T6
ELECTRICAL + ELECTRONICS

	IMMR	TST	MTST	CL-1902	CL-1919-06	CL-1930	EC-510HV	HV-1918	MD-4000-22	MD-4000-23	MD-4000-24	MP-1918
A. General												
1. Research vehicle service information, including vehicle service history, service precautions, and technical service bulletins.	P-1	P-1	P-1	X			X	X	X	X	X	X
2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).	P-1	P-1	P-1	X	X		X	X	X	X	X	X
3. Demonstrate operation and proper use of digital multimeters and other test equipment when measuring source voltage, voltage drop (including grounds), current flow, continuity, and resistance.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
4. Demonstrate knowledge of the causes and effects of shorts, grounds, opens, and resistance problems in electrical/electronic circuits; identify and locate faults in electrical/electronic circuits.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
5. Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
6. Measure parasitic (key-off) battery drain; determine needed action.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
7. Demonstrate knowledge of the function, operation, and testing of fusible links, circuit breakers, relays, solenoids, actuators, diodes, and fuses; perform inspection and testing; determine needed action.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
9. Use appropriate electronic service tool(s) and procedures to diagnose problems; check and record diagnostic codes; interpret digital multimeter (DMM) readings; clear diagnostic codes when appropriate.	P-1	P-1	P-1									X
10. Check for malfunctions caused by faults in the data bus communications network.	P-2	P-2	P-2									X
11. Identify electrical/electronic system components and configuration.	P-2	P-2	P-2	X	X	X	X	X	X	X	X	X
12. Demonstrate operation and proper use of oscilloscopes to check frequency, pulse width, and waveforms of electrical/electronic signals; interpret readings; determine needed repairs.		P-2	P-2	X	X	X	X	X	X	X	X	X
13. Demonstrate understanding of the process for software transfer, software updates, and/or reprogramming of electronic modules.			P-3									X
B. Battery System												
2. Confirm proper battery capacity for application; perform battery state-of-charge test; perform battery capacity test, determine needed action.	P-1	P-1	P-1				X					
3. Inspect and clean battery, battery cables, connectors, battery boxes, mounts, and hold-downs; service, repair, or replace as needed.	P-1	P-1	P-1				X					
C. Starting System												
1. Demonstrate understanding of starter system operation.	P-1	P-1	P-1				X					
2. Perform starter circuit cranking voltage and voltage drop tests; determine needed action.	P-1	P-1	P-1				X					
3. Inspect and test starter control circuit switches (key switch, push button, and/or magnetic switch), relays, connectors, terminals, wires, and harnesses (including over-crank protection); determine needed action.	P-1	P-1	P-1				X					
4. Diagnose causes of no-crank or slow crank condition; differentiate between electrical and engine mechanical problems; determine needed action.		P-1	P-1				X					
5. Perform starter current draw tests; determine needed action.		P-3	P-3				X					
D. Charging System												
4. Inspect cables, wires, and connectors in the charging circuit including remote sense circuit; determine needed action.	P-1	P-1	P-1				X					
5. Perform charging system voltage and amperage output tests; perform AC ripple test; determine needed action.	P-1	P-1	P-1									
6. Perform charging circuit voltage drop tests; determine needed action.		P-1	P-1				X	X	X	X	X	X
7. Remove, inspect, and/or replace generator (alternator).		P-2	P-2									
E. Lighting Systems												
1. Diagnose causes of brighter-than-normal, intermittent, dim, or no-light operation; determine needed action.	P-1	P-1	P-1	X	X	X	X	X	X	X	X	X
2. Test, replace, and aim headlights.		P-3	P-3					X				X

	IMMR	TST	MTST	CL-1902	CL-1919-06	CL-1930	EC-510HV	HV-1918	MD-4000-22	MD-4000-23	MD-4000-24	MP-1918
3. Inspect cables, wires, and connectors in the lighting systems.		P-1	P-1		X	X		X	X	X	X	X
4. Diagnose faults in tractor-to-trailer multi-wire connector(s), cables, and holders; determine needed action.		P-1	P-2					X				
5. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of exterior lighting systems; determine needed action.		P-2	P-2		X			X	X	X	X	X
6. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of interior lighting systems; determine needed action.		P-2	P-2		X			X	X	X	X	X
7. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of auxiliary lighting circuits; determine needed action.		P-2	P-2		X			X	X	X	X	X
F. Instrument Cluster and Driver Information Systems												
1. Check gauge and warning indicator operation.	P-1	P-1	P-1									X
2. Diagnose faults in the sensor/sending units, gauges, switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, printed circuits, and control components/modules of the instrument cluster, driver information systems, and warning systems; determine needed action.	P-2	P-2	P-2									X
G. Cab and Chassis Electrical Systems												
1. Diagnose operation of horn(s), wiper/washer, and occupant restraint systems.		P-1	P-1						X	X	X	
2. Demonstrate knowledge of the operation of advanced driver assistance systems (ADAS) and related circuits (such as: speed control, collision avoidance, lane departure warning and assist, and camera systems).		P-3	P-3									X
3. Demonstrate knowledge of comfort and convenience systems and related circuits (such as: power windows, power seats, power locks, remote keyless entry, steering wheel controls, and cruise control).		P-3	P-3						X	X	X	X
4. Demonstrate knowledge of entertainment systems and related circuits (such as: radio, DVD, navigation, speakers, antennas, and voice-activated accessories).		P-3	P-3									X
5. Demonstrate knowledge of power inverter, protection devices, connectors, terminals, wiring, and control components/ modules of auxiliary power systems.		P-3	P-3									X
6. Demonstrate knowledge of telematics systems.		P-3	P-3									X
H. Electrified Vehicle High Voltage Safety (See Hybrid/EV section of this catalog.)												

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HIGH VOLTAGE SAFETY

	IMMR	TST	MTST	CL-1902	CL-1919-06	CL-1930	EC-510HV	HV-1918	MD-4000-22	MD-4000-23	MD-4000-24	MP-1918
A. General												
1. Research vehicle service information, including vehicle service history, service precautions, and technical service bulletins.	P-1	P-1	P-1	X			X	X	X	X	X	X
2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).	P-1	P-1	P-1	X	X		X	X	X	X	X	X
3. Demonstrate operation and proper use of digital multimeters and other test equipment when measuring source voltage, voltage drop (including grounds), current flow, continuity, and resistance.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
4. Demonstrate knowledge of the causes and effects of shorts, grounds, opens, and resistance problems in electrical/electronic circuits; identify and locate faults in electrical/electronic circuits.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
5. Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
6. Measure parasitic (key-off) battery drain; determine needed action.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
7. Demonstrate knowledge of the function, operation, and testing of fusible links, circuit breakers, relays, solenoids, actuators, diodes, and fuses; perform inspection and testing; determine needed action.	P-1	P-1	P-1	X	X		X	X	X	X	X	X
9. Use appropriate electronic service tool(s) and procedures to diagnose problems; check and record diagnostic codes; interpret digital multimeter (DMM) readings; clear diagnostic codes when appropriate.	P-1	P-1	P-1									X
10. Check for malfunctions caused by faults in the data bus communications network.	P-2	P-2	P-2									X
11. Identify electrical/electronic system components and configuration.	P-2	P-2	P-2	X	X	X	X	X	X	X	X	X
12. Demonstrate operation and proper use of oscilloscopes to check frequency, pulse width, and waveforms of electrical/electronic signals; interpret readings; determine needed repairs.		P-2	P-2	X	X	X	X	X	X	X	X	X
13. Demonstrate understanding of the process for software transfer, software updates, and/or reprogramming of electronic modules.			P-3									X
B. Battery System												
2. Confirm proper battery capacity for application; perform battery state-of-charge test; perform battery capacity test, determine needed action.	P-1	P-1	P-1				X					
3. Inspect and clean battery, battery cables, connectors, battery boxes, mounts, and hold-downs; service, repair, or replace as needed.	P-1	P-1	P-1				X					
C. Starting System												
1. Demonstrate understanding of starter system operation.	P-1	P-1	P-1				X					
2. Perform starter circuit cranking voltage and voltage drop tests; determine needed action.	P-1	P-1	P-1				X					
3. Inspect and test starter control circuit switches (key switch, push button, and/or magnetic switch), relays, connectors, terminals, wires, and harnesses (including over-crank protection); determine needed action.	P-1	P-1	P-1				X					
4. Diagnose causes of no-crank or slow crank condition; differentiate between electrical and engine mechanical problems; determine needed action.		P-1	P-1				X					
5. Perform starter current draw tests; determine needed action.		P-3	P-3				X					
D. Charging System												
4. Inspect cables, wires, and connectors in the charging circuit including remote sense circuit; determine needed action.	P-1	P-1	P-1				X					
5. Perform charging system voltage and amperage output tests; perform AC ripple test; determine needed action.	P-1	P-1	P-1									
6. Perform charging circuit voltage drop tests; determine needed action.		P-1	P-1				X	X	X	X	X	X
7. Remove, inspect, and/or replace generator (alternator).		P-2	P-2									
E. Lighting Systems												
1. Diagnose causes of brighter-than-normal, intermittent, dim, or no-light operation; determine needed action.	P-1	P-1	P-1	X	X	X	X	X	X	X	X	X
2. Test, replace, and aim headlights.		P-3	P-3					X				X

	IMMR	TST	MTST	CL-1902	CL-1919-06	CL-1930	EC-510HV	HV-1918	MD-4000-22	MD-4000-23	MD-4000-24	MP-1918
3. Inspect cables, wires, and connectors in the lighting systems.		P-1	P-1		X	X		X	X	X	X	X
4. Diagnose faults in tractor-to-trailer multi-wire connector(s), cables, and holders; determine needed action.		P-1	P-2					X				
5. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of exterior lighting systems; determine needed action.		P-2	P-2		X			X	X	X	X	X
6. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of interior lighting systems; determine needed action.		P-2	P-2		X			X	X	X	X	X
7. Diagnose faults in switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, and control components/modules of auxiliary lighting circuits; determine needed action.		P-2	P-2		X			X	X	X	X	X
F. Instrument Cluster and Driver Information Systems												
1. Check gauge and warning indicator operation.	P-1	P-1	P-1									X
2. Diagnose faults in the sensor/sending units, gauges, switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, printed circuits, and control components/modules of the instrument cluster, driver information systems, and warning systems; determine needed action.	P-2	P-2	P-2									X
G. Cab and Chassis Electrical Systems												
1. Diagnose operation of horn(s), wiper/washer, and occupant restraint systems.		P-1	P-1						X	X	X	
2. Demonstrate knowledge of the operation of advanced driver assistance systems (ADAS) and related circuits (such as: speed control, collision avoidance, lane departure warning and assist, and camera systems).		P-3	P-3									X
3. Demonstrate knowledge of comfort and convenience systems and related circuits (such as: power windows, power seats, power locks, remote keyless entry, steering wheel controls, and cruise control).		P-3	P-3						X	X	X	X
4. Demonstrate knowledge of entertainment systems and related circuits (such as: radio, DVD, navigation, speakers, antennas, and voice-activated accessories).		P-3	P-3									X
5. Demonstrate knowledge of power inverter, protection devices, connectors, terminals, wiring, and control components/ modules of auxiliary power systems.		P-3	P-3									X
6. Demonstrate knowledge of telematics systems.		P-3	P-3									X