

	IMMR	TST	MTST	EC-490	EC-510HV	HV-145S-KB02	HV-950 (ALL)
A. General							
1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.	P-1	P-1	P-1	X		X	X
2. Inspect level and condition of fuel, oil, diesel exhaust fluid (DEF), and coolant.	P-1	P-1	P-1			X	X
3. Inspect engine assembly for fuel, oil, coolant, air, and other leaks; determine needed action.	P-1	P-1	P-1			X	X
4. Identify system components, configurations, and types of the following: cylinder head(s), valve train, engine block, engine lubrication, engine cooling, air induction, exhaust, fuel, and engine braking.	P-1	P-1	P-1			X	X
B. Cylinder Head and Valve Train							
1. Inspect electronic wiring harness and brackets for wear, bending, cracks, and proper securement; determine needed action.	P-2	P-1	P-1				X
2. Inspect valve train components; determine needed action.		P-2	P-2		X	X	X
3. Adjust valve bridges (crossheads); adjust valve clearances and injector settings.		P-1	P-1		X	X	X
4. Inspect, measure, and replace/reinstall camshaft; measure end play and backlash; determine needed action.			P-3			X	
C. Engine Block							
1. Inspect crankshaft vibration damper; inspect engine mounts; determine needed action.	P-2	P-1	P-1			X	X
2. Remove, inspect, service, and install pans, covers, gaskets, seals, wear rings, and crankcase ventilation components; determine needed action.	P-3	P-1	P-1			X	
3. Install and align flywheel housing; inspect flywheel housing(s) to transmission housing/engine mating surface(s); measure flywheel housing face and bore runout; determine needed action.		P-2	P-2			X	X
4. Inspect flywheel/flexplate (including ring gear) and mounting surfaces for cracks and wear; measure runout; determine needed action.		P-2	P-2		X	X	X
5. Disassemble and clean engine block; inspect engine block for cracks/damage; measure mating surfaces for warpage; check condition of passages, core/expansion plugs, and gallery plugs; inspect threaded holes, studs, dowel pins, and bolts for serviceability; determine needed action.			P-3			X	
6. Inspect cylinder sleeve counter bore and lower bore; check bore distortion; determine needed action.			P-3			X	
7. Clean, inspect, and measure cylinder walls or liners for wear and damage; determine needed action.			P-3			X	
8. Replace/reinstall cylinder liners and seals; check and adjust liner height (protrusion).			P-3			X	
9. Inspect camshaft bearings for wear and damage; determine needed action.			P-3			X	
10. Inspect, measure, and replace/reinstall camshaft; measure end play and backlash; determine needed action.			P-3			X	
11. Clean and inspect crankshaft for surface cracks and journal damage; check condition of oil passages; check passage plugs; measure journal diameter; determine needed action.			P-3			X	
12. Inspect main bearings for wear patterns and damage; replace as needed; check bearing clearances; check and correct crankshaft end play.			P-3			X	
13. Inspect, install, and time gear train; measure gear backlash; determine needed action.			P-3			X	
14. Inspect connecting rod and bearings for wear patterns; measure pistons, pins, retainers, and bushings; determine needed action.			P-3			X	
15. Determine piston-to-cylinder wall clearance; check ring-to-groove fit and end gap; install rings on pistons.			P-3			X	
16. Assemble pistons and connecting rods; install in block; install rod bearings and check clearances.			P-3			X	
17. Check condition of piston cooling jets (nozzles); determine needed action.			P-3			X	
D. Lubrication Systems							
1. Test engine oil pressure; check operation of pressure sensor, gauge, and/or sending unit; test engine oil temperature; check operation of temperature sensor; determine needed action.	P-2	P-1	P-1			X	X

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2. Check engine oil level, condition, and consumption; take engine oil sample; determine needed action.	P-1	P-1	P-1		X	X	X
3. Determine proper lubricant; perform oil and filter service.	P-1	P-1	P-1			X	X
4. Inspect, clean, and test oil cooler and components; determine needed action.		P-2	P-2			X	X
5. Inspect turbocharger lubrication systems; determine needed action.		P-2	P-2				X
6. Inspect and measure oil pump, drives, inlet pipes, and pick-up screens; check drive gear clearances; determine needed action.			P-3			X	
7. Inspect oil pressure regulator valve(s), by-pass and pressure relief valve(s), oil thermostat, and filters; determine needed action.			P-3			X	X
E. Cooling System							
1. Check engine coolant type, level, and condition; test coolant for freeze protection and additive package concentration.	P-1	P-1	P-1			X	X
2. Test coolant temperature; test operation of temperature and level sensors, gauge, and/or sending unit; determine needed action.	P-1	P-1	P-1			X	X
3. Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment.	P-1	P-1	P-1			X	X
4. Recover coolant; flush and refill with recommended coolant/additive package; bleed cooling system.	P-2	P-1	P-1			X	X
5. Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed.	P-2	P-1	P-1				X
6. Inspect water pump, hoses, and clamps; determine needed action.	P-1	P-1	P-1			X	X
7. Inspect and pressure test cooling system(s); pressure test cap, tank(s), and recovery systems; inspect radiator and mountings; determine needed action.	P-1	P-1	P-1			X	X
8. Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud; determine needed action.	P-1	P-1	P-1			X	X
9. Identify engine block heater(s).	P-2	P-2	P-2				X
10. Diagnose engine coolant consumption; determine needed action.		P-1	P-2			X	X
11. Inspect thermostat(s), by-passes, housing(s), and seals; replace as needed.		P-1	P-1			X	X
F. Air Induction and Exhaust Systems							
1. Inspect turbocharger(s), wastegate(s), and piping systems; determine needed action	P-2	P-2	P-2				X
2. Check air induction system including: cooler assembly, piping, hoses, clamps, and mountings; replace air filter as needed; reset restriction indicator (if applicable).	P-1	P-1	P-1			X	X
3. Inspect intake manifold, gaskets, and connections; determine needed action.	P-1	P-1	P-1			X	X
4. Perform air intake system restriction and leakage tests; determine needed action.		P-1	P-1			X	X
5. Check exhaust back pressure.	P-2	P-3	P-3			X	X
6. Inspect variable ratio geometry turbocharger (VGT), controls, and actuators (pneumatic, hydraulic, and electronic).		P-2	P-2				X
7. Demonstrate knowledge of charge air cooler operation and testing.		P-1	P-1			X	X
8. Diagnose preheater/inlet air heater or glow plug system and controls; determine needed action.		P-3	P-3				X
G. Fuel System							
1. Check fuel level and condition; determine needed action.	P-1	P-1	P-1			X	X
2. Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, hoses, lines, and fittings; determine needed action.	P-1	P-1	P-1			X	X

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3. Inspect low pressure fuel system components (fuel pump, pump drives, screens, fuel/water separators/indicators, hoses, lines, filters, heaters, coolers, ECM cooling plates, check valves, pressure regulator valves, restrictive fittings, and mounting hardware); determine needed action.	P-1	P-1	P-1			X	X
4. Replace fuel filter; prime and bleed fuel system.	P-1	P-1	P-1			X	X
5. Inspect high pressure fuel system components (fuel pump, pump drives, hoses, injection lines, filters, hold-downs, fittings, seals, and mounting hardware).	P-1	P-1	P-1			X	X
6. Demonstrate knowledge and understanding of the different types of fuel systems.		P-1	P-1			X	X
7. Perform fuel supply and return system tests; determine needed action.		P-1	P-1			X	X
H. Engine Brakes							
1. Demonstrate knowledge of engine compression and/or exhaust brake operation.	P-1	P-1	P-1				X
2. Inspect and adjust engine compression and/or exhaust brake systems; determine needed action.		P-3	P-3				X
3. Inspect, test, and adjust engine compression and/or exhaust brake control circuits, switches, and solenoids; determine needed action.		P-3	P-3				X
I. Emission Controls							
1. Inspect engine exhaust system, exhaust gas recirculation (EGR) system, and exhaust aftertreatment system for leaks, mounting, proper routing, and damaged or missing components; determine needed action.	P-1	P-1	P-1				X
2. Demonstrate knowledge of exhaust gas recirculation (EGR) system operation including; EGR valve, cooler, piping, electronic sensors, controls, and wiring; determine needed action.	P-2	P-1	P-1			X	X
3. Inspect and test exhaust aftertreatment system components and controls including diesel oxidation catalyst (DOC), selective catalytic reduction (SCR), diesel exhaust fluid (DEF), diesel particulate filter (DPF), and sensors; check regeneration system operation; determine needed action.	P-2	P-1	P-1	X			X
4. Identify emission control system components and configurations.		P-1	P-1	X			X
5. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; inspect, test, service and/or replace electrical/electronic sensors, controls, wiring, tubing, exhaust passages, cooler(s), and hoses of exhaust gas recirculation (EGR) system; determine needed action.		P-3	P-1			X	X
6. Using manufacturers/service information, interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine needed action.		P-1	P-1	X			X
J. Driveability and Electronic Engine Controls							
1. Check engine operation (starting and running) including: noise, vibration, smoke, etc.; determine needed action.	P-2	P-2	P-2		X	X	X
2. Perform cylinder contribution test using electronic service tool(s).	P-3	P-1	P-1				X
3. Demonstrate knowledge of computerized control system components and configurations.	P-1	P-1	P-1		X		X
4. Use appropriate electronic service tool(s) to check and record diagnostic codes; check and record trip/operational data; reset maintenance monitor (if applicable, clear diagnostic codes when appropriate).	P-1	P-1	P-1				X
5. Access and use service information to perform step-by-step (troubleshooting) diagnosis.	P-1	P-1	P-1	X		X	X
6. Diagnose engine no-crank, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed action.		P-2	P-1		X	X	X
7. Diagnose engine surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and/or shut down problems; determine needed action.		P-2	P-1			X	X
8. Perform intake manifold pressure (boost) test; determine needed action.		P-2	P-2				X
9. Use diagnostic tool, digital multimeter (DMM), and digital storage oscilloscope (DSO) to inspect or test computerized engine control system sensors, actuators, circuits, and electronic control modules (ECM); determine needed actions.		P-1	P-1				X
10. Demonstrate knowledge of the process for reprogramming or recalibrating the engine control module.		P-2	P-2				X
11. Diagnose drivability and emissions problems resulting from malfunctions of interrelated systems (ADAS, HVAC, automatic transmissions, auxiliary power units (APU), non-OEM installed accessories, or similar systems); determine needed action.		P-2	P-2				X
12. Diagnose failures in the data communications bus networks; determine needed action.		P-2	P-2				X
13. Demonstrate knowledge of setting performance parameters using electronic service tools and service information system access.			P-3				X