

Transportation, Distribution and Logistics Career Cluster
Advanced Automotive Technology Pathway
Advanced Automotive Technologies 4
Course Number 47.44400

Course Description: This course is designed as the first course for the Advanced Automotive Technology Pathway. Students in this course will learn the basic skills needed to gain employment as an entry level automotive technician. Students will be exposed to courses in automotive preventative maintenance, brakes, steering and suspension, electrical systems, engine repair, engine performance, automatic transmission, manual transmission and differential & automotive HVAC. The hours completed in this course are aligned with ASE standards and are a base for the entry-level technician. The prerequisite for this course is advisor approval and successful completion of Automotive Technology 3.

All the tasks are assigned a priority number: P-1, P-2, or P-3 (refer to ASE Education Foundation task list <https://www.aseeducation.org/resources>). The standards recognize that program content requirements vary by program type and regional employment needs. Therefore, flexibility has been built into the task list by assigning each task a priority number. The priority number simply indicates the minimum percentage of tasks that a program must include in their curriculum.

- Ninety-five percent (95%) of Priority 1 (P-1) tasks must be taught.
- Eighty percent (80%) of Priority 2 (P-2) tasks must be taught.
- Fifty percent (50%) of the Priority 3 (P-3) tasks must be taught.

Note: A task is a psychomotor or cognitive entry-level learning activity consisting of one or more measurable steps accomplished through an instructor presentation, demonstration, visualization or a student application.

Theory instruction and hands-on performance of all the basic tasks will provide initial training for entry-level employment in the automotive service field or prepare the student for further training. Competency in the tasks will indicate to employers that the graduate has the skills needed for entry-level employment in the automotive service field.

1. It is assumed that:

- at all levels, appropriate theory, safety, and support instruction will be required for performing each task;
- the instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks;
- the student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources;
- at all levels, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the “Three C’s” (concern, cause and correction) as a format to communicate this information.
- at all levels, students will become familiar with and use service information and reference materials to develop a problem-solving process/procedure

2. It is assumed that:

- all diagnostic and repair tasks described in this document are to be accomplished in accordance with manufacturer's recommended procedures and safety precautions as published.

3. It is assumed that:
 - Individual courses of study will differ across automobile training programs and any redundancies in the technical standards are built in to ensure that appropriate review and individual task mastery can be achieved at different levels of the program. They are also built in to allow instruction at different levels of understanding as regional and local industry needs may dictate. Additionally, these standards are a framework from which curriculum, lessons, and units of instruction are built from.
 - development of appropriate learning delivery systems and tests which monitor student progress will be the responsibility of the individual training program.
 - the learning progress of students will be monitored and evaluated against these performance standards;
 - a system is in place that informs all students of their individual progress through all phases of the training program.
4. It is assumed that:
 - all students will receive instruction in the storage, handling, and use of Hazardous Materials as required in Hazard Communication Title 29, Code of Federal Regulation Part 1910.1200, “Right to Know Law”, and state and local requirements.
 - hazardous and toxic materials will be handled, removed and recycled or disposed of according to federal, state, and local regulations.
5. It is assumed that:
 - All required supplemental tasks are being taught and reinforced continually throughout the pathway, they are not intended to be taught as stand-alone concepts or units.

REQUIRED SUPPLEMENTAL TASKS

Shop and Personal Safety

1. Identify general shop safety rules and procedures.
2. Utilize safe procedures for handling of tools and equipment.
3. Identify and use proper placement of floor jacks and jack stands.
4. Identify and use proper procedures for safe lift operation.
5. Utilize proper ventilation procedures for working within the lab/shop area.
6. Identify marked safety areas.
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.
8. Identify the location and use of eye wash stations.
9. Identify the location of the posted evacuation routes.
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.
11. Identify and wear appropriate clothing for lab/shop activities.
12. Secure hair and jewelry for lab/shop activities.
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits.
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.).
15. Locate and demonstrate knowledge of material safety data sheets (MSDS).
16. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.

Tools and Equipment

1. Identify tools and their usage in automotive applications.
2. Identify standard and metric designation.
3. Demonstrate safe handling and use of appropriate tools.
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment.
5. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dial-caliper).

Preparing Vehicle for Service

1. Identify information needed and the service requested on a repair order.
2. Identify purpose and demonstrate proper use of fender covers, mats.
3. Demonstrate use of the three C’s (concern, cause, and correction).
4. Review vehicle service history.

Preparing Vehicle for Customer

1. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, vehicle cleanliness, radio presets, etc.).

GENERAL COURSE STANDARDS

The following are the General Course Standards, to be integrated throughout the three pathway courses, they are not intended to be taught as stand-alone concepts or units.

Course Standard 1

TDL-AT4-GS1

The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways. Teachers should incorporate the elements of this standard into lesson plans during the course. The topics listed for each element of the standard may be addressed in differentiated instruction matching the content of each course. These elements may also be addressed with specific lessons from a variety of resources. This content is not to be treated as a unit or separate body of knowledge but rather integrated into class activities as applications of the concept.

Standard: Demonstrate employability skills required by business and industry.

*The following elements should be integrated throughout the content of this course.

1.1 Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities.

Person-to-Person Etiquette	Telephone and Email Etiquette	Cell Phone and Internet Etiquette	Communicating At Work	Listening
Interacting with Your Boss	Telephone Conversations	Using Blogs	Improving Communication Skills	Reasons, Benefits, and Barriers
Interacting with Subordinates	Barriers to Phone conversations	Using Social Media	Effective Oral Communication	Listening Strategies
Interacting with Co-workers	Making and Returning Calls		Effective Written Communication	Ways We Filter What We Hear
Interacting with Suppliers	Making Cold Calls		Effective Nonverbal Skills	Developing a Listening Attitude
	Handling Conference Calls		Effective Word Use	Show You Are Listening
	Handling Unsolicited Calls		Giving and Receiving Feedback	Asking Questions
				Obtaining Feedback
				Getting Others to Listen

Georgia Department of Education

Nonverbal Communication	Written Communication	Speaking	Applications and Effective Résumés
Communicating Nonverbally	Writing Documents	Using Language Carefully	Completing a Job Application
Reading Body Language and mixed Messages	Constructive Criticism in Writing	One-on-One Conversations	Writing a Cover Letter
Matching Verbal and Nonverbal communication		Small Group Communication	Things to Include in a Résumé
Improving Nonverbal Indicators		Large Group Communication	Selling Yourself in a Résumé
Nonverbal Feedback		Making Speeches	Terms to Use in a Résumé
Showing Confidence Nonverbally		Involving the Audience	Describing Your Job Strengths
Showing Assertiveness		Answering Questions	Organizing Your Résumé
		Visual and Media Aids	Writing an Electronic Résumé
		Errors in Presentation	Dressing Up Your Résumé

1.2 Demonstrate creativity by asking challenging questions and applying innovative procedures and methods.

Teamwork and Problem Solving	Meeting Etiquette
Thinking Creatively	Preparation and Participation in Meetings
Taking Risks	Conducting Two-Person or Large Group Meetings
Building Team Communication	Inviting and Introducing Speakers
	Facilitating Discussions and Closing
	Preparing Visual Aids
	Virtual Meetings

1.3 Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations.

Problem Solving	Customer Service	The Application Process	Interviewing Skills	Finding the Right Job
Transferable Job Skills	Gaining Trust and Interacting with Customers	Providing Information, Accuracy and Double Checking	Preparing for an Interview	Locating Jobs and Networking
Becoming a Problem Solver	Learning and Giving Customers What They Want	Online Application Process	Questions to Ask in an Interview	Job Shopping Online
Identifying a Problem	Keeping Customers Coming Back	Following Up After Submitting an Application	Things to Include in a Career Portfolio	Job Search Websites
Becoming a Critical Thinker	Seeing the Customer's Point	Effective Résumés:	Traits Employers are Seeking	Participation in Job Fairs
Managing	Selling Yourself and the Company	Matching Your Talents to a Job	Considerations Before Taking a Job	Searching the Classified Ads
	Handling Customer Complaints	When a Résumé Should be Used		Using Employment Agencies
	Strategies for Customer Service			Landing an Internship
				Staying Motivated to Search

1.4 Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity.

Workplace Ethics	Personal Characteristics	Employer Expectations	Business Etiquette	Communicating at Work
Demonstrating Good Work Ethic	Demonstrating a Good Attitude	Behaviors Employers Expect	Language and Behavior	Handling Anger
Behaving Appropriately	Gaining and Showing Respect	Objectionable Behaviors	Keeping Information Confidential	Dealing with Difficult Coworkers
Maintaining Honesty	Demonstrating Responsibility	Establishing Credibility	Avoiding Gossip	Dealing with a Difficult Boss
Playing Fair	Showing Dependability	Demonstrating Your Skills	Appropriate Work Email	Dealing with Difficult Customers
Using Ethical Language	Being Courteous	Building Work Relationships	Cell Phone Etiquette	Dealing with Conflict
Showing Responsibility	Gaining Coworkers' Trust		Appropriate Work Texting	
Reducing Harassment	Persevering		Understanding Copyright	
Respecting Diversity	Handling Criticism		Social Networking	
Making Truthfulness a Habit	Showing Professionalism			
Leaving a Job Ethically				

1.5 Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills.

Expected Work Traits	Teamwork	Time Management
Demonstrating Responsibility	Teamwork Skills	Managing Time
Dealing with Information Overload	Reasons Companies Use Teams	Putting First Things First
Transferable Job Skills	Decisions Teams Make	Juggling Many Priorities
Managing Change	Team Responsibilities	Overcoming Procrastination
Adopting a New Technology	Problems That Affect Teams	Organizing Workspace and Tasks
	Expressing Yourself on a Team	Staying Organized
	Giving and Receiving Constructive Criticism	Finding More Time
		Managing Projects
		Prioritizing Personal and Work Life

1.6 Present a professional image through appearance, behavior and language.

On-the-Job Etiquette	Person-to-Person Etiquette	Communication Etiquette	Presenting Yourself
Using Professional Manners	Meeting Business Acquaintances	Creating a Good Impression	Looking Professional
Introducing People	Meeting People for the First Time	Keeping Phone Calls Professional	Dressing for Success
Appropriate Dress	Showing Politeness	Proper Use of Work Email	Showing a Professional Attitude
Business Meal Functions		Proper Use of Cell Phone	Using Good Posture
Behavior at Work Parties		Proper Use in Texting	Presenting Yourself to Associates
Behavior at Conventions			Accepting Criticism
International Etiquette			Demonstrating Leadership
Cross-Cultural Etiquette			
Working in a Cubicle			

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

L9-10RST 1-10 and L9-10WHST 1-10:

Georgia Standards of Excellence ELA/Literacy standards have been written specifically for technical subjects and have been adopted as part of the official standards for all CTAE courses. Additional Georgia Standards of Excellence ELA/Literacy standards for Speaking and Listening are listed in the foundational course standards below.

Course Standard 2

TDL-AT4-GS2

Identify and utilize safety procedures and proper tools.

- 2.1 Identify general shop safety rules and procedures.
- 2.2 Utilize safe procedures for handling of tools and equipment.
- 2.3 Identify and use proper placement of floor jacks and jack stands.
- 2.4 Identify and use proper procedures for safe lift operation.
- 2.5 Utilize proper ventilation procedures for working within the lab/shop area.
- 2.6 Identify marked safety areas.
- 2.7 Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.
- 2.8 Identify the location and use of eye wash stations.
- 2.9 Identify the location of the posted evacuation routes.
- 2.10 Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.
- 2.11 Identify and wear appropriate clothing for lab/shop activities.
- 2.12 Secure hair and jewelry for lab/shop activities.
- 2.13 Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits.
- 2.14 Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.
- 2.15 Locate and demonstrate knowledge of material safety data sheets (MSDS).

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

Course Standard 3

TDL-AT4-GS3

Research and utilize proper tools and equipment.

- 3.1 Identify tools and their usage in automotive applications.
- 3.2 Identify standard and metric designations.
- 3.3 Demonstrate safe handling and use of appropriate tools.
- 3.4 Demonstrate proper cleaning, storage, and maintenance of tools and equipment.
- 3.5 Demonstrate proper use of precision measuring tools (e.g. micrometer, dial-indicator, and dial-caliper).

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Course Standard 4

TDL-AT4-GS4

Research and utilize vehicle service information.

- 4.1 Identify information needed and the service requested on a repair order.
- 4.2 Identify purpose and demonstrate proper use of fender covers and mats.
- 4.3 Demonstrate use of the three C's (concern, cause, and correction).
- 4.4 Review vehicle service history.
- 4.5 Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
- 4.6 Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.).
- 4.7 Identify and use applicable service information materials to include service manuals, manufacturer service information, and bulletins to develop a process/procedure for diagnostics.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

Course Standard 5

TDL-AT4-GS5

Develop an understanding of automotive careers, describing the principal fields of specializations and identifying associated career opportunities.

- 5.1 Identify education requirements for automotive occupations and locations where programs of study are available.
- 5.2 Match automotive job titles with qualifications and responsibilities.
- 5.3 Participate in activities related to career interests.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Course Standard 6

TDL-AT4-GS6

Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, and competitive events.

- 6.1 Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA.
- 6.2 Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development.

- 6.3 Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs.
- 6.4 Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including, but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

TECHNICAL STANDARDS

TDL-AT4-TS1

Technical Standard 1

Perform general engine service.

(ASE: A1 Engine Repair)

For every task in Engine Repair, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

I. ENGINE REPAIR

A. General: Engine Diagnosis; Removal and Reinstallation (R & R)

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1
2. Research vehicle service information including fluid type, internal engine operation, vehicle service history, service precautions, and technical service bulletins. P-1
3. Verify operation of the instrument panel engine warning indicators. P-1
4. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed action. P-1
5. Install engine covers using gaskets, seals, and sealers as required. P-1
6. Verify engine mechanical timing. P-1
7. 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
8. Inspect, remove and/or replace engine mounts. P-2
9. Identify service precautions related to service of the internal combustion engine of a hybrid vehicle. P-2
10. Remove and reinstall engine on a newer vehicle equipped with OBD; reconnect all attaching components and restore the vehicle to running condition. P-3

I. ENGINE REPAIR

D. Lubrication and Cooling Systems Diagnosis and Repair

1. Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, heater core, and galley plugs; determine needed action. P-1
2. Identify causes of engine overheating. P-1
3. Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. P-1
4. Inspect and/or test coolant; drain and recover coolant; flush and refill cooling system; use proper fluid type per manufacturer specification; bleed air as required. P-1
5. Inspect, remove, and replace water pump. P-2
6. Remove and replace radiator. P-2
7. Remove, inspect, and replace thermostat and gasket/seal. P-1
8. Inspect and test fan(s), fan clutch (electrical or mechanical), fan shroud, and air dams; determine needed action. P-1
9. Perform oil pressure tests; determine needed action. P-1
10. Perform engine oil and filter change; use proper fluid type per manufacturer specification. P-1

- 11. Inspect auxiliary coolers; determine needed action. P-3
- 12. Inspect, test, and replace oil temperature and pressure switches and sensors. P-2
- 13. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform needed action. P-2

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

TDL-AT4-TS2

Technical Standard 2

Perform general automatic transmission service.

(ASE: A2 Automatic Transmission/Transaxle Service and Repair)

For every task in Automatic Transmission/Transaxle Service and Repair, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

II. AUTOMATIC TRANSMISSION AND TRANSAXLE

A. General: Transmission and Transaxle Diagnosis

1. Identify and interpret transmission/transaxle concerns, differentiate between engine performance and transmission/transaxle concerns; determine needed action. P-1
2. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
3. Diagnose fluid loss and condition concerns; determine needed action. P-1
4. Check fluid level in a transmission or a transaxle equipped with a dip-stick. P-1
5. Check fluid level in a transmission or a transaxle not equipped with a dip-stick. P-1
6. Perform pressure tests (including transmissions/transaxles equipped with electronic pressure control); determine needed action. P-1
7. Diagnose noise and vibration concerns; determine needed action. P-2
8. Perform stall test; determine needed action. P-2
9. Perform lock-up converter system tests; determine needed action. P-3
10. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles. P-1
11. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information. P-1
12. Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law). P-2

II. AUTOMATIC TRANSMISSION AND TRANSAXLE

B. In-Vehicle Transmission/Transaxle Maintenance and Repair

1. Inspect, adjust, and/or replace external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch. P-1
2. Inspect for leakage; replace external seals, gaskets, and bushings. P-2
3. Inspect, test, adjust, repair, and/or replace electrical/electronic components and circuits including computers, solenoids, sensors, relays, terminals, connectors, switches, and harnesses; demonstrate understanding of the relearn procedure. P-1
4. Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification. P-1
5. Inspect, replace and align powertrain mounts. P-2

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

TDL-AT4-TS3

Technical Standard 3

Perform general manual transmission/transaxle/axle service.

(ASE: A3 Manual Drivetrain and Axle Service and Repair)

For every task in Manual Drivetrain and Axle Service and Repair, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

III. MANUAL DRIVE TRAIN AND AXLES

B. Clutch Diagnosis and Repair

1. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action. P-1
2. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform needed action. P-1
3. Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing, linkage, and pilot bearing/bushing (as applicable). P-1
4. Bleed clutch hydraulic system. P-1
5. Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification. P-1
6. Inspect flywheel and ring gear for wear, cracks, and discoloration; determine needed action. P-1
7. Measure flywheel runout and crankshaft end play; determine needed action. P-2
8. Describe the operation and service of a system that uses a dual mass flywheel. P-3

C. Transmission/Transaxle Diagnosis and Repair

1. Inspect, adjust, lubricate, and/or replace shift linkages, brackets, bushings, cables, pivots, and levers. P-2
2. Describe the operational characteristics of an electronically-controlled manual transmission/transaxle. P-2
3. Diagnose noise concerns through the application of transmission/transaxle powerflow principles. P-2
4. Diagnose hard shifting and jumping out of gear concerns; determine needed action. P-2
5. Diagnose transaxle final drive assembly noise and vibration concerns; determine needed action. P-3
6. Disassemble, inspect clean, and reassemble internal transmission/transaxle components. P-2

III. MANUAL DRIVE TRAIN AND AXLES

E. Drive Axle Diagnosis and Repair

E.1 Ring and Pinion Gears and Differential Case Assembly

1. Clean and inspect differential case; check for leaks; inspect housing vent. P-1
2. Check and adjust differential case fluid level; use proper fluid type per manufacturer specification. P-1
3. Drain and refill differential case; use proper fluid type per manufacturer specification. P-1
4. Diagnose noise and vibration concerns; determine needed action. P-2
5. Inspect and replace companion flange and/or pinion seal; measure companion flange runout. P-2
6. Inspect ring gear and measure runout; determine needed action. P-3
7. Remove, inspect, reinstall and/or drive pinion and ring gear, spacers, sleeves, and bearings. P-3
8. Measure and adjust drive pinion depth. P-3
9. Measure and adjust drive pinion bearing preload. P-3

10. Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types). P-3
11. Check ring and pinion tooth contact patterns; perform needed action. P-3
12. Disassemble, inspect, measure, adjust, and/or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case. P-3
13. Reassemble and reinstall differential case assembly; measure runout; determine needed action. P-3

E.2 Limited Slip Differential

1. Diagnose noise, slippage, and chatter concerns; determine needed action. P-3
2. Measure rotating torque; determine needed action. P-3

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

TDL-AT4-TS4

Technical Standard 4

Perform general suspension and steering systems service.

(ASE: A4 Suspension and Steering)

For every task in Suspension and Steering, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

IV. SUSPENSION AND STEERING

B. Steering Systems Diagnosis and Repair

1. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation. P-1

2. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring). P-1
3. Diagnose steering column noises, looseness, and binding concerns (including tilt/telescoping mechanisms); determine needed action. P-2
4. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action. P-2
5. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action. P-2
6. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; determine needed action. P-2
7. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets. P-2
8. Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots; replace as needed. P-1
9. Inspect power steering fluid level and condition. P-1
10. Flush, fill, and bleed power steering system; use proper fluid type per manufacturer specification. P-2
11. Inspect for power steering fluid leakage; determine needed action. P-1
12. Remove, inspect, replace, and/or adjust power steering pump drive belt. P-1
13. Remove and reinstall power steering pump. P-2
14. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment. P-2
15. Inspect, remove and/or replace power steering hoses and fittings. P-2
16. Inspect, remove and/or replace pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper. P-2
17. Inspect, replace, and/or adjust tie rod ends (sockets), tie rod sleeves, and clamps. P-1
18. Inspect, test and diagnose electrically- assisted power steering systems (including using a scan tool); determine needed action. P-2
19. Identify hybrid vehicle power steering system electrical circuits and safety precautions. P-2
20. Test power steering system pressure; determine needed action. P-2

IV. SUSPENSION AND STEERING

C. Suspension Systems Diagnosis and Repair

1. Diagnose short and long arm suspension system noises, body sway, and uneven ride height concerns; determine needed action. P-1
2. Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine needed action. P-1
3. Inspect, remove, and/or replace upper and lower control arms, bushings, shafts, and rebound bumpers. P-3
4. Inspect, remove, and/or replace strut rods and bushings. P-3
5. Inspect, remove, and/or replace upper and/or lower ball joints (with or without wear indicators). P-2
6. Inspect, remove, and/or replace steering knuckle assemblies. P-3
7. Inspect, remove and/or replace short and long arm suspension system coil springs and spring insulators. P-3
8. Inspect, remove, and/or replace torsion bars and mounts P-3
9. Inspect, remove, and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links. P-3
10. Inspect, remove, and/or replace strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount. P-3
11. Inspect, remove, and/or replace track bar, strut rods/radius arms, and related mounts and bushings. P-3

12. Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts.

P-1

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

TDL-AT4-TS5

Technical Standard 5

Brake System Service

(ASE: A5 Brakes System Service and Repair)

For every task in Brakes, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

V. BRAKES

G. Electronic Brake Control Systems: Antilock Brake (ABS), Traction Control (TCS), and Electronic Stability Control (ESC) Systems Diagnosis and Repair

- 1. Identify and inspect electronic brake control system components (ABS, TCS, ESC); determine needed action. P-1
- 2. Describe the operation of a regenerative braking system. P-3
- 3. Diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system; determine needed action. P-2
- 4. Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine needed action. P-2
- 5. Depressurize high-pressure components of an electronic brake control system. P-2
- 6. Bleed the electronic brake control system hydraulic circuits. P-1
- 7. Test, diagnose, and service electronic brake control system speed sensors (digital and analog), toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data). P-2
- 8. Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.). P-1

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

TDL-AT4-TS6

Technical Standard 6

Electrical System Service

(ASE: A6 Electrical/Electronic Systems Service and Repair)

For every task in Electrical/Electronic Systems, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

VI. ELECTRICAL/ELECTRONIC SYSTEMS

G. Body Electrical Systems Diagnosis and Repair

1. Diagnose operation of comfort and convenience accessories and related circuits (such as: power window, power seats, pedal height, power locks, truck locks, remote start, moon roof, sun roof, sun shade, remote keyless entry, voice activation, steering wheel controls, back-up camera, parking assist, cruise control, and auto dimming headlamps); determine needed repairs. P-2
2. Diagnose operation of security/anti-theft systems and related circuits (such as: theft deterrent, door locks, remote keyless entry, remote start, and starter/fuel disable); determine needed repairs. P-2
3. Diagnose operation of entertainment and related circuits (such as: radio, DVD, remote CD changer, navigation, amplifiers, speakers, antennas, and voice-activated accessories); determine needed repairs. P-3

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

TDL-AT4-TS7

Technical Standard 7

Heating, Ventilation and Air Conditioning Service (Automotive HVAC)

(ASE: A7 Heating and Air Conditioning System Service and Repair)

For every task in Heating, Ventilation and Air Conditioning (HVAC), the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

A. General: A/C System Diagnosis and Repair

1. Identify and interpret heating and air conditioning problems; determine needed action. P-1
2. Research vehicle service information including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins. P-1
3. Performance test A/C system; identify problems. P-1
4. Identify abnormal operating noises in the A/C system; determine needed action. P-2
5. Identify refrigerant type; select and connect proper gauge set/test equipment; record temperature and pressure readings. P-1
6. Leak test A/C system; determine needed action. P-1
7. Inspect condition of refrigerant oil removed from A/C system; determine needed action. P-2
8. Determine recommended oil and oil capacity for system application. P-1
9. Using a scan tool, observe and record related HVAC data and trouble codes. P-3

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

B. Refrigeration System Component Diagnosis and Repair

1. Inspect, remove, and/or replace A/C compressor drive belts, pulleys, tensioners and visually inspect A/C components for signs of leaks; determine needed action. P-1
2. Inspect, test, service and/or replace A/C compressor clutch components and/or assembly; check compressor clutch air gap; adjust as needed. P-2
3. Remove, inspect, reinstall, and/or replace A/C compressor and mountings; determine recommended oil type and quantity. P-2
4. Identify hybrid vehicle A/C system electrical circuits and service/safety precautions. P-2
5. Determine need for an additional A/C system filter; perform needed action. P-3
6. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform needed action. P-2
7. Inspect for proper A/C condenser airflow; determine needed action. P-1
8. Remove, inspect, and replace receiver/drier or accumulator/drier; determine recommended oil type and quantity. P-2
9. Remove, inspect, and install expansion valve or orifice (expansion) tube. P-1
10. Inspect evaporator housing water drain; perform needed action. P-1
11. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and/or control module) to interrupt system operation; determine needed action. P-2
12. Determine procedure to remove and reinstall evaporator; determine required oil type and quantity. P-2
13. Remove, inspect, reinstall, and/or replace condenser; determine required oil type and quantity. P-2

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

C. Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair

- 1. Inspect engine cooling and heater systems hoses and pipes; perform needed action. P-1
- 2. Inspect and test heater control valve(s); perform needed action. P-2
- 3. Diagnose temperature control problems in the HVAC system; determine needed action. P-2
- 4. Determine procedure to remove, inspect, reinstall, and/or replace heater core. P-2

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

D. Operating Systems and Related Controls Diagnosis and Repair

- 1. Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action. P-1
- 2. Diagnose A/C compressor clutch control systems; determine needed action. P-2
- 3. Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the heating, ventilation, and A/C (HVAC) system; determine needed action. P-2
- 4. Inspect and test HVAC system control panel assembly; determine needed action. P-3
- 5. Inspect and test HVAC system control cables, motors, and linkages; perform needed action. P-3
- 6. Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; perform needed action. P-1
- 7. Identify the source of HVAC system odors. P-2
- 8. Check operation of automatic or semi-automatic HVAC control systems; determine needed action. P-2

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

E. Refrigerant Recovery, Recycling, and Handling

- 1. Perform correct use and maintenance of refrigerant handling equipment according to equipment manufacturer's standards. P-1
- 2. Identify A/C system refrigerant; test for sealants; recover, evacuate, and charge A/C system; add refrigerant oil as required. P-1
- 3. Recycle, label, and store refrigerant. P-1

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

TDL-AT4-TS8

Technical Standard 8

Engine Performance Service

(ASE: A8 Engine Performance Service and Repair)

For every task in Engine Performance the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

VIII. ENGINE PERFORMANCE

A. General: Engine Diagnosis

- | | |
|---|-----|
| 1. Identify and interpret engine performance concerns; determine needed action. | P-1 |
| 2. Research vehicle service information including vehicle service history, service precautions, and technical service bulletins. | P-1 |
| 3. Diagnose abnormal engine noises or vibration concerns; determine needed action. | P-3 |
| 4. Diagnose the cause of excessive oil consumption, coolant consumption, unusual exhaust color, odor, and sound; determine needed action. | P-2 |
| 5. Perform engine absolute manifold pressure tests (vacuum/boost); determine needed action. | P-1 |
| 6. Perform cylinder power balance test; determine needed action. | P-2 |
| 7. Perform cylinder cranking and running compression tests; determine needed action. | P-1 |
| 8. Perform cylinder leakage test; determine needed action. | P-1 |
| 9. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine needed action. | P-2 |
| 10. Verify engine operating temperature; determine needed action. | P-1 |
| 11. Verify correct camshaft timing including engines equipped with variable valve timing systems (VVT). | P-1 |

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.