
Automotive Technology Curriculum Standards and Policy Change

The Background:

Curriculum frameworks are mandated by Rules, Regulations, and Minimum Standards of the State Board of Education (Section 0520-01-03-.05, State Curriculum, Requirement D).

National Automotive Technicians Education Foundation (NATEF) is the certifying agency for Tennessee automotive programs at the secondary and postsecondary levels. The courses submitted with this item, entitled Maintenance and Light Repair I, II, III, and IV, align to a shift in the industry standards to a focus at this level on general, light maintenance repair from a focus on specialized automotive technology repair. The alignment with the national certifying agency will permit continued dual credit and dual enrollment at the post secondary level, as well as earlier preparation for industry certification exams.

The Maintenance and Light Repair courses prepare students for entry into maintenance and light repair in the automotive industry. Students explore career opportunities and requirements of a professional service technician. Content emphasizes beginning transportation service skills and workplace success skills. Students study safety, tools, equipment, shop operations, basic engine fundamentals, and basic technician skills. Upon completing the Maintenance and Light Repair courses, students may enter the automotive service industry as an Automotive Service Excellence (ASE) Certified Maintenance and Light Repair Technician.

NATEF has called the new standards “one of the most significant changes to the program in the organization’s history. The update to the NATEF standards used to accredit automotive training programs at the secondary and postsecondary school level reflects the changing needs of the automotive industry for entry-level technicians.”

“The new NATEF model establishes three levels of accreditation: Maintenance and Light Repair (MLR); Auto Service Technology (AST), and Master Auto Service Technology (MAST). The differences at each level are reflected in the number of tasks, number of instructional hours and the instructor qualifications. Each level builds on the previous one and covers all major automotive systems, but to different depths of learning.”

Following approval of this course, the course title will be added to State Board of Education Policy 3.205, the list of Approved High School Courses, in the Transportation section of Trade and Industrial Education.

Changes since first reading include:

- Cosmetic formatting changes to reflect new course description document format. This new format includes additional information about the course to assist school leadership in implementing the course, including pre-requisites, as requested by the Board on first reading. This format has been reviewed by division and department leadership.
- Learning expectations and performance indicators have been combined with duplicate performance indicators (competencies) removed.

The Recommendation:

The Department of Education recommends adoption of the standards on final reading. The SBE staff concurs with this recommendation.



TENNESSEE DEPARTMENT OF

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Maintenance and Light Repair I

Primary Career Cluster:	Transportation, Distribution, & Logistics
Consultant:	Sue Tucker, (615) 532-2835, Sue.Tucker@tn.gov
Course Code(s):	TBA
Prerequisite(s):	None
Credit:	One
Grade Level:	9 th – 10 th
Graduation Requirement Substitution:	None
Programs of Study and Sequence:	This is the first course in the <i>Automotive Technology</i> program of study.
Necessary Equipment:	Visit www.natef.org for equipment list.
Aligned Student Organization(s):	SkillsUSA www.tnskillsusa.org
Coordinating Work-Based Learning:	NATEF certified program and AYES internship
Available Student Industry Certifications:	ASE Student Certification http://www.asestudentcertification.com/
Dual Credit or Dual Enrollment Opportunities:	LEAs should work with their local Tennessee Technology Center for potential dual credit or dual enrollment opportunities.
Teacher Endorsement(s):	506, 508
Additional Required Teacher Certifications/Training:	ASE A-4, A-5, A-6, A-8 Industry Certifications
Teacher Resources:	http://www.state.tn.us/education/cte/index.shtml

Course Description

The Maintenance and Light Repair I (MLR I) course prepares students for entry into Maintenance and Light Repair II. Students explore career opportunities and requirements of a professional service technician. Content emphasizes beginning transportation service skills and workplace success skills. Students study safety, tools, equipment, shop operations, basic engine fundamentals, and basic technician skills. Upon completing all of the Maintenance and Light Repair courses, students may enter automotive service industry as an ASE Certified MLR Technician.

Hours earned in the Maintenance and Light Report courses may be used toward meeting National Automotive Technicians Education Foundation (NATEF) standards and Tennessee Department of Education standards. NATEF requires that 95% of the P-1 tasks, 80% of the P-2 tasks, and 50% of the P-3 tasks will be accomplished. These tasks are notated in these standards.

Program of Study (POS) Application

MLR I is the first course in the *Automotive Technology* program of study and serves as a foundation of safety skills and knowledge on becoming a professional service technician. Transportation Core, at the discretion of a local system or in the case where more than one POS in Transportation, Distribution and Logistics Cluster are being taught, may be substituted for MLR I.

Course Standards

Standard 1.0

Students will perform safety examinations and maintain safety records.

Learning Expectations and Performance Indicators:

- 1.1 Use and inspect personal protective equipment and demonstrate appropriate related safety procedures.
- 1.2 Inspect, maintain, and employ safe operating procedures with tools and equipment, such as hand and power tools, ladders, scaffolding, and lifting equipment.
- 1.3 Demonstrate continuous awareness of potential hazards to self and others and respond appropriately.
- 1.4 Assume responsibilities under HazCom (Hazard Communication) regulations.
- 1.5 Adhere to responsibilities, regulations, and Occupational Safety & Health Administration (OSHA) policies to protect coworkers and bystanders from hazards; report accidents and observed hazards; and comply with emergency response procedures.
- 1.6 Pass with 100% accuracy a written examination relating to safety issues relating specifically to Maintenance and Light Repair.
- 1.7 Pass with 100% accuracy a performance examination relating to safety issues relating specifically to Maintenance and Light Repair.
- 1.8 Maintain a portfolio record of written safety examinations and equipment examination for which the student has passed an operational checkout by the instructor.

Standard 2.0

Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

Learning Expectations and Performance Indicators:

- 2.1 Cultivate positive leadership skills. Take part in opportunities to practice and demonstrate personal leadership skills. For example, taking advantage of opportunities provided by a career and technical student organization (CTSO), such as SkillsUSA.
- 2.2 Assess situations, apply problem-solving techniques and decision-making skills within the school, community, and workplace.
- 2.3 Participate as a team member in a learning environment.
- 2.4 Respect the opinions, customs, and individual differences of others.
- 2.5 Build personal career development by identifying career interests, strengths, and opportunities.



Standard 3.0

Students will demonstrate shop and personal safety.

Learning Expectations and Performance Indicators:

- 3.1 Identify and demonstrate knowledge of how to utilize marked safety areas and equipment, such as location and use of eye wash stations; types of fire extinguishers and other fire safety equipment; posted evacuation routes; and proper ventilation procedures for working within the lab/shop area.
- 3.2 Comply with the required use of safety glasses, ear protection, gloves, appropriate clothing, and shoes during lab/shop activities; demonstrate knowledge of procedures for securing hair and jewelry for lab/shop activities.
- 3.3 Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits.
- 3.4 Locate and demonstrate knowledge of material safety data sheets (MSDS).

Standard 4.0

Students will identify and properly use, maintain, and store automotive service hand tools, power tools, and shop equipment.

Learning Expectations and Performance Indicators:

- 4.1 Identify tools and their usage in automotive applications.
- 4.2 Identify standard and metric designation.
- 4.3 Demonstrate safe handling and use of appropriate tools.
- 4.4 Demonstrate proper cleaning, storage, and maintenance of tools and equipment.
- 4.5 Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dial-caliper).

Standard 5.0

Students will prepare a vehicle for service.

Learning Expectations and Performance Indicators:

- 5.1 Identify information needed and the service requested on a repair order.
- 5.2 Identify purpose and demonstrate proper use of fender covers, mats.
- 5.3 Demonstrate use of the three C's: concern, cause, and correction.
- 5.4 Review vehicle service history.
- 5.5 Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.

Standard 6.0

Students will perform basic vehicle engine service and maintenance.

Learning Expectations and Performance Indicators:

- 6.1 Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. (P-1)
- 6.2 Verify operation of the instrument panel engine warning indicators. (P-1)
- 6.3 Inspect engine assembly for fuel, oil, coolant, and other leaks; and determine necessary action. (P-1)
- 6.4 Install engine covers using gaskets, seals, and sealers as required. (P-1)



- 6.5 Remove and replace timing belt; verify correct camshaft timing. (P-1)
- 6.6 Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert. (P-1)
- 6.7 Identify hybrid vehicle internal combustion engine service precautions. (P-3)
- 6.8 Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, and heater core; determine necessary action. (P-1)
- 6.9 Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. (P-1)
- 6.10 Remove, inspect, and replace thermostat and gasket/seal. (P-1)
- 6.11 Inspect and test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required. (P-1)
- 6.12 Perform engine oil and filter change. (P-1)

Standard 6.0

Students will properly inspect and service tires and wheels.

Learning Expectations and Performance Indicators:

- 7.1 Inspect tire condition; identify tire wear patterns; check for correct size and application (load and speed ratings) and adjust air pressure; determine necessary action.
- 7.2 Rotate tires according to manufacturer's recommendations.
- 7.3 Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly (static and dynamic).
- 7.4 Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor.
- 7.5 Inspect tire and wheel assembly for air loss; perform necessary action.
- 7.6 Repair tire using internal patch.
- 7.7 Identify and test tire pressure monitoring systems (indirect and direct) for operation; verify operation of instrument panel lamps.
- 7.8 Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system.

Teacher Resources

The following resources are available to assist teachers of this course.

- *Development Guidance: Classroom Activities*, Center on Education and Work, Madison, WI
- *A0 Fundamentals of Transportation Service Technology Course*, AYES Curriculum: A Tenth Grade Course, AYES Corporation, www.ayes.org
- *Introduction to Transportation Service Technology*, Service Series, Curriculum and Instructional Material Center (CIMC), Oklahoma Department of Vocational and Technical Education
- *Module 1 Introduction to Transportation Technology*, Instructional Materials Laboratory (IML), University of Missouri
- *Today's Technician Basic Transportation Service & Systems*, Webster & Owens, Delmar/ITP
- 2008 Automobile Task List, National Automotive Technicians Education Foundation (NATEF), www.natef.org
- General Motors Diagnostic Plan
- Ford Motor Company Diagnostic Plan
- Harley Davidson Institute





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Maintenance and Light Repair II

Primary Career Cluster:	Transportation, Distribution, & Logistics
Consultant:	Sue Tucker, (615) 532-2835, Sue.Tucker@tn.gov
Course Code(s):	TBA
Prerequisite(s):	Maintenance and Light Repair I (MLR I)
Credit:	One
Grade Level:	10 th
Graduation Requirement Substitution:	None
Programs of Study and Sequence:	This is the second course in the <i>Automotive Technology</i> program of study.
Necessary Equipment:	Visit www.natef.org for equipment list.
Aligned Student Organization(s):	SkillsUSA www.tnskillsusa.org
Coordinating Work-Based Learning:	NATEF certified program and AYES internship
Available Student Industry Certifications:	ASE Student Certification http://www.asestudentcertification.com/
Dual Credit or Dual Enrollment Opportunities:	LEAs should work with their local Tennessee Technology Center for potential dual credit or dual enrollment opportunities.
Teacher Endorsement(s):	506, 508
Additional Required Teacher Certifications/Training:	ASE A-4, A-5, A-6, A-8 Industry Certifications
Teacher Resources:	http://www.state.tn.us/education/cte/index.shtml

Course Description

The Maintenance and Light Repair II (MLR II) course prepares students for entry into Maintenance and Light Repair III. Students study automotive general electrical systems, starting and charging systems, batteries, lighting, and electrical accessories. Upon completing all of the Maintenance and Light Repair courses, students may enter automotive service industry as an ASE Certified MLR Technician.

Hours earned in the Maintenance and Light Report courses may be used toward meeting National Automotive Technicians Education Foundation (NATEF) standards and Tennessee Department of Education standards. NATEF requires that 95% of the P-1 tasks, 80% of the P-2 tasks, and 50% of the P-3 tasks will be accomplished. These tasks are notated in these standards.

Program of Study Application

MLR II is the second course in the *Automotive Technology* program of study and covers important skills and knowledge on becoming a professional service technician.

Course Standards

Standard 1.0

Students will perform safety examinations and maintain safety records.

Learning Expectations and Performance Indicators:

- 1.1 Use and inspect personal protective equipment. Demonstrate appropriate related safety procedures.
- 1.2 Inspect, maintain, and employ safe operating procedures with tools and equipment, such as hand and power tools, ladders, scaffolding, and lifting equipment.
- 1.3 Demonstrate continuous awareness of potential hazards to self and others and respond appropriately.
- 1.4 Assume responsibilities under HazCom (Hazard Communication) regulations.
- 1.5 Adhere to responsibilities, regulations, and Occupational Safety & Health Administration (OSHA) policies to protect coworkers and bystanders from hazards; reporting of accidents and observed hazards; and regarding emergency response procedures.
- 1.6 Pass with 100% accuracy a written examination relating to safety issues relating specifically to Maintenance and Light Repair.
- 1.7 Pass with 100% accuracy a performance examination relating to safety issues relating specifically to Maintenance and Light Repair.
- 1.8 Maintain a portfolio record of written safety examinations and equipment examinations for which the student has passed an operational checkout by the instructor.

Standard 2.0

Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

Learning Expectations and Performance Indicators:

- 2.1 Cultivate positive leadership skills. Take part in opportunities to practice and demonstrate personal leadership skills. For example, taking advantage of opportunities provided by a career and technical student organization (CTSO), such as SkillsUSA.
- 2.2 Assess situations, apply problem-solving techniques and decision-making skills within the school, community, and workplace.
- 2.3 Participate as a team member in a learning environment.
- 2.4 Respect the opinions, customs, and individual differences of others.
- 2.5 Build personal career development by identifying career interests, strengths, and opportunities.



Standard 3.0

Students will properly test, diagnose, repair, and service general automotive electrical systems.

Learning Expectations and Performance Indicators:

- 3.1 Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. (P-1)
- 3.2 Demonstrate knowledge of electrical/electronic series, parallel, and series parallel circuits using principles of electricity (Ohm's Law). (P-1)
- 3.3 Use wiring diagrams to trace electrical/electronic circuits. (P-1)
- 3.4 Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow, and resistance. (P-1)
- 3.5 Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits. (P-2)
- 3.6 Check operation of electrical circuits with a test light. (P-2)
- 3.7 Check operation of electrical circuits with fused jumper wires. (P-2)
- 3.8 Measure key-off battery drain (parasitic draw). (P-1)
- 3.9 Inspect and test fusible links, circuit breakers, and fuses; determine necessary action. (P-1)
- 3.10 Perform solder repair of electrical wiring. (P-1)
- 3.11 Replace electrical connectors and terminal ends. (P-1)

Standard 4.0

Students will service inspect, test, and service vehicle batteries.

Learning Expectations and Performance Indicators:

- 4.1 Perform battery state-of-charge test; determine necessary action. (P-1)
- 4.2 Confirm proper battery capacity for vehicle application; perform battery capacity test; determine necessary action. (P-1)
- 4.3 Maintain or restore electronic memory functions. (P-1)
- 4.4 Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps, and hold-downs. (P-1)
- 4.5 Perform slow/fast battery charge according to manufacturer's recommendations. (P-1)
- 4.6 Jump-start vehicle using jumper cables and a booster battery or auxiliary power supply. (P-1)
- 4.7 Identify high-voltage circuits of electric or hybrid electric vehicle and related safety precautions. (P-3)
- 4.8 Identify electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery. (P-1)
- 4.9 Identify hybrid vehicle auxiliary (12v) battery service, repair, and test procedures. (P-3)

Standard 5.0

Students will inspect, test, service, and repair vehicle starting and charging systems.

Learning Expectations and Performance Indicators:

- 5.1 Perform starter current draw test; determine necessary action. (P-1)
- 5.2 Perform starter circuit voltage drop tests; determine necessary action. (P-1)
- 5.3 Inspect and test starter relays and solenoids; determine necessary action. (P-2)
- 5.4 Remove and install starter in a vehicle. (P-1)
- 5.5 Inspect and test switches, connectors, and wires of starter control circuits; determine necessary action. (P-2)



- 5.6 Perform charging system output test; determine necessary action. (P-1)
- 5.7 Inspect, adjust, or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment. (P-1)
- 5.8 Remove, inspect, and re-install generator (alternator). (P-2)
- 5.9 Perform charging circuit voltage drop tests; determine necessary action. (P-1)
- 5.10 Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed. (P-1)
- 5.11 Aim headlights. (P-2)
- 5.12 Identify system voltage and safety precautions associated with high-intensity discharge headlights. (P-2)

Standard 6.0

Students will inspect, test, service, and repair vehicle lighting and accessory systems.

Learning Expectations and Performance Indicators:

- 6.1 Disable and enable airbag system for vehicle service; verify indicator lamp operation. (P-1)
- 6.2 Remove and reinstall door panel. (P-1)
- 6.3 Describe the operation of keyless entry/remote-start systems. (P-3)
- 6.4 Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators. (P-1)
- 6.5 Verify windshield wiper and washer operation; replace wiper blades. (P-1)

Teacher Resources

The following resources are available to assist teachers of this course.

- *Development Guidance: Classroom Activities*, Center on Education and Work, Madison, Wisconsin
- *A0 Fundamentals of Transportation Service Technology Course*, AYES Curriculum: A Tenth Grade Course, AYES Corporation, www.ayes.org
- *Introduction to Transportation Service Technology*, Service Series, Curriculum and Instructional Material Center (CIMC), Oklahoma Department of Vocational and Technical Education
- *Module 1 Introduction to Transportation Technology*, Instructional Materials Laboratory (IML), University of Missouri
- *Today's Technician Basic Transportation Service & Systems*, Webster & Owens, Delmar/ITP
- 2008 Automobile Task List, National Automotive Technicians Education Foundation (NATEF), www.natef.org
- General Motors Diagnostic Plan
- Ford Motor Company Diagnostic Plan
- Harley Davidson Institute





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Maintenance and Light Repair III

Primary Career Cluster:	Transportation, Distribution, & Logistics
Consultant:	Sue Tucker, (615) 532-2835, Sue.Tucker@tn.gov
Course Code(s):	TBA
Prerequisite(s):	Maintenance and Light Repair II (MLR II)
Credit:	Two
Grade Level:	11 th
Graduation Requirement Substitution:	None
Programs of Study and Sequence:	This is the third course in the <i>Automotive Technology</i> program of study.
Necessary Equipment:	Visit www.natef.org for equipment list.
Aligned Student Organization(s):	SkillsUSA www.tnskillsusa.org
Coordinating Work-Based Learning:	NATEF certified program and AYES internship
Available Student Industry Certifications:	ASE Student Certification http://www.asestudentcertification.com/
Dual Credit or Dual Enrollment Opportunities:	LEAs should work with their local Tennessee Technology Center for potential dual credit or dual enrollment opportunities.
Teacher Endorsement(s):	506, 508
Additional Required Teacher Certifications/Training:	ASE A-4, A-5, A-6, A-8 Industry Certifications
Teacher Resources:	http://www.state.tn.us/education/cte/index.shtml

Course Description

The Maintenance and Light Repair III (MLR III) course prepares students for entry into Maintenance and Light Repair IV. Students study and service suspension and steering systems and brake systems. Upon completing all of the Maintenance and Light Repair courses, students may enter automotive service industry as an ASE Certified MLR Technician.

Hours earned in the Maintenance and Light Report courses may be used toward meeting National Automotive Technicians Education Foundation (NATEF) standards and Tennessee Department of Education standards. NATEF requires that 95% of the P-1 tasks, 80% of the P-2 tasks, and 50% of the P-3 tasks will be accomplished. These tasks are notated in these standards.

Program of Study Application

MLR III is the third course in the *Automotive Technology* program of study and covers important skills and knowledge on becoming a professional service technician.

Course Standards

Standard 1.0

Students will perform safety examinations and maintain safety records.

Learning Expectations and Performance Indicators:

- 1.1 Use and inspect personal protective equipment. Demonstrate appropriate related safety procedures.
- 1.2 Inspect, maintain, and employ safe operating procedures with tools and equipment, such as hand and power tools, ladders, scaffolding, and lifting equipment.
- 1.3 Demonstrate continuous awareness of potential hazards to self and others and respond appropriately.
- 1.4 Assume responsibilities under HazCom (Hazard Communication) regulations.
- 1.5 Adhere to responsibilities, regulations, and Occupational Safety & Health Administration (OSHA) policies to protect coworkers and bystanders from hazards; reporting of accidents and observed hazards; and regarding emergency response procedures.
- 1.6 Pass with 100% accuracy a written examination relating to safety issues relating specifically to Maintenance and Light Repair.
- 1.7 Pass with 100% accuracy a performance examination relating to safety issues relating specifically to Maintenance and Light Repair.
- 1.8 Maintain a portfolio record of written safety examinations and equipment examinations for which the student has passed an operational checkout by the instructor.

Standard 2.0

Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

Learning Expectations and Performance Indicators:

- 2.1 Cultivate positive leadership skills. Take part in opportunities to practice and demonstrate personal leadership skills. For example, taking advantage of opportunities provided by a career and technical student organization (CTSO), such as SkillsUSA.
- 2.2 Assess situations, apply problem-solving techniques and decision-making skills within the school, community, and workplace.
- 2.3 Participate as a team member in a learning environment.
- 2.4 Respect the opinions, customs, and individual differences of others.
- 2.5 Build personal career development by identifying career interests, strengths, and opportunities.



Standard 3.0

Students will inspect, service, and repair suspension and steering systems.

Learning Expectations and Performance Indicators:

- 3.1 Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. (P-1)
- 3.2 Disable and enable supplemental restraint system (SRS). (P-1)
- 3.3 Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellow boots. (P-1)
- 3.4 Determine proper power steering fluid type; inspect fluid level and condition. (P-1)
- 3.5 Flush, fill, and bleed power steering system. (P-2)
- 3.6 Inspect for power steering fluid leakage; determine necessary action. (P-1)
- 3.7 Remove, inspect, replace, and adjust power steering pump drive belt. (P-1)
- 3.8 Inspect and replace power steering hoses and fittings. (P-2)
- 3.9 Replace power steering pump filter(s). (P-2)
- 3.10 Inspect pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper. (P-1)
- 3.11 Inspect tie rod ends (sockets), tie rod sleeves, and clamps. (P-1)
- 3.12 Inspect upper and lower control arms, bushings, and shafts. (P-1)
- 3.13 Inspect and replace rebound and jounce bumpers. (P-1)
- 3.14 Inspect track bar, strut rods/radius arms, and related mounts and bushings. (P-1)
- 3.15 Inspect upper and lower ball joints (with or without wear indicators). (P-1)
- 3.16 Inspect suspension system coil springs and spring insulators (silencers). (P-1)
- 3.17 Inspect suspension system torsion bars and mounts. (P-1)
- 3.18 Inspect and replace front stabilizer bar (sway bar) bushings, brackets, and links. (P-1)
- 3.19 Inspect strut cartridge or assembly. (P-1)
- 3.20 Inspect front strut bearing and mount. (P-1)
- 3.21 Inspect rear suspension system lateral links/arms (track bars), control (trailing) arms. (P-1)
- 3.22 Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts. (P-1)
- 3.23 Inspect, remove, and replace shock absorbers; inspect mounts and bushings. (P-1)
- 3.24 Inspect electric power-assisted steering. (P-3)
- 3.25 Identify hybrid vehicle power steering system electrical circuits and safety precautions. (P-2)
- 3.26 Describe the function of the power steering pressure switch. (P-3)
- 3.27 Perform pre-alignment inspection and measure vehicle ride height; determine necessary action. (P-1)

Standard 4.0

Students will inspect, service, and repair vehicle brake systems.

Learning Expectations and Performance Indicators:

- 4.1 Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. (P-1)
- 4.2 Describe procedure for performing a road test to check brake system operation, including an anti-lock brake system (ABS). (P-1)
- 4.3 Measure brake pedal height, travel, and free play (as applicable); determine necessary action. (P-1)
- 4.4 Check master cylinder for external leaks and proper operation. (P-1)



- 4.5 Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, loose fittings and supports; determine necessary action. (P-1)
- 4.6 Select, handle, store, and fill brake fluids to proper level. (P-1)
- 4.7 Identify components of brake warning light system. (P-3)
- 4.8 Bleed and/or flush brake system. (P-1)
- 4.9 Test brake fluid for contamination. (P-1)
- 4.10 Remove, clean, inspect, and measure brake drum diameter; determine necessary action. (P-1)
- 4.11 Refinish brake drum and measure final drum diameter; compare with specifications. (P-1)
- 4.12 Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble. (P-1)
- 4.13 Inspect wheel cylinders for leaks and proper operation; remove and replace as need (P-2)
- 4.14 Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; make final checks and adjustments. (P-2)
- 4.15 Install wheel and torque lug nuts. (P-1)
- 4.16 Remove and clean caliper assembly; inspect for leaks and damage/wear to caliper housing; determine necessary action. (P-1)
- 4.17 Clean and inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine necessary action. (P-1)
- 4.18 Remove, inspect, and replace pads and retaining hardware; determine necessary action. (P-1)
- 4.19 Lubricate and reinstall caliper, pads, and related hardware; seat pads and inspect for leaks. (P-1)
- 4.20 Clean and inspect rotor, measure rotor thickness, thickness variation, and lateral runout; determine necessary action. (P-1)
- 4.21 Remove and reinstall rotor. (P-1)
- 4.22 Refinish rotor on vehicle; measure final rotor thickness and compare with specification (P-1)
- 4.23 Refinish rotor off vehicle; measure final rotor thickness and compare with specifications. (P-1)
- 4.24 Retract and re-adjust caliper piston on an integral parking brake system. (P-3)
- 4.25 Check brake pad wear indicator; determine necessary action. (P-2)
- 4.26 Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations. (P-1)

Standard 5.0

Students will inspect, service, and repair related vehicle brake systems.

Learning Expectations and Performance Indicators:

- 5.1 Check brake pedal travel with, and without, engine running to verify proper power boost operation. (P-2)
- 5.2 Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster. (P-1)
- 5.3 Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings. (P-1)
- 5.4 Check parking brake cables and components for wear, binding, and corrosion; clean lubricate, adjust or replace as needed. (P-2)
- 5.5 Check parking brake operation and parking brake indicator light system operation; determine necessary action. (P-1)
- 5.6 Check operation of brake stop light system. (P-1)
- 5.7 Replace wheel bearing and race. (P-2)
- 5.8 Identify traction control/vehicle stability control system components. (P-3)
- 5.9 Describe the operation of a regenerative braking system. (P-3)



Teacher Resources

The following resources are available to assist teachers of this course.

- *Development Guidance: Classroom Activities*, Center on Education and Work, Madison, Wisconsin
- *A0 Fundamentals of Transportation Service Technology Course*, AYES Curriculum: A Tenth Grade Course, AYES Corporation, www.ayes.org
- *Introduction to Transportation Service Technology*, Service Series, Curriculum and Instructional Material Center (CIMC), Oklahoma Department of Vocational and Technical Education
- *Module 1 Introduction to Transportation Technology*, Instructional Materials Laboratory (IML), University of Missouri
- *Today's Technician Basic Transportation Service & Systems*, Webster & Owens, Delmar/ITP
- 2008 Automobile Task List, National Automotive Technicians Education Foundation (NATEF), www.natef.org
- General Motors Diagnostic Plan
- Ford Motor Company Diagnostic Plan
- Harley Davidson Institute





TENNESSEE DEPARTMENT OF

EDUCATION

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Maintenance and Light Repair IV

Primary Career Cluster:	Transportation, Distribution, & Logistics
Consultant:	Sue Tucker, (615) 532-2835, Sue.Tucker@tn.gov
Course Code(s):	TBA
Prerequisite(s):	Maintenance and Light Repair III (MLR III)
Credit:	Two
Grade Level:	12 th
Graduation Requirement Substitution:	None
Programs of Study and Sequence:	This is the fourth course in the <i>Automotive Technology</i> program of study.
Necessary Equipment:	Visit www.natef.org for equipment list.
Aligned Student Organization(s):	SkillsUSA www.tnskillsusa.org
Coordinating Work-Based Learning:	NATEF certified program and AYES internship
Available Student Industry Certifications:	ASE Student Certification http://www.asestudentcertification.com/
Dual Credit or Dual Enrollment Opportunities:	LEAs should work with their local Tennessee Technology Center for potential dual credit or dual enrollment opportunities.
Teacher Endorsement(s):	506, 508
Additional Required Teacher Certifications/Training:	ASE A-4, A-5, A-6, A-8 Industry Certifications
Teacher Resources:	http://www.state.tn.us/education/cte/index.shtml

Course Description

The Maintenance and Light Repair IV (MLR IV) course prepares students for entry into the automotive workforce or into post secondary training. Students study and service automotive HVAC systems, engine performance systems, automatic and manual transmission/transaxle systems, and practice workplace soft skills. Upon completing all of the Maintenance and Light Repair courses, students may enter automotive service industry as an ASE Certified MLR Technician.

Hours earned in the Maintenance and Light Report courses may be used toward meeting National Automotive Technicians Education Foundation (NATEF) standards and Tennessee Department of Education standards. NATEF requires that 95% of the P-1 tasks, 80% of the P-2 tasks, and 50% of the P-3 tasks will be accomplished. These tasks are notated in these standards.

Program of Study Application

MLR IV is the fourth, and final, course in the *Automotive Technology* program of study and covers important skills and knowledge on becoming a professional service technician.

Course Standards

Standard 1.0

Students will perform safety examinations and maintain safety records.

Learning Expectations and Performance Indicators:

- 1.1 Use and inspect personal protective equipment. Demonstrate appropriate related safety procedures.
- 1.2 Inspect, maintain, and employ safe operating procedures with tools and equipment, such as hand and power tools, ladders, scaffolding, and lifting equipment.
- 1.3 Demonstrate continuous awareness of potential hazards to self and others and respond appropriately.
- 1.4 Assume responsibilities under HazCom (Hazard Communication) regulations.
- 1.5 Adhere to responsibilities, regulations, and Occupational Safety & Health Administration (OSHA) policies to protect coworkers and bystanders from hazards; reporting of accidents and observed hazards; and regarding emergency response procedures.
- 1.6 Pass with 100% accuracy a written examination relating to safety issues relating specifically to Maintenance and Light Repair.
- 1.7 Pass with 100% accuracy a performance examination relating to safety issues relating specifically to Maintenance and Light Repair.
- 1.8 Maintain a portfolio record of written safety examinations and equipment examinations for which the student has passed an operational checkout by the instructor.

Standard 2.0

Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

Learning Expectations and Performance Indicators:

- 2.1 Cultivate positive leadership skills. Take part in opportunities to practice and demonstrate personal leadership skills. For example, taking advantage of opportunities provided by a career and technical student organization (CTSO), such as SkillsUSA.
- 2.2 Assess situations, apply problem-solving techniques and decision-making skills within the school, community, and workplace.
- 2.3 Participate as a team member in a learning environment.
- 2.4 Respect the opinions, customs, and individual differences of others.
- 2.5 Build personal career development by identifying career interests, strengths, and opportunities.



Standard 3.0

Students will inspect, test, service and repair heating and a/c systems.

Learning Expectations and Performance Indicators:

- 3.1 Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. (P-1)
- 3.2 Identify vehicle's A/C components. (P-1)
- 3.3 Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action. (P-1)
- 3.4 Identify hybrid vehicle A/C system electrical circuits and the service/safety precautions. (P-2)
- 3.5 Inspect A/C condenser for airflow restrictions; determine necessary action. (P-1)
- 3.6 Inspect engine cooling and heater systems hoses; perform necessary action. (P-1)
- 3.7 Inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets; perform necessary action. (P-1)
- 3.8 Identify the source of A/C system odors. (P-2)

Standard 4.0

Students will inspect, test, service, and repair engine performance systems.

Learning Expectations and Performance Indicators:

- 4.1 Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. (P-1)
- 4.2 Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action. (P-1)
- 4.3 Perform cylinder power balance test; determine necessary action. (P-2)
- 4.4 Perform cylinder cranking and running compression tests; determine necessary action. (P-1)
- 4.5 Perform cylinder leakage test; determine necessary action. (P-1)
- 4.6 Verify engine operating temperature. (P-1)
- 4.7 Remove and replace spark plugs; inspect secondary ignition components for wear and damage. (P-1)
- 4.8 Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable. (P-1)
- 4.9 Describe the importance of operating all OBDII monitors for repair verification. (P-1)
- 4.10 Replace fuel filter(s). (P-1)
- 4.11 Inspect, service, or replace air filters, filter housings, and intake duct work. (P-1)
- 4.12 Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; determine necessary action. (P-1)
- 4.13 Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; repair or replace as needed. (P-1)
- 4.14 Check and refill diesel exhaust fluid (DEF). (P-3)
- 4.15 Inspect, test, and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action. (P-2)



Standard 5.0

Students will properly inspect and service automatic transmissions and transaxles.

Learning Expectations and Performance Indicators:

- 5.1 Research applicable vehicle and service information, fluid type, vehicle service history, service precautions, and technical service bulletins. (P-1)
- 5.2 Check fluid level in a transmission or a transaxle equipped with a dip-stick. (P-1)
- 5.3 Check fluid level in a transmission or a transaxle not equipped with a dip-stick. (P-1)
- 5.4 Check transmission fluid condition; check for leaks. (P-2)
- 5.5 Inspect, adjust, and replace external manual valve shift linkage, transmission range sensor/switch, and park/neutral position switch. (P-2)
- 5.6 Inspect for leakage at external seals, gaskets, and bushings. (P-2)
- 5.7 Inspect power train mounts. (P-2)
- 5.8 Drain and replace fluid and filter(s). (P-1)
- 5.9 Describe the operational characteristics of a continuously variable transmission (CVT). (P-3)
- 5.10 Describe the operational characteristics of a hybrid vehicle drive train. (P-3)

Standard 6.0

Students will properly inspect and service manual transmissions and transaxles.

Learning Expectations and Performance Indicators:

- 6.1 Research applicable vehicle and service information, fluid type, vehicle service history, service precautions, and technical service bulletins. (P-1)
- 6.2 Drain and refill manual transmission/transaxle and final drive unit. (P-1)
- 6.3 Check fluid condition; check for leaks. (P-2)
- 6.4 Check and adjust clutch master cylinder fluid level. (P-1)
- 6.5 Check for system leaks. (P-1)
- 6.6 Describe the operational characteristics of an electronically-controlled manual transmission/transaxle. (P-1)
- 6.7 Inspect, remove, and replace front wheel drive (FWD) bearings, hubs, and seals. (P-2)
- 6.8 Inspect, service, and replace shafts, yokes, boots, and universal/CV joints. (P-2)
- 6.9 Clean and inspect differential housing; check for leaks; inspect housing vent. (P-2)
- 6.10 Check and adjust differential housing fluid level. (P-1)
- 6.11 Drain and refill differential housing. (P-1)
- 6.12 Inspect and replace drive axle wheel studs. (P-2)
- 6.13 Inspect front-wheel bearings and locking hubs. (P-3)
- 6.14 Check for leaks at drive assembly seals; check vents; check lube level. (P-2)

Standard 7.0

Students will properly demonstrate workplace etiquette, communication skills, writing skills, and professional appearance.

Learning Expectations and Performance Indicators:

- 7.1 Identify and exhibit appropriate oral and written communications on a personal and professional level.
- 7.2 Identify the need for leadership and describe leadership qualities, such as honesty and integrity, fairness, responsible behavior, ethical work habits, passion for goals, positive attitude, enthusiasm, and empathy.



- 7.3 Perform mock interviews; prepare resume, job applications, cover letters, and portfolios.
- 7.4 Identify legal issues of employment, including sexual harassment, discrimination, violence, and unemployment.
- 7.5 Analyze ways of handling stress in the workplace.

Teacher Resources

The following resources are available to assist teachers of this course.

- *Development Guidance: Classroom Activities*, Center on Education and Work, Madison, Wisconsin
- 2012 Automobile Task List, National Automotive Technicians Education Foundation (NATEF), www.natef.org
- Introduction to Transportation Service Technology, Service Series, Curriculum and Instructional Material Center (CIMC), Oklahoma Department of Vocational and Technical Education
- Module 1 Introduction to Transportation Technology, Instructional Materials Laboratory (IML), University of Missouri

