



**MASSACHUSETTS**  
**DEPARTMENT of**  
**EDUCATION**

**Vocational Technical Education  
Framework**

**Transportation Cluster**

***Diesel Technology***

**August 2007**

---

**Massachusetts Department of Education**  
**Career/Vocational Technical Education Unit**  
**address** 350 Main Street, Malden, MA 02148  
**telephone** 781-338-3910  
**internet** [www.doe.mass.edu/cte/](http://www.doe.mass.edu/cte/)  
**email** [careervoctech@doe.mass.edu](mailto:careervoctech@doe.mass.edu)

## **Strand 1: Safety and Health Knowledge and Skills**

### **1.A Define health and safety regulations.**

- 1.A.01a Identify and apply OSHA and other health and safety regulations that apply to specific tasks and jobs in the occupational area.
- 1.A.02a Identify and apply EPA and other environmental protection regulations that apply to specific tasks and jobs in the occupational area.
- 1.A.03a Identify and apply Right-To-Know (Hazard Communication Policy) and other communicative regulations that apply to specific tasks and jobs in the occupational area.
- 1.A.04a Explain procedures for documenting and reporting hazards to appropriate authorities.
- 1.A.05a List penalties for non-compliance with appropriate health and safety regulations.
- 1.A.06a Identify contact information for appropriate health and safety agencies and resources.

### **1.B Demonstrate health and safety practices.**

- 1.B.01a Identify, describe and demonstrate the effective use of Material Safety Data Sheets (MSDS).
- 1.B.02a Read chemical, product, and equipment labels to determine appropriate health and safety considerations.
- 1.B.03a Identify, describe and demonstrate personal, shop and job site safety practices and procedures.
- 1.B.04a Demonstrate safe dress and use of relevant safety gear and personal protective equipment (PPE), including wrist rests, adjustable workspaces and equipment, gloves, boots, earplugs, eye protection, and breathing apparatus.
- 1.B.05a Illustrate appropriate safe body mechanics, including proper lifting techniques and ergonomics.
- 1.B.06a Locate emergency equipment in your lab, shop, and classroom, including (where appropriate) eyewash stations, shower facilities, sinks, fire extinguishers, fire blankets, telephone, master power switches, and emergency exits.
- 1.B.07a Demonstrate the safe use, storage, and maintenance of every piece of equipment in the lab, shop, and classroom.
- 1.B.08a Describe safety practices and procedures to be followed when working with and around electricity .
- 1.B.09a Properly handle, store, dispose of, and recycle hazardous, flammable, and combustible materials.
- 1.B.10a Demonstrate proper workspace cleaning procedures.

### **1.C Demonstrate responses to situations that threaten health and safety.**

- 1.C.01a Illustrate First Aid procedures for potential injuries and other health concerns in the occupational area.
- 1.C.02a Describe the importance of emergency preparedness and an emergency action plan.

- 1.C.03a Illustrate procedures used to handle emergency situations and accidents, including identification, reporting, response, evacuation plans, and follow-up procedures.
- 1.C.04a Identify practices used to avoid accidents.
- 1.C.05a Identify and describe fire protection, precautions, and response procedures.
- 1.C.06a Discuss the role of the individual and the company/organization in ensuring workplace safety.
- 1.C.07a Discuss ways to identify and prevent workplace/school violence.

## **Strand 2: Technical Knowledge and Skills**

### **2.A Compare and contrast fasteners.**

- 2.A.01c Identify commonly used threaded fasteners.
- 2.A.02c Identify SAE bolt head markings.
- 2.A.03c Identify metric bolt head markings.
- 2.A.04c Identify commonly used nuts.
- 2.A.05c Identify commonly used washers.
- 2.A.06c Explain the need for flat washers and lock washers.
- 2.A.07c Identify and describe machine screws.
- 2.A.08c Identify and describe commonly used snap rings.
- 2.A.09c Explain the concept of fastener torque.
- 2.A.10c Explain how to find fastener torque specifications.
- 2.A.11c Explain when to use a general fastener torque chart.
- 2.A.12c Explain what torque sequence refers to.
- 2.A.13c Describe the various types of torque wrenches.
- 2.A.14c Explain the basic rules to follow when using a torque wrench.

#### **Performance Example:**

1. Torque fasteners according to manufacturer's specifications and according to sequence.

### **2.B Demonstrate proper measuring procedures.**

- 2.B.01c Describe commonly used low precision measuring tools (steel rule, tape measure, ruler, and combination square).
- 2.B.02c Identify an outside caliper and demonstrate its use.
- 2.B.03c Identify an inside caliper and demonstrate its use.
- 2.B.04c Identify a feeler gauge and demonstrate its use.
- 2.B.05c Identify a hole gauge and demonstrate its use.
- 2.B.06c Identify a telescoping/snap gauge and demonstrate its use.
- 2.B.07c Identify a vernier caliper and demonstrate its use.
- 2.B.08c Identify an outside micrometer and demonstrate its use.
- 2.B.09c Identify an inside micrometer and demonstrate its use.
- 2.B.10c Identify a depth indicator gauge and demonstrate its use.
- 2.B.11c Identify a dial indicator and demonstrate its use.

#### **Performance Example:**

1. Demonstrate measurement skills using both American and metric system using variety of tool.

### **2.C Demonstrate the use of hand tools.**

- 2.C.01c Identify types of screwdrivers.
- 2.C.02c Identify types of pliers.
- 2.C.03c Identify types of combination wrenches.
- 2.C.04c Identify open-end wrenches.
- 2.C.05c Identify box end wrenches.
- 2.C.06c Identify types of punches.
- 2.C.07c Identify types of chisel.
- 2.C.08c Identify types of hammers.
- 2.C.09c Identify types of pipe wrenches.

- 2.C.10c Identify types of adjustable wrenches.
- 2.C.11c Identify types of sockets.
- 2.C.12c Identify types of extensions.
- 2.C.13c Identify types of torque wrenches.
- 2.C.14c Identify types of Allen wrenches.
- 2.C.15c Identify various types of files.
- 2.C.16c Identify types of hacksaws.
- 2.C.17c Identify various types of thread cutting taps.
- 2.C.18c Identify various types of thread cutting dies.
- 2.C.19c Identify a tubing cutter.
- 2.C.20c Identify a double flaring tool.
- 2.C.21c Identify an ISO flaring tool.
- 2.C.22c Identify different types of gasket scrapers.
- 2.C.23c Identify types of wire brushes.
- 2.C.24c Identify types of bench vises.

**Performance Example:**

1. Student chooses correct tools to match assigned task.

**2.D Demonstrate the use of power tools.**

- 2.D.01c Drill holes to given specifications using an electric drill.
- 2.D.02c Identify types of drill bits.
- 2.D.03c Describe the difference in drilling speed for different metals.
- 2.D.04c Describe safety procedures to be followed when using an electric drill.
- 2.D.05c Identify and explain the purpose of an air impact wrench.
- 2.D.06c Identify and explain the purpose of impact sockets.
- 2.D.07c Describe maintenance needs of an impact wrench.
- 2.D.08c Describe safety procedures to follow when using an air impact wrench.
- 2.D.09c Identify and explain the purpose of an electric soldering iron.
- 2.D.10c Describe safety procedures to be followed when using an electric soldering iron.
- 2.D.11c List the type of solder to use when soldering electrical component.
- 2.D.12c Identify and explain the purpose of a bench grinder.
- 2.D.13c Describe safety procedures to follow when using a bench grinder.

**Performance Examples:**

1. Select the correct tool to drill a hole.
2. Choose the correct tools and supplies to solder an electrical connection.

**2.E Diagnose generic engine malfunctions.**

- 2.E.01 Inspect fuel, oil, and coolant levels, condition, and consumption; determine needed action.
- 2.E.02 Diagnose causes of engine fuel, oil, coolant, air, and other leaks; determine needed action.
- 2.E.03 Interpret engine noises; determine needed action.
- 2.E.04 Observe engine exhaust smoke color and quantity; determine needed action.
- 2.E.05 Test for air intake system restriction and leakage; determine needed action.

- 2.E.06 Perform intake manifold pressure (boost) test; determine needed action.
- 2.E.07 Test crankcase pressure; determine needed action.
- 2.E.08 Diagnose no cranking, cranks but fails to start, hard starting, and starts but does not continue to run problems and determine needed action.
- 2.E.09 Diagnose surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems; determine needed action.
- 2.E.10 Check, record, and clear electronic diagnostic (fault) codes, monitor electronic data; determine needed action.
- 2.E.11 Test cylinder compression; determine needed action.

**Performance Examples:**

1. Verify the complaint, and road/dyno test vehicle; review driver/customer interview and past maintenance documents (if available); determine further diagnosis.
2. Diagnose no cranking, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed repairs.

**2.F Diagnose and repair cylinder head and valve train.**

- 2.F.01 Remove, clean, inspect for visible damage, and replace cylinder head(s) assembly.
- 2.F.02 Clean and inspect threaded holes, studs, and bolts for serviceability; determine needed action.
- 2.F.03 Inspect cylinder head for cracks/damage; check mating surfaces for warpage; check condition of passages; inspect core/expansion and gallery plugs; determine needed action.
- 2.F.04 Disassemble head and inspect valves, guides, seats, springs, retainers, rotators, locks, and seals; determine needed action.
- 2.F.05 Measure valve head height relative to deck and valve face-to-seat contact; determine needed action.
- 2.F.06 Inspect and adjust valve bridges (crossheads) and guides and perform needed action.
- 2.F.07 Inspect pushrods, rocker arms, rocker arm shafts, electronic wiring harness, and brackets for wear, bending, cracks, looseness, and blocked oil passages and perform needed action.
- 2.F.08 Inspect cam followers and perform needed action.
- 2.F.09 Adjust valve clearance.

**Performance Example:**

1. Measure cylinder head deck-to-deck thickness, and check mating surfaces for warpage and surface finish; inspect for cracks/damage; check condition of passages; inspect core, gallery, and plugs; service as needed.

**2.G Diagnose and repair engine block.**

- 2.G.01 Remove, inspect, service, and install pans, covers, vents, gaskets, seals, and wear rings.
- 2.G.02 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.
- 2.G.03 Inspect cylinder sleeve counterbore and lower bore, check bore distortion; determine needed action.
  - 2.G.04 Clean, inspect, and measure cylinder walls or liners for wear and damage and determine needed action.
  - 2.G.05 Replace/reinstall cylinder liners and seals; check and adjust liner height (protrusion).
  - 2.G.06 Inspect in-block camshaft bearings for wear and damage; determine needed action.
  - 2.G.07 Inspect, measure, and replace/reinstall in-block camshaft; measure/adjust end play.
  - 2.G.08 Clean and inspect crankshaft for surface cracks and journal damage; check condition of oil passages; check passage plugs; measure journal diameter determine needed action.
  - 2.G.09 Inspect main bearings for wear patterns and damage; replace as needed; check bearing clearances; check and adjust crankshaft end play.
  - 2.G.10 Inspect, install, and time gear train, measure gear backlash; determine needed action.
  - 2.G.11 Inspect connecting rod and bearings for wear patterns; measure pistons, pins, retainers, and bushings and perform needed action.
  - 2.G.12 Assemble pistons and connecting rods, install in block, install rod bearings and check clearances.
  - 2.G.13 Check condition of piston cooling jets (nozzles); determine needed action.

**Performance Example:**

1. Inspect cylinder sleeve counterbore and lower bore; check bore distortion; determine needed service.

**2.H Diagnose and repair lubrication systems.**

- 2.H.01 Test engine oil pressure and check operation of pressure sensor, gauge, and/or sending unit and determine needed action.
- 2.H.02 Check engine oil level, condition, and consumption and determine needed action.
- 2.H.03 Inspect and measure oil pump, drives, inlet pipes, and pick-up screens and determine needed action.
- 2.H.04 Inspect turbocharger lubrication system and determine needed action.
- 2.H.05 Determine proper lubricant and perform oil and filter change.

**Performance Example:**

1. Inspect, measure, repair/replace oil pump, drives, inlet pipes, and screens.

**2.I Diagnose and repair cooling systems.**

- 2.I.01 Check engine coolant type, level, condition, and consumption and determine needed action.
- 2.I.02 Test coolant temperature and check operation of temperature sensor, gauge, and/or sending unit and determine needed action.

- 2.1.03 Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment.
- 2.1.04 Inspect thermostat(s), by-passes, housing(s), and seals; replace as needed.
- 2.1.05 Test coolant for freeze protection and additive package concentration; adjust as needed.
- 2.1.06 Recover, flush, and refill with recommended coolant/additive package; bleed cooling system.
- 2.1.07 Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fillings and replace as needed.
- 2.1.08 Inspect water pump and hoses and replace as needed.
- 2.1.09 Inspect, clean, and pressure test radiator, pressure cap, tank(s), and recovery systems and determine needed action.
- 2.1.10 Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud and replace as needed.

**Performance Examples:**

1. Inspect and replace thermostat(s), bypasses, and seals.
2. Inspect thermostat, bypasses, housing(s), and seals; replace as needed.

**2.J Diagnose and repair air induction and exhaust systems.**

- 2.J.01 Inspect turbocharger(s), wastegate, and piping systems; determine needed action.
- 2.J.02 Check air induction system: piping, hoses, clamps, and mounting; check for air restrictions and leaks; service or replace air filter as needed.
- 2.J.03 Remove and reinstall turbocharger/wastegate assembly.
- 2.J.04 Inspect, clean, and test charge air cooler assemblies; replace as needed.
- 2.J.05 Inspect exhaust manifold, piping, mufflers, exhaust after-treatment device(s), and mounting hardware; repair or replace as needed.
- 2.J.06 Inspect and test preheater/inlet air heater, or glow plug system and controls; perform needed action.
- 2.J.07 Inspect and test exhaust gas recirculation (EGR) system; determine needed action.
- 2.J.08 State all applicable emission standards for diesel systems.

**Performance Examples:**

1. Perform air intake system restriction and leakage tests; determine needed repairs.
2. Inspect, service/replace air induction piping, air cleaner, and element; check air restriction.
3. Inspect intake manifold, gaskets, and connections; repair or replace as needed.

**2.K Diagnose and repair fuel systems.**

- 2.K.01 Check fuel level, quality, and consumption; determine needed action.
- 2.K.02 Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, supply and return lines and fillings; determine needed action.

- 2.K.03 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.
- 2.K.04 Inspect and test low pressure regulator systems (check valves, pressure regulator valves, and restrictive fillings); determine needed action.
- 2.K.05 Check fuel system for air; determine needed action; prime and bleed fuel system; check primer pump.

**2.L Diagnose and repair electronic fuel management systems.**

- 2.L.01 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.
- 2.L.02 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.
- 2.L.03 Locate and use relevant service information (to include diagnostic procedures, flow charts, and wiring diagrams).
- 2.L.04 Inspect and replace electrical connector terminals, seals, and locks.
- 2.L.05 Inspect and test switches, sensors, controls, actuator components, and circuits; adjust or replace as needed.
- 2.L.06 Using recommended electronic diagnostic tools (to include PC based software and/or data scan tools), access and change customer parameters.
- 2.L.07 Inspect, test, and adjust electronic unit injectors (EUI); determine needed action.
- 2.L.08 Remove and install electronic unit injectors (EUI) and related components; recalibrate ECM (if applicable).
- 2.L.09 Perform cylinder contribution test utilizing recommended electronic diagnostic tool.
- 2.L.10 Perform on-engine inspections and tests on hydraulic electronic unit injectors and system electronic controls; determine needed action.
- 2.L.11 Perform on-engine inspections and tests on hydraulic electronic unit injector high-pressure oil supply and control systems; determine needed action.
- 2.L.12 Perform on-engine inspections and tests on distributor-type injection pump electronic controls; determine needed action.
- 2.L.13 Perform on-engine inspections and tests on in-line type injection pump electronic controls; determine needed action.
- 2.L.14 Perform on-engine inspections and tests on common rail type injection systems; determine needed action.

**Performance Examples:**

1. Inspect, clean, test, repair/replace fuel transfer (lift) pump, pump drives, screens, fuel/water separators/indicators, filters, heaters and associated mounting hardware.

2. Inspect, clean, test fuel transfer (lift) pump, pump drives, screens, water separators, filters, heaters and mounting hardware; determine needed repairs.

## **2.M Diagnose and repair engine brakes.**

- 2.M.01 Inspect and adjust engine compression/exhaust brakes; determine needed action.
- 2.M.02 Inspect, test, and adjust engine compression/exhaust brake control circuits, switches, and solenoids; repair or replace as needed.

### **Performance Examples:**

1. Inspect, test, and adjust engine/exhaust brakes.
2. Inspect, test, adjust, and repair/replace engine/exhaust brake control circuits, switches, and solenoids.
3. Inspect, repair/replace engine/exhaust brake housing, valves, seals, screens, lines, and fittings.

## **2.N Diagnose and repair clutches.**

- 2.N.01 Diagnose clutch noise, binding, slippage, pulsation, vibration, grabbing, dragging, and chatter problems; determine needed action.
- 2.N.02 Inspect and adjust clutch linkage, cables, levers, brackets, bushings, pivots, springs, and clutch safety switch (includes push and pull-type assemblies); check pedal height and travel; perform needed action.
- 2.N.03 Inspect, adjust, repair, or replace hydraulic clutch slave and master cylinders, lines, and hoses; bleed system.
- 2.N.04 Inspect, adjust, lubricate, or replace release (throw-out) bearing, sleeve, bushings, springs, housing, levers, release fork, fork pads, rollers, shafts, and seals.
- 2.N.05 Inspect, adjust, and replace single-disc clutch pressure plate and clutch disc.
- 2.N.06 Inspect, adjust, and replace two-plate clutch pressure plate, clutch discs, intermediate plate, and drive pins/lugs.
- 2.N.07 Inspect and/or replace clutch brake assembly; inspect input shaft and bearing retainer; perform needed action.
- 2.N.08 Inspect, adjust, and replace self-adjusting/continuous-adjusting clutch mechanisms.
- 2.N.09 Inspect and replace pilot bearing.
- 2.N.10 Inspect flywheel mounting area on crankshaft, rear main oil seal, and measure crankshaft end play; determine needed action.
- 2.N.11 Inspect flywheel and starter ring gear and measure flywheel face and pilot bore runout; determine needed action.
- 2.N.12 Inspect flywheel housing(s) to transmission housing/engine mating surface(s) and measure flywheel housing face and bore runout; determine needed action.

## **2.O Diagnose and repair transmissions.**

- 2.O.01 Diagnose transmission noise, shifting, lockup, jumping-out-of-gear, overheating, and vibration problems; determine needed action.

- 2.O.02 Diagnose transmission component failure cause, both before and during disassembly procedures; determine needed action.
- 2.O.03 Inspect, adjust, service, repair, or replace transmission remote shift linkages, brackets, bushings, pivots, and levers.
- 2.O.04 Inspect, test, repair, or replace air shift controls, lines, hoses, valves, regulators, filters, and cylinder assemblies.
- 2.O.05 Inspect for leakage and replace transmission cover plates, gaskets, seals, and cap bolts; inspect seal surfaces and vents; repair as needed.
- 2.O.06 Check transmission fluid level and condition; determine needed service; add proper type of lubricant.
- 2.O.07 Inspect, adjust, and replace transmission shift lever, cover, rails, forks, levers, bushings, sleeves, detents, interlocks, springs, and lock bolts/safety wires.
- 2.O.08 Remove and reinstall transmission.
- 2.O.09 Inspect input shaft, gear, spacers, bearings, retainers, and slingers; replace as needed.
- 2.O.10 Inspect output shafts, gears, washers, spacers, bearings, retainers, and keys; replace as needed.
- 2.O.11 Inspect reverse idler shafts, gears, bushings, bearings, thrust washers, and retainers; check reverse idler gear end play (where applicable); replace as needed.
- 2.O.12 Inspect synchronizer hub, sleeve, keys (inserts), springs, blocking rings, synchronizer plates, blocker pins, and sliding clutches; replace as needed.
- 2.O.13 Inspect transmission oil filters and coolers; replace as needed.
- 2.O.14 Inspect mechanical and electronic speedometer components; determine needed action.
- 2.O.15 Inspect and test function of backup light, neutral start, and warning device circuits; repair as needed.
- 2.O.16 Inspect and test transmission temperature gauge and sending unit/sensor; determine needed action.
- 2.O.17 Inspect, test operation of, adjust, repair, or replace automated mechanical transmission and manual electronic shift controls, shift, range and splitter solenoids, shift motors, indicators, speed and range sensors, electronic/transmission control units (ECU/TCU), neutral/in gear and reverse switches, and wiring harnesses.
- 2.O.18 Inspect, test operation of, repair, or replace automated mechanical transmission electronic shift selectors, air and electrical switches, displays and indicators, wiring harnesses, and air lines.
- 2.O.19 Diagnose automated mechanical transmission problems using appropriate diagnostic tools and procedures; check and record diagnostic codes, clear codes, and interpret digital multimeter (DMM) readings; determine needed repairs.
- 2.O.20 Diagnose automatic transmission problems using appropriate diagnostic tools and procedures; check and record diagnostic codes, clear codes, and interpret digital multimeter (DMM) readings; determine needed repairs.

**2.P Diagnose and repair driveshafts and universal joints.**

- 2.P.01 Diagnose driveshaft and universal joint noise and vibration problems; determine needed action.
- 2.P.02 Inspect, service, or replace driveshaft, slip joints, yokes, drive flanges, and universal joints; check phasing of all yokes.
- 2.P.03 Inspect driveshaft center support bearings and mounts; determine needed action.
- 2.P.04 Measure and adjust drive line angles.

**2.Q Diagnose and repair drive axels.**

- 2.Q.01 Diagnose drive axle(s) drive unit noise and overheating problems; determine needed action.
- 2.Q.02 Check and repair fluid leaks; inspect and replace drive axle housing cover plates, gaskets, sealants, vents, magnetic plugs, and seals.
- 2.Q.03 Check drive axle fluid level and condition; determine needed service; add proper type of lubricant.
- 2.Q.04 Remove and replace differential carrier assembly.
- 2.Q.05 Inspect, repair, or replace 2-speed axle shift control system, speedometer adapters, motors, axle shift units, wires, air lines, and connectors.
- 2.Q.06 Inspect power divider (inter-axle differential) assembly; determine needed action.
- 2.Q.07 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.
- 2.Q.08 Inspect, repair, or replace drive axle lubrication system: pump, troughs, collectors, slingers, tubes, and filters.
- 2.Q.09 Inspect and replace drive axle shafts.
- 2.Q.10 Remove and replace wheel assembly; check rear wheel seal and axle flange gasket for leaks; perform needed action.
- 2.Q.11 Diagnose drive axle for wheel bearing noise and damage; perform needed action.
- 2.Q.12 Inspect and test drive axle temperature gauge and sending unit/sensor; determine needed action.
- 2.Q.13 Clean, inspect, lubricate, and replace wheel bearings; replace seals and wear rings; adjust drive axle wheel bearings.

**2.R Diagnose and repair air brakes.**

- 2.R.01 Diagnose poor stopping, air leaks, premature wear, pulling, grabbing, or dragging problems caused by supply and service system malfunctions; determine needed action.
- 2.R.02 Check air system build-up time; determine needed action.
- 2.R.03 Drain air reservoir tanks; check for oil, water, and foreign material; determine needed action.
- 2.R.04 Inspect, adjust, and align compressor drive belts, pulleys, and tensioners; replace as needed.
- 2.R.05 Inspect air compressor, air cleaner/supply; inspect oil supply and coolant lines, fittings, and mounting brackets; repair or replace as needed.

- 2.R.06 Inspect and test system pressure controls: governor, unloader assembly valves, intake screens, filters, lines, hoses, and fittings; replace as needed.
  - 2.R.07 Inspect air system lines, hoses, fittings, and couplings; repair or replace as needed.
  - 2.R.08 Inspect and test air tank relief (safety) valves, one-way (single) check valves, two-way (double) check-valves, manual and automatic drain valves; replace as needed.
  - 2.R.09 Inspect and clean air drier systems, filters, valves, heaters, wiring, and connectors; repair or replace as needed.
  - 2.R.10 Inspect and test brake application (foot) valve, fittings, and mounts; adjust or replace as needed.
  - 2.R.11 Inspect and test stop light circuit switches, wiring, and connectors; repair or replace as needed.
  - 2.R.12 Inspect and test hand brake (trailer) control valve, lines, fittings, and mountings; repair or replace as needed.
  - 2.R.13 Inspect and test brake relay valve; replace as needed.
  - 2.R.14 Inspect and test quick release valves; replace as needed.
  - 2.R.15 Inspect and test tractor protection valve; replace as needed.
  - 2.R.16 Inspect and test emergency (spring) brake control/modulator valve(s); replace as needed.
  - 2.R.17 Inspect and test low pressure warning devices, wiring, and connectors; replace as needed.
  - 2.R.18 Inspect and test air pressure gauges, lines, and fillings; replace as needed.
- 2.S Diagnose and repair air brake mechanical/foundation problems.**
- 2.S.01 Diagnose poor stopping, brake noise, premature wear, pulling, grabbing, or dragging problems caused by the foundation brake, slack adjuster, and brake chamber problems; determine needed action.
  - 2.S.02 Inspect and test service brake chambers, diaphragm, clamp, spring, pushrod, clevis, and mounting brackets; repair or replace as needed.
  - 2.S.03 Inspect and service manual and automatic slack adjusters; perform needed action.
  - 2.S.04 Inspect camshafts, rollers, bushings, seals, spacers, retainers, brake spiders, shields, anchor pins, and springs; replace as needed.
  - 2.S.05 Inspect and measure brake shoes, linings, or pads; perform needed action.
  - 2.S.06 Inspect and measure brake drums and rotors; perform needed action.
- 2.T Diagnose and repair parking brakes.**
- 2.T.01 Inspect and test parking (spring) brake chamber diaphragm and seals; replace parking (spring) brake chamber; dispose of removed chambers in accordance with local regulations.
  - 2.T.02 Inspect and test parking (spring) brake check valves, lines, hoses, and fittings; replace as needed.
  - 2.T.03 Inspect and test parking (spring) brake application and release valve; replace as needed.

- 2.T.04 Manually release (cage) and reset (uncage) parking (spring) brakes in accordance with manufacturers' recommendations.

**Performance Examples:**

1. Inspect, test, adjust, repair, or replace brake application (foot) valve, fittings, and mounts.
2. Diagnose poor stopping, premature wear, brake noises, air leaks, pulling, grabbing, or dragging problems caused by supply and service system malfunctions; determine needed repairs.

**2.U Diagnose and repair hydraulic brakes.**

- 2.U.01 Diagnose poor stopping, premature wear, pulling, dragging or pedal feel problems caused by the hydraulic system; determine needed action.
- 2.U.02 Inspect and test master cylinder for internal/external leaks and damage; replace as needed.
- 2.U.03 Inspect brake lines, flexible hoses, and fittings for leaks and damage; replace as needed.
- 2.U.04 Inspect and test metering (hold-off), load sensing/proportioning, proportioning, and combination valves; replace as needed.
- 2.U.05 Inspect and test brake pressure differential valve and warning light circuit switch, bulbs, wiring, and connectors; repair or replace as needed.
- 2.U.06 Inspect and clean disc brake caliper assemblies; replace as needed.
- 2.U.07 Inspect/test brake fluid; bleed and/or flush system; determine proper fluid type.
- 2.U.08 Test and adjust brake stop light switch, bulbs, wiring, and connectors; repair or replace as needed.

**2.V Diagnose and repair mechanical brake mechanical/foundation problems.**

- 2.V.01 Diagnose poor stopping, brake noise, premature wear, pulling, grabbing, dragging, or pedal feel problems; determine needed action.
- 2.V.02 Inspect and measure brake drums and rotors; perform needed action.
- 2.V.03 Inspect and measure drum brake shoes and linings; inspect mounting hardware, adjuster mechanisms, and backing plates; perform needed action.
- 2.V.04 Inspect and measure disc brake pads/linings; inspect mounting hardware; perform needed action.
- 2.V.05 Check parking brake operation; inspect parking brake application and holding devices; adjust and replace as needed.

**2.W Diagnose and repair power assist units.**

- 2.W.01 Diagnose stopping problems caused by the brake assist (booster) system; determine needed action.
- 2.W.02 Inspect, test, repair, or replace power brake assist (booster), hoses, and control valves; determine proper fluid type.
- 2.W.03 Check emergency (back-up, reserve) brake assist system.

**2.X Diagnose and repair air and hydraulic antilock brake systems (abs) and automatic traction control (atc).**

- 2.X.01 Monitor antilock brake system (ABS) warning light operation (includes dash mounted trailer ABS warning light); determine needed action.
- 2.X.02 Diagnose antilock brake system (ABS) electronic control(s) and components using self-diagnosis and/or specified test equipment (scan tool, PC computer); determine needed action.
- 2.X.03 Diagnose poor stopping and wheel lock-up caused by failure of the antilock brake system (ABS); determine needed action.
- 2.X.04 Inspect, test, and replace antilock brake system (ABS) air, hydraulic, electrical, and mechanical components; perform needed action.
- 2.X.05 Diagnose, service, and adjust antilock brake system (ABS) wheel speed sensors and circuits following manufacturers' recommended procedures (including voltage output, resistance, shorts to voltage/ground, and frequency data).
- 2.X.06 Bleed the ABS hydraulic circuits following manufacturers' procedures.
- 2.X.07 Diagnose automatic traction control (ATC) electronic control(s) and components using self-diagnosis and/or specified test equipment (scan tool, PC computer); determine needed action.

**Performance Examples:**

1. Diagnose poor stopping, pulling, premature wear, noise, or dragging complains caused by hydraulic system problems; determine needed repairs.
2. Diagnose antilock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determine needed repairs.

**2.Y Diagnose and repair steering systems.**

- 2.Y.01 Diagnose fixed and driver adjustable steering column and shaft noise, looseness, and binding problems; determine needed action.
- 2.Y.02 Inspect steering shaft U-joint(s), slip joints, bearings, bushings, and seals; phase shaft U-joints; determine needed action.
- 2.Y.03 Check and adjust cab mounting and ride height.
- 2.Y.04 Center the steering wheel as needed.
- 2.Y.05 Disable and enable supplemental restraint system (SRS) in accordance with manufacturers' procedures.

**2.Z Diagnose and repair steering units.**

- 2.Z.01 Diagnose power steering system noise, steering binding, darting/oversteer, reduced wheel cut, steering wheel kick, pulling, non-recovery, turning effort, looseness, hard steering, overheating, fluid leakage, and fluid aeration problems; determine needed action.
- 2.Z.02 Determine recommended type of power steering fluid; check level and condition; determine needed action.
- 2.Z.03 Flush and refill power steering system; purge air from system.
- 2.Z.04 Perform power steering system pressure, temperature, and flow tests; determine needed action.
- 2.Z.05 Inspect, service, or replace power steering reservoir including filter, seals, and gaskets.

- 2.Z.06 Inspect and reinstall/replace pulleys, tensioners, and drive belts; adjust drive belts and check alignment.
- 2.Z.07 Inspect, adjust, or replace power steering pump, mountings, and brackets.
- 2.Z.08 Inspect and replace power steering system cooler, lines, hoses, clamps/mountings, hose routings, and fittings.
- 2.Z.09 Inspect, adjust, repair, or replace integral type power steering gear and mountings.

**2.AA Inspect steering linkage.**

- 2.AA.01 Inspect and align pitman arm; replace as needed.
- 2.AA.02 Inspect drag link (relay rod) and tie rod ends; adjust or replace as needed.
- 2.AA.03 Inspect steering arm and levers, and linkage pivot joints; replace as needed.
- 2.AA.04 Inspect clamps and retainers on cross tube/relay rod/centerlink/tie rod; position or replace as needed.
- 2.AA.05 Check and adjust wheel stops.
- 2.AA.06 Lubricate steering linkage joints as needed.

**Performance Examples:**

1. Perform power steering system pressure and flow tests; determine needed repairs.
2. Inspect, adjust, or replace drag link (relay rod) and tie rod ends (ball and adjustable socket type).

**2.BB Diagnose and repair suspension systems.**

- 2.BB.01 Inspect front axles, U-bolts, and nuts; determine needed action.
- 2.BB.02 Inspect and service king pin, steering knuckle bushings, locks, bearings, seals, and covers; determine needed action.
- 2.BB.03 Inspect shock absorbers, bushings, brackets, and mounts; replace as needed.
- 2.BB.04 Inspect leaf springs, center bolts, clips, eye bolts and bushings, shackles, slippers, insulators, brackets, and mounts; determine needed action.
- 2.BB.05 Inspect torque arms, bushings, and mounts; determine needed action.
- 2.BB.06 Inspect axle aligning devices such as radius rods, track bars, stabilizer bars, and related bushings, mounts, shims, and cams; determine needed action.
- 2.BB.07 Inspect walking beams, center (cross) tube, bushings, mounts, load pads, and saddles/caps; replace as needed.
- 2.BB.08 Inspect and test air suspension pressure regulator and height control valves, lines, hoses, dump valves, and fittings; adjust, repair or replace as needed.
- 2.BB.09 Inspect and test air springs, mounting plates, springs, suspension arms, and bushings; replace as needed.
- 2.BB.10 Measure vehicle ride height; determine needed action.

**Performance Example:**

1. Inspect, service, adjust, or replace kingpin, steering knuckle bushings, locks, bearings, seals, and covers.

**2.CC Diagnose and repair wheel adjustment problems.**

- 2.CC.01 Diagnose vehicle wandering, pulling, shimmy, hard steering, and off-center steering wheel problem(s); adjust and repair as needed.
- 2.CC.02 Check toe; adjust as needed.
- 2.CC.03 Check rear axle(s) alignment (thrustline/centerline) and tracking; adjust or repair as needed.
- 2.CC.04 Check front axle alignment (centerline); adjust or repair as needed.

**2.DD Diagnose and repair wheel and tire problems**

- 2.DD.01 Diagnose unusual tire wear patterns, check tread depth, mismatched tread design; determine needed action.

**Performance Examples:**

1. Check and adjust caster
2. Check and adjust toe

**2.EE Service and repair frames.**

- 2.EE.01 Inspect and adjust fifth wheel, pivot pins, bushings, locking jaw mechanisms, and mounting bolts; determine needed action.
- 2.EE.02 Inspect sliding fifth wheel, tracks, stops, locking systems, air cylinders, springs, lines, hoses, and controls.
- 2.EE.03 Inspect frame and frame members for cracks, breaks, corrosion, distortion, elongated holes, looseness, and damage; determine needed repairs.
- 2.EE.04 Inspect, repair, or replace pintle hooks and thaw bars.

**Performance Example:**

1. Inspect, adjust, service, repair, or replace fifth wheel, pivot pins, bushings, locking jaw mechanisms, and mounting bolts.

**2.FF Diagnose and repair general electrical systems.**

- 2.FF.01 Read, interpret, and diagnose electrical/electronic circuits using wiring diagrams.
- 2.FF.02 Check continuity in electrical/electronic circuits using appropriate test equipment.
- 2.FF.03 Check applied voltages, circuit voltages, and voltage drops in electrical/electronic circuits using a digital multimeter (DMM).
- 2.FF.04 Check current flow in electrical/electronic circuits and components using a digital multimeter (DMM) or clamp-on ammeter.
- 2.FF.05 Check resistance in electrical/electronic circuits and components using a digital multimeter (DMM).
- 2.FF.06 Find shorts, grounds, and opens in electrical/electronic circuits.
- 2.FF.07 Diagnose parasitic (key-off) battery drain problems.
- 2.FF.08 Inspect and test fusible links, circuit breakers, relays, solenoids, and fuses; replace as needed.

**Performance Examples:**

1. Check continuity in electrical/electronic circuits using appropriate test equipment.
2. Check applied voltages, circuit voltages, and voltage drops in electrical/electronic circuits using a digital multimeter (DMM), or clamp-on ammeter.
3. Check current flow in electrical/electronic circuits and components using an ammeter, digital multimeter (DMM), or clamp-on ammeter.
4. Check resistance in electrical/electronic circuits and components using an ohmmeter or digital multimeter (DMM).

## **2.GG Diagnose and repair batteries.**

- 2.GG.01 Perform battery load test; determine needed action.
- 2.GG.02 Determine battery state of charge using an open circuit voltage test.
- 2.GG.03 Inspect, clean, and service battery; replace as needed.
- 2.GG.04 Inspect and clean battery boxes, mounts, and hold downs; repair or replace as needed.
- 2.GG.05 Charge battery using slow or fast charge method as appropriate.
- 2.GG.06 Inspect, test, and clean battery cables and connectors; repair or replace as needed.
- 2.GG.07 Jump start a vehicle using jumper cables and a booster battery or auxiliary power supply using proper safety procedures.
- 2.GG.08 Perform battery capacitance test; determine needed action.

### **Performance Examples:**

1. Perform battery load test; determine needed service.
2. Determine battery state of charge by measuring terminal post voltage using a digital multimeter (DMM).
3. Determine battery state of charge using an open circuit voltage test.

## **2.HH Diagnose and repair starting systems.**

- 2.HH.01 Perform starter circuit cranking voltage and voltage drop tests; determine needed action.
- 2.HH.02 Inspect and test components (key switch, push button and/or magnetic switch) and wires in the starter control circuit; replace as needed.
- 2.HH.03 Inspect and test starter relays and solenoids/switches; replace as needed.
- 2.HH.04 Remove and replace starter; inspect flywheel ring gear or flex plate.

### **Performance Examples:**

1. Perform starter circuit voltage drop tests; determine needed repairs.
2. Inspect, test, and replace components (key switch, push button, and/or magnetic switch) and wires in the starter control circuit.
3. Inspect, test, and replace starter relays and solenoids/switches.

## **2.II Diagnose and repair charging systems.**

- 2.II.01 Diagnose instrument panel mounted volt meters and/or indicator lamps that show a no charge, low charge, or overcharge condition; determine needed action.

- 2.II.02 Diagnose the cause of a no charge, low charge, or overcharge condition; determine needed action.
- 2.II.03 Inspect and replace alternator drive belts, pulleys, fans, tensioners, and mounting brackets; adjust drive belts and check alignment.
- 2.II.04 Perform charging system voltage and amperage output tests; determine needed action.
- 2.II.05 Perform charging circuit voltage drop tests; determine needed action.
- 2.II.06 Remove and replace alternator.
- 2.II.07 Inspect, repair, or replace connectors and wires in the charging circuit.
- 2.II.08 Diagnose AC voltage leakage (failed rectifier) at alternator output; determine needed action.

**Performance Examples:**

1. Diagnose the cause of a no charge, low charge, or overcharge condition; determine needed repairs.
2. Perform charging circuit voltage drop tests; determine needed repairs.

**2.JJ Diagnose and repair lighting systems.**

- 2.JJ.01 Diagnose the cause of brighter than normal, intermittent, dim, or no headlight and daytime running light (DRL) operation.
- 2.JJ.02 Test, aim, and replace headlights.
- 2.JJ.03 Test headlight and dimmer circuit switches, relays, wires, terminals, connectors, sockets, and control components; repair or replace as needed.
- 2.JJ.04 Inspect and test switches, bulbs/LEDs, sockets, connectors, terminals, relays, and wires of parking, clearance, and taillight circuits; repair or replace as needed.
- 2.JJ.05 Inspect and test instrument panel light circuit switches, relays, bulbs, sockets, connectors, terminals, wires, and printed circuits/control modules; repair or replace as needed.
- 2.JJ.06 Inspect and test interior cab light circuit switches, bulbs, sockets, connectors, terminals, and wires; repair or replace as needed.
- 2.JJ.07 Inspect and test tractor-to-trailer multi-wire connector(s); repair or replace as needed.
- 2.JJ.08 Inspect and test turn signal and hazard circuit flasher(s), switches, relays, bulbs/LEDs, sockets, connectors, terminals, and wires; repair or replace as needed.
- 2.JJ.09 Inspect, test, and adjust backup lights and warning device circuit switches, bulbs/LEDs, sockets, horns, buzzers, connectors, terminals, and wires; repair or replace as needed.

**Performance Examples:**

1. Check Headlights, Daytime Running Lights, Parking, Clearance, Tail, Cab, and Dash Lights.
2. Test, repair, and replace headlight and dimmer switches, wires, connectors, terminals, sockets, relays, and control components.
3. Stoplights, Turn Signals, Hazard Lights, and Backup Lights.
4. Inspect, test, adjust, repair or replace stoplight circuit switches, bulbs, sockets, connectors, terminals, relays, and wires.

5. Inspect, test, repair or replace turn signal and hazard circuit flashers, switches, bulbs, sockets, connectors, terminals, relays, and wires.

**2.KK Diagnose and repair gauges and warning systems.**

- 2.KK.01 Interface with vehicle's on-board computer; perform diagnostic procedure using recommended electronic diagnostic equipment and tools (including PC based software and/or data scan tools); determine needed action.
- 2.KK.02 Diagnose the cause of intermittent, high, low, or no gauge readings; determine needed action.
- 2.KK.03 Diagnose the cause of data bus-driven gauge malfunctions; determine needed action.
- 2.KK.04 Inspect and test gauge circuit sending units, gauges, connectors, terminals, and wires; repair or replace as needed.
- 2.KK.05 Inspect and test warning devices (lights and audible) circuit sending units, bulbs/LEDs, sockets, connectors, wires, and printed circuits/control.

**Performance Example:**

- 1. Inspect, test, adjust, repair, or replace gauge circuit sending units, gauges, connectors, terminals, and wires.

**2.LL Diagnose and repair related electrical systems.**

- 2.LL.01 Diagnose the cause of constant, intermittent, or no horn operation; determine needed action.
- 2.LL.02 Inspect and test horn circuit relays, horns, switches, connectors, and wires; repair or replace as needed.
- 2.LL.03 Diagnose the cause of constant, intermittent, or no wiper operation; diagnose the cause of wiper speed control and/or park problems; determine needed action.
- 2.LL.04 Inspect and test wiper motor, resistors, park switch, relays, switches, connectors, and wires; repair or replace as needed.
- 2.LL.05 Inspect wiper motor transmission linkage, arms, and blades; adjust or replace as needed.
- 2.LL.06 Inspect and test sideview mirror motors, heater circuit grids, relays, switches, connectors, terminals, and wires; repair or replace as needed.
- 2.LL.07 Inspect and test heater and A/C electrical components including: A/C clutches, motors, resistors, relays, switches, connectors, terminals, and wires; repair or replace as needed.
- 2.LL.08 Diagnose the cause of slow, intermittent, or no power side window operation; determine needed action.
- 2.LL.09 Inspect and test motors, switches, relays, connectors, terminals, and wires of power side window circuits; repair or replace as needed.
- 2.LL.10 Inspect and test engine cooling fan electrical control components; repair or replace as needed.

**Performance Example:**

- |   |
|---|
| <ol style="list-style-type: none"><li>1. Inspect, test, repair, or replace heater and A/C electrical components including: A/C clutches, motors, resistors, relays, switches, controls, connectors, terminals, and wires.</li></ol> |
|---|

**2.MM Diagnose and repair engine systems.**

- 2.MM.01 Check engine starting/operation (including unusual noises, vibrations, exhaust smoke, etc.); record idle and governed rpm.
- 2.MM.02 Inspect vibration damper.
- 2.MM.03 Inspect belts, tensioners, and pulleys; check and adjust belt tension; check belt alignment.
- 2.MM.04 Check engine oil level; check engine for oil, coolant, and fuel leaks (Engine Off).
- 2.MM.05 Inspect engine mounts for looseness and deterioration.
- 2.MM.06 Check engine for oil, coolant, air, fuel, and exhaust leaks (Engine Running).
- 2.MM.07 Check electrical wiring, routing, and hold-down clamps, including Engine.
- 2.MM.08 Control Module/Powertrain Control Module (ECM/PCM).

**2.NN Diagnose and repair fuel systems.**

- 2.NN.01 Check fuel tanks, mountings, lines, caps, and vents.
- 2.NN.02 Inspect throttle linkages and return springs.
- 2.NN.03 Drain water from fuel system.
- 2.NN.04 Inspect water separator/fuel heater; replace fuel filter(s); prime and bleed fuel system.

**2.OO Diagnose and repair cooling systems.**

- 2.OO.01 Check operation of fan clutch.
- 2.OO.02 Inspect radiator (including air flow restriction, leaks, and damage) and mountings.
- 2.OO.03 Inspect fan assembly and shroud.
- 2.OO.04 Pressure test cooling system and radiator cap.
- 2.OO.05 Inspect coolant hoses and clamps.
- 2.OO.06 Inspect coolant recovery system.
- 2.OO.07 Check coolant for contamination, supplemental coolant additives (SCA) concentration, and protection level (freeze point).
- 2.OO.08 Service coolant filter/conditioner.
- 2.OO.09 Inspect water pump for leaks and bearing play.

**2.PP Inspect cab and hood.**

- 2.PP.01 Inspect key condition and operation of ignition switch.
- 2.PP.02 Check warning indicators.
- 2.PP.03 Check instruments; record oil pressure and system voltage.
- 2.PP.04 Check mechanical, electronic, and emergency shut down operation.
- 2.PP.05 Check mechanical and electronic engine speed controls.
- 2.PP.06 Check heater, ventilation, and air conditioning (HVAC) controls.
- 2.PP.07 Check operation of all accessories.

2.PP.08 Using diagnostic tool or on-board diagnostic system; extract engine monitoring information.

**2.QQ Inspect safety equipment.**

2.QQ.01 Check operation of electric/air horns and back-up warning devices.

2.QQ.02 Check condition and documentation of safety flares, spare fuses, triangles, fire extinguisher, and all required decals.

2.QQ.03 Inspect seat belts and sleeper restraints.

2.QQ.04 Inspect wiper blades and arms.

**2.RR Inspect Hardware.**

2.RR.01 Check wiper and washer operation.

2.RR.02 Inspect windshield glass for cracks or discoloration; check sun visor.

2.RR.03 Check seat condition, operation, and mounting.

2.RR.04 Check door glass and window operation.

2.RR.05 Inspect steps and grab handles.

2.RR.06 Inspect mirrors, mountings, brackets, and glass.

2.RR.07 Record all observed physical damage.

2.RR.08 Lubricate all cab and hood grease fittings.

2.RR.09 Inspect and lubricate door and hood hinges, latches, strikers, lock cylinders, safety latches, linkages, and cables.

2.RR.10 Inspect cab mountings, hinges, latches, linkages, and ride height; service as needed.

2.RR.11 Inspect tilt cab hydraulic pump, lines, and cylinders for leakage; inspect safety devices; service as needed.

**2.SS Diagnose and repair Heating, Ventilation, & Air Conditioning (HVAC).**

2.SS.01 Inspect A/C condenser and lines for condition and visible leaks; check mountings.

2.SS.02 Inspect A/C compressor and lines for condition and visible leaks; check mountings.

2.SS.03 Check A/C system condition and operation; check A/C monitoring system, if applicable.

2.SS.04 Check HVAC air inlet filters and ducts; service as needed.

**2.TT Diagnose and repair electrical systems.**

2.TT.01 Inspect battery box(es), cover(s), and mountings.

2.TT.02 Inspect battery hold-downs, connections, cables, and cable routing; service as needed.

2.TT.03 Check/record battery state-of-charge (open circuit voltage) and condition.

2.TT.04 Perform battery test (load and/or capacitance).

2.TT.05 Inspect starter, mounting, and connections.

2.TT.06 Engage starter; check for unusual noises, starter drag, and starting difficulty.

2.TT.07 Inspect alternator, mountings, wiring, and wiring routing; determine needed action.

2.TT.08 Perform alternator current output test.

2.TT.09 Perform alternator voltage output test.

- 2.TT.10 Check operation of interior lights; determine needed action.
- 2.TT.11 Check all exterior lights, lenses, reflectors, and conspicuity tape; check headlight alignment; determine needed action.
- 2.TT.12 Inspect and test tractor-to-trailer multi-wire connector(s), cable(s), and holder(s); determine needed action.

**2.UU Inspect frame and fifth wheel.**

- 2.UU.01 Inspect fifth wheel mounting bolts, air lines, and locks.
- 2.UU.02 Test operation of fifth wheel locking device; adjust if necessary.
- 2.UU.03 Check mud flaps and brackets.
- 2.UU.04 Check pintle hook assembly and mounting.
- 2.UU.05 Lubricate all fifth wheel grease fittings and plate.
- 2.UU.06 Inspect frame and frame members for cracks and damage.

## **Strand 3: Embedded Academics Knowledge and Skills**

### **3.A English Language Arts**

<b>VTE #</b>	<b>Acad #</b>	<b>Standard</b>	<b>Grade</b>	<b>Topic</b>
3.A.01c	2.4	Integrate relevant information gathered from group discussions and interviews for reports.	Pre-9th	Language
3.A.02c	13.19	Identify and use knowledge of common graphic features (charts, maps, diagrams).	Pre-9th	Reading
3.A.03c	19.21	Write reports based on research that include quotations, footnotes or endnotes, and a bibliography.	Pre-9th	Composition
3.A.04c	24.4	Apply steps for obtaining information from a variety of sources, organizing information, documenting sources, and presenting research in individual projects.	Pre-9th	Composition
3.A.05c	19.27	For informational/expository writing: Write well-organized research papers that prove a thesis statement using logical organization, effective supporting evidence, and variety in sentence structure.	11/12	Composition
3.A.06c	24.6	Formulate original, open-ended questions to explore a topic of interest, design and carry out research, and evaluate the quality of the research paper in terms of the adequacy of its questions, materials, approach, and documentation of sources.	11/12	Composition
3.A.07c	3.17	Deliver formal presentations for particular audiences using clear enunciation and appropriate organization, gestures, tone, and vocabulary.	11/12	Language
3.A.08c	4.27	Use general dictionaries, specialized dictionaries, thesauruses, histories of language, books of quotations, and other related references as needed.	11/12	Language
3.A.09c		Comprehend and use problem-solving techniques and decision trees that are contained in service manuals and databases to determine cause-and-effect relationships.		Voc

3.A.10c		Interpret charts, tables, or graphs to determine the manufacturer's specifications for systems operation to identify out-of-tolerance systems and subsystems.		Voc
3.A.11c		Read technical manuals, guides, resource books and technical literature to gain information and solve problems (Operator's manual, service manuals and databases etc.).		Voc
3.A.12c		Read, comprehend, and follow written technical directions for repairs, procedures and processes. (Shop manuals, etc.).		Voc
3.A.13c		Write warranty reports and work orders to include information regarding problem resolution and the results of the work performed for the customer or manufacturer.		Voc

### 3.B Mathematics

VTE #	Acad #	Standard	Grade	Topic
3.B.01c	7.G.5	Use a ruler, protractor, and compass to draw polygons and circles.	Pre-9th	Geometry
3.B.02c	7.M.2	Given the formulas, convert from one system of measurement to another. Use technology as appropriate.	Pre-9th	Measurement
3.B.03c	7.P.4	Solve linear equations using tables, graphs, models, and algebraic methods.	Pre-9th	Patterns, relations, algebra
3.B.04c	7.P.6	Use linear equations to model and analyze problems involving proportional relationships. Use technology as appropriate.	Pre-9th	Patterns, relations, algebra
3.B.05c	8.M.2	Given the formulas, convert from one system of measurement to another. Use technology as appropriate.	Pre-9th	Measurement
3.B.06c	8.N.1	Compare, order, estimate, and translate among integers, fractions and mixed numbers (i.e., rational numbers), decimals, and percents.	Pre-9th	Numbers

3.B.07c	10.D.1	Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table, stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.	9/10	Data Analysis, Probability and Statistics
3.B.08c	10.G.10	Demonstrate the ability to visualize solid objects and recognize their projections and cross sections.	9/10	Geometry
3.B.09c	10.G.3	Recognize and solve problems involving angles formed by transversals of coplanar lines. Identify and determine the measure of central and inscribed angles and their associated minor and major arcs. Recognize and solve problems associated with radii, chords, and arcs within or on the same circle.	9/10	Geometry
3.B.10c	10.G.8	Find linear equations that represent lines either perpendicular or parallel to a given line and through a point, e.g., by using the "point-slope" form of the equation.	9/10	Geometry
3.B.11c	10.M.1.	Calculate perimeter, circumference, and area of common geometric figures such as parallelograms, trapezoids, circles, and triangles.	9/10	Measurement
3.B.12c	10.M.2	Given the formula, find the lateral area, surface area, and volume of prisms, pyramids, spheres, cylinders, and cones, e.g., find the volume of a sphere with a specified surface area.	9/10	Measurement
3.B.13c	10.M.4	Describe the effects of approximate error in measurement and rounding on measurements and on computed values from measurements.	9/10	Measurement
3.B.14c	10.P.8	Solve everyday problems that can be modeled using systems of linear equations or inequalities. Apply algebraic and graphical methods to the solution. Use technology when appropriate. Include mixture, rate, and work problems.	9/10	Patterns, relations, algebra

3.B.15c	G.G.2	Write simple proofs of theorems in geometric situations, such as theorems about congruent and similar figures, parallel or perpendicular lines. Distinguish between postulates and theorems. Use inductive and deductive reasoning, as well as proof by contradiction. Given a conditional statement, write its inverse, converse, and contrapositive.	9/12	Geometry
3.B.16c	12.D.1	Design surveys and apply random sampling techniques to avoid bias in the data collection.	11/12	Data Analysis, Probability and Stats
3.B.17c	12.D.2	Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.	11/12	Data Analysis, Probability and Stats
3.B.18c	12.D.5	Describe a set of frequency distribution data by spread (variance and standard deviation), skewness, symmetry, number of modes, or other characteristics. Use these concepts in everyday applications.	11/12	Data Analysis, Probability and Stats
3.B.19c	12.D.6	Use combinatorics (e.g., "fundamental counting principle," permutations, and combinations) to solve problems, in particular, to compute probabilities of compound events. Use technology as appropriate.	11/12	Data Analysis, Probability and Stats
3.B.20c	12.D.7	Compare the results of simulations (e.g., random number tables, random functions, and area models) with predicted probabilities.	11/12	Data Analysis, Probability and Stats
3.B.21c	12.G.5	Apply properties of angles, parallel lines, arcs, radii, chords, tangents, and secants to solve problems.	11/12	Geometry
3.B.22c	12.M.1	Describe the relationship between degree and radian measures, and use radian measure in the solution of problems, in particular, problems involving angular velocity and acceleration.	11/12	Measurement
3.B.23c	12.M.2	Use dimensional analysis for unit conversion and to confirm that expressions and equations make sense.	11/12	Measurement

3.B.24c	12.P.11	Solve everyday problems that can be modeled using polynomial, rational, exponential, logarithmic, trigonometric, and step functions, absolute values, and square roots. Apply appropriate graphical, tabular, or symbolic methods to the solution. Include growth and decay; joint (e.g., $I = Prt$ , $y = k(w_1 + w_2)$ ) and combined ( $F = G(m_1m_2)/d^2$ ) variation, and periodic processes.	11/12	Patterns, relations, algebra
3.B.25c	12.P.7	Find solutions to quadratic equations (with real coefficients and real or complex roots) and apply to the solutions of problems.	11/12	Patterns, relations, algebra
3.B.26c	12.P.8	Solve a variety of equations and inequalities using algebraic, graphical, and numerical methods, including the quadratic formula; use technology where appropriate. Include polynomial, exponential, logarithmic, and trigonometric functions; expressions involving absolute values; trigonometric relations; and simple rational expressions.	11/12	Patterns, relations, algebra
3.B.27c	12.P.9	Use matrices to solve systems of linear equations. Apply to the solution of everyday problems.	11/12	Patterns, relations, algebra
3.B.28c		Apply mathematical operations and processes to determine conformance with the manufacturer's specifications for location, proportion, mixture, system and sub-system analysis, alignment, etc.		Voc
3.B.29c		Compute mentally whether the observed measurement is out-of-tolerance when comparing the observed measurement to the manufacturer's specifications.		Voc
3.B.30c		Determine the proper sequence of arithmetic operations that are needed to arrive at a solution that can be compared to other specifications when comparing system measurements or tolerances to the manufacturer's specifications and apply them.		Voc

3.B.31c		Measure and/or test with tools designed for English or metric measurements, then convert the result to the manufacturers system used for specifying the correct measurement or tolerance.		Voc
3.B.32c		Solve problems that involve determining whether the proportion of the existing volume or mixture compares to the manufacturers specifications and is within the recommended tolerance.		Voc

### 3.C Science and Engineering/Technology

VTE #	Acad #	Standard	Grade	Topic
3.C.01c	1	Differentiate between weight and mass, recognizing that weight is the amount of gravitational pull on an object.	Pre-9th	Physical
3.C.02c	3	Recognize that the measurement of volume and mass requires understanding of the sensitivity of measurement tools (e.g., rulers, graduated cylinders, balances) and knowledge and appropriate use of significant digits.	Pre-9th	Physical
3.C.03c	5.5	Calculate mass-mass, mass-volume, volume-volume, and limiting reactant problems for chemical reactions. (as they relate to compounds used in an automobile).		Chemistry
3.C.04c	6.2	Explain the relationship between temperature and average kinetic energy.		Chemistry
3.C.05c	6.6	Use the combined gas law to determine changes in pressure, volume, or temperature.		Chemistry
3.C.06c	11.1	Describe the chemical processes known as oxidation and reduction.		Chemistry
3.C.07c	11.5	Explain how a typical battery, such as a lead storage battery or a dry cell, works.		Chemistry
3.C.08c	1.1	Identify and explain the steps of the engineering design process, i.e., identify the problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.		Eng/Tech

3.C.09c	3.1	Differentiate between open (e.g., irrigation, forced hot air system) and closed (e.g., forced hot water system, hydroponics) fluid systems and their components such as valves, controlling devices, and metering devices.		Eng/Tech
3.C.10c	3.2	Identify and explain sources of resistance (e.g., 45deg. elbow, 90deg. elbow, type of pipes, changes in diameter) for water moving through a pipe.		Eng/Tech
3.C.11c	3.3	Explain the relationship among temperature change in a substance for a given amount of heat transferred, the amount (mass) of the substance, and the specific heat of the substance.		Eng/Tech
3.C.12c	3.4	Differentiate between hydraulic and pneumatic systems and provide examples of appropriate applications of each as they relate to manufacturing and transportation systems.		Eng/Tech
3.C.13c	3.6	Solve problems related to hydrostatic pressure and depth in fluid systems.		Eng/Tech
3.C.14c	4.1	Differentiate among conduction, convection, and radiation in a thermal system, e.g., heating and cooling <i>systems</i> .		Eng/Tech
3.C.15c	4.2	Give examples of how conduction, convection, and radiation are used in the selection of materials, e.g., home and vehicle thermostat designs, circuit breakers.		Eng/Tech
3.C.16c	4.4	Explain how environmental conditions influence heating and cooling of buildings and automobiles.		Eng/Tech
3.C.17c	4.5	Identify and explain the tools, controls, and properties of materials used in a thermal system, e.g., thermostats, R Values, thermal conductivity, temperature sensors.		Eng/Tech
3.C.18c	5.2	Identify and explain the components of a circuit including a source, conductor, load, and controllers (controllers are switches, relays, diodes, transistors, integrated circuits).		Eng/Tech
3.C.19c	5.3	Explain the relationship between resistance, voltage, and current (Ohm's Law).		Eng/Tech

3.C.20c	5.4	Determine the voltages and currents in a series circuit and a parallel circuit).		Eng/Tech
3.C.21c	5.5	Explain how to measure voltage, resistance, and current in electrical systems.		Eng/Tech
3.C.22c	5.6	Describe the differences between Alternating Current (AC) and Direct Current (DC).		Eng/Tech
3.C.23c	7.2	Differentiate the selection of tools and procedures used in the safe production of products in the manufacturing process, e.g., hand tools, power tools, computer-aided manufacturing, three-dimensional modeling.		Eng/Tech
3.C.24c	1.3	Distinguish between, and solve problems involving, velocity, speed, and constant acceleration.		Physics
3.C.25c	1.4	Create and interpret graphs of motion (position vs. time, speed vs. time, velocity vs. time, constant acceleration vs. time).		Physics
3.C.26c	1.9	Qualitatively distinguish between static and kinetic friction, what they depend on and their effects on the motion of objects. ( <i>apply lubrication principles to the reduction of friction, voc</i> )		Physics
3.C.27c	1.12	Identify appropriate standard international units of measurement for force, mass, distance, speed, acceleration, and time, and explain how they are measured.		Physics
3.C.28c	2.4	Describe the relationship among energy, work, and power both conceptually and quantitatively.		Physics
3.C.29c	2.5	Interpret the law of conservation of momentum and provide examples that illustrate it. Calculate the momentum of an object.		Physics
3.C.30c	2.6	Identify appropriate standard international units of measurement for energy, work, power, and momentum.		Physics
3.C.31c	3.2	Differentiate between specific heat and heat capacity.		Physics

3.C.32c	3.3	Explain the relationship among temperature change in a substance for a given amount of heat transferred, the amount (mass) of the substance, and the specific heat of the substance.		Physics
3.C.33c	3.4	Recognize that matter exists in four phases, and explain what happens during a phase change.		Physics
3.C.34c	5.5	Identify appropriate units of measurement for current, voltage, and resistance, and explain how they are measured.		Physics
3.C.35c		Describe electromagnetism coil and explain electromagnetism magnetic fields and forces.		Voc
3.C.36c		State and explain the application of Pascal's law		Voc
3.C.37c		Describe force torque.		Voc
3.C.38c		Describe viscosity.		Voc
3.C.39		Describe the chemical reactions occurring in combustion, convection, and contamination in a given system.		Voc
3.C.40		Explain material reactions that cause expansion and contraction of system parts due to chemical, heat, or atmospheric influences.		Voc
3.C.41		Explain the effect that heat has on the state of matter.		Voc
3.C.42		Describe the material composition of insulation and the physical principles behind the use of insulation for sound and heat control.		Voc
3.C.43		Identify the types of vibrational waves (centrifugal and torque) and the effect they have on parts and components of a vehicle.		Voc
3.C.44		Explain how chemical reactions that occur in a contaminated liquid can cause deterioration.		Voc
3.C.45		Explain how rotational motion is changed to linear motion affecting rotating systems (toe-out, tracking).		Voc
3.C.46		Explain how variances in flow rate in air flow sensors or cooling systems can affect engine performance.		Voc

## **Strand 4: Employability Knowledge and Skills**

### **4.A Develop employability skills to secure and keep employment in chosen field.**

- 4.A.01a Evaluate industries, organizations, and careers based on multiple sources of research and information.
- 4.A.02a Assess interest areas to determine potential career pathways, including career ladders.
- 4.A.03a Develop a career plan with alternatives.
- 4.A.04a Complete job applications and related employment documents (e.g. W-4).
- 4.A.05a Create professional cover letters, resumes, and portfolios in a variety of formats (print and electronic).
- 4.A.06a Apply job search skills to seek, evaluate, apply for, and accept employment.
- 4.A.07a Explain good interviewing skills.
- 4.A.08a Demonstrate employability skills needed to get and keep a job.
- 4.A.09a Assess alternative occupational choices (e.g. working conditions, benefits, and opportunities to change).

#### **Performance Examples:**

1. Research positions open within a variety of companies and compare/contrast their descriptions, duties, and expectations.
2. Prepare responses to standard interview questions.
3. Participate in a mock-interview with industry professionals.

### **4.B Communicate in multiple modes to address needs within the career and technical field.**

- 4.B.01a Apply strategies to enhance effectiveness of all types of communications in the workplace.
- 4.B.02a Apply reading skills and strategies to work-related documents.
- 4.B.03a Locate information from books, journals, magazines, and the Internet.
- 4.B.04a Apply basic writing skills to work-related communication.
- 4.B.05a Write work-related materials.
- 4.B.06a Explain information presented graphically.
- 4.B.07a Use writing/publishing/presentation applications.
- 4.B.08a Apply basic skills for work-related oral communication.
- 4.B.09a Explain proper telephone etiquette and skills.
- 4.B.10a Lead formal and informal group discussions.
- 4.B.11a Demonstrate effective negotiation and conflict management.
- 4.B.12a Apply active listening skills to obtain and clarify information.
- 4.B.13a Communicate with others in a diverse workforce.

#### **Performance Examples:**

1. Review a professional journal; choose one article to summarize.
2. Call the publisher for free products in journal.
3. Develop an oral presentation regarding an article in a journal.
4. Summarize trends presented in a graph.

**4.C Solve problems using critical thinking.**

- 4.C.01a Demonstrate skills used to define and analyze a given problem.
- 4.C.02a Explain the importance and dynamics of individual and teamwork approaches of problem solving.
- 4.C.03a Describe methods of researching and validating reliable information relevant to the problem.
- 4.C.04a Explain strategies used to formulate ideas, proposals and solutions to problems.
- 4.C.05a Select potential solutions based on reasoned criteria.
- 4.C.06a Implement and evaluate solution(s).

**4.A Demonstrate positive work behaviors.**

- 4.A.01a Identify time management and task prioritization skills.
- 4.A.02a Explain the importance of following workplace etiquette/protocol.
- 4.A.03a Demonstrate willingness to learn and further develop skills.
- 4.A.04a Demonstrate self-management skills.
- 4.A.05a List causes of stress and effective stress management techniques.
- 4.A.06a Describe the importance of having a positive attitude and techniques that boost morale.
- 4.A.07a Show initiative by coming up with unique solutions and taking on extra responsibilities.
- 4.A.08a Explain the importance of setting goals and demonstrate the ability to set, reach, and evaluate goals.
- 4.A.09a Explain the importance of taking pride in work accomplished and extrinsic and intrinsic motivators that can be used to increase pride.
- 4.A.10a Value the importance of professionalism, including reliability, honesty, responsibility, and ethics.
- 4.A.11a Demonstrate a respect for diversity and its benefit to the workplace.

## **Strand 5: Management and Entrepreneurship Knowledge and Skills**

### **5.A Analyze basic business practices required to start and run a company/organization.**

- 5.A.01a Define entrepreneurship.
- 5.A.02a Describe the relationship between suppliers, producers, and consumers.
- 5.A.03a Compare and contrast types of businesses, including sole proprietorships, small businesses, companies, corporations, governmental agencies, and non-profit organizations.
- 5.A.04a Describe practices that ensure quality customer service.
- 5.A.05a Explain the value of competition in business/field.

#### **Performance Examples:**

1. Prepare a business plan for a new company in your community.
2. Participate in a discussion with members of a local small-business incubator or chamber of commerce, identifying opportunities and summarizing best practices of new companies.
3. Create an equipment list, with costs, of equipment required for doing specific tasks.
4. Identify local zoning and environmental laws that apply to businesses in your industry.

### **5.B Manage all resources related to a business/organization.**

- 5.B.01a Identify a company's/organization's chain of command and organizational structure.
- 5.B.02a Define and demonstrate leadership and teamwork skills.
- 5.B.03a Explain ways a company or organization can market itself, including choosing a name, designing logos and promotional materials, advertising, and the importance of word-of-mouth.
- 5.B.04a Identify methods to track inventory, productivity, income, expenses, and personnel.
- 5.B.05a Explain the importance of written operating procedures and policies.
- 5.B.06a Identify professional organizations and their benefits.
- 5.B.07a Explain methods to effectively run a meeting.

#### **Performance Examples:**

1. Create a plan to keep track of tools and supplies in your classroom/shop.
2. Work as a team to complete a project, including running and participating in problem-solving meetings.
3. Contact a relevant professional organization and request information about its benefits, membership requirements, and costs.
4. Clip print advertisements from local companies, identifying common themes and contrasting different styles.

### **5.C Describe methods for managing, organizing, retrieving and reporting financial data.**

- 5.C.01a Explain the role of small businesses in the economy.
- 5.C.02a Extract and extrapolate data from financial documents, such as a pay-stub, budget, tax statement, and financial report.

**Performance Examples:**

1. Create and follow a budget for an in-class project.
2. Identify equipment in your shop/lab that are considered as capital.
3. From a pay-stub, determine gross salary, deductions, and net pay for a calendar year.
4. Create a rate card or other list of standardized costs for services provided, based on research of local rates and practices.

**5.D Apply labor and civil rights law and guidelines to business practice and decisions.**

- 5.D.01a List federal and state mandated employee rights.
- 5.D.02a Describe proper working conditions for your industry.
- 5.D.03a Explain the role of labor organizations.
- 5.D.04a Discuss the importance of diversity and list methods of encouraging diversity in the workplace.
- 5.D.05a Describe standard forms of employment contracts applicable to your industry.
- 5.D.06a State the current minimum wage, as well as wages for common jobs found within the field.
- 5.D.07a List opportunities for continual professional development.

**Performance Examples:**

1. Participate in and summarize a discussion with a member of a labor organization.
2. Participate in and summarize a discussion with a member of a civil rights organization.
3. While participating in a group project, write and follow job descriptions for each member of the team.
4. Evaluate a shop/lab in terms of safety, ergonomics, and workflow.

**5.E Evaluate the effects of community relations on companies and the industry.**

- 5.E.01a Describe the role that the industry/organization plays in different communities.
- 5.E.02a Describe the role that community interests play in a company's/organization's decision-making process.

**Performance Example:**

1. Participate in a service project or community-centered event.

**5.F Apply legal requirements and ethical considerations to business practice and decisions.**

- 5.F.01a Identify laws that regulate businesses/organizations in your field.
- 5.F.02a Define the requirements for and protections given by copyright and trademark law.
- 5.F.03a Define the impact of the Americans with Disabilities Act and other civil rights legislation on your business/organization, employees, and customers.
- 5.F.04a Define ethical business practices for your field.

- 5.F.05a Identify trade-specific practices that support clean energy technologies and encourage environmental sustainability.
- 5.F.06c Express a sense of personal obligation to each individual customer and his or her vehicle.
- 5.F.07c Exercise care for the customer's property while in your possession.
- 5.F.08c Repair the vehicle with the highest regard for the environment .
- 5.F.09c Promote and foster goodwill between the repair industry and customers.
- 5.F.10c Recommend corrective and maintenance services, explaining to the customer which of these are required to correct existing problems and which are for preventative maintenance.
- 5.F.11c Create a price estimate for work to be performed.
- 5.F.12c Explain legal standards regarding estimates, as established by the Commonwealth of Massachusetts Attorney General's Office.
- 5.F.13c Create an itemized invoice which clearly identifies any used or remanufactured parts.
- 5.F.14c Explain the importance of using merchandise meeting or exceeding the original manufacturers' standards.
- 5.F.15c Discuss offering warranties covering parts or services.
- 5.F.16c Identify the importance of obtaining prior authorization for all work performed.
- 5.F.17c List ways to notify the customer if appointments or completion promises cannot be kept.
- 5.F.18c Explain and identify ways to follow the Certified Technician's Code of Ethics published by the ASE: Automotive Service Excellence.
- 5.F.19c Explain and identify ways to follow the Auto Sales and Repair Regulations of the Massachusetts Attorney General.

**Performance Examples:**

1. Research the ethical guidelines set forth by a professional organization related to your industry and participate in a debate over how to apply these guidelines to a variety of situations.
2. Create a portfolio of a variety of completed contracts and their uses.
3. Participate in and summarize a discussion with a lawyer, consumer advocate, or other legal professionals.
4. Create a quick reference outline listing legal topics and related resources.

## **Strand 6: Technological Knowledge and Skills**

### **6.A Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity.**

- 6.A.01a Select and utilize the appropriate technology to solve a problem or complete a task.
- 6.A.02a Demonstrate file management skills (e.g., install new software, compress and expand files as needed, download files as appropriate).
- 6.A.03a Differentiate between different operating systems and demonstrate use of at least one to open and switch between programs and files.
- 6.A.04a Identify and demonstrate resolutions to simple hardware and software problems as they occur (e.g., frozen screen, disk error, printing problems).
- 6.A.05a Save, retrieve, load, format, and import data into, and export a variety of electronic documents (word processing, spreadsheet, database, AND desktop publishing).
- 6.A.06a Demonstrate the proper use of a variety of external peripherals and how they connect to a computer.
- 6.A.07a Illustrate methods of selecting and using search engines.
- 6.A.08a Send, receive, and manage electronic correspondence and files, in accordance with school policy.
- 6.A.09a Demonstrate proper use of electronic proofreading tools and explain reasons why these shouldn't be relied upon solely.

#### **Performance Example:**

1. In the development of work-based projects, students demonstrate computer skills inherent in the word processing techniques used, the organization of data, use of photographic representation, research projects, and other relevant project based activities.

### **6.B Demonstrate responsible use of technology and an understanding of ethics and safety issues in using electronic media.**

- 6.B.01a Identify ways in which technology is used in the workplace and in society.
- 6.B.02a Summarize the rights and responsibilities of the school's Acceptable Use Policy.
- 6.B.03a Explain laws restricting use of copyrighted materials on the Internet.
- 6.B.04a Discuss the concerns about electronic communications, privacy and security, including protection from spyware and viruses.

#### **Performance Example:**

1. Describe how computers are used to increase efficiency, accuracy, and professionalism in the industry.

### **6.C Demonstrate ability to use technology for research, problem solving, and communication.**

- 6.C.01a Locate, evaluate, collect, and process information from a variety of electronic sources.

- 6.C.02a Demonstrate the use of telecommunications and other media to interact or collaborate with peers, experts, and other audiences.
- 6.C.03a Demonstrate the use of appropriate electronic sources to conduct research (e.g., Web sites, online periodical databases, and online catalogs).
- 6.C.04a Demonstrate proper style (with correct citations) when integrating electronic research results into a research project.
- 6.C.05a Collect, organize, analyze, and graphically present data using the most appropriate tools.
- 6.C.06a Present information, ideas, and results of work using any of a variety of communications technologies (e.g., multimedia presentations, Web pages, videotapes, desktop-published documents).
- 6.C.07a Identify capabilities of technology resources and describe how they can be used for lifelong learning.
- 6.C.08a Demonstrate the proper use of electronic tools and office communications equipment (telephone, fax, copier, etc).

**Performance Example:**

1. Student is able to effectively use various technologies in the workplace.