

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.

VI. ELECTRICAL/ELECTRONIC SYSTEMS

A. General Electrical System Diagnosis

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1
2. Identify and interpret electrical/electronic system concern; determine necessary action. P-1
3. Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins. P-1
4. Locate and interpret vehicle and major component identification numbers. P-1
5. Diagnose electrical/electronic integrity of series, parallel and series-parallel circuits using principles of electricity (Ohm's Law). P-1
6. Use wiring diagrams during diagnosis of electrical circuit problems. P-1
7. Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems, including: source voltage, voltage drop, current flow, and resistance. P-1
8. Check electrical circuits with a test light; determine necessary action. P-2
9. Check electrical/electronic circuit waveforms; interpret readings and determine needed repairs. P-2
10. Check electrical circuits using fused jumper wires; determine necessary action. P-2

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| 11. | Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action. | P-1 |
| 12. | Measure and diagnose the cause(s) of excessive parasitic draw; determine necessary action. | P-1 |
| 13. | Inspect and test fusible links, circuit breakers, and fuses; determine necessary action. | P-1 |
| 14. | Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; perform necessary action. | P-1 |
| 15. | Remove and replace terminal end from connector; replace connectors and terminal ends. | P-1 |
| 16. | Repair wiring harness (including CAN/BUS systems). | P-1 |
| 17. | Perform solder repair of electrical wiring. | P-1 |
| 18. | Identify location of hybrid vehicle high voltage circuit disconnect (service plug) location and safety procedures | P-2 |

VI. ELECTRICAL/ELECTRONIC SYSTEMS

B. Battery Diagnosis and Service

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| 1. | Perform battery state-of-charge test; determine necessary action. | P-1 |
| 2. | Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action. | P-1 |
| 3. | Maintain or restore electronic memory functions. | P-1 |
| 4. | Inspect, clean, fill, and/or replace battery, battery cables, connectors, clamps, and hold-downs. | P-1 |
| 5. | Perform battery charge. | P-1 |
| 6. | Start a vehicle using jumper cables or an auxiliary power supply. | P-1 |
| 7. | Identify high voltage circuits of electric or hybrid electric vehicle and related safety precautions. | P-3 |
| 8. | Identify electronic modules, security systems, radios, and other accessories that require reinitialization or code entry following battery disconnect. | P-1 |

9. Identify hybrid vehicle auxiliary (12v) battery service, repair and test procedures. P-3

VI. ELECTRICAL/ELECTRONIC SYSTEMS

C. Starting System Diagnosis and Repair

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

VI. ELECTRICAL/ELECTRONIC SYSTEMS

D. Charging System Diagnosis and Repair

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

VI. ELECTRICAL/ELECTRONIC SYSTEMS

E. Lighting Systems Diagnosis and Repair

1. Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action. P-1
2. Inspect, replace, and aim headlights and bulbs. P-2

3. Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action. P-2
4. Identify system voltage and safety precautions associated with high intensity discharge headlights. P-2

VI. ELECTRICAL/ELECTRONIC SYSTEMS

F. Gauges, Warning Devices, and Driver Information Systems Diagnosis and Repair

1. Inspect and test gauges and gauge sending units for cause of abnormal gauge readings; determine necessary action. P-1
2. Inspect and test connectors, wires, and printed circuit boards of gauge circuits; determine necessary action. P-3
3. Diagnose the cause of incorrect operation of warning devices and other driver information systems; determine necessary action. P-1
4. Inspect and test sensors, connectors, and wires of electronic (digital) instrument circuits; determine necessary action. P-3

VI. ELECTRICAL/ELECTRONIC SYSTEMS

G. Horn and Wiper/Washer Diagnosis and Repair

1. Diagnose incorrect horn operation; perform necessary action. P-1
2. Diagnose incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action. P-1
3. Diagnose incorrect washer operation; perform necessary action. P-2

VI. ELECTRICAL/ELECTRONIC SYSTEMS

H. Accessories Diagnosis and Repair

1. Diagnose incorrect operation of motor-driven accessory circuits; determine necessary action. P-1
2. Diagnose incorrect heated glass, mirror, or seat operation; determine necessary action. P-3
3. Diagnose incorrect electric lock operation (including remote keyless entry); P-1

- determine necessary action.
4. Diagnose incorrect operation of cruise control systems; determine necessary action. P-3
 5. Diagnose supplemental restraint system (SRS) concerns; determine necessary action. P-1
 6. Disarm and enable the airbag system for vehicle service. P-1
 7. Diagnose radio static and weak, intermittent, or no radio reception; determine necessary action. P-3
 8. Remove and reinstall door panel. P-1
 9. Diagnose body electronic system circuits using a scan tool; determine necessary action. P-2
 10. Check for module communication (including CAN/BUS systems) errors using a scan tool. P-2
 11. Diagnose the cause of false, intermittent, or no operation of anti-theft systems. P-3
 12. Describe the operation of keyless entry/remote-start systems. P-3
 13. Perform software transfers, software updates, or flash reprogramming on electronic modules. P-3