

Diesel Technology: Engines

NATEF Crosswalk

The following NATEF Diesel Engines tasks (rev. 2004) are covered in this publication. The chart shows where each task is located within the publication. The first column identifies the NATEF task by name and number. The second column identifies the exact location by unit number and assignment sheet or job sheet number.

| NATEF Tasks | MAVCC Tasks |
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| I. Diesel Engines | |
| A. General Engine Diagnosis | |
| I. A. 1.—Inspect fuel, oil, and coolant levels, condition and consumption; determine needed actions. P-1 | Unit 1-C, Job Sheet 1—Check fuel level, quality, and consumption. Unit 2-D, Job Sheet 1—Inspect engine coolant level and condition. Unit 2-D, Job Sheet 5—Perform a daily preventive maintenance check. |
| I. A. 2.—Diagnose causes of engine fuel, oil, coolant, air, and other leaks, determine needed action. P-1 | Unit 2-D, Job Sheet 5—Perform a daily preventive maintenance check. Unit 2-D, Job Sheet 6—Perform a mileage preventive maintenance check. |
| I. A. 3.—Interpret engine noises; determine needed action. P-2 | Unit 2-C, Job Sheet 1—Isolate, remove, test rebuild or replace, and reinstall injection nozzles. Unit 2-C, Job Sheet 2—Isolate, remove, test, and reinstall or replace mechanical unit injectors. Unit 1-D, Job Sheet 6—Locate a misfiring cylinder. |
| I. A. 4.—Observe engine exhaust smoke color and quantity; determine needed action. P-1 | Unit 4-C, Job Sheet 1—Check vehicle for presence and operation of emission control devices. |
| I. A. 5.—Perform air intake system restriction and leakage tests; determine needed action. P-1 | Unit 1-D, Job Sheet 1—Check air intake system for restrictions. |
| I. A. 6.—Perform intake manifold pressure (boost) test; determine needed action. P-1 | Unit 8-B, Job Sheet 1—Inspect and test air induction system. |
| I. A. 7.—Perform exhaust back pressure test; determine needed action. P-2 | Unit 1-D, Job Sheet 2—Check exhaust back pressure. |
| I. A. 8.—Perform crankcase pressure test; determine needed action. P-1 | Unit 1-D, Job Sheet 3—Check crankcase pressure. |
| I. A. 9.—Diagnose no cranking, cranks but fails to start, hard starting, and starts but doesn't continue to run problems; determine needed action. P-1 | Unit 2-D, Job Sheet 5—Perform a daily preventive maintenance check. |
| I. A. 10.—Diagnose surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems; determine needed action. P-1 | Unit 2-D, Job Sheet 5—Perform a daily preventive maintenance check. |
| I. A. 11.—Diagnose engine vibration problems; determine needed action. P-2 | Unit 2-D, Job Sheet 5—Perform a daily preventive maintenance check. |
| I. A. 12.—Check, record, and clear electronic diagnostic fault codes; monitor electronic data; determine needed action. P-1 | Unit 3-C, Job Sheet 2—Check diagnostic trouble codes using electronic diagnostic equipment and technical information; determine needed repairs. |

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| I. A. 13.—Perform cylinder compression test; determine needed action. P-3 | Unit 3-B, Job Sheet 1—Pressure test a cylinder block. |
| B. Cylinder Head and Valve Train Diagnosis and Repair | |
| I. B. 1.—Remove, clean, inspect for visible damage, and replace cylinder head(s) assembly. P-1 | Unit 7-B, Job Sheet 1—Clean and inspect a cylinder head. Unit 7-B, Job Sheet 3—Install a cylinder head assembly and adjust valves. |
| I. B. 2.—Clean and inspect threaded holes, studs, and bolts for serviceability. Determine needed action. P-1 | Unit 7-B, Job Sheet 1—Clean and inspect a cylinder head. |
| I. B. 3.—Inspect cylinder head for cracks/damage; check mating surfaces for warpage; check condition of passages; inspect core/expansion and gallery plugs; determine needed action. P-1 | Unit 3-B, Job Sheet 1—Pressure test a cylinder block. Unit 3-B, Job Sheet 5—Clean and inspect cylinder bores. Unit 7-B, Job Sheet 1—Clean and inspect a cylinder head. |
| I. B. 4.—Disassemble head and inspect valves, guides, seats, springs, retainers, rotators, locks, and seals; determine needed action. P-3 | Unit 7-B, Job Sheet 2—Recondition a cylinder head. Unit 2-D, Job Sheet 7—Perform an engine tune-up. |
| I. B. 5.—Measure valve head height relative to deck and valve face-to-seat contact; determine needed action. P-3 | Unit 7-B, Job Sheet 2—Recondition a cylinder head. Unit 2-D, Job Sheet 7—Perform an engine tune-up. |
| I. B. 6.—Inspect injector sleeves and seals; measure injector tip or nozzle protrusion; perform needed action. P-3 | Unit 2-C, Job Sheet 1—Isolate, remove, test, rebuild or replace, and reinstall injection nozzles. Unit 3-C, Job Sheet 6—Remove, inspect, reinstall, and adjust electronic unit injectors; determine needed repairs. Unit 2-D, Job Sheet 7—Perform an engine tune-up. |
| I.B. 7.—Inspect and adjust valve bridges (crossheads) and guides; perform needed action. P-2 | Unit 7-B, Job Sheet 2—Recondition a cylinder head. |
| I. B. 8.—Reassemble cylinder head. P-3 | Unit 7-B, Job Sheet 3—Install a cylinder head assembly and adjust valves. |
| I. B. 9.—Inspect, measure, and replace/ reinstall overhead camshaft; measure/adjust end play and backlash. P-2 | Unit 6-B, Job Sheet 1—Remove, clean, and inspect a camshaft. Unit 6-B, Job Sheet 3—Install a camshaft and set cam timing. |
| I. B. 10.—Inspect pushrods, rocker arms, rocker arm shafts, electronic wiring harness, and brackets for wear, bending, cracks, looseness, and blocked oil passages; perform needed action. P-2 | Unit 6-B, Job Sheet 1—Remove, clean, and inspect a camshaft. |

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| I. B. 11.—Inspect cam followers; perform needed action. P-2 | Unit 6-B, Job Sheet 1—Remove, clean, and inspect a camshaft. |
| I. B. 12.—Adjust valve clearance. P-1 | Unit 7-B, Job Sheet 3—Install a cylinder head assembly and adjust valves. Unit 2-C, Job Sheet 2—Isolate, remove, test, and reinstall or replace mechanical unit injectors. Unit 3-C, Job Sheet 6—Remove, inspect, reinstall, and adjust electronic unit injectors; determine needed repairs. Unit 2-D, Job Sheet 7—Perform an engine tune-up. |
| C. Engine Block Diagnosis and Repair | |
| I. C. 1.—Remove, inspect, service, and install pans, covers, vents, gaskets, seals, and wear rings. P-1 | Unit 1-C, Job. Sheet 2—Inspect and service basic fuel supply components. |
| I. C. 2.—Disassemble, clean, and inspect engine block for cracks/damage; measure mating surfaces for warpage; check condition of passages, core/expansion and gallery plugs; inspect threaded holes, studs, dowel pins, and bolts for serviceability; determine needed action. P-3 | Unit 3-B, Job Sheet 2—Disassemble and clean a cylinder block. Unit 3-B, Job Sheet 3—Inspect a cylinder block. |
| I. C. 3.—Inspect cylinder sleeve counterbore and lower bore; check bore distortion; determine needed action. P-3 | Unit 3-B, Job Sheet 5—Clean and inspect cylinder bores. |
| I. C. 4.—Clean, inspect, and measure cylinder walls or liners for wear and damage; determine needed action. P-2 | Unit 3-B, Job Sheet 5—Clean and inspect cylinder bores. Unit 3-B, Job Sheet 6—Install cylinder liners and set liner protrusion. |
| I. C. 5.—Replace/reinstall cylinder liners and seals; check and adjust liner height (protrusion). P-2 | Unit 3-B, Job Sheet 6—Install cylinder liners and set liner protrusion. |
| I. C. 6.—Inspect in-block camshaft bearings for wear and damage; determine needed action. P-3 | Unit 6-B, Job Sheet 2—Remove, inspect, and install cam bushings. |
| I. C. 7.—Inspect, measure, and replace/reinstall in-block camshaft; measure/adjust end play. P-3 | Unit 6-B, Job Sheet 1—Remove, clean, and inspect a camshaft. Unit 6-B, Job Sheet 3—Install a camshaft and set cam timing. |
| I. C. 8.—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-2 | Unit 4-B, Job Sheet 1—Remove, clean, and inspect a crankshaft. |
| I. C. 9.—Inspect main bearings for wear patterns and damage; replace as needed; check bearing clearances; check and adjust crankshaft end play. P-2 | Unit 4-B, Job Sheet 1—Remove, clean, and inspect a crankshaft. |

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| I. C. 10.—Inspect, install, and time gear train; measure gear backlash; determine needed action. P-3 | Unit 6-B, Job Sheet 3—Install a camshaft and set cam timing. |
| I. C. 11.—Inspect connecting rod and bearings for wear patterns; measure pistons, pins, retainers, and bushing; perform needed action. P-2 | Unit 5-B, Job Sheet 1—Remove, disassemble, and inspect a piston and connecting rod assembly. |
| I. C. 12.—Determine piston-to-cylinder wall clearance; check ring-to-groove clearance and end gap; install rings on pistons. P-2 | Unit 5-B, Job Sheet 2—Measure piston-to-cylinder wall clearance and ring end gap. |
| I. C. 13.—Assemble pistons and connecting rods; install in block; replace rod bearings and check clearances. P-2 | Unit 5-B, Job Sheet 3—Assemble and install piston and connecting rod assembly. |
| I. C. 14.—Check condition of piston cooling jets (nozzles); determine needed action. P-2 | Unit 5-B, Job Sheet 3—Assemble and install piston and connecting rod assembly. |
| I. C. 15.—Inspect and measure crankshaft vibration damper; determine needed action. P-2 | Unit 4-B, Job Sheet 4—Inspect viscous vibration damper/harmonic balancer. Unit 4-B, Job Sheet 5—Inspect bonded vibration damper/harmonic balancer. |
| I. C. 16.—Install and align flywheel housing; inspect flywheel housing(s) to transmission housing/engine mating surface(s) and measure flywheel housing face and bore runout; determine needed action. P-3 | Unit 4-B, Job Sheet 6—Inspect flywheel. |
| I. C. 17.—Inspect flywheel/flexplate (including ring gear) and mounting surfaces for cracks and wear; measure runout; determine needed action. P-3 | Unit 4-B, Job Sheet 1—Remove, clean, and inspect a crankshaft. |
| D. Lubrication Systems Diagnosis and Repair | |
| I. D. 1.—Test engine oil pressure and check operation of pressure sensor, gauge, and/or sending unit; determine needed action. P-1 | Unit 1-D, Job Sheet 4—Check oil pressure. |
| I. D. 2.—Check engine oil level, condition and consumption; determine needed action. P-1 | Unit 1-C, Job Sheet 1—Check fuel level, quality, and consumption. |
| I. D. 3.—Inspect and measure oil pump, drives, inlet pipes, and pick-up screens; determine needed action. P-3 | Unit 1-B, Job Sheet 1—Service and install oil pump and oil pump drive components. Unit 1-B, Job Sheet 2—Service and inspect lubrication system screens and pipes. |
| I. D. 4.—Inspect oil pressure regulator valve(s), by-pass and pressure relief valve(s), oil thermostat, and filters; determine needed action. P-3 | Unit 1-B, Job Sheet 3—Service and inspect oil pressure regulator valve and bypass valve. |
| I. D. 5.—Inspect, clean, and test oil cooler and components; determine needed action. P-3 | Unit 1-B, Job Sheet 4—Service and inspect oil cooler and lines. |
| I. D. 6.—Inspect turbocharger lubrication system; determine needed action. P-2 | Unit 8-B, Job Sheet 2—Inspect and service turbo/supercharger and related components. |
| I. D. 7.—Determine proper lubricant and perform oil and filter change. P-1 | Unit 2-D, Job Sheet 3—Take oil sample, and change oil and filter(s). |

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| E. Cooling System Diagnosis and Repair | |
| I. E. 1.—Check engine coolant type, level, condition, and consumption; determine needed action. P-1 | Unit 2-B, Job Sheet 1—Flush, refill, and bleed coolant system. Unit 2-D, Job Sheet 1—Inspect engine coolant level and condition. |
| I. E. 2.—Test coolant temperature and check operation of temperature sensor, gauge, and/or sending unit; determine needed action. P-2 | Unit 2-B, Job Sheet 6—Check operation and accuracy of temperature indicating system. |
| I. E. 3.—Inspect and reinstall/replace pulleys, tensioners, and drive belts; adjust drive belts and check alignment. P-1 | Unit 2-B, Job Sheet 2—Inspect water pump, belts, and hoses. |
| I. E. 4.—Inspect thermostat(s), by-passes, housing(s), and seals; replace as needed. P-2 | Unit 2-B, Job Sheet 4—Test operation of thermostat installed in engine. Unit 2-B, Job Sheet 5—Test operation of thermostat on the bench. |
| I. E. 5.—Test coolant for freeze protection and additive package concentration; adjust as needed. P-1 | Unit 2-D, Job Sheet 1—Inspect engine coolant level and condition. |
| I. E. 6.—Recover, flush, and refill with re-commended coolant/additive package; bleed cooling system. P-1 | Unit 2-B, Job Sheet 1—Flush, refill, and bleed coolant system. |
| I. E. 7.—Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed. P-1 | Unit 2-D, Job Sheet 1—Inspect engine coolant level and condition. |
| I. E. 8.—Inspect water pump and hoses; replace as needed. P-1 | Unit 2-B, Job Sheet 2—Inspect water pump, belts, and hoses. |
| I. E. 9.—Inspect, clean, and pressure test radiator, pressure cap, tank(s) and recovery systems; determine needed action. P-1 | Unit 2-B, Job Sheet 1—Flush, refill, and bleed coolant system. Unit 2-D, Job Sheet 2—Pressure test coolant system and radiator cap. |
| I. E. 10.—Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud; replace as needed. P-2 | Unit 2-B, Job Sheet 3—Check operation of fan assembly and controls. |
| F. Air Induction and Exhaust Systems Diagnosis and Repair | |
| I. F. 1.—Inspect turbocharger(s), wastegate, and piping systems; determine needed action. P-2 | Unit 8-B, Job Sheet 1—Inspect and test air induction system. |
| I. F. 2.—Check air induction system; piping, hoses, clamps, and mounting; check for air restrictions and leaks; service or replace air filter as needed. P-1 | Unit 8-B, Job Sheet 1—Inspect and test air induction system. |
| I. F. 3.—Remove and reinstall turbocharger/wastegate assembly. P-2 | Unit 8-B, Job Sheet 2—Inspect and service turbo/supercharger and related components. |
| I. F. 4.—Inspect intake manifold, gaskets, and connections; replace as needed. P-3 | Unit 8-B, Job Sheet 1—Inspect and test air induction system. |
| I. F. 5.—Inspect, clean, and test charge air cooler assemblies; replace as needed. P-2 | Unit 8-B, Job Sheet 3—Clean and test jacket water intercooler. Unit 8-B, Job Sheet 4—Clean and test air-to-air intercooler. |

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| I. F. 6.—Inspect exhaust manifold, piping, mufflers, exhaust after-treatment device(s), and mounting hardware; repair or replace as needed. P-2 | Unit 8-B, Job Sheet 5—Inspect and test exhaust system. |
| I. F. 7.—Inspect and test preheater/inlet air heater, or glow plug system and controls; perform needed action. P-2 | Unit 8-B, Job Sheet 6—Inspect starting preheater controls. Unit 8-B, Job Sheet 7—Test starting fluid system and controls. |
| I. F. 8—Inspect and test exhaust gas recirculation (EGR) system; determine needed action. P-3 | Not covered. |
| G. Fuel System Diagnosis and Repair | |
| 1. Fuel Supply System Diagnosis and Repair | |
| I. G. 1. 1.—Check fuel level and quality and consumption; determine needed action. P-1 | Unit 1-C, Job Sheet 1—Check fuel level, quality, and consumption. |
| I. G. 1. 2.—Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, supply and return lines and fittings; determine needed action. P-1 | Unit 1-C, Job Sheet 2—Inspect and service basic fuel supply components. |
| I. G. 1. 3.—Inspect, clean, and test fuel transfer (lift) pump, pump drives, screens, fuel/water separators/indicators, filters, heaters, coolers, ECM cooling plates, and mounting hardware; determine needed action. P-1 | Unit 3-C, Job Sheet 5—Remove, inspect, and rebuild or replace a fuel transfer pump. |
| I. G. 1. 4.—Inspect and test low pressure regulator systems (check valves, pressure regulator valves, and restrictive fittings); determine needed action. P-1 | Unit 1-C, Job Sheet 2—Inspect and service basic fuel supply components. |
| I. G. 1. 5.—Check fuel system for air; determine needed action; prime and bleed fuel system; check primer pump. P-1 | Unit 1-C, Job Sheet 2—Inspect and service basic fuel supply components. |
| 2. Mechanical Fuel Injection Diagnosis and Repair | |
| I. G. 2. 1.—Perform on-engine inspections, tests, and adjustments; check and adjust timing or replace and time a distributor (rotary) type injection pump; determine needed action. P-3 | Unit 2-C, Job Sheet 3—Inspect, test, adjust, and time a distributor-type (rotary) injection pump; determine needed repairs. |
| I. G. 2. 2.—Perform on-engine inspections, tests, and adjustments; check and adjust timing or replace and time an in-line type injection pump; determine needed action. P-3 | Unit 2-C, Job Sheet 4—Inspect, test, adjust, and time an in-line injection pump; determine needed repairs. |
| I.G. 2. 3.—Inspect and adjust throttle control linkage; determine needed action. P-3 | Unit 2-C, Job Sheet 3—Inspect, test, adjust, and time a distributor-type (rotary) injection pump; determine needed repairs. |
| I. G. 2. 4.—Inspect air/fuel ratio control systems; determine needed action. P-3 | Unit 2-C, Job Sheet 1—Isolate, remove, test, rebuild or replace, and reinstall injection nozzles. |
| I. G. 2. 5.—Inspect, test, and adjust engine fuel shut-down devices and controls; determine needed action. P-3 | Not covered. |

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| I. G. 2. 6.—Inspect high pressure injection lines, hold downs, fittings and seals; replace as needed. P-3 | Unit 2-C, Job Sheet 5—Inspect, test, and adjust a PT injection pump and time the injectors; determine needed repairs. Unit 2-D, Job Sheet 5—Perform a daily preventive maintenance check. |
| 3. Electronic Fuel Management System Diagnosis and Repair | |
| I. G. 3. 1.—Inspect and test power and ground circuits and connections; measure and interpret voltage, voltage drop, amperage, and resistance readings using a digital multimeter (DMM); determine needed action. P-1 | Unit 3-C, Job Sheet 1—Inspect and test power and ground circuits and connections; determine needed repairs. |
| I. G. 3. 2.—Interface with vehicle's on-board computer; perform diagnostic procedures using recommended electronic diagnostic equipment and tools (to include PC based software and/or data scan tools); determine needed action. P-1 | Unit 3-C, Job Sheet 2—Check diagnostic trouble codes using electronic diagnostic equipment and technical information; determine needed repairs. |
| I. G. 3. 3.—Locate and use relevant service information (to include diagnostic procedures, flow charts, and wiring diagrams). P-1 | Throughout publication. |
| I. G. 3. 4.—Inspect and replace electrical connector terminals, seals, and locks. P-1 | Unit 3-C, Job Sheet 3—Inspect and replace electrical connectors, terminals, seals, and locks. |
| I. G. 3. 5.—Inspect and test switches, sensors, controls, actuator components, and circuits; adjust or replace as needed. P-1 | Unit 3-C, Job Sheet 2—Check diagnostic trouble codes using electronic diagnostic equipment and technical information; determine needed repairs. Unit 2-D, Job Sheet 4—Inspect and test indicator system components. |
| I. G. 3. 6.—Using recommended electronic diagnostic tools (to include PC base software and/or data scan tools), access and change customer parameters. P-1 | Unit 3-C, Job Sheet 4—Access engine parameters; monitor or change as requested by customer. |
| I. G. 3. 7.—Inspect, test, and adjust electronic unit injectors (EUI); determine needed action. P-2 | Unit 3-C, Job Sheet 6—Remove, inspect, reinstall, and adjust electronic unit injectors; determine needed repairs. |
| I. G. 3. 8.—Remove and install electronic unit injectors (EUI) and related components; recalibrate ECM (if applicable). P-2 | Unit 3-C, Job Sheet 6—Remove, inspect, reinstall, and adjust electronic unit injectors; determine needed repairs. |
| I. G. 3. 9.—Perform cylinder contribution test utilizing recommended electronic diagnostic tool. P-1 | Unit 3-C, Job Sheet 4—Access engine parameters; monitor or change as requested by customer. |
| I. G. 3. 10.—Perform engine timing sensor calibration (if applicable). P-3 | Unit 3-C, Job Sheet 4—Access engine parameters; monitor or change as requested by customer. |
| I. G. 3. 11.—Perform on-engine inspections and tests on hydraulic electronic unit injectors and system electronic controls; determine needed action. P-2 | Unit 3-C, Job Sheet 6—Remove, inspect, reinstall, and adjust electronic unit injectors; determine needed repairs. |

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| I. G. 3. 12.—Perform on-engine inspections and tests on hydraulic electronic unit injector high pressure oil supply and control systems; determine needed action. P-2 | Unit 3-C, Job Sheet 6—Remove, inspect, reinstall, and adjust electronic unit injectors; determine needed repairs. |
| I. G. 3. 13.—Perform on-engine inspections and tests on distributor-type injection pump electronic controls; determine needed action. P-2 | Unit 2-C, Job Sheet 3—Inspect, test, adjust, and time a distributor-type (rotary) injection pump; determine needed repairs. |
| I. G. 3. 14.—Perform on-engine inspections and tests on in-line type injection pump electronic controls; determine needed action. P-2 | Unit 2-C, Job Sheet 5—Inspect, test, and adjust a PT injection pump and time the injectors; determine needed repairs. |
| I. G. 3. 15—Perform on-engine inspections and tests on common rail type injection systems; determine needed action. P-3 | Not covered. |
| H. Engine Brakes | |
| I. H. 1.—Inspect and adjust engine compression/exhaust brakes; determine needed action. P-2 | Unit 9-B, Job Sheet 1—Remove, inspect, install, and adjust a Jacobs engine brake. |
| I. H. 2.—Inspect, test, and adjust engine compression/exhaust brake control circuits, switches, and solenoids; repair or replace as needed. P-3 | Unit 9-B, Job Sheet 1—Remove, inspect, install, and adjust a Jacobs engine brake. |
| I. H. 3.—Inspect engine compression/exhaust brake housing, valves, seals, screens, lines, and fittings; repair or replace as needed. P-3 | Unit 9-B, Job Sheet 1—Remove, inspect, install, and adjust a Jacobs engine brake. |