Maryland
STATE DEPARTMENT OF EDUCATION

Program of Study Guide: Medium/Heavy Truck and Equipment - DRAFT

Comprehensive guidelines and course standards for the Medium/Heavy Truck and Equipment pathway

Office of College and Career Pathways

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Purpose

The purpose of this document is to communicate the required Career and Technical Education (CTE) academic standards for the Medium/Heavy Truck and Equipment Program of Study. The academic standards in this document are theoretical and performance based. The standards contain content from multiple state departments of education, industry related resources and have been reviewed and vetted by members of the Maryland business and industry community.

In addition to academic standards, the Maryland State Department of Education (MSDE) has incorporated into this document Labor Market Information (LMI) definitions and explanations for the Program of Study; program aligned Industry Recognized Credentials; and Work-Based Learning resources and requirements by course level.

Standards Sources

The following sources collectively support a progression of standards from foundational to advanced Medium/Heavy Truck and Equipment Technology concepts in a high school context, preparing students for industry-aligned certifications like ASE Entry Level Certifications, OSHA 10/30, and EPA, with the necessary knowledge and skills for career readiness in Medium/Heavy Truck and Equipment maintenance careers.

Here are the key standards sources for Medium/Heavy Truck and Equipment curriculum:

1. **Automotive Service Excellence (ASE)**
   A. **Description**: ASE is the leading certification organization for automotive professionals, including medium/heavy truck and equipment technicians. Through the ASE Education Foundation, they provide comprehensive program standards, task lists, and accreditation guidelines for automotive education programs.
   B. **Usage**: When teaching Medium/Heavy Truck and Equipment courses, ASE resources serve as the foundation for curriculum development and student assessment. The detailed task lists can be used to create lesson plans that align with industry standards, while practice tests help prepare students for certification. The accreditation guidelines ensure your program meets industry requirements, and the provided instructional materials can be integrated into daily lessons. ASE resources are particularly valuable for developing hands-on lab activities that match real-world scenarios technicians encounter in the field.
   C. **Source**: www.ase.com/educators and www.aseeducationfoundation.org

2. **Agricultural Equipment Technician (AET) Standards**
   A. **Description**: AET standards are industry-developed benchmarks specifically focused on agricultural machinery maintenance and repair. They cover comprehensive technical knowledge and skills needed for servicing farm equipment, including tractors, combines, and various implements.
   B. **Usage**: AET standards can be integrated to provide specialized focus on agricultural machinery. These standards help create comprehensive lessons on hydraulic systems, power trains, and electronic controls specific to agricultural equipment. They can be used to develop hands-on training modules that simulate real-world repair scenarios, and to create assessment tools that evaluate students' practical skills. The standards also provide guidance for structuring internship programs with equipment dealers, offering students valuable industry experience.
   C. **Source**: Access through state agricultural education department or equipment manufacturers' education programs.

3. **Construction Equipment Certification Commission (CECC)**
   A. **Description**: CECC focuses on establishing standards and certification programs specifically for construction equipment technicians. They provide comprehensive guidelines for repair and maintenance of various construction equipment types.
   B. **Usage**: CECC standards can guide instruction specific to construction equipment maintenance and repair. These standards help develop lessons focused on heavy equipment systems like hydraulics, powertrains, and electronic controls. They provide a framework for creating safety protocols in the shop environment and designing practical assessments that reflect industry needs. The standards are particularly valuable for structuring hands-on training modules that cover various types of construction equipment, from bulldozers to excavators.

C. **Source**: Access through local construction industry association or state department of education.

4. Heavy Equipment Maintenance Alliance (HEMA)

A. **Description**: HEMA is an industry consortium that develops standardized maintenance and repair protocols for heavy equipment. They focus on creating unified standards across different types of equipment and manufacturers.

B. **Usage**: For Medium/Heavy Truck and Equipment instruction, HEMA standards provide valuable resources for teaching standardized repair procedures across different equipment types. These standards can be used to create comprehensive maintenance checklists for student practice, develop quality control guidelines for shop activities, and incorporate industry best practices into daily lessons. The cross-manufacturer approach helps students understand common systems and components while recognizing manufacturer-specific variations, preparing them for real-world equipment maintenance scenarios.

C. **Source**: Access through local heavy equipment industry association or equipment dealers.

Course Descriptions

Course Level	Course Information	Description
Core: Course 1	Medium/Heavy Truck and Equipment: Cab and Electrical Systems SCED: <XX> Grades: 9-12 Prerequisite: None Credit: 1	This foundational course introduces students to the foundational electrical knowledge needed for modern diesel technology. Students learn to diagnose and repair electrical circuits, starting and charging systems, and lighting systems while using digital multimeters and diagnostic equipment. The course also covers cab system maintenance, including instrumentation, safety equipment, and hardware components, preparing students to diagnose and repair essential vehicle electronic systems.
Core: Course 2	Medium/Heavy Truck and Equipment: Brake and Hydraulic Systems SCED: <XX> Grades: 10-12 Prerequisite: None Principles Credit: 1	Students in this course will focus on the critical safety systems of heavy trucks and equipment. Students learn to service both air and hydraulic brake systems, including system components, maintenance procedures, and diagnostic techniques. The course covers brake system fundamentals, hydraulic principles, and control systems while emphasizing safety protocols and proper testing procedures for brake performance.
Optional Flex: Course 1	Medium/Heavy Truck and Equipment: Engine and HVAC Systems SCED: <XX> Grades: 11-12 Prerequisite: Medium/Heavy Truck and Equipment: Brake and Hydraulic Systems Credit: 1	This course focuses servicing diesel engines and climate control systems in heavy trucks. Students learn to diagnose engine problems, maintain lubrication and cooling systems, and service fuel system components. The course also covers heating, ventilation, and air conditioning system maintenance, including EPA-compliant practices for handling refrigerants and performing system repairs.

Course Level	Course Information	Description
Optional Flex: Course 2	Medium/Heavy Truck and Equipment: Chassis Systems SCED: <XX> Grades: 11-12 Prerequisite: Medium/Heavy Truck and Equipment: Engine and HVAC Systems Credit: 1	The final course concentrates on the mechanical systems that support and move the vehicle. Students learn to service clutch systems, transmissions, drivelines, and universal joints while developing skills in suspension and steering system maintenance. The course emphasizes proper diagnostic procedures, component alignment, and safe handling of heavy equipment components, preparing students for real-world repair scenarios.
Optional Flex: Course 3	Career Connected Learning I SCED: <XX> Grades: 11-12 Prerequisite: Medium/Heavy Truck and Equipment: Brake and Hydraulic Systems Credit: 1	This flexible, work-based learning course introduces students to real-world applications of classroom knowledge and technical skills through on-the-job experiences and reflective practice. Students engage in career exploration, skill development, and professional networking by participating in youth apprenticeships, registered apprenticeships, pre-apprenticeships, internships, capstone projects, or other approved career-connected opportunities. Variable credit (1–3) accommodates the required on-the-job training hours and related instruction. By integrating industry standards, employability skills, and personalized learning goals, Career Connected Learning I equips students to make informed career decisions, develop a professional portfolio, and build a strong foundation for success in postsecondary education, training, or the workforce.

Course Level	Course Information	Description
Optional Flex: Course 4	Career Connected Learning II SCED: <XX> Grades: 11-12 Prerequisite: Career Connected Learning I Credit: 1	Building on the foundational experiences of Career Connected Learning I, this advanced work-based learning course provides students with deeper on-the-job practice, leadership opportunities, and refined career exploration. Students continue to enhance their technical and professional skills, expanding their industry networks and aligning personal goals with evolving career interests. Variable credit (1–3) remains aligned with the required training hours and related instruction. Through elevated responsibilities and skill application, Career Connected Learning II prepares students to confidently transition into higher-level postsecondary programs, apprenticeships, or the workforce.

Dual Enrollment and Career Connected Learning Experiences Must be Aligned to the CTE Core.

Industry-Recognized Credentials and Work-Based Learning

Industry-Recognized Credentials
By the end of Medium/Heavy Truck and Equipment: Cab and Electrical Systems: ASE Entry Level Electrical/Electronic Systems Certification and Inspection Maintenance and Minor Repair Certification **By the end of Medium/Heavy Truck and Equipment: Brake and Hydraulic Systems:** ASE Entry Level Brakes Certification **By the end of Medium/Heavy Truck and Equipment: Engine and HVAC Systems:** ASE Entry Level Diesel Engines **By the end of Medium/Heavy Truck and Equipment: Chassis Systems:** ASE Entry Level Suspension and Steering Certification **Potential Additional Certifications:** EPA 609, OSHA 10/30

Work-Based Learning Examples and Resources		
M/H T&E: Cab and Electrical Systems **Career Awareness**	**M/H T&E: Brake and Hydraulic Systems** **Career Preparation**	**M/H T&E: Engine & HVAC, Chassis** **Career Preparation**
• Industry Visits • Guest Speakers • Participation in Career and Technical Student Organizations • Postsecondary Visits – Program Specific Site Tours • Mock Interviews	• All of Career Awareness plus the following: • Job Shadow • Paid and Unpaid Internships	• Paid and Unpaid Internships • Apprenticeships

Labor Market Information: Definitions and Data

Labor market information (LMI) plays a crucial role in shaping Career and Technical Education (CTE) programs by providing insights into industry demands, employment trends, and skills gaps. This data helps education leaders assess the viability of existing programs and identify opportunities for new offerings. By aligning CTE programs with real-time labor market needs, schools can better prepare students for in-demand careers and ensure that resources are effectively utilized to support pathways that lead to high-quality, sustainable employment.

Standard Occupational Code (SOC) and Aligned Industry:

Indicator	Definition	Pathway Labor Market Data
High Wage[1]	Those occupations that have a 25th percentile wage equal to or greater than the most recent MIT Living Wage Index for one adult in the state of Maryland, and/or leads to a position that pays at least the median hourly or annual wage for the DC-VA-MD-WV Metropolitan Statistical Area (MSA). *Note: A 25th percentile hourly wage of $24.74 or greater is required to meet this definition.*	**Standard Occupational Code:** 49-3031: Bus and Truck Mechanics and Diesel Engine Specialists **Hourly Wage/Annual Salary:** 25th Percentile: $26.50/$55,120 50th Percentile: $30.98/$64,440 75th Percentile: $36.48/$75,870
High Skill	Those occupations located within the DC-VA-MD-WV Metropolitan Statistical Area (MSA) with the following education or training requirements: completion of an apprenticeship program; completion of an industry-recognized certification or credential; associate's degree, bachelor's degree, or higher.	**Typical Entry-Level Education:** While there are several organized training programs in the region, there is no formal post-secondary training necessary to enter the workforce for students who have completed this program.
In-Demand	Annual growth plus replacement, across all Maryland occupations, is 405 openings between 2024-2029.	**Annual Openings**

[1] Living Wage Calculator: https://livingwage.mit.edu/states/24

Labor Market Information Data Source

Lightcast Q4 2024 Data Set. Lightcast occupation employment data are based on final Lightcast industry data and final Lightcast staffing patterns. Wage estimates are based on Occupational Employment Statistics (QCEW and Non-QCEW Employees classes of worker) and the American Community Survey (Self-Employed and Extended Proprietors). Occupational wage estimates are also affected by county-level Lightcast earnings by industry. Foundational data for the state of Maryland is collected and reported by the Maryland Department of Labor.

Methodology for High Wage Calculations

To combine labor market data across multiple Standard Occupational Classifications (SOCs), a weighted average approach was used to ensure accurate representation of the marketplace. Median wages for each SOC were weighted based on their respective employment levels, reflecting the relative demand for each occupation. This method ensures that occupations with higher employment contribute proportionately to the overall wage calculation. Additionally, job openings from all relevant SOCs were summed to determine the total projected demand. For example, if Mechanical Engineers account for 67% of total employment and Electrical Engineers for 33%, their respective wages are weighted accordingly, and job openings are aggregated to provide a comprehensive view of labor market opportunities. This approach delivers a balanced and accurate representation of both wages and employment demand for the program.

Methodology for In-Demand Calculations

The baseline for annual job openings, taking into account new positions and replacement positions, was determined by taking the average of all annual job openings between 2024 and 2029 across all 797 career sectors at the 5-digit SOC code level. For the 2024-2029 period, average job openings (growth + replacement) is 405.

Course Standards: Medium/Heavy Truck and Equipment: Cab and Electrical Systems

1. **GENERAL REQUIREMENTS.** This course is recommended for students in Grades 9-12.

2. **INTRODUCTION**
   A. Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
   B. The Supply Chain & Transportation Career Cluster encompasses the transfer, coordination, and management of goods from production to consumption, ensuring efficient movement across various modes of transportation including air, ground, and water, as well as maintenance of the respective transport modes. This Cluster integrates logistics and distribution networks to facilitate the seamless flow of materials and products, playing a crucial role in global commerce,
   C. The Medium/Heavy Truck and Equipment Technician Program of Study is a comprehensive four-course sequence that prepares students for careers in diesel technology and heavy equipment maintenance. Throughout the program, students perform essential tasks such as testing electrical circuits, servicing brake systems, conducting engine diagnostics, and aligning steering components. The curriculum aligns with ASE Education Foundation standards, preparing students for ASE Entry-Level certification in Medium/Heavy Truck as well as other industry credentials such as EPA Section 609 MVAC certification. Graduates are prepared for entry-level positions as diesel technicians, fleet maintenance technicians, or heavy equipment service technicians.
   D. The Medium/Heavy Truck and Equipment: Cab and Electrical Systems course introduces students to the foundational electrical knowledge needed for modern diesel technology. Students learn to diagnose and repair electrical circuits, starting and charging systems, and lighting systems while using digital multimeters and diagnostic equipment. The course also covers cab system maintenance, including instrumentation, safety equipment, and hardware components, preparing students to diagnose and repair essential vehicle electronic systems.
   E. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.
   F. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. **KNOWLEDGE AND SKILLS**
   A. The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:
      1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work.
      2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn.
      3. Employ effective reading, writing, and technical documentation skills.

4. Solve problems using critical thinking techniques and structured troubleshooting methodologies.
5. Demonstrate leadership skills and collaborate effectively as a team member.
6. Implement safety procedures, including proper handling of hardware and following OSHA guidelines.
7. Exhibit an understanding of legal and ethical responsibilities in the Medium/Heavy Truck and Equipment field, following applicable laws and best practices for safety.
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting.

B. The student identifies various career pathways in the Medium/Heavy Truck and Equipment field. The student is expected to:

1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles as a technician or in the Medium/Heavy Truck and Equipment field.
2. Create a professional resume and portfolio that reflects skills, projects, certifications, and recommendations.
3. Demonstrate effective interview skills for roles in the Medium/Heavy Truck and Equipment field.

C. The student identifies the issues associated with Medium/Heavy Truck and Equipment hazards found on a jobsite. The student is expected to:

1. Demonstrate safe working procedures in a lab/shop environment.
2. Explain the purpose of the Occupational Safety and Health Administration (OSHA) and how it promotes safety on the job.
3. Identify Medium/Heavy Truck and Equipment related workplace hazards and how to avoid or minimize them.
4. Explain safety issues concerning lockout and tagout procedures, personal protection using assured grounding and isolation programs, automotive lift safety, and other equipment related safety protocols.

D. The student integrates core academic skills into Medium/Heavy Truck and Equipment practices. The student is expected to:

1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards.
2. Use Ohm's Law calculations for voltage, current, and resistance; calculating voltage drop percentages; measurement and conversion of electrical units; calculating power consumption in electrical circuits; basic algebra for electrical formulas; and interpreting numerical diagnostic readings from digital multimeters.
3. Study electrical theory and electron flow; principles of electromagnetism; conductivity and resistance in materials; chemical reactions in batteries; principles of voltage and current in series and parallel circuits; heat generation in electrical circuits; and principles of electronic signal transmission.

E. The student demonstrates knowledge of general electrical/electronic systems concepts and safety. The student is expected to:

1. Research and apply vehicle service information, including vehicle service history, service precautions, and technical service bulletins.

2. Analyze electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).
3. Use digital multimeters and test equipment to measure voltage, voltage drop, current flow, continuity, and resistance.
4. Evaluate and diagnose the causes and effects of electrical/electronic circuit problems including shorts, grounds, opens, and resistance problems to include identification of parasitic draw.
5. Interpret wiring diagrams and perform diagnostic procedures using electronic service tools.
6. Conduct safe practices of testing and evaluation of electronic systems.

F. The student performs battery system diagnosis and service. The student is expected to:

1. Identify battery types and analyze state-of-charge and capacity.
2. Inspect, clean, and service battery, cables, connectors, and associated components.
3. Perform battery charging and jump-starting procedures using appropriate safety precautions.

G. The student diagnoses and repairs starting systems. The student is expected to:

1. Understand the basic functions of a starter motor and it's components.
2. Analyze starter system operation and perform circuit voltage drop tests.
3. Inspect and test starter control circuit components including switches, relays, connectors, terminals and harnesses.
4. Diagnose starter system concerns including no-crank and slow-crank conditions.

H. The student diagnoses and repairs charging systems. The student is expected to:

1. Understand the basic functions of an alternator and it's components.
2. Interpret charging system operation and test instrument panel indicators.
3. Conduct amperage tests on charging systems.
4. Inspect and service alternator drive components and mounting systems.
5. Test charging system output and perform circuit voltage drop tests.
6. Analyze cables, wires, and connectors in the charging circuit.

I. The student diagnoses and repairs lighting systems. The student is expected to:

1. Diagnose lighting system operation including brighter-than-normal, intermittent, dim, or non-functioning lights.
2. Inspect and test tractor-to-trailer lighting connections.
3. Verify proper operation of instrument cluster and warning indicators.

J. The student demonstrates knowledge of cab systems and components. The student is expected to:

1. Inspect and verify operation of instrumentation systems and electronic control systems.
2. Test safety equipment operation including horns, wipers, and warning devices.
3. Inspect and service cab hardware components including glass, mirrors, doors and mounting systems.
4. Document physical damage and maintain service records.
5. Verify proper operation of accessory and auxiliary cab systems.

Course Standards: Medium/Heavy Truck and Equipment: Brake and Hydraulic Systems

1. **GENERAL REQUIREMENTS.** This course is recommended for students in Grades 10-12.

2. **INTRODUCTION**
   A. Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
   B. The Supply Chain & Transportation Career Cluster encompasses the transfer, coordination, and management of goods from production to consumption, ensuring efficient movement across various modes of transportation including air, ground, and water, as well as maintenance of the respective transport modes. This Cluster integrates logistics and distribution networks to facilitate the seamless flow of materials and products, playing a crucial role in global commerce, economic development, and community health.
   C. The Medium/Heavy Truck and Equipment Technician Program of Study is a comprehensive four-course sequence that prepares students for careers in diesel technology and heavy equipment maintenance. Throughout the program, students perform essential tasks such as testing electrical circuits, servicing brake systems, conducting engine diagnostics, and aligning steering components. The curriculum aligns with ASE Education Foundation standards, preparing students for ASE Entry-Level certification in Medium/Heavy Truck as well as other industry credentials such as EPA Section 609 MVAC certification. Graduates are prepared for entry-level positions as diesel technicians, fleet maintenance technicians, or heavy equipment service technicians.
   D. Students in Medium/Heavy Truck and Equipment: Brake and Hydraulic Systems course will focus on the critical safety systems of heavy trucks and equipment. Students learn to service both air and hydraulic brake systems, including system components, maintenance procedures, and diagnostic techniques. The course covers brake system fundamentals, hydraulic principles, and control systems while emphasizing safety protocols and proper testing procedures for brake performance.
   E. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.
   F. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. **KNOWLEDGE AND SKILLS**
   A. The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:
      1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work.
      2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn.

3. Employ effective reading, writing, and technical documentation skills.
4. Solve problems using critical thinking techniques and structured troubleshooting methodologies.
5. Demonstrate leadership skills and collaborate effectively as a team member.
6. Implement safety procedures, including proper handling of hardware and following OSHA guidelines.
7. Exhibit an understanding of legal and ethical responsibilities in the automotive field, following applicable laws and best practices for safety.
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting.

B. The student identifies various career pathways in the Medium/Heavy Truck and Equipment field. The student is expected to:

1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles as a technician or in the Medium/Heavy Truck and Equipment field.
2. Create a professional resume and portfolio that reflects skills, projects, certifications, and recommendations.
3. Demonstrate effective interview skills for roles in the Medium/Heavy Truck and Equipment field.

C. The student identifies the issues associated with Medium/Heavy Truck and Equipment hazards found on a jobsite. The student is expected to:

1. Demonstrate safe working procedures in a lab/shop environment.
2. Explain the purpose of the Occupational Safety and Health Administration (OSHA) and how it promotes safety on the job.
3. Identify Medium/Heavy Truck and Equipment related workplace hazards and how to avoid or minimize them.
4. Explain safety issues concerning lockout and tagout procedures, personal protection using assured grounding and isolation programs, automotive lift safety, and other equipment related safety protocols.

D. The student integrates core academic skills into Medium/Heavy Truck and Equipment practices. The student is expected to:

1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards.
2. Perform calculations related to brake force and mechanical advantage; measuring system pressures and converting units (PSI/kPa); calculating brake pedal ratio and leverage; determining brake pad wear rates and measurements; and calculating air system leakage rates.
3. Explore scientific principles that include Pascal's Law and hydraulic force multiplication; principles of pneumatic systems and air compression; friction and heat dissipation in brake systems; properties of hydraulic fluids; principles of mechanical advantage in lever systems; and vacuum principles in power assist systems.

E. The student demonstrates knowledge of brake system fundamentals and safety. The student is expected to:

1. Research and interpret vehicle service information including fluid types, service history, and technical bulletins.
2. Understand fundamentals of hydraulic principles.
3. Identify brake system components and configurations for air and hydraulic systems.
4. Analyze brake performance problems and use appropriate diagnostic tools.
5. Demonstrate safe practices when working with brake systems including handling of brake dust and fluids.

F. The student services air brake supply and service systems. The student is expected to:

1. Inspect and test air system components including compressor, governor, air dryer, tanks, and lines.
2. Verify proper gauge operation and warning device function.
3. Perform air system tests including pressure build-up, governor settings, and leakage tests.
4. Service air system filtration and drainage components.

G. The student services air brake mechanical/foundation systems. The student is expected to:

1. Inspect and service brake chambers, slack adjusters, and associated components.
2. Measure and analyze brake system components including drums, rotors, and friction materials.
3. Service cam brake components including camshafts, rollers, bushings, and hardware.
4. Perform disc brake caliper service and adjustment procedures.

H. The student performs hydraulic brake system service. The student is expected to:

1. Test hydraulic system operation including pedal travel, fluid condition, and system pressure.
2. Inspect hydraulic system components for leaks and damage.
3. Service hydraulic brake components including master cylinders, lines, and wheel cylinders.
4. Perform brake bleeding procedures following proper safety protocols.

I. The student services brake control and parking brake systems. The student is expected to:

1. Test parking brake operation and inspect application/holding devices.
2. Inspect and service air and hydraulic power assist systems.
3. Verify operation of brake warning systems and indicator lights.
4. Test anti-lock brake system (ABS) warning light circuits and sensor operation.

J. The student demonstrates knowledge of hydraulic system fundamentals. The student is expected to:

1. Research hydraulic system service information and safety procedures.
2. Identify hydraulic system components and filtration requirements.
3. Inspect hoses and connections for leaks, damage, and proper routing.
4. Check fluid levels and condition following manufacturer specifications.

Course Standards: Medium/Heavy Truck and Equipment: Engine and HVAC Systems

1. **GENERAL REQUIREMENTS.** This course is recommended for students in Grades 11-12.

2. **INTRODUCTION**
   A. Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
   B. The Supply Chain & Transportation Career Cluster encompasses the transfer, coordination, and management of goods from production to consumption, ensuring efficient movement across various modes of transportation including air, ground, and water, as well as maintenance of the respective transport modes. This Cluster integrates logistics and distribution networks to facilitate the seamless flow of materials and products, playing a crucial role in global commerce, economic development, and community health.
   C. The Medium/Heavy Truck and Equipment Technician Program of Study is a comprehensive four-course sequence that prepares students for careers in diesel technology and heavy equipment maintenance. Throughout the program, students perform essential tasks such as testing electrical circuits, servicing brake systems, conducting engine diagnostics, and aligning steering components. The curriculum aligns with ASE Education Foundation standards, preparing students for ASE Entry-Level certification in Medium/Heavy Truck as well as other industry credentials such as EPA Section 609 MVAC certification. Graduates are prepared for entry-level positions as diesel technicians, fleet maintenance technicians, or heavy equipment service technicians.
   D. The Medium/Heavy Truck and Equipment: Engine and HVAC Systems course learn to service diesel engines and climate control systems in heavy trucks. Students learn to diagnose engine problems, maintain lubrication and cooling systems, and service fuel system components. The course also covers heating, ventilation, and air conditioning system maintenance, including EPA-compliant practices for handling refrigerants and performing system repairs.
   E. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.
   F. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. **KNOWLEDGE AND SKILLS**
   A. The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:
      1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work.
      2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn.
      3. Employ effective reading, writing, and technical documentation skills.

4. Solve problems using critical thinking techniques and structured troubleshooting methodologies.
5. Demonstrate leadership skills and collaborate effectively as a team member.
6. Implement safety procedures, including proper handling of hardware and following OSHA guidelines.
7. Exhibit an understanding of legal and ethical responsibilities in the field, following applicable laws and best practices for safety.
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting.

B. The student identifies various career pathways in the Medium/Heavy Truck and Equipment field. The student is expected to:

1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles as a technician or in the Medium/Heavy Truck and Equipment field.
2. Create a professional resume and portfolio that reflects skills, projects, certifications, and recommendations.
3. Demonstrate effective interview skills for roles in the Medium/Heavy Truck and Equipment field.

C. The student identifies the issues associated with Medium/Heavy Truck and Equipment hazards found on a jobsite. The student is expected to:

1. Demonstrate safe working procedures in a lab/shop environment.
2. Explain the purpose of the Occupational Safety and Health Administration (OSHA) and how it promotes safety on the job.
3. Identify Medium/Heavy Truck and Equipment related workplace hazards and how to avoid or minimize them.
4. Explain safety issues concerning lockout and tagout procedures, personal protection using assured grounding and isolation programs, automotive lift safety, and other equipment related safety protocols.

D. The student integrates core academic skills into Medium/Heavy Truck and Equipment practices. The student is expected to:

1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards.
2. Calculate compression ratios; measuring engine component tolerances and clearances; converting temperature scales (Fahrenheit/Celsius); calculating cooling system pressures; measuring refrigerant pressures and temperatures; and determining proper fluid capacities.
3. Use scientific principles including thermodynamics of engine operation; heat transfer in cooling systems; gas laws in air conditioning systems; principles of combustion; chemical properties of fuels and lubricants; and principles of air flow and turbocharged induction systems.

E. The student demonstrates knowledge of diesel engine fundamentals and safety. The student is expected to:

1. Research and apply engine service information, including fluid types, service precautions, and technical bulletins.

2. Identify engine components and their configurations including cylinder head, valve train, and engine block.
3. Inspect engine assemblies for fuel, oil, coolant, and air system leaks.
4. Verify proper fluid levels and conditions for engine operation.

F. The student services engine lubrication and cooling systems. The student is expected to:

1. Test engine oil pressure and temperature sensor operation.
2. Analyze engine oil condition and perform oil/filter service procedures.
3. Test coolant temperature and level sensor operation.
4. Service cooling system components including belts, hoses, filters, and thermostats.
5. Perform cooling system pressure tests and verify proper operation.

G. The student maintains air induction and exhaust systems. The student is expected to:

1. Inspect turbocharger, air cooler, and piping systems.
2. Service air filtration components and verify system operation.
3. Inspect exhaust system components including aftertreatment devices.
4. Verify operation of exhaust gas recirculation (EGR) systems.

H. The student diagnoses and repairs fuel system components. The student is expected to:

1. Inspect fuel system components including tanks, lines, and filtration devices.
2. Service fuel/water separators and priming systems.
3. Test low and high pressure fuel system operation.
4. Verify proper operation of fuel injection components.

I. The student demonstrates knowledge of HVAC system fundamentals. The student is expected to:

1. Research HVAC service information and identify system components.
2. Verify A/C system operation and inspect components for leaks.
3. Inspect A/C compressor drive belts and verify proper alignment.
4. Service HVAC air distribution components and cabin filters.

J. The student performs HVAC system maintenance. The student is expected to:

1. Inspect engine cooling and heater system components.
2. Verify proper heater operation and temperature control.
3. Test HVAC blower motor operation and air distribution.
4. Demonstrate knowledge of EPA regulations regarding refrigerant handling.

Course Standards: Medium/Heavy Truck and Equipment: Drivetrain and Suspension Systems

1. **GENERAL REQUIREMENTS.** This course is recommended for students in Grades 11-12.

2. **INTRODUCTION**
   A. Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
   B. The Supply Chain & Transportation Career Cluster encompasses the transfer, coordination, and management of goods from production to consumption, ensuring efficient movement across various modes of transportation including air, ground, and water, as well as maintenance of the respective transport modes. This Cluster integrates logistics and distribution networks to facilitate the seamless flow of materials and products, playing a crucial role in global commerce, economic development, and community health.
   C. The Medium/Heavy Truck and Equipment Technician Program of Study is a comprehensive four-course sequence that prepares students for careers in diesel technology and heavy equipment maintenance. Throughout the program, students perform essential tasks such as testing electrical circuits, servicing brake systems, conducting engine diagnostics, and aligning steering components. The curriculum aligns with ASE Education Foundation standards, preparing students for ASE Entry-Level certification in Medium/Heavy Truck as well as other industry credentials such as EPA Section 609 MVAC certification. Graduates are prepared for entry-level positions as diesel technicians, fleet maintenance technicians, or heavy equipment service technicians.
   D. The Medium/Heavy Truck and Equipment: Chassis Systems concentrate on the mechanical systems that support and move the vehicle. Students learn to service clutch systems, transmissions, drivelines, and universal joints while developing skills in suspension and steering system maintenance. The course emphasizes proper diagnostic procedures, component alignment, and safe handling of heavy equipment components, preparing students for real-world repair scenarios.
   E. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.
   F. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. **KNOWLEDGE AND SKILLS**
   A. The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:
      1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work.
      2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn.
      3. Employ effective reading, writing, and technical documentation skills.

4. Solve problems using critical thinking techniques and structured troubleshooting methodologies.
5. Demonstrate leadership skills and collaborate effectively as a team member.
6. Implement safety procedures, including proper handling of hardware and following OSHA guidelines.
7. Exhibit an understanding of legal and ethical responsibilities in the Medium/Heavy Truck and Equipment field, following applicable laws and best practices for safety.
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting.

B. The student identifies various career pathways in the Medium/Heavy Truck and Equipment field. The student is expected to:

1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles as a technician or in the Medium/Heavy Truck and Equipment field.
2. Create a professional resume and portfolio that reflects skills, projects, certifications, and recommendations.
3. Demonstrate effective interview skills for roles in the Medium/Heavy Truck and Equipment field.

C. The student identifies the issues associated with Medium/Heavy Truck and Equipment hazards found on a jobsite. The student is expected to:

1. Demonstrate safe working procedures in a lab/shop environment.
2. Explain the purpose of the Occupational Safety and Health Administration (OSHA) and how it promotes safety on the job.
3. Identify Medium/Heavy Truck and Equipment related workplace hazards and how to avoid or minimize them.
4. Explain safety issues concerning lockout and tagout procedures, personal protection using assured grounding and isolation programs, automotive lift safety, and other equipment related safety protocols.

D. The student integrates core academic skills into Medium/Heavy Truck and Equipment practices. The student is expected to:

1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards.
2. Calculate gear ratios; measuring angles in steering and driveline components; determining torque specifications; calculating tire rolling radius; measuring suspension alignment angles; and interpreting weight distribution calculations.
3. Use scientific principles including principles of mechanical advantage in gear systems; friction and wear in moving components; principles of centrifugal force in rotating assemblies; physics of suspension movement and load distribution; principles of hydraulic power steering systems; and tire compression and load rating principles.

E. The student demonstrates knowledge of drivetrain fundamentals and safety. The student is expected to:

1. Research vehicle service information including fluid types, service history, and technical bulletins.
2. Identify drivetrain components and configurations.

3. Explain the operation of various drivetrain systems.
4. Use appropriate diagnostic tools and procedures to evaluate drivetrain operation.
5. Demonstrate safe practices when working with heavy drivetrain components.

F. The student services clutch systems. The student is expected to:

1. Explain the operation and purpose of clutch systems.
2. Inspect and adjust clutch linkage, cables, and control components.
3. Test clutch master cylinder operation and inspect for leaks.
4. Inspect release bearing, bushings, springs, and associated components.
5. Verify proper clutch operation and adjustment.

G. The student maintains transmission systems. The student is expected to:

1. Explain the operation and purpose of transmission systems.
2. Inspect transmission mounts, insulators, and mounting hardware.
3. Check transmission fluid levels and condition.
4. Inspect transmission components for leaks and proper operation.
5. Test transmission control systems including reverse lights and neutral switches.
6. Explain electronically controlled transmissions.

H. The student services driveshafts and universal joints. The student is expected to:

1. Explain the operation and purpose of driveshafts and universal joints.
2. Inspect and service driveshaft components including slip joints, universal joints, and support bearings.
3. Check driveline angles and phasing.
4. Verify proper driveshaft operation and identify vibration concerns.
5. Service drive axle seals and verify proper operation.

I. The student demonstrates knowledge of suspension system fundamentals. The student is expected to:

1. Explain the operation and purpose of suspension systems.
2. Inspect leaf springs, bushings, brackets, and mounting components.
3. Service shock absorbers and verify proper operation.
4. Inspect air suspension components including air springs and height control valves.
5. Measure and record suspension ride height.

J. The student performs steering system service. The student is expected to:

1. Explain the operation and purpose of steering systems.
2. Inspect steering linkage components including tie rod ends, ball joints, and steering arms.
3. Service power steering pump and verify proper operation.
4. Check power steering fluid condition and system operation.
5. Verify proper steering column operation and inspect mounting components.

K. The student maintains wheel and tire assemblies. The student is expected to:

1. Explain the operation and purpose of wheel and tire configurations.
2. Inspect tire condition and measure tread depth.
3. Verify proper tire matching and inflation.
4. Service wheel mounting hardware and verify proper torque.
5. Diagnose wheel/tire vibration and balance concerns.

Course Standards: Career Connected Learning I and II

Career connected learning is an educational approach that integrates classroom instruction with real-world experiences, enabling high school students to explore potential careers and develop relevant skills before graduation. By participating in work-based learning opportunities—such as apprenticeships, internships, capstone projects, and school-based enterprises—students apply academic concepts in authentic settings, gain practical industry knowledge, and build professional networks. This hands-on engagement helps students connect their studies to future career paths, strengthens their problem-solving and communication skills, and supports a smoother transition into college, vocational programs, or the workforce.

All Career and Technical Education Programs of Study include aspects of work-based learning, and almost all of the programs include two Career Connected Learning (CCL) courses. Below are the course descriptions for CCL I and CCL II. The CCL standards can be found via this link: