Diesel Equipment Technology

I. Demonstrate competencies related to using precision measurements in diesel equipment technology

Tasks Instructions:

Each number to the right refers to a single student/candidate (1-10). Place a check (√) in the respective column for the appropriate student/candidate number (1-10) if the skills listed below are observed as stated. Leave blank if not observed. Student/candidate will only get credit for the skills they have demonstrated.	1	2	3	4	5	6	7	8	9	10
Interpret and follow verbal instructions										
Interpret and follow written instructions										
Read and explain basic prints										
Use dial indicator										
Calibrate dial indicator										
Use valve spring compressor to remove valve from head										
Use valve spring compressor to install valve in head										
Use metric micrometers										
Use U.S. standard micrometers										
Record metric measurements correctly										
Record U.S. standards correctly										
Use bore gauge correctly										
Compare readings taken with standards to determine if part is within manufacturer's tolerances										
Use dial calipers										
Calibrate dial calipers										
Use an inside telescoping gauge										
Use a depth micrometer										
Safety and infection control are adhered to during all aspects of this task.										

The student completed task within the time limited.										
Points earned										
Total possible points (19)										
II. Demonstrate competencies needed to complete live engine troubleshooting										
Tasks Instructions:										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Inspect fuel, oil and coolant levels, condition and consumption; determine needed action										
Diagnose causes of engine fuel, oil, coolant, air and other leaks; determine needed action										
Interpret engine noises; determine needed action										
Observe engine exhaust smoke color and quantity; determine needed action										
Perform air intake system restriction and leakage tests; determine needed action										
Perform intake manifold pressure (boost) test; determine needed action										
Perform exhaust back pressure test; determine needed action										
Perform crankcase pressure test; determine needed action										
Diagnose no cranking, cranks but fails to start, hard starting and starts but does not continue to run problems; determine needed action										
Diagnose surging, rough operation, misfiring, low power, slow deceleration, slow acceleration and shutdown problems; determine needed action										
Diagnose engine vibration problems; determine needed action										
Check, record and clear electronic diagnostic (fault) codes; monitor electronic data; determine needed action										
Perform cylinder compression test; determine needed action										
Test engine oil pressure and check operation of pressure sensor, gauge										

and/or sending unit; determine needed action										
Check engine coolant type, level, condition and consumption; determine needed action										
Test coolant temperature and check operation of temperature sensor, gauge and/or sending unit; determine needed action										
Inspect thermostatic cooling fan system (hydraulic, pneumatic and electronic) and fan shroud; replace as needed										
Inspect turbocharger(s), wastegate and piping systems; determine needed action										
Check air induction system: piping, hoses, clamps and mounting; check for air restrictions and leaks; service or replace air filter as needed										
Remove and reinstall turbocharger/wastegate assembly										
Inspect intake manifold, gaskets and connections; replace as needed										
Inspect, clean and test charge air cooler assemblies; replace as needed										
Inspect exhaust manifold, piping, mufflers, exhaust after-treatment device(s) and mounting hardware; repair or replace as needed										
Inspect and test pre-heater/inlet air heater, or glow plug system and controls; perform needed action										
Inspect and test exhaust gas recirculation (EGR) system; determine needed action										
Check fuel level, quality and consumption; determine needed action										
Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system and supply and return lines and fittings; determine needed action										
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										
Inspect and test low pressure regulator systems (check valves, pressure regulator valves and restrictive fittings); determine needed action										
Check fuel system for air; determine needed action; prime and bleed fuel system; check primer pump										

Inspect, test and adjust engine fuel shutdown devices and controls; determine needed action										
Inspect high pressure injection lines, hold downs, fittings and seals; replace as needed										
Inspect and diagnose electronic fuel management system										
Inspect and test power and ground circuits and connections; measure and interpret voltage, voltage drop, amperage and resistance readings using a digital multi-meter (DMM); determine needed action										
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										
Locate and use relevant service information (to include diagnostic procedures, flow charts and wiring diagrams)										
Inspect and replace electrical connector terminals, seals and locks										
Inspect and test switches, sensors, controls, actuator components and circuits; adjust or replace as needed										
Using recommended electronic diagnostic tools (to include PC based software and/or data scan tools), access and change customer parameters										
Inspect, test and adjust electronic unit injectors (EUI); determine needed action										
Remove and install electronic unit injectors (EUI) and related components; recalibrate ECM (if applicable)										
Perform cylinder contribution test using recommended electronic diagnostic tool										
Perform engine timing sensor calibration (if applicable)										
Perform on-engine inspections and tests on hydraulic electronic unit injectors and system electronic controls; determine needed action										
Inspect and adjust engine compression/exhaust brakes; determine needed action										
Inspect, test and adjust engine compression/exhaust brake control										

circuits, switches and solenoids; repair or replace as needed										
Inspect engine compression/exhaust brake housing, valves, seals, screens, lines and fittings; repair or replace as needed										
Read and follow written directions										
Comprehend and follow verbal directions										
Diagnose engine-related problems										
Comprehend and follow diagnostic procedures										
Use basic diagnostic tools										
Comprehend and follow general safety requirements										
Demonstrate knowledge of safety requirements when working around running engines										
Demonstrate knowledge of pre-trip inspection before starting engine (fuel, coolant, oil, belts, etc)										
Explain the basic operations of a diesel engine (key, throttle control, gauge cluster)										
Explain the principles of the four-cycle (stroke) engine (intake, compression, power, exhaust)										
Describe related environmental concerns (fuel/oil/filter disposal)										
Use basic computer operating skills and diagnostic programs										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (62)										
III. Demonstrate competencies related to drive line component and system diagnosis and repair										
Tasks Instructions:										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Distinguish lubricant leaks and lubricant seeps per specifications										
Remove and replace drive axle housing cover plates, gaskets, sealants, vents, magnetic plugs and seals										
Remove and replace drive axle carrier assembly from drive axle housing										
Remove and replace axle shafts										
Check drive axle fluid level and condition • Determine needed service • Add proper type of lubricant										
Remove and replace driveline yokes										
Disassemble carrier assembly internal/external components										
Inspect carrier assembly components to determine reuse, to include but not limited to: spider gears, cross, side gears, thrust washers, case halves, bearings, ring gear, pinion, inter-axle differential case assembly components, driver controlled differential lock components, inter-axle differential lock components, drive axle lubrication system pump, troughs, collectors, slingers, tubes, filters, driveline yoke, spigot bearing, adjusting rings, carrier case, and planetary gear type two-speed axle assembly including: case, idler pinion, pins, thrust washers, sliding clutch gear, shift fork, pivot, seals, cover and springs										
Inspect, repair, or replace two-speed axle shift control system, speedometer adapters, motors, axle shift units, wires, air lines and connectors										
Inspect, adjust, repair, or replace air operated power divider (inter-axle differential) lockout assembly including diaphragms, seals, springs, yokes, pins, lines, hoses, fittings and controls										
Assemble carrier assembly internal/external components										
Inspect, adjust or replace ring gear thrust block/bolt										
Assemble drive pinion assembly in carrier housing and adjust bearing preload to specification										
Assemble drive pinion assembly in carrier housing and adjust pinion depth to										

specification										
Check, and if possible, set ring gear run out to specification										
Assemble main differential, check rotating resistance and adjust to specification										
Install main differential case and ring gear and set bearing preload to specification										
Remove and replace the ring gear from the flange case half of the main differential case										
Check and interpret ring gear and pinion tooth contact pattern; determine needed action; if necessary, adjust to specification										
Set ring and pinion gear backlash to specification										
Assemble main differential lock components										
Assemble inter-axle differential components										
Check input shaft end play, adjust as necessary per specifications										
Adjust ring gear thrust screw clearance per specifications										
Clean, inspect, lubricate and replace wheel bearings; replace seals and wear rings; adjust drive axle wheel bearings to specifications										
Diagnose drive axle for wheel bearing noise and damage; perform needed action										
Inspect and test drive axle temperature gauge and sending unit/sensor; determine needed action										
Diagnose drive axle(s)/drive unit noise, vibration and overheating problems; determine needed action										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (30)										
IV. Demonstrate knowledge of basic hydraulic theory and demonstrate competencies needed to inspect, diagnose and service hydraulic systems										

Tasks Instructions:

	1	2	3	4	5	6	7	8	9	10
Demonstrate knowledge of fluids (e.g., fluids have no shape of their own, are practically incompressible, apply equal pressure in all directions and provide great increases in work force)										
Explain the function of a reservoir, pump, filters, relief valve, control valve and a cylinder in relation to each other both descriptively and schematically										
Describe a basic, but complete, open center hydraulic system, explaining the operation of the system, the route of fluid during the use of a function and the route of the fluid while the machine is running when no hydraulic function is being used										
Describe a basic, but complete, closed center hydraulic system, explaining the operation of the system, the route of fluid during the use of a function and the route of the fluid while the machine is running when no hydraulic function is being used										
Identify open and closed center systems and the benefits of those applications on vocational equipment										
Describe the purpose of a charge circuit										
Explain the differences between hydraulic and hydrostatic systems										
Identify hydraulic and hydrostatic applications and the benefits of those applications on vocational equipment										
Exhibit the ability to select the proper hose for a given function, taking into consideration the flow needed, pressures to be used, routing, clamping, fittings required and pulsating of lines										
Identify and select various fittings and thread styles (O-ring boss, NPT, NPTF, British, Metric, O-ring flange, ORFS, etc.)										
Describe the use of various filters in hydraulic and hydrostatic systems										

Understand oils and show familiarity with various fluids and their effects on hydraulic systems										
Describe the applications and reactions of various types of sealants with different types of hydraulic systems										
Practice good hydraulic maintenance and safety practices										
Describe proper contamination control procedures dealing with hydraulics										
Follow the proper manufacturer's cleaning/flushing procedures										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (18)										
V. Perform basic shop skills										
Tasks Instructions:										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Demonstrate reading comprehension skills										
Comprehend and follow verbal directions										
Identify root cause of engine component failures										
Identify root cause of transmission component failures										
Identify root cause of carrier component failures										
Interpret oil analysis readings										
Identify root cause of elevated oil analysis readings										
Identify mechanical type failures										
Identify operator error type failures										
Identify environmental type failures										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										

Points earned										
Total possible points (12)										
VI. Demonstrate the competencies to diagnose, service and repair HVAC systems in a given situation at the operator environment station										
Tasks Instructions:										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Verify the need for service or repair of HVAC systems based on unusual operating noises; determine needed action										
Verify the need for service or repair of HVAC systems based on unusual visual, smell and touch conditions; determine needed action										
Identify system type and components (cycling clutch orifice tube — CCOT, expansion valve) and conduct performance test(s) on HVAC systems; determine needed action										
Diagnose the cause of temperature control problems in the A/C system; determine needed action										
Identify refrigerant type and check for contamination; determine needed action										
Diagnose A/C system problems indicated by pressure gauge and temperature readings; determine needed action										
Diagnose A/C system problems indicated by visual, aural, smell and touch procedures; determine needed action										
Perform A/C system leak test; determine needed action										
Evacuate A/C system using appropriate equipment										
Internally clean contaminated A/C system components and hoses										
Charge A/C system with refrigerant										
Identify lubricant type needed for system application										
Safety and infection control are adhered to during all aspects of this task.										

The student completed task within the time limited.										
Points earned										
Total possible points (12)										
VII. Diagnose, service and repair compressor and clutch components in a HVAC system.										
Tasks Instructions:										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Diagnose A/C system problems that cause protection devices (pressure, thermal and electronic) to interrupt system operation; determine needed action										
Inspect, test and replace A/C system pressure and thermal and electronic protection devices										
Inspect and replace A/C compressor drive belts, pulleys and tensioners; adjust belt tension and check alignment										
Inspect, test, service and replace A/C compressor clutch components or assembly										
Inspect and correct A/C compressor lubricant level (if applicable)										
Inspect, test and replace A/C compressor										
Inspect, repair, or replace A/C compressor mountings and hardware										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (9)										
VIII. Diagnose, service and repair evaporator, condenser and related components in a HVAC system.										
Tasks Instructions:										

	1	2	3	4	5	6	7	8	9	10
Correct system lubricant level when replacing the evaporator, condenser, receiver/drier or accumulator/drier and hoses										
Inspect A/C system hoses, lines, filters, fittings and seals; determine needed action										
Inspect A/C condenser for proper air flow										
Inspect and test A/C system condenser and mountings; determine needed action										
Inspect and replace receiver/drier or accumulator/drier										
Inspect and test cab/sleeper refrigerant solenoid, expansion valve(s); check placement of thermal bulb (capillary tube); determine needed action										
Inspect and replace orifice tube										
Inspect and test cab/sleeper evaporator core; determine needed action										
Inspect, clean and repair evaporator housing and water drain; inspect and service or replace evaporator air filter										
Identify and inspect A/C system service ports (gauge connections); determine needed action										
Diagnose system failures resulting in refrigerant loss from the A/C system high pressure relief device; determine needed action										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (13)										

IX. Diagnose, service and repair heating and engine cooling components in a HVAC system.

Tasks Instructions:

	1	2	3	4	5	6	7	8	9	10
Diagnose the cause of outlet air temperature control problems in the HVAC system; determine needed action										
Diagnose window fogging problems; determine needed action										
Perform engine cooling system tests for leaks, protection level, contamination, coolant level, coolant type, temperature and conditioner concentration; determine needed action										
Inspect engine cooling and heating system hoses, lines and clamps; determine needed action										
Inspect and test radiator, pressure cap and coolant recovery system (surge tank); determine needed action										
Inspect water pump for leaks and bearing play; determine needed action										
Inspect and test thermostats, bypasses, housings and seals; determine needed repairs										
Recover, flush and refill with recommended coolant/additive package; bleed cooling system										
Inspect thermostatic cooling fan system (hydraulic, pneumatic and electronic) and fan shroud; replace as needed										
Inspect and test heating system coolant control valve(s) and manual shut-off valves; determine needed action										
Inspect and flush heater core; determine needed action										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (13)										

X. Diagnose, service and repair electrical operating systems and related control components in a HVAC system.

Tasks Instructions:

	1	2	3	4	5	6	7	8	9	10
Diagnose the cause of failures in HVAC electrical control systems; determine needed action										
Inspect and test A/C heater blower motors, resistors, switches, relays, modules, wiring and protection devices; determine needed action										
Inspect and test A/C compressor clutch relays, modules, wiring, sensors, switches, diodes and protection devices; determine needed action										
Inspect and test A/C-related electronic engine control systems; determine needed action										
Inspect and test engine cooling/condenser fan motors, relays, modules, switches, sensors, wiring and protection devices; determine needed action										
Inspect and test electric actuator motors, relays/modules, switches, sensors, wiring and protection devices; determine needed action										
Inspect and test HVAC system electrical control panel assemblies; determine needed action										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (9)										

XI. Diagnose, service and repair air, vacuum and mechanical operating systems and related control components in a HVAC system.

Tasks Instructions:

	1	2	3	4	5	6	7	8	9	10
Diagnose the cause of failures in HVAC air, vacuum and mechanical switches										

and controls; determine needed action										
Inspect and test HVAC system air/vacuum/mechanical control panel assemblies; determine needed action										
Inspect, test and adjust HVAC system air/vacuum/mechanical control cables and linkages; determine needed action										
Inspect and test HVAC system vacuum actuators (diaphragms/motors) and hoses; determine needed action										
Inspect and test HVAC system vacuum reservoir(s), check valve(s) and restrictors; determine needed action										
Inspect, test and adjust HVAC system ducts, doors and outlets; determine needed action										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (8)										
XII. Demonstrate knowledge of refrigerant recovery, recycling and handling procedures in accordance with published EPA and appropriate SAE "J" standards for R-12, R-134a and EPA approved refrigerant blends.										
Tasks Instructions:										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Maintain and verify correct operation of certified equipment										
Identify (by label application or use of a refrigerant identifier) and recover A/C system refrigerant										
Recycle refrigerant										
Handle, label and store refrigerant										
Test recycled refrigerant for non-condensable gases										
Perform various tasks by navigating vehicle dash controls, including onboard										

diagnostics, users settings, display settings, etc.										
Perform various tasks by navigating vehicle sound system controls										
Safety and infection control are adhered to during all aspects of this task.										
The student completed task within the time limited.										
Points earned										
Total possible points (9)										
Total points earned for all sections (A)										
Total possible points for all sections (B) 214										
Student/candidate score (divide A/B)										