless entry/remote-start systems. |
| 146 | F.30 | Perform disabling and enabling procedures for supplemental restraint system (SRS); verify indicator lamp operation. |
| 147 | F.31 | Verify proper windshield wiper and washer operation; replace wiper blades. |
| **INDEX** | **TASK** | **G. xEV HIGH VOLTAGE SYSTEMS** |
|  |  | **These tasks must only be performed when the apprentice is being observed and directed by a mentor who is fully qualified by manufacturer standards for the xEV being serviced.** |
| 148 | G.1 | Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS); perform software updates as needed per manufacturer requirements. |
| 149 | G.2 | Locate procedures to safely de-energize/destable and energize/enable high-voltage systems. |
| 150 | G.3 | Identify potential safety and materials handling concerns associated with high voltage battery/energy storage systems. |
| 151 | G.4 | Demonstrate knowledge of special multimeters, insulated tools, and other test equipment required for use in high-voltage circuits. |
| 152 | G.5 | Demonstrate knowledge of personal protective equipment (PPE) required for use while servicing high-voltage circuits. |
| 153 | G.6 | Demonstrate knowledge of the use of a live-dead-live/zero potential test to verify isolation of the high-voltage battery/energy storage system. |
| 154 | G.7 | Demonstrate knowledge of the testing and verification of ground circuit isolation between vehicle chassis ground and the high-voltage circuits and components. |
| 155 | G.8 | Locate and perform procedures to safely de-energize/disable and energize/enable high-voltage systems. |
| 156 | G.9 | Identify electrified propulsion vehicle (xEV) high-voltage system configurations and components. |
| 157 | G.10 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed. |
| 158 | G.11 | Identify high-voltage circuits. |
| 159 | G.12 | Identify the various warning lights, pedestrian awareness alarms, and labels on and around the vehicle. |
| 160 | G.13 | Demonstrate knowledge of the safety concerns associated with servicing electrified propulsion vehicles, including scheduled maintenance, conventional low-voltage services, and high-voltage services and repairs; follow the manufacturer procedures and safety practices for working around and on high-voltage systems. |
| 161 | G.14 | Demonstrate knowledge of special multimeters, insulated tools, and other test equipment required for use in high-voltage circuits. |
| 162 | G.15 | Demonstrate knowledge of personal protective equipment (PPE) required for use while servicing high-voltage circuits. |
| 163 | G.16 | Demonstrate knowledge of safe handling procedures associated with high-voltage A/C compressors and wiring. |
| 164 | G.17 | Demonstrate knowledge of high-voltage battery thermal management systems and perform periodic coolant and filter service per manufacturer specifications. |
| **INDEX** | **TASK** | **H. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)** |
| 165 | H.1 | Research vehicle service information, including refrigerant/oil/fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS); perform software updates as needed per manufacturer requirements. |
| 166 | H.2 | **Obtain EPA-required credentials** and recover, recycle, and handle refrigerants using proper equipment and procedures. |
| 167 | H.3 | Identify heating, ventilation, and air conditioning (HVAC) components and configurations. |
| 168 | H.4 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed. |
| 169 | H.5 | Perform an A/C performance test and interpret pressure readings as recommended by manufacturer. |
| 170 | H.6 | Differentiate normal and abnormal operating noises in the A/C system. |
| 171 | H.7 | Visually inspect A/C system for signs of leaks. |
| 172 | H.8 | Inspect and/or replace A/C compressor drive belts, pulleys, and tensioners. |
| 173 | H.9 | Inspect for proper A/C condenser airflow. |
| 174 | H.10 | Inspect evaporator housing condensation drain and clear if needed. |
| 175 | H.11 | Inspect engine cooling and heater systems hoses and pipes and replace as needed. |
| 176 | H.12 | Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets. |
| 177 | H.13 | Identify the source of HVAC system odors. |
| 178 | H.14 | Remove and replace A/C system components such as compressor, lines, hoses, receiver/drier, expansion valve, evaporator, and condenser; determine recommended oil type and quantity. |
| **INDEX** | **TASK** | **I. ICE ENGINE PERFORMANCE** |
| 179 | I.1 | Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS); perform software updates as needed per manufacturer requirements. |
| 180 | I.2 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed. |
| 181 | I.3 | Verify proper engine cooling system operation. |
| 182 | I.4 | Perform cylinder power balance test, cylinder cranking and running compression tests, and cylinder leakage tests; determine needed action. |
| 183 | I.5 | Use scan tool to actuate camshaft timing controls on engines equipped with variable valve timing (VVT) systems. |
| 184 | I.6 | Identify computerized control system components and configurations. |
| 185 | I.7 | Identify ignition system components and configurations. |
| 186 | I.8 | Remove, inspect, and replace spark plugs; inspect and test secondary ignition components for wear and damage. |
| 187 | I.9 | Identify fuel, air induction, and exhaust system components and configurations and replace as needed. |
| 188 | I.10 | Replace fuel pumps and filter(s) where applicable. |
| 189 | I.11 | Demonstrate knowledge of forced air induction systems and components. |
| 190 | I.12 | Inspect, service, or replace air filters, filter housings, and intake duct work. |
| 191 | I.13 | Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields and replace as needed. |
| 192 | I.14 | Inspect condition of exhaust system hangers, brackets, clamps, and heat shields and replace as needed. |
| 193 | I.15 | Demonstrate knowledge of catalytic converter operation and testing procedures. |
| 194 | I.16 | Check and refill diesel exhaust fluid (DEF) as needed. |
| 195 | I.17 | Identify emission control system components and configurations. |
| 196 | I.18 | Inspect, test, service, and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses. |
| 197 | I.19 | Inspect, test, and service EVAP system components as needed. |

**Disclaimer:** *These materials have been prepared for informational purposes only. Nothing in the materials is intended to constitute legal advice. Consumers should contact their attorney to obtain advice with respect to any particular legal matter. The presentation of this information is not intended to encourage concerted action among competitors or any other action on the part of dealers that would in any manner fix or stabilize the price or any element of the price of any good or service.*