Wisconsin Youth Apprenticeship

TRANSPORTATION, DISTRIBUTION AND LOGISTICS

PROGRAM GUIDE

Investing in Wisconsin's Future

Department of Workforce Development

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TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP PROGRAM GUIDE

Description

Transportation, Distribution and Logistics (TDL) is a critical sector of the U.S. economy. This industry sector represents over 11 percent of the gross domestic product and is among the fastest growing of all sectors. There will be a growing number of career opportunities in a variety of professional and technical occupations as well as high-paid entry level occupations that provide career advancement opportunities.

This diverse career cluster encompasses careers and business involved in the planning, management, and movement of people, materials, and products by road, air, rail, and water, including related support services such as infrastructure planning and management, logistics services, and maintenance of mobile equipment and facilities. This Youth Apprenticeship occupational area focuses on three of the entry level pathways within the TDL industry: Facility & Mobile Equipment Maintenance, Logistics Planning & Management Services, and Warehouse & Distribution Center Operations.

Mobile Equipment Maintenance responsibilities include maintenance, repair, and servicing vehicles. Transportation relies on functioning equipment. Employees keep mobile machinery running while looking for more efficient safe and cost-effective ways to do so. Motor vehicles aren't a trend or a fad. The world needs cars and trucks to function. Demand will likely increase in the next few years as the number of vehicles in operation increases, reflecting continued growth in the driving age population and in the number of multi-car families, as well as maintaining current vehicles over the purchase of newer ones in a slow economy. Furthermore, as more freight is shipped across the country, additional diesel-powered trucks will be needed. Employment of service technicians and mechanics is expected to increase 15 percent between 2006 and 2020, compared to 10 percent for all occupations.[1] Job opportunities in this occupation are expected to be very good for those who complete high school or postsecondary technician training programs and earn ASE certification.

Careers in Logistics and Warehousing involve the planning, management and control of the physical distribution of materials and products. Often more than one mode of transportation is used as distribution efforts can be a complex national and global effort. This industry is responsible to ensure cargo arrives in the right location, at the right time, in the safest and most economical manner. Growth Opportunities in this area are found with large manufacturers, wholesale and retail trade companies and in government,

[1] Bureau of Labor Statistics Occupational Outlook Handbook, www.bls.gov, April 2013.

especially the armed forces. Growth in the industry does reflect ups and downs in the national economy. As the national economy grows and the production and sales of goods increases, there is an increase in the demand for transportation services to move goods from their producers to consumers. During economic downturns, the truck transportation and warehousing industry is one of the first to slow down as orders for goods and shipments decline. Nevertheless, Logistics, Trucking and Warehousing are expected to grow faster than the rest of the industry. Employment growth will result from manufacturers' willingness to concentrate more on their core competencies—producing goods—while outsourcing their distribution functions to trucking and warehousing companies which can perform these tasks with greater efficiency. As firms in other industries increasingly employ the industry's logistical services, such as inventory management and just-in-time shipping, many new jobs will be created. Also, as more consumers and businesses make purchases over the Internet, the expansion of electronic commerce will continue to increase demand for the transportation, logistical, and value-added services offered by the truck transportation and warehousing industry.[2]

The Youth Apprenticeship Program was approved by the Wisconsin State legislature in 1991 to provide a direct link between business, schools, and youth to meet the demands of technology, teamwork, communication, and leadership.

Wisconsin Youth Apprenticeship (YA) is a rigorous program that combines academic and related technical classroom instruction with mentored on the job learning for high school students. By training youth apprentices, employers play an active role in shaping the quality of their future workforce, improving the skill level of potential workers, and enhancing their competitive positioning in the marketplace. Employers, school districts, local consortiums, parents, and potential YA students are referred to the *Youth Apprenticeship Program Operations Manua*l for general YA Program requirements.

Objective

The Wisconsin Transportation, Distribution and Logistics (TDL) YA Program is designed to provide students with a working understanding of occupational and technical skills within two entry level pathways within the TDL industry. This program provides the framework for educators and industry to work together to produce work-ready, entry-level employees that will compete favorably in a global market, as well as, provide for post-secondary educational advancement while integrating work-based learning in the school and worksite.

The following features distinguish a YA Program from other similar youth school to work programs.

[2] Bureau of Labor Statistics Occupational Outlook Handbook, www.bls.gov, 2009.

Level Two Youth Apprenticeship is a two-year program for high school juniors and seniors with an interest in a particular field; e.g., automotive repair. One-year Youth Apprenticeship Programs are also available to pursue.

Youth apprentices, parents, employers, YA program coordinators, and school districts enter into a written agreement approved by the Department of Workforce Development.

Statewide skills are established by the industry, making the youth apprentice skill set more relevant to the state's employers.

Youth apprentices are trained at the worksite by skilled mentors and are paid minimum wage or better for their work. Students average 10-15 hours/week.

Youth apprentices receive a high school diploma and a Certificate of Occupational Proficiency from the Wisconsin Department of Workforce Development (DWD) at graduation.

Youth apprentices may receive advanced standing credit and/or transcripted credit for the YA Program at a Wisconsin Technical College and/or at some four year colleges. See **Appendix F** for current details.

Statewide skill standards focus on skills and knowledge needed by employers for entry level employment in the TDL industry.

Students apply and are interviewed by TDL employers for positions in the Transportation, Distribution and Logistics YA Program. The state approved skill standards and program guide for the Transportation, Distribution and Logistics YA Program are used in both the classroom instruction and worksite learning. If the local school district is unable to provide the related technical classroom instruction courses, they may contract with their local technical college or employer practitioners to do so.

The skill standards are competency based. Competencies are performance-based outcome statements of occupational related skills defined by representatives of TDL worksites throughout Wisconsin and aligned with national skill standards. The competencies in the program include many of those required for the certified tests in Collision Repair and Refinishing, Automobile/Light Truck Repair, and Heavy/Medium Truck Repair administered by the National Institute for Automotive Service Excellence (ASE) (http://www.ase.com/), and the standards and knowledge outlined in the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) Career Cluster Skill Standards (http://www.careerclusters.org/) for the Logistics Planning & Management Services, Warehousing & Distribution Center Operations, and Facility & Mobile Equipment Maintenance pathways in the TDL Career Cluster

The competencies will be taught at the worksite in combination with supportive, related technical classroom instruction. While the skill competencies are established statewide, program implementation and oversight occurs through local consortium committees to assure local needs are met.

Target Population

This Youth Apprenticeship occupational area focuses on three of the entry level pathways within the TDL industry: Facility & Mobile Equipment Maintenance, Logistics Planning & Management Services, and Warehouse & Distribution Center Operations.

The **Auto Collision, Auto Tech, or Diesel Tech** units are appropriate for students who have expressed an interest in this occupational area and like hands-on work and problem solving while performing repairs and installations. The **Logistics/Supply Chain Management (SCM)** units provide students with multiple business opportunities to plan and manage movement of materials. These students should be detail-oriented and efficient in order to work in a fast-paced, time-driven environment.

All students successfully meeting current high school graduation requirements and with a good attendance record for that year are encouraged to apply for the Transportation, Distribution and Logistics Youth Apprenticeship (YA) Program. The student must apply to the program in the year previous to program entry and be on track toward fulfilling high school graduation requirements in their school district. SEE **Appendix G** for students entering or continuing the Transportation, Distribution and Logistics YA Program in 2013.

All Youth Apprentices must complete the industry-wide foundational skill competencies consisting of competencies in core employability skills and safety. The Required Skill competencies may be completed concurrently with the specific technical skills.

Potential TDL youth apprentices will be required to complete a minimum of 450 work hours with 180 hours (2 semesters) of related technical classroom instruction for a Level One (1-year) Transportation, Distribution and Logistics (TDL) YA Program or a minimum of 900 work hours with 360 hours (4 semesters) of related technical classroom instruction for a Level Two (2-year) TDL YA program.

TDL YA students are required to perform all of the Core and Safety skills. **Level One (one year)** YA students are to choose additional competencies as indicated below in a specific TDL Pathway. **Level Two (two year)** YA students are to complete competencies in the specific TDL Pathway as indicated below.

Worksites can be chosen from any number of TDL settings including auto repair shops, auto collision shops, fleet management facilities, manufacturing facilities, distribution centers, and so on PROVIDED THAT the competencies related to the TASKS and EQUIPMENT USED are allowable by DWD Child Labor Laws. See **Appendix A** for more detail or contact the Department of Workforce Development's Equal Rights Division/Labor Standards Bureau at 608-266-6860 for questions regarding child labor laws.

TDL Units

1. Mobile Equipment Maintenance Pathway

Auto Collision- Unit competencies aligned with NATEF 2005 Collision Repair and Refinish skills. *2 Units per year.*

- Collision Repair Basics Unit- REQUIRED FIRST
- Non-Structural Analysis and Repair Unit
- Painting and Refinishing Unit
- Damage Analysis and Electrical Repair Unit

Auto Technician- Unit competencies aligned with NATEF 2012 Maintenance and Light Repair Automotive Standards skills. *1 Unit per year.*

- General Auto Service Unit- REQUIRED FIRST
- Auto/Light Truck Systems Unit

Diesel Technician- Unit competencies aligned with NATEF 2007 Medium/Heavy Truck Standards skills. *1 or 2 year program as indicated on Skill Standards Checklist.*

- Diesel Technician Unit

2. Logistics/Supply Chain Management Pathway- *2 Units per year*.

Planning and Purchasing Unit
Inventory Management and Production Unit
Storage and Warehousing Unit
Distribution and Transportation Operations Unit

Transportation, Distribution and Logistics Program Responsibilities

The following responsibilities are outlined for individuals involved in the Transportation, Distribution and Logistics (TDL) YA Program.

Students –

1. Maintain academic skills and attendance at the high school to remain on track for high school graduation.
2. Participate in progress reviews as scheduled.
3. Exhibit maturity and responsibility to meet requirements of employment as designated by the employer.

Parents or Guardians-

4. Ensure that adequate transportation is available to and from the worksite.
5. Participate in student progress reviews as scheduled.

School District-

6. Recruit students and coordinate student enrollment in the program with the consortiums and/or employers.
7. Integrate the YA Program related technical classroom instruction and worksite training into the student's overall education program with high school graduation credit issued for each semester successfully completed.
8. Participate in student progress reviews as scheduled.

YA Program Coordinators-

9. Apply and maintain approval from the DWD to operate a YA Program.
10. Ensure a minimum of 450 hours of worksite instruction/experience plus a minimum of 180 hours of related technical classroom instruction for each one year YA program.
11. Establish and meet regularly with an advisory committee that will identify when and where tasks will be taught during the Transportation, Distribution and Logistics YA Program.
12. Develop and maintain a yearly commitment with participating high schools, technical colleges, and local businesses to accommodate the number of students involved in the Transportation, Distribution and Logistics YA Program.
13. Establish and maintain a YA student grievance procedure.
14. Provide employer mentor training.

Related Technical Classroom Instruction Faculty-

15. Qualify in the specialty areas being taught in the YA Program.

Employers and Worksite Mentors-

16. SEE **Appendix B –** Transportation, Distribution and Logistics YA Implementation Guide for Employers.
17. Participate in a mentor training session and provide on the job training of the Youth Apprentices.

Department of Workforce Development-

18. Monitor national and state regulatory agencies, such as OSHA, for changes and impact on the Transportation, Distribution and Logistics Youth Apprenticeship Program.

Program Guide Organization

The competencies in the program include many of those required for the certified tests in Collision Repair and Refinishing, Automobile/Light Truck Repair, and Medium/Heavy Truck administered by the National Institute for Automotive Service Excellence (ASE) (http://www.ase.com/), and the standards and knowledge outlined in the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) Career Cluster Skill Standards (http://www.careerclusters.org/) for the Logistics Planning & Management Services, Warehousing & Distribution Center Operations, and Facility & Mobile Equipment Maintenance pathways in the TDL Career Cluster

The Transportation, Distribution and Logistics YA Program also requires that Related Technical Classroom Instruction is provided to support attainment of the knowledge necessary to master the competencies. While recommendations for specific Related Technical Classroom Instruction are detailed separately in **Appendix C**, instructional requirements will vary depending on local consortium and advisory group decisions. It is strongly advised that local consortiums work with their advisory groups to determine appropriate Related Technical Classroom Instruction based on their local needs and resources.

The Youth Apprenticeship Program curriculum is written and organized according to the Worldwide Instructional Design System (WIDS) format and includes the Transportation, Distribution and Logistics YA Skill Standards Checklist, Program Appendices and Unit Appendices for the program. Overall progress is documented on the Skill Standards Checklist which lists skill level achievement for each competency achieved. The Unit Appendices outline each skill competency with corresponding performance standards and learning objectives. The Performance Standards describe the tasks and behaviors, as applicable, that employers should look for in order to evaluate the competency. The Learning Objectives outline the recommended content to be covered in the related technical classroom instruction. SEE **Appendix D** - Wisconsin Instructional Design System (WIDS) Format and Youth Apprenticeship Program Guide Terms and **Appendix E** - Use and Distribution of the Curriculum for further details.

Evaluation

The student must successfully complete the related technical classroom instruction and demonstrate the minimum skill level required on the Transportation, Distribution and Logistics YA Skill Standards Checklist for each competency according to the applicable curriculum. Worksite mentors and/or instructors use this checklist to evaluate the learner on each of the required skills. It is the responsibility of the mentor(s) to rate the students skill level on all tasks performed at the worksite.

Transportation, Distribution and Logistics YA Program Completion

Upon successful completion of high school and the Level Two (2 year) TDL YA Program requirements, the youth apprentice will receive a high school diploma and a Certificate of Occupational Proficiency from the Department of Workforce Development indicating "Transportation, Distribution and Logistics Youth Apprenticeship." Youth Apprentices who successfully complete a Level One (1 year) TDL YA Program and who are on track for graduation will be eligible for a Level One Certificate from the Department of Workforce Development. Furthermore, the YA students may;

1. Continue to work in the TDL industry.
2. Apply to a registered apprenticeship.
3. Pursue a degree or diploma from a Wisconsin Technical College with advanced standing and/or transcripted credit.
4. Apply for admission to a four-year University of Wisconsin school with high school academic elective credit for admission.
5. Go into military service.

SEE **Appendix F** for current agreements for post-secondary credit at Wisconsin Technical Colleges and University of Wisconsin colleges.

Appendices

Appendix A - Work Contracts, Child Labor Laws, Liability & Insurance

Appendix B - Transportation, Distribution and Logistics YA Implementation Guide for Employers

Benefits to the Employer
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Appendix D - Wisconsin Instructional Design System (WIDS) Format and Youth Apprenticeship Program Guide Terms

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Appendix M- Auto Collision: Painting & Refinishing Curriculum (Unit 5)

Appendix N- Auto Collision: Damage Analysis & Electrical Repair Curriculum (Unit 6)

Appendix O- ***Invalid beginning Fall 2015;*** Auto Technician: Vehicle Basics & General Service Curriculum (Unit 7)

Appendix P- ***Invalid beginning Fall 2015;*** Auto Technician: Brake Systems Curriculum (Unit 8)

Appendix Q- ***Invalid beginning Fall 2015;*** Auto Technician: Electrical/Electronics Curriculum (Unit 9)

Appendix R- ***Invalid beginning Fall 2015;*** Auto Technician: Suspension & Steering Curriculum (Unit 10)

Appendix S- ***Invalid beginning Fall 2015;*** Auto Technician: Engine Performance & Repair Curriculum (Unit 11)

Appendix T- Logistics/Supply Chain Management: Planning & Purchasing Curriculum (Unit 12)

Appendix U- Logistics/Supply Chain Management: Inventory Management & Production Curriculum (Unit 13)

Appendix V- Logistics/Supply Chain Management: Storage & Warehousing Curriculum (Unit 14)

Appendix W- Logistics/Supply Chain Management: Distribution & Transportation Curriculum (Unit 15)

Appendix X- Diesel Technician (unit 16)

Appendix Y- Auto Technician- General Auto Service (Unit 17)

Appendix Z- Auto Technician- Auto/Light Truck Systems (Unit 18)

Appendix A

WORK CONTRACTS, CHILD LABOR LAWS, LIABILITY & INSURANCE

WORK CONTRACTS

Education Training Agreement -

Students and employers participating in an approved youth apprenticeship program must have a **signed Education/Training Agreement (ETA) on file with both the school and the employer.** Employers without a valid ETA may be assessed (a) double compensation in the event of injury on the job, and/or (b) fines ranging from $25 to $1,000 for every day without a permit for a first offense to $250 to $5,000 for every day without a permit for a second offense within a five year period. The Local Youth Apprenticeship Coordinator will provide the employer with a copy of the ETA. This form is also available from the Department of Workforce Development at http://dwd.wisconsin.gov/youthapprenticeship/forms_pubs.htm.

Work Permits -

Students and employers participating in an approved youth apprenticeship program do not need to obtain a separate work permit for the work to be performed as a part of the youth apprenticeship program, **although it is highly recommended**. If employers hire the youth apprentices to perform other work duties outside of their youth apprenticeship duties, a work permit will be required. Employers without a valid work permit (if applicable) may be assessed (a) double compensation in the event of injury on the job, and/or (b) fines ranging from $25 to $1,000 for every day without a permit for a first offense to $250 to $5,000 for every day without a permit for a second offense within a five year period.

CHILD LABOR LAWS

Youth apprentices enrolled in approved youth apprenticeship programs and their employers are subject to all state and federal child labor laws regarding the employment of minors. The Department of Workforce Development (DWD) will review all statewide youth apprenticeship curriculum for compliance with the child labor laws and will clarify the laws whenever necessary to allow for program implementation. Youth apprentices **are allowed** to work in **some prohibited** occupations because they meet the criteria of **"student learner" AND** the work performed is **incidental** to their training **and** is for **intermittent and for short periods of time** (Wis. Admin. Code DWD 270.14(3)(c)1 at http://docs.legis.wisconsin.gov/code/admin_code/dwd/270.pdf). However, they are **not exempt** from the child labor laws by virtue of being enrolled in a youth apprenticeship program.

While DWD can interpret the law, DWD cannot exonerate employers from liability should an accident occur on the job which results in injury to an employee and a subsequent lawsuit. Determining liability for an accident can only be settled in a court of law. DWD can assure employers that they will not be cited (by DWD) for illegally employing a minor in a prohibited occupation as long as the students are enrolled in a DWD approved youth apprenticeship program and a signed Education/Training Agreement is on file with both the student's high school and the employer. This means that employers will not be assessed treble fines should an injury occur which results in the employer being cited.

Readers should refer to DWD 270.12 and 270.14 Child Labor Laws and the *Guide to Wisconsin's Child Labor Laws* for descriptions and definitions of the occupations or activities which are normally prohibited to minors.

Transportation, Distribution & Logistics-

Youth apprentices who are 16-17 years old can perform the following tasks, *only after appropriate operation/safety training* AND *only as indicated below*. The **student learner exception** limits the minor to **using *hazardous* equipment** on an **incidental** basis [less than 5% of their work time] and only **occasionally** [can't be a regular part of their job]. For example, the student learner exception may apply in a situation, such as carpentry, where most of the work is acceptable but once in a while you might need the minor to use a portable saw to cut a piece to fit. Further interpretation or clarification of Child Labor Laws should be directed to the Department of Workforce Development (DWD) Labor Standards Bureau Director at 608-266-6860.

Hoists and Hoisting Apparatus (DWD 270.12(12)(b))-

- Students age 16 and 17 years old are **not allowed to:**
  - operate an elevator, crane, derrick, hoist or high-lift truck (including hoists commonly used on tow trucks and other hoists), **except** operating an unattended automatic operation passenger elevator or an electric or air-operated hoist not exceeding one-ton capacity;
  - perform work that involves riding on a man lift or on a freight elevator, **except** a freight elevator operated by an assigned operator;
  - assist in the operation of a crane, derrick or hoist performed by crane hookers, crane chasers, hookers-on, riggers, rigger helpers and like occupations.
- Students under age 18 **may operate** an automatic elevator and an automatic signal operation elevator under certain conditions. Refer to DWD 270.12(12)(b) for exceptions and definitions of the terms used in this section.
- Minors 16 and 17 years of age **may operate** floor jacks, hand jacks, drive-on lifts, and arm lifts used in conjunction with repairing or servicing motor vehicles. They may also use air compressors, tire changers, truck tire changers and wheel balancers as long as there are automatic safety features which lock vehicles to the lifts.

Motor Vehicle Driver and Outside Helper (DWD 270.12(21))-

- Minors under age 17 cannot drive as part of their job. A minor, age 17, **may operate a motor vehicle** as a part of employment if:
  - 1) the vehicle does not exceed 6,000 pounds gross weight;
  - 2) driving is done during daylight hours only;
  - 3) the driving amounts to no more than 20% of the work week or 1/3 of the work day;
  - 4) the student has attended drivers' education training and holds a valid driver's license;
  - 5) the driving takes place within a 30-mile radius of the minor's place of employment;
  - 6) the minor has no record of any moving violations at the time of hire; and
  - 7) the driving does not involve: towing of vehicles, route deliveries or sales, transportation for hire, urgent time-sensitive deliveries, transporting more than 3 passengers who are employees of employer at one time.

Student Learner Criteria -

In order to be considered a student learner, youth apprentices must meet the following criteria:

1. They are enrolled in a youth apprenticeship program approved by DWD;
2. They are enrolled in school and receiving school credit for program participation;
3. They receive appropriate safety instruction at the school and at the workplace;
4. The work performed is under direct and close supervision of a qualified and experienced person;
5. The ***work performed in any occupation declared hazardous*** is incidental to their training and is for intermittent and short periods of time (DWD 270.14(3)(c)1); and
6. There is a schedule of organized and progressive work processes to be performed on the job (i.e. the worksite is following the state curriculum).

Hours of Work -

The hours an apprentice spends working in the program *during* the hours school is in session during the day DO NOT COUNT towards the limitation on total hours a minor may work. See the DWD Child Labor web site for applicable hours and times of the day that minors may work in Wisconsin.

LIABILITY AND INSURANCE

As employees of the company, youth apprentices are covered by worker's compensation in the event of injury on the job. Employers should review their specific liability coverage to ensure there are no restrictions on employing minors and/or on coverage of minors operating particular machinery. Schools are not allowed to cover

youth apprentices through their own workers' compensation policy while the youth apprentice is an employee of the local business.

As stated previously, DWD and/or local schools cannot exonerate employers from liability if a youth apprentice is injured on the job and a subsequent lawsuit is filed against the employer. Determining liability for an accident can only be settled in a court of law and will be based on the specific circumstances for each case. It is important that a signed ETA be on kept on file by both the school and the employer to ensure that employers will not be cited for illegally employing a minor in a prohibited occupation.

General Liability –

An employer is liable for the service provided at their facility. In general an employer has adequate general liability and workers compensation coverage, no additional liability is required as a result of the Youth Apprenticeship program. However, before participating in the program, an employer may wish to consult with their insurance carrier.

Transportation –

In general, the party responsible for transportation is liable in case of an accident. Youth apprentices responsible for their own transportation to and from the worksite are responsible for their own insurance. In instances where the school provides transportation for the youth apprentices, the school is responsible for insurance coverage. Only if the facility provides transportation to and from work for the youth apprentice is the facility responsible for this insurance coverage.

Workers Compensation –

Once a youth apprentice becomes a paid employee they must be covered by the employer's workers compensation coverage.

Unemployment Compensation –

If a youth apprentice is enrolled full-time in a public educational institution and receives school credit for their participation in the YA program, then they are generally NOT eligible to file for unemployment compensation from the employer. Youth apprentices who do NOT meet these criteria may be eligible for unemployment compensation benefits.

Worker Displacement –

No employer may hire a youth apprentice who will displace any currently employed worker, including a partial displacement, such as reduction in the hours of non-overtime work, wages, or employment benefits.

Layoffs/Strikes –

A youth apprentice cannot be hired when any other individual is on temporary layoff, with the clear possibility of recall, from the same or equivalent job OR if the employer has terminated the employment of any regular employee, or otherwise reduced the workforce, with the intention of filling the vacancy created with a youth apprentice. Local bargaining units should determine the status of youth apprentices already working in the facility in the event of a layoff. Youth apprentices may be laid off or transferred to work areas to take the place of laid off workers. Child labor laws prohibit youth apprentices from working in a company where a strike or lockout is in active progress.

Collective Bargaining Agreements –

The youth apprenticeship program should not impair existing contracts for services or collective bargaining agreements. Any youth apprenticeship program that would be inconsistent with the terms of a collective bargaining agreement shall be approved only with the written concurrence of the labor organization and employer involved.

Appendix B

Wisconsin Transportation, Distribution & Logistics Youth Apprenticeship
Implementation Guide for Employers

BENEFITS TO THE EMPLOYER

The transportation, distribution and logistics services industry is one of the largest and most diverse for career opportunities. The economy of our country depends on the movement of people, materials and products locally, nationally and globally. The Transportation, Distribution and Logistics (TDL) Youth Apprenticeship Program was designed with the needs of employers in mind. Employers across all industries have expressed concern that the education system has not adequately prepared young people with the work readiness and technical skills necessary to meet their business needs. This program was developed with the Wisconsin Technical College System and employer representatives from different TDL industries to meet the needs of you, our TDL employers.

By working with the Transportation, Distribution and Logistics Youth Apprenticeship Program you make an investment in the young people in your community. You will have access to a dependable recruitment pipeline of entry level workers that can be used to increase workforce diversity and provide supervisory opportunity for staff. You will be directly involved in the economic development efforts of your community as well as become a part of the creation of highly skilled workers, an excellent point in any public relations marketing.

A unique opportunity and added incentive for participation in the Transportation, Distribution and Logistics Youth Apprenticeship Program for both the employer and the student is that the competencies are directly aligned with national occupational skill standards recognized by the National Institute for Automotive Service Excellence (ASE) (http://www.ase.com/) and by the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) Career Cluster Skill Standards in Transportation, Distribution & Logistics, http://www.careertech.org/.

Employers also play an active role in improving the quality of the future workforce by helping develop skill standards geared to employer needs, reducing employee turnover by hiring program graduates, supporting program graduates as they continue their education in post-secondary settings, raising the interest of other employees in education and training, and increasing the potential for teamwork and flexibility in work sharing. One employer noted, “This program is the single most effective use of taxpayer dollars to link our business community to the workforce and training needs of the community. We must expand, celebrate, promote and encourage participation in this endeavor. I have personally gained staff, changed some lives, and enjoyed the

successes of the participants. It has enriched our staff in learning to operate as mentors, and enhanced our perception in the community as involved participants."[1]

ROLE OF THE EMPLOYER

The work-based learning component of the Youth Apprenticeship Program is the **primary** method for teaching the required competencies. The local business becomes an extension of the classroom for the youth apprentice. The related classroom instruction is intended to *support* the work-based learning experience by providing theoretical knowledge and, when needed, providing appropriate skill development. The work-based learning component is designed to provide an on-the-job learning environment for students by being "apprenticed" to an experienced mentor.

As an employer of a youth apprentice, you will be responsible for the following:

Student Selection

Review employment applications, interview candidates, and select the student(s) they want to hire. New Employee Orientation is provided by you according to your facility's Human Resources policies.

Wages

Youth apprentices must receive minimum wage or higher. A pay schedule is agreed upon with the employer, local YA coordinator and the student. Most employers grant periodic raises dependent upon performance or length of employment.

Workers Compensation

Once a youth apprentice becomes a paid employee they must be covered by the employer's workers compensation coverage. Other benefits may be provided at the discretion of the employer.

Education/Training Agreement (ETA)

Employers must sign and comply with the requirements in the ETA, and have a copy on file. See *Appendix A* "*Work Contracts, Child Labor Laws, Liability & Insurance"* for more detail.

Work Permits

See *Appendix A* "*Work Contracts, Child Labor Laws, Liability & Insurance"* for more detail.

Child Labor Laws

Employers must ensure that the work of any student at their worksite is allowed by Child Labor Laws and is under the direct and close supervision of a qualified and experienced person. Students must be provided with adequate safety training both in the school and

[1] Kent Olson, YA Employer, Wausau, WI

at the worksite. All Transportation, Distribution and Logistics Youth Apprenticeship skill standards competencies have been reviewed by the Wisconsin Department of Workforce Developments Labor Standards Bureau and are in compliance with the child labor rules.
See *Appendix A* "*Work Contracts, Child Labor Laws, Liability & Insurance"* for more detail.

Unemployment Compensation
YA students are typically not eligible for unemployment compensation from the employer.
See *Appendix A* "*Work Contracts, Child Labor Laws, Liability & Insurance"* for more detail.

Job Performance
Employers review, evaluate, and report on the youth apprentice's job performance approximately every nine weeks to ensure they are learning the required competencies. Mentors are expected to participate in progress reviews with the apprentice, school staff and/or Youth Apprenticeship instructors, and parent(s)/guardian(s).

Worksite Hours
Employers must provide for the youth apprentice to meet the following work requirements:

> Youth Apprentices in a Level Two (2-year) program must complete a *minimum* of **900 hours** of work-based learning while they are enrolled in the program. At least 500 hours of the required minimum work-based learning hours must take place when related classes are being held, so that classroom instruction can be integrated with worksite learning.
>
> Youth apprentices in a Level One (1 year) program must complete a *minimum* of **450 hours** of work based learning while they are enrolled in the program. At least 250 hours of the required minimum work-based learning hours must take place when related classes are being held, so that classroom instruction can be integrated with worksite learning.
>
> Youth apprentices may work *more* than the required minimum hours throughout the program.

Training to Competencies
The employer is responsible for providing the worksite training required to meet the skills standard competencies specified in the applicable AFNR area. This requirement means that while the youth apprentice may be hired under one particular job function, he/she must be allowed to rotate and perform other functions in other departments to meet competencies even if some of them are not normally a part of that job function.

Mentors
Employers assign worksite mentors to supervise and train youth apprentices. They also allow the mentors to attend special training classes provided by the local YA consortium to become successful mentors of high school apprentices.
See "Role of Mentors" below for more detail.

Organized Labor
Usually the Transportation, Distribution and Logistics Youth Apprenticeship is considered an educational activity rather than a job classification/position status. However, the youth apprenticeship program should not impair existing contracts for services or collective bargaining agreements. Any youth apprenticeship program that would be inconsistent with the terms of a collective bargaining agreement shall be approved only with the written concurrence of the labor organization and employer involved. If youth apprentices will be working in areas covered by labor agreements, organized labor must be involved to approve the program at the worksite.
See *Appendix A* "*Work Contracts, Child Labor Laws, Liability & Insurance"* for more detail.

ROLE OF THE MENTOR

Workplace mentors are one of the most critical elements which often determine the success of a youth apprenticeship. One mentor may work with more than one youth apprentice at a worksite, and the mentor may assign multiple "trainers" to instruct the youth apprentice while they rotate among various departments.

Effective Mentor Qualifications.

- Experience working with adolescents either on the job, through family, or through outside activities
- Effective teaching/training skills with adults and/or youth
- Highly skilled in the area in which the youth apprentices will be trained
- Good communication skills in the workplace
- Knowledge of and commitment to the Transportation, Distribution and Logistics Youth Apprenticeship program

Mentor Responsibilities.

- Develop a cooperative training schedule for the youth apprentice to ensure performance of the required work-based skills
- Work with instructors to coordinate the application of classroom learning objectives to the worksite
- Communicate regularly with the school, YA coordinator, and the instructor to ensure work-based learning objectives are being met
- Demonstrate tasks to youth apprentices and explain their importance
- Identify other trainers appropriate to train youth in the required competencies

- Evaluate the youth apprentice's progress on a regular basis and document achievements and skills
- Meet with the student, the student's parent(s)/guardian(s), and school staff and/or YA instructor at least once each grading period to review and update them on the student's progress
- Provide encouragement, support, and direction about the work site culture and skills
- Help the youth apprentice build self-confidence and self-esteem
- Be alert to personal problems that may affect the apprentice's work performance and guide them to seek help from appropriate sources
- Attend mentor training workshops and mentor meetings

Obtain additional resources for mentoring guidance from your YA coordinator.

CHECKLIST FOR PROGRAM PARTICIPATION

The following checklist will help you to participate in a Transportation, Distribution and Logistics Youth Apprenticeship (YA) Program.

- Discuss the Transportation, Distribution and Logistics (TDL) YA program with the local partnership that offers Youth Apprenticeship Programs.
- Consult with the management team of your organization and union officials, if applicable.
- Obtain approval from appropriate organization officials to hire youth apprentices.
- Identify mentors and arrange for mentor training through your local YA Coordinator.
- Interview TDL YA candidates for the program.
- Select youth apprentice(s).
- Sign Education/Training Agreement (ETA).
- Secure a Work Permit form.
- Orient your new youth apprentice to the workplace according to your organization's Human Resources policies.

CHECKLIST FOR PROGRAM OPERATION

The following checklist will help ensure continued operation of the Transportation, Distribution and Logistics (TDL) Youth Apprenticeship (YA) Program.

- Provide worksite training according to the TDL Youth Apprenticeship Area curriculum.
- Participate in progress reviews with youth apprentices, school staff and/or YA instructors, and parents/guardians.
- Meet regularly with the youth apprentices to discuss their performance and any other issues.
- Employ youth apprentices during school breaks, either part-time or full-time.
- Participate in recognition events organized by the school for youth apprenticeship graduates.

FREQUENTLY ASKED QUESTIONS

For questions not addressed here, do not hesitate to call your local youth apprenticeship coordinator or visit the Department of Workforce Development Youth Apprenticeship website.

How does this program differ from other work-based programs like coop education?
Skilled Certified Coop Education and Youth Apprenticeship are similar in that they are both components of Wisconsin's overall school to work transition programs. An important difference, however, is that Youth Apprenticeship students are exposed to an occupational cluster versus a specific job. Additionally, the skills the student learns are developed in association with Wisconsin transportation services industry personnel, Wisconsin technical college faculty, YA consortium coordinators, and school district coordinators/instructors. The curriculum is standardized throughout the state.

Will the mentor have to spend his/her entire time at work teaching the student?
No. Apprentices need to be supervised, but you are not required to "shadow" them at all times. However, someone should be available for guidance as necessary. One mentor may work with more than one youth apprentice at a worksite, and the mentor may assign multiple "trainers" to instruct the youth apprentice while they rotate among various departments.

Will the student do productive work?
Yes. After appropriate training, youth apprentices can become productive employees of the facility. However, since they are often rotated through different departments they will require more training time than employees who stay in the same department. It is important to remember that this is a training program. Upon completion of the probationary period, students are expected to meet the requirements of the position.

Will there be a lot of paperwork for me to complete?
Prior to the program, employers are required to sign the Education Training Agreement and maintain it. During the program, employers are expected to verify the youth apprentice's skills on the job and provide input during grading periods. Mentors must complete/maintain a simple "Skill Standards Checklist" as the student completes their competencies.

What happens if I cannot provide all of the required competencies at my facility?
In order to successfully complete the program and receive a Certificate of Occupational Proficiency, the youth apprentice must demonstrate proficiency in all areas required on the Skill Standards Checklist. If your facility does not provide the full range of services needed for competency mastery, the local youth apprenticeship coordinator may be able to arrange for the missing skills to be provided by another company. This arrangement should be discussed with the coordinator before you hire the youth apprentice.

What costs will my business incur and will I be reimbursed?
Primary costs to the employers are the wages paid to the youth apprentice and mentor during the training period.

Will I have to treat the youth apprentice differently than my other employees?
It is important to remember youth apprentices are placed in your facility to learn. Patience and guidance are required while they learn responsible work habits as well as the required skills. However, they are expected to follow your facility's work rules, e.g., dress code, behavior, discipline, etc., and to become a productive member of the transportation, distribution and logistics team.

What is the typical time frame for activities over the course of a youth apprentice's stay with a facility?
Most program activities follow a one-year or two-year cycle depending on the offerings within your company. There may be variance in the timing of learning activities to accommodate local and seasonal needs including trainer availability.

Appendix C

RECOMMENDATIONS FOR RELATED TECHNICAL CLASSROOM INSTRUCTION FOR TRANSPORTATION, DISTRIBUTION AND LOGISTICS YA

These recommendations are intended to be used by the YA Consortiums when determining appropriate related technical instruction for Transportation, Distribution and Logistics (TDL) YA. It is not all inclusive but should be used to assist the partnership with identification and/or development of course work that supports the work-based competencies as identified in the Skill Standards Checklist. As with all YA programs the consortium must ensure that the related instruction meets with the approval of their administration and school board.

OPERATIONAL NOTES

Related Technical Classroom Instruction maybe offered by the employer, within the school district, at another school district, at a Wisconsin Technical College, and/or at a Community College or University by instructors qualified according to the *Youth Apprenticeship Program Operations Manual*.

Learning Objectives are the foundation of related technical classroom instruction. Consortiums may teach using locally developed coursework; however, it is recommended that agreements with the local technical college be pursued to obtain post-secondary credit for YA worksite and classroom experiences.

A minimum of 180 hours (2 semesters) of related technical instruction is required for each one year YA program with 250 of the **work** hours coinciding with the instruction. The student must also receive high school credit towards graduation for this instruction, no matter the provider.

It is suggested that the following courses or learning experiences be provided as a pre-requisite OR concurrently for students interested in this youth apprenticeship:

- Introduction to Transportation, Distribution & Logistics Careers
- Computer Applications
- Additionally, students should complete a job shadow prior to enrollment in the TDL YA program.

If applicable and available at the worksite, efforts should be made with the employer to offer the student a continuing Registered Adult Apprenticeship upon high school graduation.

Commercial programs or Employer provided classroom certification programs are also appropriate provided that the student receives high school credit towards graduation for the class work.

A variety of **Transportation Maintenance** courses are highlighted here. It is well known by **TDL maintenance** industry leaders that the national standards are the NATEF (National Automotive Technicians Education Foundation) standards which provide the educational base for the ASE (Automotive Service Excellence) certification tests. While YA does not require ASE certification or even taking NATEF certified courses, we recognize the importance of alignment to these industry recognized standards.

NOTE: Taking NATEF certified courses does NOT require sitting for the ASE tests.

- **Local HS classes-**
  - Most common form of related technical training. Courses and curriculum are not standardized statewide for Transportation Maintenance programs.
- **Local Technical College classes** http://www.wtcsystem.edu/colleges.htm -
  - Common form of related technical instruction training. NATEF certified Transportation Maintenance courses are available at all 16 technical colleges.
- **AYES (Automotive Youth Educational Systems)** https://www.ayes.org/ -
  - High school based NATEF certified automotive instruction is available through some regional high schools or consortiums. At this time, the curriculum is only available to HS programs willing to become NATEF certified.
  - Contact the Wisconsin Automotive and Truck Dealers Association to find out more about the criteria for NATEF Accreditation of Secondary Auto Programs.
- **Manufacturer post-secondary training programs-**
  - Some specific dealer programs exist if a student is placed through a dealership. These include programs such as the Toyota T-Ten (http://www.toyota.com/about/tten/) program. While geared towards technical colleges and associate degree earners, these classes may be appropriate for students if programs are available near you.
- **Online coursework**- A small sampling of online programs include
  - ADAMM (Automobile Dealers Association of Metro Milwaukee) http://www.adamm.com/education.asp
  - I-CAR (Collision Repair Training) http://www.i-car.com/index_us.shtml
- While medium/heavy truck driving is prohibited by Child Labor Laws, it is recommended that students in the Diesel Technician program for Medium/Heavy Trucks earn their CDL (Commercial Driver's License) once they turn 18. Driving is a very important diagnostic tool for mechanics.

Crosswalks of the YA Curriculum to the NATEF skill standards in Auto/Light Truck (2012), Medium/Heavy Truck (2007), and Collision Repair and Refinish (2009) are available upon request.

Recommendations for this Appendix were obtained from Employers, the Wisconsin Department of Public Instruction, Wisconsin Technical College Faculty, YA Consortium/School District Coordinators during the Production Agriculture YA Survey, August 2008 & 2012, and through the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) recommendations at http://www.careertech.org/- Funded in part by the U.S. Department of Education.

Transportation, Distribution and Logistics Youth Apprenticeship (YA) Plan of Study

NAME: _____ **DATE:** _____

The Related Technical Instruction course selection and delivery are entirely within local consortium control. The recommendations listed below are only a suggested path of YA career planning and should be individualized to meet each learner's educational and career goals. All plans should meet high school graduation requirements, as well as, college entrance requirements if applicable.

HIGHLY Recommended for **ALL TDL** YA students

Educational Level	Grade	**English/ Language Arts** 4 required	**Social Studies Social Sciences** 3 Required	**Math** 2 Required	**Science** 2 Required	**Career Pathway Courses** **(Electives)**	**Recommended Enhancement Electives or Activities**
Secondary	**9**	Oral Communications (Speech) Technical Writing		Algebra	Physical Science	Computer Applications Energy, Power, Transportation Systems	Skills USA DECA or FBLA
	10				Chemistry	Computer Applications	Skills USA DECA or FBLA Job-Shadowing
	11				Physics	**TDL Youth Apprenticeship - Level One or Two** Employability Skills Customer Service <u>Transportation Maintenance</u> Electronics/Electricity Small Engines/Automotive/Diesel Classes Welding NATEF Certification programs such as AYES <u>Distribution & Logistics</u> Business & Marketing	
	12		Economics				

Post-Secondary Occupational Opportunities

The chart below shows examples of career ladders organized by pathway.
For additional career cluster information, visit www.careertech.org
For additional career information on a specific occupation, visit http://wicareerpathways.org/ or http://worknet.wisconsin.gov/worknet/default.aspx

		High School Diploma, On-the-Job Training	Certificate, Licensing, and/or Associate's Degree (1-2 years college)	Bachelor's/Master's Degree (4 year college)
Transportation, Distribution & Logistics Pathways	**Transportation Operations**	Truck/Bus/ Taxi Terminal support services Bus Driver Ships Mate Chauffeur Taxi Driver Delivery Drivers	Transportation Dispatchers Flight Attendant Rail Yard Conductors & Yardmasters Heavy Truck Drivers Port/Harbor/Marina operations Cargo Handling Supervisors Locomotive Engineer	Air Traffic Controller Traffic Manager Transportation Managers Pilot
	Logistics Planning & Management Services	Operations Clerk	Logistics Analysts Supply Chain Technicians & Supervisors Global Business Specialist	Logistics Managers Logistics Engineers
	Warehousing & Distribution Center	Material Movers Packers Car, Truck & Ship Loaders Traffic, Shipping & Receiving Clerks Production Clerks	Production, Planning & Expediting Supervisors Line Supervisors	Warehouse Managers Storage & Distribution Managers Industrial & Packaging Engineers

		High School Diploma, On-the-Job Training	Certificate, Licensing, and/or Associate's Degree (1-2 years college)	Bachelor's/Master's Degree (4 year college)
	Mobile Equipment Maintenance	Bicycle Repairers Small Engine Repairers Tire Repairers and Changers	Aircraft Mechanics Auto Collision Technicians Auto Service Technicians Electrical/Electronic Installers & Repairers Heavy Equipment Mechanics Master Mechanics Diesel Mechanics Ship Mechanics & Repairers Signal & Switch Repairers	Mobile Equipment Maintenance Managers Aerospace Engineers
	Transport Systems Infrastructure, Management & Regulation		Surveying & Mapping Technicians Aviation Inspectors Motor Vehicle Inspectors Freight Inspectors Railroad Inspectors Marine Cargo Inspectors Vessel Traffic Control Specialists	Air Traffic Controllers Urban & Regional Planners Civil Engineers Traffic Engineers
	Health, Safety & Environmental Management		Compliance Officers Environmental Science and Protection Technicians, Including Health Environmental Engineering Technicians	Environmental Managers & Engineers Environmental Scientists & Specialists, Including Health Occupational Health &Safety Specialists Industrial Health & Safety Technicians
	Sales & Service	Customer Order & Billing Clerks Cashiers Counter & Rental Clerks	Sales Representatives Cargo & Freight Agents	Marketing Managers Sales Managers Customer Service Managers

SOURCES: National Association of State Directors of CTE Consortium, 2009 & 2013, www.careertech.org; Wisconsin's Worknet, http://worknet.wisconsin.gov; Waukesha County Technical College (WCTC), Susan Maresh, Waukesha County School-to-Work, 2007.

Appendix D

WISCONSIN INSTRUCTIONAL DESIGN SYSTEM (WIDS)
FORMAT AND YOUTH APPRENTICESHIP PROGRAM GUIDE TERMS

WIDS/YA Program DOCUMENTS:

Course Outcome Summary (COS), i.e. Appendix I

The overview summary of the Transportation, Distribution & Logistics (TDL) YA program listing the program units and their corresponding *competencies*.

Transportation, Distribution & Logistics YA Program Guide

Description of the Transportation, Distribution & Logistics (TDL) YA Program. The appendices contain program information; and competencies with their corresponding performance standards and learning objectives by unit. This is similar to the Program Outcome Summary (POS) in WIDS.

Skill Standards Checklist

Listing of ALL the competencies in ALL of the industry-wide and industry-specific skill areas. The checklist provides the overall documentation for DWD of the skill achievement levels for the competencies in the specific units.

WIDS TERMS:

Competency

The major skill or outcome stated in observable, measurable terms telling learners what they must be **able to do** AFTER a learning experience.

Performance Standards

Specifications by which performance of a competency will be evaluated (criteria) and the circumstances/situation (condition) in which the competency will be evaluated. This is what the employer should look for when assessing the student's skills, as applicable to that worksite.

Core Skills

Competencies that address the abilities, values, and attitudes required for productive and successful employment.

Learning Objective

The background knowledge that is recommended in order for the student to master the competency. These objectives can direct learning in the related technical classroom instruction information that can be taught on-the-job, in a class, online, or through supplemental reading.

Appendix E

USE AND DISTRIBUTION OF THE CURRICULUM

New and current employers should be given at least one set of the complete curriculum package. The **curriculum package** includes a copy of the Program Guide, Skill Standards Checklist, Unit Appendices, and the Course Outcome Summary (COS). In particular, the performance standards for each competency should be highlighted with the employer mentor(s) so that they know HOW to assess the learner for competency evaluation.

All related technical classroom **instructors** will need to be provided with the **Unit Appendices** in order to see the Learning Objectives for each competency for the related technical classroom instruction. The local Transportation, Distribution & Logistics (TDL) Youth Apprenticeship advisory group should determine the requirements and delivery of the required related technical classroom instruction ***prior to*** offering this YA program in the local consortium area. It is recommended that the advisory group ensure that the learning objectives are being taught either at the employer facility, school, and/or technical college.

At the beginning of the TDL YA program, **student learners** should receive a copy of the **Skill Standards Checklist** and the applicable pages from the **Unit Appendices** to review with their instructor(s) **and** worksite mentor(s). This is the opportunity for instructors and mentors to highlight the worksite experiences, related technical classroom instruction, and assessments that will occur. In a performance-based curriculum successful learning is enhanced when the learners have the opportunity to review what will be expected of them in advance of the lessons.

It is recommended that a portfolio be prepared for EACH learner. The learner should be given the responsibility for maintaining this documentation and making it available to the instructor and/or worksite mentor for recording performance assessments.

When the performance criteria are completed successfully, the learner achievement level information must be recorded on the **Skill Standards Checklist**. A copy of the completed Skill Standards Checklist is the piece of documentation required by DWD in order to issue the Certificate of Occupational Proficiency.

Appendix F

POST SECONDARY CREDITS

Wisconsin Technical College System

Graduates of one-year or two-year Transportation, Distribution & Logistics (TDL) Youth Apprenticeship programs may be awarded credits in Wisconsin Technical College programs. Each Technical College may grant credit through specific local articulation agreements. Contact the local technical college to determine the number and type of articulated credits available for TDL YA. The credits may be taken as technical college courses within Youth Apprenticeship programs or may be granted through advanced standing agreements when students enroll in the technical college.

In addition, YA students should request a credit evaluation of their YA classroom and work experiences upon admission to the local technical college under the Wisconsin Technical College System (WTCS) "Credit for Prior Learning Policy" #323 and through the WTCS-YA Credit Articulation Guidance Document.

UW Institutions Credits for *Admission* –

Admission Credits for the Transportation, Distribution and Logistics Youth Apprenticeship Program are yet TO BE DETERMINED.

Appendix G

GRANDFATHER CLAUSE – PROGRAM TRANSITION GUIDELINES

For NEW and CONTINUING Transportation, Distribution & Logistics (TDL) YA Students

If the student begins a Transportation, Distribution & Logistics (TDL) YA Program using a specific checklist version, then the student must complete the YA program using that same checklist version. The appropriate Level One or Level Two Certificate of Occupational Proficiency from the Wisconsin Department of Workforce Development (DWD) will be awarded.

Senior in 2013-14, **Level Two** YA: The youth apprentice completes the OLD JUL 2009 checklist for the year 2 curriculum for TDL. An appropriate Level Two Certificate of Occupational Proficiency from the Wisconsin Department of Workforce Development (DWD) will be awarded.

Junior or Senior in 2013-2014, **starting TDL YA**: The youth apprentice may use either the JUL 2009 checklist in TDL ***OR*** the revised 2013 TDL checklist. However, if completing a **Level Two** Program, the youth apprentice must complete the YA program using the same checklist the 2nd year, in their Senior year. The appropriate Level Two Certificate of Occupational Proficiency from the Wisconsin Department of Workforce Development (DWD) will be awarded.

Senior in 2014-2015, **Level Two** YA: The youth apprentice must finish either the JUL 2009 checklist in TDL ***OR*** the revised 2013 TDL checklist, whichever version was used in their Junior year. The appropriate Level Two Certificate of Occupational Proficiency from the Wisconsin Department of Workforce Development (DWD) will be awarded.

Junior or Senior in 2014-15, **starting TDL YA**: New youth apprentices must use the revised 2013 TDL YA checklist **by the 2014-15** school year. A Certificate of Occupational Proficiency will not be issued to students who submit the old checklist.

NOTE: Additionally, Youth Apprenticeship students must maintain good academic standing and be on track for graduation to be eligible for a Certificate of Occupational Proficiency from the Department of Workforce Development.

Appendix H

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

SKILL STANDARDS CHECKLIST

(Download most current)

dwd.wisconsin.gov/youthapprenticeship/skills_checklists.htm

Appendix I

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

COURSE OUTCOME SUMMARY: OVERVIEW AND TABLE OF CONTENTS

Transportation, Distribution & Logistics Youth Apprenticeship
Course Outcome Summary

Course Information

Organization	Cooperative Educational Service Agency 6 (CESA 6)
Developers	Robin Kroyer-Kubicek
Development Date	2013

Description
This curriculum describes the performance-based worksite Competencies, Performance Standards, and Learning Objectives for the Wisconsin Youth Apprenticeship (YA) Program in Transportation, Distribution and Logistics (TDL). The Wisconsin TDL YA Program is designed to provide students with a working understanding of core industry skills and occupationally specific technical skills that serve as the standard for occupations in the TDL industry. This program provides the framework for educators and industry to work together to produce work-ready, entry-level employees that will compete favorably in a global market, as well as, provide for post-secondary educational advancement while integrating work-based learning in the school and worksite.

The Transportation, Distribution and Logistics YA program competencies are aligned with the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) standards (http://www.careerclusters.org/) and the National Automotive Technicians Education Foundation (NATEF) skill standards. TDL YA students are required to perform all of the Core and Safety skill. **Level One (one year)** YA students are to choose additional competencies as indicated below in a specific TDL Pathway. **Level Two (two year)** YA students are to complete competencies in the specific TDL Pathway as indicated below.

TDL Units:

1. Mobile Equipment Maintenance Pathway

   Auto Collision- Unit competencies aligned with NATEF 2005 Collision Repair and Refinish skills. *2 Units per year.*
   - 0 Collision Repair Basics Unit- REQUIRED FIRST
   - o Non-Structural Analysis and Repair Unit
   - o Painting and Refinishing Unit
   - o Damage Analysis and Electrical Repair Unit

   Auto Technician- Unit competencies aligned with NATEF 2012 Maintenance and Light Repair Automotive Standards skills. *1 Unit per year.*
   - 0 General Auto Service Unit- REQUIRED FIRST
   - o Auto/Light Truck Systems Unit

   Diesel Technician- Unit competencies aligned with NATEF 2007 Medium/Heavy Truck Standards skills. *1 or 2 year program as indicated on Skill Standards Checklist.*
   - 0 Diesel Technician Unit

2. Logistics/Supply Chain Management Pathway- *2 Units per year*.

   Planning and Purchasing Unit
   Inventory Management and Production Unit

Storage and Warehousing Unit
Distribution and Transportation Operations Unit

EACH competency (work site skill) is listed with its corresponding Performance Standards and Learning Objectives in the Appendices. The Performance Standards describe the behaviors, ***as applicable***, that employers should look for in order to evaluate the competency. The Learning Objectives describe the classroom learning content for the required related technical instruction.

Curriculum Sources

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Northeast Technical College, Associate Degree course outline for Supply Chain Management, 2008-2009.

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Wisconsin Department of Workforce Development, Auto Collision, Auto Technician, and Logistics Youth Apprenticeship curriculum dated May 1995, August 1998, and July 1997, respectively.

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Worknet Occupation Task Lists for Automotive Body Repairers, Tire Repairers, Electronic Equipment Repairers, Automotive Master Mechanics, Shipping, Receiving, & Traffic Clerks, Transportation Managers, Storage & Distribution Managers, Logisticians, Procurement Clerks, Production, Planning & Expediting Clerks, Buyers, and Purchasing Agents, accessed August – October 2008; Mobile Heavy Equipment Mechanics, Bus & Truck Mechanics & Diesel Engine Specialists, accessed July 2012 from http://worknet.wisconsin.gov/worknet/default.aspx

This curriculum was developed through a Grant from the Wisconsin Department of Workforce Development to the University of Wisconsin-Oshkosh's Center for Career Development and Employability Training (CCDET).

In 2012, the Auto Technician and this curriculum was revised and the Diesel Technician Unit added through a grant from the Wisconsin Department of Workforce Development to the Cooperative Educational Service Agency 6 (CESA 6).

Transportation, Distribution & Logistics Youth Apprenticeship

Table of Contents

REQUIRED SKILLS

APPENDIX J:

Unit 1: Core Skills

1. Apply applicable academic knowledge
2. Apply applicable career knowledge
3. Communicate effectively
4. Act professionally
5. Cooperate with others in a team setting
6. Think critically
7. Exhibit legal and ethical responsibilities
8. Use technology

Unit 2: Safety

1. Follow personal safety requirements
2. Maintain a safe work environment
3. Demonstrate professional role in an emergency

APPENDIX K:

Unit 3: Mobile Equipment Maintenance Pathway-Auto Collision: Collision Repair Basics

1. Obtain and apply basic vehicle and collision repair knowledge
2. Obtain required tools, equipment and materials before work
3. Maintain work area
4. Operate tools and equipment safely
5. Clean and store tools after use
6. Dispose of parts, garbage, and recyclables properly
7. Locate & record vehicle information
8. Maintain service & repair records
9. Remove old decals, stripes, emblems & moldings
10. Apply decals, tapes, stripes, emblems & moldings
11. Remove exterior dirt, grease, wax, and coatings from surfaces
12. Clean interior, exterior, body openings and glass
13. Mask exterior/interior panels & parts adjacent to repair areas
14. Remove over-spray
15. Apply anti-corrosion primers
16. Apply anti-corrosion protection to surfaces
17. Apply corrosion protection to joints, seams & weld areas
18. Sand and buff polish with appropriate compounds

APPENDIX L:

Unit 4: Mobile Equipment Maintenance Pathway-Auto Collision: Non-Structural Analysis & Repair

1. Remove undamaged body panels and components
2. Remove mechanical and electrical components
3. Rough straighten damaged metal panels

4. Remove damaged sections of metal body panels
5. Remove door and all components
6. Check door fit & function
7. Remove & install door lock and handle components
8. Assist to diagnose and repair water leaks, dust leaks and wind noise
9. Remove, replace, and align hood, hood hinges, and hood latch/lock
10. Remove, replace, and align deck lid, lid hinges, and lid latch/lock
11. Remove, replace, and align bumpers, reinforcements, guards, absorbers, isolators, and mounting hardware
12. Check and adjust clearances of front fenders, headlight mounting panel, and other panels
13. Remove and reinstall interior door trim panels
14. Remove and reinstall headliners and other interior panels
15. Remove and install upholstery and related items
16. Remove & install door glass & lower channel from door glass
17. Remove & install window regulator
18. Align door glass
19. Remove & install vent & hinged window assembly & glass
20. Assist to repair plastic parts
21. Assist to reshape and shrink flexible exterior plastic parts
22. Clean metal to be welded
23. Assist to weld metal

APPENDIX M:

Unit 5: Mobile Equipment Maintenance Pathway-Auto Collision: Painting & Refinishing

1. Sand area to be painted/refinished
2. Strip finish or other protective coatings
3. Featheredge adjacent areas for blending
4. Prepare undercoating
5. Apply undercoating
6. Smooth undercoating
7. Prepare painting and drying areas
8. Prepare paint mixing area
9. Prepare air supply equipment
10. Clean spray guns
11. Test spray guns
12. Assist to determine type, color & formula of paint
13. Assist to mix and strain paint or primer
14. Assist to apply paint on test panel or let-down panel
15. Assist to check color match; tint as necessary

APPENDIX N:

Unit 6: Mobile Equipment Maintenance Pathway-Auto Collision: Damage Analysis & Electrical Repair

1. Prepare vehicle for inspection
2. Assist to determine structural damage
3. Assist to determine suspension, mechanical, and electrical damage
4. Assist to determine if refinishing is required

5. Assist to plan repair work
6. Inspect, clean, and replace battery
7. Perform battery state-of-charge test
8. Perform battery charge
9. Retrieve codes and settings and disconnect the battery if needed
10. Assist to diagnose electrical circuits, wiring, and connectors
11. Assist to inspect, test, and replace fusible links, circuit breakers, and fuses
12. Assist to check & repair exterior lighting & wires
13. Aim headlamp assemblies and fog/driving lamps
~~14.~~ Check & replace horn
15. Check & replace wiper/washer system motors & pumps
16. Check & replace power window system switches & motors
17. Check operation of electrically heated mirrors, windshields, back lights, panels, etc.
18. Inspect, remove and replace components of power antenna circuits

APPENDIX O:

Unit 7: Mobile Equipment Maintenance Pathway-Auto Technician: Vehicle Basics & General Service

Invalid beginning Fall 2015

1. Obtain and apply basic vehicle and servicing knowledge
2. Operate tools and equipment safely
3. Maintain work area
4. Process work order
5. Acquire parts
6. Assist to diagnose vehicle problems
7. Check & adjust fluid levels
8. Inspect & replace air filter
9. Perform oil & filter change
10. Replace fuel filter
11. Replace cabin filter
12. Drain, recover, flush & refill cooling system
13. Lubricate suspension & steering systems
14. Rotate tires
15. Inspect, replace, adjust drive belts, tensioners, & pulleys
16. Inspect, replace, transmission fluid & filters

APPENDIX P:

Unit 8: Mobile Equipment Maintenance Pathway-Auto Technician: Brake Systems

Invalid beginning Fall 2015

1. Assist to diagnose common brake problems
2. Measure brake pedal height, travel, & free play as applicable
3. Check master cylinder for leaks & proper operation
4. Inspect brake lines, flexible hoses, & fittings
5. Bleed &/or flush brake system
6. Remove & inspect caliper assembly
7. Remove, inspect & replace brake pads & retaining hardware

8. Reassemble, lubricate, & reinstall calipers, pads, & related hardware
9. Clean, inspect, & measure rotor thickness, lateral runout, & thickness variation
10. Install wheel
11. Check parking brake cables & components
12. Check brake & indicator light system
13. Inspect, replace wheel studs
14. Service wheel bearings & race
15. Remove, inspect or replace sealed wheel bearing assembly

APPENDIX Q:

Unit 9: Mobile Equipment Maintenance Pathway-Auto Technician: Electrical/Electronics

Invalid beginning Fall 2015

1. Assist to diagnose electrical/electronic integrity of series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law)
2. Demonstrate proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems, including source voltage, voltage drop, current flow, and resistance
3. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits
4. Inspect, test fusible links, circuit breakers, & fuses
5. Inspect, test switches, connectors, relays, solenoid devices, & wires of electrical/electronic circuits
6. Remove/replace terminal end from connector; replace connectors & terminal ends
7. Perform battery state-of-charge test
8. Perform battery load (capacity) test
9. Inspect, clean, fill, &/or replace battery, battery cables, connectors, clamps, & hold-downs
10. Perform battery charge
11. Start a vehicle using jumper cables or auxiliary power supply
12. Perform starter current draw tests
13. Perform starter circuit voltage drop tests
14. Remove, install starter in a vehicle
15. Perform charging system output test
16. Remove, inspect, install generator (alternator)
17. Inspect, replace, aim headlights & bulbs
18. Inspect, test gauges & gauge sending units for cause of abnormal gauge readings
19. Remove, reinstall door panel
20. Check for module communication (including CAN/BUS systems) errors using scan tool
21. Diagnose electronic transmission control systems using a scan tool

APPENDIX R:

Unit 10: Mobile Equipment Maintenance Pathway-Auto Technician: Suspension & Steering

Invalid beginning Fall 2015

1. Assist to diagnose common suspension & steering problems
2. Disable, enable supplemental restraint system (SRS)
3. Determine proper power steering fluid type; inspect fluid level & condition
4. Flush, fill, bleed power steering system
5. Remove, inspect, replace, adjust power steering pump belt
6. Inspect, replace, adjust tie rod ends (sockets), tie rod sleeves, & clamps

7. Remove, inspect, install upper & lower ball joints
8. Remove, inspect, install strut cartridge or assembly, strut coil spring, insulators (silencers), & upper strut bearing mount
9. Inspect, remove, replace shock absorbers
10. Perform pre-alignment inspection & measure vehicle ride height
11. Perform four wheel alignment by checking and adjusting front & rear wheel caster, camber, and toe as required
12. Center steering wheel
13. Inspect tire condition & tire wear patterns; check air pressure
14. Measure wheel, tire, axle flange, & hub runout
15. Dismount, inspect, remount tire on wheel; balance wheel & tire assembly (static & dynamic)
16. Inspect tire & wheel assembly for air loss; repair tire using internal patch

APPENDIX S:

Unit 11: Mobile Equipment Maintenance Pathway-Auto Technician: Engine Performance & Repair

Invalid beginning Fall 2015

1. Assist to diagnose common engine performance problems
2. Inspect engine assembly for fuel, oil, coolant, & other leaks
3. Perform cranking & running compression tests
4. Perform cylinder leakage test
5. Perform cooling system pressure tests; check coolant condition; inspect & test radiator, pressure cap, coolant recovery tanks, & hoses
6. Retrieve, record diagnostic trouble codes, OBD monitor status & freeze frame data
7. Inspect, test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, & circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO)
8. Inspect, test fuel pumps & pump control systems for pressure, regulation & volume
9. Inspect, test fuel injectors
10. Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s) & heat shield(s)
11. Perform exhaust system back-pressure test
12. Inspect, test, replace components of the EGR system including EGR tubing, exhaust passages, vacuum pressure controls, filters & hoses
13. Remove, replace timing belt; verify correct camshaft timing
14. Inspect, test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, & fan control devices
15. Install gaskets, seals, & sealers as required
16. Perform oil pressure tests
17. Inspect, replace engine cooling & heater system hoses
18. Inspect, test, replace thermostat housing, gasket, & seal
19. Inspect, remove, replace water pump
20. Remove, replace radiator
21. Inspect, service, replace shafts, yokes, boots, & CV joints

APPENDIX T:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway: Planning & Purchasing

1. Respond to customer inquiries

2. Provide product and service information
3. Assist to process claims
4. Collect and maintain data & files
5. Process documentation & prepare reports
6. Compile customer & order information
7. Process customer sales order
8. Assist to plan for customer order using production and logistics documents
9. Purchase raw materials/services
10. Track and maintain order and receipt schedules
11. Review requisition orders
12. Prepare purchase orders
13. Contact suppliers to verify shipment details
14. Process supplier invoices
15. Monitor customer order status
16. Inform internal & external customers of order status
17. Compile purchasing, production, & shipping information for status reports

APPENDIX U:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway: Inventory Management & Production

1. Respond to customer inquiries
2. Collect and maintain data & files
3. Process documentation & prepare reports
4. Gather qualified supplier information for materials to be ordered
5. Assist to determine prices, specifications, and delivery dates from potential suppliers
6. Gather and organize data for demand forecasting
7. Assist to develop forecasts
8. Assist to develop production & inventory solutions based on production and logistics plan
9. Assist to develop packaging and material handling requirements based on production and logistics plan
10. Verify receipt of goods/services
11. Complete inventory transfer forms for bookkeeping purposes
12. Assist to coordinate schedules for materials/product/services movement
13. Assist to perform physical inventory
14. Report inventory shortage
15. Assist with inventory inaccuracies investigations

APPENDIX V:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway: Storage & Warehousing

1. Operate tools and equipment safely
2. Assist to plan for customer order using production and logistics documents
3. Unload materials
4. Inspect package for integrity, damage, quality specifications
5. Check order accuracy against packing slip/purchase order
6. Deliver materials to staging/storage location
7. Store or discard packaging materials as required
8. Pull items from warehouse storage location
9. Store orders for transporting
10. Check container and packing materials for labeling

11. Verify contents match order and description
12. Isolate defective contents prior to packing
13. Load orders
14. Perform cycle counts
15. Check stock for outdated or damaged supplies
16. Rotate raw materials and stock to minimize old and outdated inventory
17. Respond to recall procedures by removing and discarding inventory according to regulations
18. Assist to examine loss, damage & returns reports for trends

APPENDIX W:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway: Distribution & Transportation Operations

1. Assist to plan distribution of products
2. Compile transportation documentation
3. Assist to schedule transportation of products and materials
4. Ensure product is shipped on time
5. Prepare invoice for products and shipment
6. Operate tools and equipment safely
7. Inspect outgoing product packaging and labeling
8. Verify packing list against actual shipment
9. Load vehicles OR stage for courier transportation
10. Complete required shipping documents
11. Assist to plan and route shipments
12. Assist to coordinate and schedule drivers, pickups, deliveries
13. Determine shipment status
14. Maintain shipping and customs records/documentation
15. Follow up with customer regarding shipment receipt

APPENDIX X:

Unit 16: Mobile Equipment Pathway- Diesel Technician

1. Obtain & apply basic diesel servicing knowledge
2. Operate tools & equipment safely
3. Maintain work area
4. Assist to process work order
5. Research information
6. Acquire parts
7. Assist to diagnose common concerns & determine action
8. Assist to retrieve, record, interpret diagnostic codes
9. Perform engine lubrication PM
10. Perform oil & filter change
11. Perform fuel system checks
12. Perform air induction & exhaust PM
13. Perform cooling system PM
14. Pressure test cooling system
15. Assist to bleed cooling system
16. Assist to perform engine brake PM
17. Perform instrument checks
18. Perform safety equipment checks
19. Perform hardware checks
20. Check HVAC operation

21. Lubricate grease fittings
22. Perform transmission PM
23. Change transmission oil & filter
24. Perform clutch PM
25. Perform drive axle PM
26. Change drive axle oil & filter
27. Inspect driveshaft
28. Use wiring diagrams
29. Properly use a digital mulimeter (DMM)
30. Perform battery PM
31. Perform battery load test
32. Determine battery state of charge test
33. Jump start a vehicle
34. Engage starter
35. Perform charging system PM
36. Assist to remove & replace alternator
37. Perform lighting system PM
38. Perform air brake PM
39. Perform hydraulic brake PM
40. Check ABS & ATC warning lights
41. Read & interpret hydraulic system diagrams
42. Service filtration/reservoirs (tanks)
43. Check hoses, fittings, connections
44. Perform suspension & steering PM
45. Perform steering linkage PM
46. Perform tire checks
47. Assist to remove & install steering & drive axle wheel/tire assemblies
48. Perform fifth wheel, frame, trailer PM

APPENDIX Y:

Unit 17: Mobile Equipment Pathway- Auto Technician: General Auto Service

1. Obtain & apply basic vehicle & servicing knowledge
2. Operate tools & equipment safely
3. Maintain work area
4. Assist to process work order
5. Research information
6. Acquire parts
7. Assist to diagnose common concerns & determine action
8. Perform engine oil & filter change
9. Replace fuel filter
10. Check, drain, recover, flush, refill cooling system
11. Assist to inspect engine assembly for leaks
12. Inspect, replace air filter
13. Retrieve, record, interpret diagnostic codes
14. Check for leaks & fluid conditions
15. Check & adjust differential housing fluid level
16. Check fluid level in a transmission/transaxle
17. Inspect, replace, flush transmission fluid & filters
18. Test brake fluid for contamination

19. Inspect power steering fluid level & condition
20. Flush, fill, bleed power steering system
21. Inspect for power steering fluid leakage
22. Lubricate suspension & steering systems
23. Inspect tire condition & adjust air pressure
24. Rotate tires
25. Verify, replace, refill wiper & washer operation
26. Check brake lights
27. Test, replace, aim lights
28. Inspect, check, replace battery
29. Perform battery capacity test
30. Perform slow/fast battery charge
31. Perform battery state-of-charge test
32. Verify panel gauges & lights; reset maintenance indicators
33. Jump start a vehicle
34. Replace cabin filter
35. Inspect engine cooling & heater systems hoses, ducts, doors, filters

APPENDIX Z:

Unit 18: Mobile Equipment Pathway- Auto Technician: Auto/Light Truck Systems

1. Install engine covers using gaskets, seals, & sealers
2. Assist to remove & replace timing belt, verify camshaft timing
3. Perform cooling system pressure tests to identify leaks
4. Inspect, replace, adjust drive belts, tensioners, & pulleys
5. Remove, inspect, replace thermostat & gasket/seal
6. Inspect, remove, replace water pump
7. Perform cylinder cranking & running compression tests
8. Perform cylinder leakage tests
9. Remove, replace spark plugs
10. Inspect exhaust manifold, pipes, muffler, catalytic converter, resonator, & heat shields
11. Remove, replace radiator
12. Inspect, replace external seals, gaskets, bushings
13. Inspect powertrain mounts
14. Drain/refill differential or transfer case housings
15. Remove & replace drive axle shafts
16. Assist to disable & enable supplemental restraint system (SRS)
17. Assist to remove, inspect, replace, adjust power steering pump drive belt
18. Assist to remove, reinstall power steering pump
19. Inspect, replace, adjust tie rod ends (sockets), tie rod sleeves, & clamps
20. Assist to inspect, remove, install upper &/or lower ball joints
21. Inspect, remove, install front stabilizer bar bushings, brackets, links
22. Assist to inspect, remove, install strut cartridge or assembly, strut coil spring, insulators, & upper strut bearing mount
23. Inspect rear suspension system leaf springs, bushings, center pins/bolts, & mounts
24. Perform pre-alignment inspection & measure vehicle ride height
25. Dismount, inspect, balance, remount tire on wheel
26. Inspect tire for air loss; Repair tire using internal patch
27. Assist to test & calibrate pressure monitoring system for operation
28. Inspect brake lines, hoses, fittings for leaks kinks, rust, cracks, bulging, wear, loose fittings

29. Select, handle, store, fill brake fluids
30. Bleed &/or flush brake system
31. Measure brake pedal height, travel, free play
32. Check master cylinder for leaks & operation
33. Remove, clean, inspect, measure brake drum diameter
34. Assist to remove, clean, inspect, lubricate, reassemble brake shoes, springs, pins, clips, levers, adjusters, etc.
35. Remove, clean, inspect, caliper assembly
36. Clean, inspect caliper mounting & slides/pins
37. Remove, inspect, replace pads & retaining hardware
38. Lubricate, reinstall caliper, pads, & related hardware
39. Clean, inspect, measure rotor, rotor thickness, variation, & lateral run-out
40. Remove, reinstall rotor
41. Check brake pad wear indicator
42. Remove, clean, inspect, repack, install wheel bearings, seals, hub
43. Check parking brake cables & components
44. Check parking brake operation & indicator lights
45. Assist to replace wheel bearing & race
46. Properly use a digital multimeter (DMM)
47. Use wiring diagrams
48. Inspect, test fusible links, breakers, fuses
49. Replace electrical connectors & terminal ends
50. Perform starter current draw tests
51. Perform starter circuit voltage drop tests
52. Remove, install starter
53. Remove, inspect, reinstall generator (alternator)
54. Remove, reinstall door panel

Appendix J

TRANSPORTATION, DISTRIBUTION AND LOGISTICS
YOUTH APPRENTICESHIP

REQUIRED SKILLS CURRICULUM
UNITS 1-2

Core Abilities

Competency (Work Tasks)	Performance Standards What employer checks for while doing task. **Train YA Student on.** YA student will ...	Learning Objectives What to know/learn to do this task. **Content Suggested** for Class/Reading/On-the-Job Training:
1. Apply academic knowledge	Read and comprehend work related materials Apply mathematical operations involving whole numbers, fractions, decimals, percentages, formulas and methods of measurement accurately when necessary Interpret charts, tables, and graphs	MATH Add, subtract, multiply, and divide whole numbers, fractions, decimals and percents Calculate averages, ratios, proportions, and rates Convert decimals to fractions, fractions to percents and vice versa Measure and accurately report measurements of time, temperature, length, width, height, width, perimeter, area, volume, and weight Use appropriate formulas Convert measurements correctly (e.g., English (standard) to metric) Interpret meaning from data ENGLISH Use standard English to compile information and prepare written reports Apply English language correctly (spelling, grammar, structure) Derive meaning from text through summarizing Discern meaning from written word Use acceptable language Write legibly SCIENCE Explain the key elements of the scientific process Define the differences in qualitative and quantitative measurements Compare and contrast subjective and objective information Discriminate between fact and opinion
2. Apply career knowledge	Demonstrate understanding of career development in the	Explain the process for seeking employment

	transportation, distribution and logistics industry Obtain necessary skills and knowledge to meet position requirements	Describe the major functions and duties of the career pathways within the Transportation, Distribution & Logistics career cluster Discuss educational, training, and credentialing requirements for a selected job Research job requirements and characteristics of a selected job Contrast "positive" and "less positive" aspects of a selected job Describe opportunities for advanced training in Transportation, Distribution & Logistics careers
3. Apply Transportation, Distribution & Logistics industry knowledge	Demonstrate Transportation, Distribution & Logistics (TDL) industry systems understanding based on current knowledge and training	SYSTEMS, PRINCIPLES, CONCEPTS Discuss common vocabulary terms used in the Transportation, Distribution & Logistics (TDL) industry HISTORY and TRENDS Describe a brief history of TDL and governmental regulation Examine the current state and future trends in the TDL industry List major milestones in the TDL industry Describe the impact of technology on the TDL industry
4. Communicate effectively	Deliver coherent verbal messages in words that can be understood Use appropriate and bias-free language Use appropriate body language Listen actively to others Demonstrate courtesy with self-introduction Respond to inquiries or statements within the scope of current responsibilities and understanding Does not overreact in response to anger Record information in a timely manner Record written information legibly and accurately Organize and compile messages, technical information, and summaries accurately Use instant messaging, email, the Internet, printer, copier, scanner, and fax machine equipment appropriately as applicable Is sensitive to special, multicultural, and/or multilingual	GENERAL Compare verbal and nonverbal behaviors Explain how empathy and bias can be communicated verbally and non-verbally LISTEN Discuss effective and active listening skills Differentiate between hearing and listening WRITTEN Discern meaning from written instructions Write clearly to communicate written ideas Discuss common recording errors and how to avoid them CUSTOMER Identify internal and external customers at your facility Discuss steps to assess customer understanding Describe the steps to follow when dealing with complaints TOOLS

	needs	Describe technology used in communicating such as, telephone, texting, instant messaging (IM), computers, fax, intercom, beepers, etc. Explain the proper use and etiquette required for these forms of communication technology Review the policies and procedures for using written communication tools in your company such as IM, email, Internet, printer, copier, scanner, and/or fax
5. Act professionally	Follow oral and written instructions Is pleasant, courteous, and professional with coworkers and internal and external customers Appearance and dress are appropriate according to the requirements of the employer Take personal responsibility for attendance Is punctual Begin work promptly Organize and prioritize tasks efficiently Exhibit positive attitude and commitment to task at hand Complete assigned tasks accurately and in a timely manner Take responsibility for actions and decisions Recognize lack of knowledge and seeks help from information sources Evaluate work goals periodically with worksite professional Accept constructive criticism and apply suggestions Communicate safety, training, and job-specific needs Adhere to safety rules and regulations	Locate and explain written organizational policies, rules and procedures to help employees perform their jobs Locate and explain your company's employee manual for policies on Appearance, Breaks, Time Off, Cell Phone Use, Weather, Personal Issues, etc. List qualities of successful Transportation, Distribution & Logistics employees Describe how you can demonstrate enthusiasm and commitment at the worksite Define initiative Explain ways that you can show initiative at a worksite Explain methods to evaluate work assignments and prioritize them Describe how to effectively receive feedback
6. Demonstrate customer service skills	Is knowledgeable about products and services Address the customer, either in person, by telephone, e-mail or other means Gather information about customer's needs, and customer's knowledge of products or services Respond to customer's comments and questions Solicit supervisor or co-worker support and advice when necessary to meet customer needs Coordinate as needed with other services to expedite	Define customer service Identify internal and external customers at your facility Describe how customer service affects a company's "bottom line" Describe standards of service List strategies for maximizing customer satisfaction Describe the functions of other departments or units to serve the customer Describe the steps to follow when dealing with

	delivery of service or product Handle complaints tactfully without insult or conflict	complaints Identify customer service methods to use when encountering an angry customer Review material pertaining to products and services produced by your department or company
7. Cooperate with others in a team setting	Demonstrate respect relating to people Contribute to a group with ideas, suggestions, and effort Listen and respond appropriately to team member contributions Work collaboratively with people from other backgrounds/cultures Resolve differences for the benefit of the team Complete their share of tasks necessary to complete a project	Explain the functions of each department or unit within the larger organization Identify roles found in teams such as leader, facilitator, recorder, etc. List effective meeting management skills Demonstrate techniques that show respect for others Describe how to effectively give and receive feedback Describe conflict resolution methods Discuss ways to participate within a team setting Explain how to interact appropriately with diverse ethnic, age, cultural, religious, and economic groups in different situations Describe how work teams coordinate work flow and help manage resources
8. Think critically	Recognize the existence of a problem Apply problem-solving steps Differentiate between fact and opinion Consider other viewpoints and perspectives Apply the principles and strategies of organized thinking Evaluate information, ideas, and problems Collect information through probing questions and research Define the problem Use techniques such as brainstorming to acquire alternative solutions Demonstrate comparison skills Make decisions based on analysis Present ideas for critical evaluation Support viewpoints with evidence Respond to problems with the appropriate level of urgency	Describe how to break a problem down in order to brainstorm, evaluate, and analyze possible solutions Discuss the difference between fact and opinion Discuss data collection techniques for the problem solving process Describe how to present a solution with evidence Explain ways to reach a decision by consensus Discuss methods to evaluate a solution that has been implemented
9. Exhibit regulatory & ethical responsibilities	Follow all safety and worksite standards and regulations Perform legally and ethically by all local, state, and	GENERAL Explain the role of government in regulating the

	national standards Use instant messaging, email, the Internet, printer, copier, scanner, and fax machine equipment appropriately and correctly as applicable Operate within scope of authority adhering to company rules, regulations, and policies as established in employee handbook/procedures Comply with legal requirements for documentation Document work processes as required Record and file appropriate documents in timely manner Maintain confidentiality of company, customer, and co-worker information Document reportable incidents to worksite professional immediately, if applicable Receive, handle, package, and ship materials and product according to shipping laws and regulations if applicable	Transportation, Distribution & Logistics (TDL) industry Compare international, national, state, and local regulators that oversee the TDL industry: Department of Transportation (DOT), Department of Commerce (DOC), Federal Aviation Administration (FAA), North American Free Trade Agreement (NAFTA), Environmental Protection Agency (EPA), Department of Natural Resources (DNR), National Transportation Safety Board (NTSB), etc. Identify the major TDL industry associations: American Trucking Association (ATA), Air Transportation Association (ATA), International Air transport Association (IATA), American Association of State Highway & Transportation Officials (AASHTO), American Association of Port Authorities (AAPA), American Production & Inventory Control Society (APICS), American Society of Transportation & Logistics (ASTL), American Waterways Association (AWA), Association of American Railroads (AAR), International Maritime Organization (IMO), etc. Identify the management structure and employees' roles within your organization Describe common legal requirements that must be met in TDL facilities Describe your legal responsibilities, limitations, and implications for action in your professional job role Compare and contrast behaviors and practices that could result in liability or negligence Summarize the rights and responsibilities of TDL workers Explain what situations are reportable in TDL facilities ETHICAL Explain the difference between an ethical practice and a legal responsibility Identify current ethical issues common to the TDL industry Describe ethical work values such as confidentiality, productivity during the day, following safety standards SAFETY Define ethical and legal responsibilities for safety

		procedures Describe the certification/license requirements to operate specific equipment RECORDS Identify the main functions of documents and documentation Identify the guidelines for retaining common documents
10. Use resources wisely	Follow the facility pollution/waste prevention plan Recycle whenever possible Dispose of materials appropriately Dispose of hazards legally and with regard to environmental impact	Identify current environmental issues affecting the Transportation, Distribution & Logistics industry Define what is meant by making "green" choices Compare renewable and nonrenewable natural resources Explain the meaning of sustainable resources use Identify practices that contribute to sustainability Describe why wise use of resources at the worksite is important Give examples of wasteful uses of resources (unnecessary waste and duplication) at the worksite List materials that can be recycled Describe materials that require special disposal Explain purpose of pollution control systems Relate power generation to energy sources Compare environmental impact of energy sources (e.g., fuel cells, chemical, wind, hydro, nuclear, electric, mechanical, solar, biological)
11. Use basic technology	Use communication technology (such as pagers, radios, phone, fax, email, Internet) to access and distribute data and other information within the scope of the job Follow rules for proper computer and communication technology usage Use calculating tools such as computer, calculator, and adding machine correctly Enter, edit, and store data on computerized equipment according to worksite guidelines Verify data entry prior to data storage or equipment operation	Identify the parts and functions of a computer system using correct terminology including the keyboard, monitor, mouse, printer Point out the storage device locations on the computer such as the Hard drive, CD-ROM drive, and Portable File Storage drive, etc Show the appropriate connections and positioning of peripheral devices such as a mouse, keyboard, monitor, and printer Discuss the importance of backing up computerized files Compare different forms of communications technology including email, texting, word processing, spreadsheets, database, presentation software, and use of the internet to communicate, search and display information

		Describe how to evaluate internet websites and information for validity and reliability Explain appropriate and inappropriate uses of email and internet while at work

Safety

Competency (Work Tasks)	**Performance Standards** What employer checks for while doing task. **Train YA Student on.** YA student will ...	**Learning Objectives** What to know/learn to do this task. **Content Suggested** for Class/Reading/On-the-Job Training:
1. Follow personal safety requirements	Participate in all required safety training Follow all worksite guidelines for personal safety Apply principles of proper body mechanics when necessary Report any exposures, injuries, or accidents, personal or to others, immediately, if applicable Locate and can find key information on Material Safety Data Sheets (MSDS) Handle and dispose of any hazardous materials appropriately, if applicable Operate only equipment that he/she is trained on Adhere to equipment safety standards Visually inspect equipment to ensure safety compliance and function before operation Wear the required Personal Protective Equipment (PPE) at all times as required by the worksite for specific tasks Be alert for moving equipment, machinery, and traffic	Discuss the regulatory purpose and responsibility of the Occupational Safety and Health Administration (OSHA) List your rights as a worker according to OSHA Explain the procedure to follow in case of an exposure, injury, or accident to self or to another Explain ways your company prevents accidents List engineering controls that are taken to protect workers from accidents Describe safe and unsafe work habits and their implications List safety hazards at your facility Explain potential hazards associated with blood borne pathogens Explain the ergonomic impact of work techniques Describe proper techniques for lifting loads Describe the Material Safety Data Sheet (MSDS) and its purpose Discuss the procedures of handling and disposing of hazardous material List mechanical, chemical, electrical, compressed air, and equipment safety hazards at your facility Describe your facility's chemical hygiene plan Explain how Lock Out/Tag Out procedures prevent accidents Define the Personal Protective Equipment (PPE)

		required for specific tasks in your facility Explain the use of safety equipment such as eyeball washers and chemical safety showers and when you would use them Describe ways to prevent burns
2. Maintain a safe work environment	Comply with posted safety warnings and symbols Identify unsafe conditions and/or work habits and reports them to the worksite professional immediately, if applicable Help maintain a clean and safe working environment free of debris and obstacles Clean, organize, put away items in the work area Safely identify, handle, store, and use hazardous materials according to company procedure, if applicable Report any indications of insects or pests	List the major components of a facility safety program List the different state and federal agencies that provide regulatory oversight at your facility for personal safety, environmental safety, and equipment safety List accident and fire prevention techniques Describe posted safety warnings and symbols and what they mean Describe safe and unsafe work habits and their implications Discuss the importance of keeping the work area and tools/equipment clean List mechanical, electrical, and equipment safety hazards at your facility Discuss how to identify and report unsafe conditions in your facility Discuss safety procedures to prevent accidents Describe the requirements at your facility for safety training and auditing Assess need for good housekeeping practices List accident and fire prevention techniques List hazards that contribute to injury due to slips, trips, or falls Outline compliance requirements of sanitation and health inspections
3. Demonstrate professional role to be used in an emergency	Participate in emergency safety simulations and drills Outline the company's policy and procedure for worksite incidents, accidents, electrical, fire, tornado, bomb threats, robbery, hostage situations, and other emergency situations Identify the closest fire alarms and emergency exits in the assigned worksite area Identify the fire extinguishers in the assigned worksite	Describe the procedures in your company to report an emergency Review your company procedures for responding to exposures, injuries, accidents, spills, fire, tornado, bomb threat, robbery, hostage situations, etc. Demonstrate how to use the fire blanket and/or fire extinguisher Explain the evacuation plan for the worksite

	area Identify appropriate alarms and procedures for using alarms Contact emergency personnel according to company requirements in the event of an emergency Document any emergency incidents according to company requirements	Indicate the demeanor necessary during an emergency Identify methods to cope with emergency situations Name the resources for assistance in crimes or accidents Locate and explain use of first aid emergency care kits Detail steps to use in medical emergencies requiring First Aid, CPR, and/or Heimlich maneuver Locate and explain use of spill kits, if applicable to worksite Explain who in your facility can give first aid care in the event of an emergency Explain the local protocols in place with local law enforcement Explain the role of the Hazardous Materials (HAZMAT) team Detail how to access help in a robbery or terrorist situation Explain the use of safety equipment such as eyeball washers and chemical safety showers and when you would use them

Appendix K

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

AUTO COLLISION PATHWAY COLLISION REPAIR BASICS (UNIT 3)

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency

1. Obtain and apply basic vehicle and collision repair knowledge

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- in the classroom

Performance Standard Criteria

Performance will be successful when learners:

- Demonstrate vehicle systems knowledge based on current understanding
- Comply with personal safety practices concerning clothing, hand and power tool usage, proper ventilation of fumes and lifting and securing of vehicles
- Comply with environmental safety standards concerning handling, storage and disposal of hazardous materials and chemicals in accordance with local, state and federal regulations
- Comply with safety and hazards requirements associated with volatile organic compounds (VOC)
- Apply knowledge of Low VOC regulations and refinish technology
- Identify approved service procedure prior to completing any work on a vehicle
- Perform all procedures according to manufacturer and regulatory requirements

Learning Objectives

- Explain body design and frame variations
- Compare unibody and body-over-frame construction
- Identify major structural parts, sections, and assemblies of body-over-frame vehicles
- Identify major structural parts, sections, and assemblies of unibody vehicles
- Summarize how to classify vehicles by body, engine, and drive train configurations
- Identify commonly used automotive fasteners
- Explain common broken fastener removal techniques
- Define VOC
- List the hazards associated with VOCs
- Describe steps for reducing exposure to VOCs
- Locate VOC content on paint & solvent products
- Identify shop materials regulated by the EPA
- Describe the sources for obtaining VOC content
- Identify hazardous operations and materials according to federal, state, and local regulations
- Discuss/evaluate auto collision industry trends

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency

2. Obtain required tools, equipment and materials before work

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- in the classroom

Performance Standard Criteria

Performance will be successful when learners:

- Determine procedure to be completed
- Note required tools, equipment, and materials needed
- Choose correct tool or equipment for the task
- Verify tool/equipment is current for preventative maintenance and/or calibration

Learning Objectives

- Explain the types of equipment used in a collision repair shop
- Outline applications of each tool and equipment
- List which tools and equipment require safety certification
- Explain the purpose of preventative maintenance
- Compare & contrast power tools, pneumatic tools and hand tools and their uses
- Explain low emissions spray equipment and regulations
- Explain the operation of spray booths and drying rooms
- Identify various types of spray guns and how each operates

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency
3. Maintain work area

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- in the classroom

Performance Standard Criteria

Performance will be successful when learners:

- Maintain and retrieve shop manuals and/or electronic retrieval systems
- Organize tools
- Sweep work area
- Put shop equipment away
- Clean work bench
- Dispose of garbage and recyclables properly
- After servicing, clean work area
- After servicing, return tools to proper location
- After servicing, complete and store appropriate documentation

Learning Objectives

- Describe the typical movement of a vehicle through the collision repair facility
- Summarize the major areas of repair in a body shop
- Describe typical shop layouts

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency

4. Operate tools and equipment safely

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- in the classroom

Performance Standard Criteria

Performance will be successful when learners:

- Operates only equipment that he/she is trained on
- Verifies tool/equipment is available for use and in working order
- Verifies safety equipment and any Personal Protective Equipment (PPE) needed for tool/equipment use
- Operates tool/equipment safely with guarding devices if applicable in the manner required for the job task
- Monitors tool/equipment for safe operation while operating
- Properly shuts down and labels any tool/equipment that is not operating as expected, if applicable
- Follows Lock Out/Tag Out procedures as applicable
- Documents use and maintenance as required

Learning Objectives

- Describe and demonstrate the safety requirements for each tool and equipment
- Discuss start up and shut down procedures for each tool/equipment you will operate
- Describe emergency shutdown procedures for the tool/equipment you will operate
- Explain how to recognize and address malfunctions for the tool/equipment you will operate
- Describe how to recognize wear and tear on equipment components
- List the OSHA and other regulatory requirements as they apply to the equipment that you operate
- Describe proper techniques for lifting loads
- List the safeguards that apply to the equipment used in your facility for tools, automated machines, material handling equipment, and lifts
- Explain Lock Out/Tag Out indications and procedures in your facility

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency

5. Clean and store tools after use

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- in the classroom

Performance Standard Criteria

Performance will be successful when learners:

- Follows procedures for clean up and shut down after use
- Performs any required preventative maintenance procedures
- Investigates and promptly reports abnormal tool/equipment conditions
- Store tools in proper manner in proper locations

Learning Objectives

- Explain the importance of proper cleaning and storage of tools after use
- List the common cleaning procedures for typical tools in an auto collision repair shop
- Describe any special handling requirements for tools

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency

6. Dispose of parts, garbage, and recyclables properly

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- in the classroom

Performance Standard Criteria

Performance will be successful when learners:

- Dispose of materials and wastes as required
- Dispose of damaged parts as required
- Segregate and recycle materials as required

Learning Objectives

- List common auto body repair shop wastes
- List common items considered recyclable
- List common items that are regulated for disposal
- Describe the disposal procedures for old parts, hazardous materials and substances
- Define Toxic Characteristic Leaching Procedure (TCLP)
- Explain the rationale for special disposal requirements
- Describe container requirements for flammables & combustibles
- Describe container requirements for hazardous wastes
- Explain the procedures for handling & disposing lead-acid batteries
- Describe handling and disposal requirements for paint solids and waterborne materials

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency

7. Locate & record vehicle information

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain customer information and vehicle identifying information such as VIN, year, make model, engine, optional equipment, mileage
- Identify & note all pre-collision damage
- Check technical service bulletins/updates and identify approved procedures prior to completing any collision work
- Retrieve shop manuals and/or electronic information systems
- Research applicable vehicle and service information, normal body system specifications, vehicle service history, service precautions, and applicable technical service bulletins

Learning Objectives

- Define basic auto collision and repair terminology
- Define the purpose & use of the vehicle identification number (VIN), engine numbers, and date codes
- Describe how to locate and determine vehicle information such as the vehicle identification number (VIN) information, nation of origin, make, model, restraint system, body type, production date, engine type, and assembly plant
- Identify references that are used to estimate vehicle repair charges
- Describe the different types of service manuals
- Find and use the service manual index and contents sections
- Explain the different kinds of information and illustrations used in a service manual
- Describe the three basic types of troubleshooting charts found in service manuals
- Explain how to use computer-based service information
- Demonstrate the use of NAGS (auto glass) domestic and foreign catalogs

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency

8. Maintain service & repair records

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Select appropriate forms/records
- Code documents as required
- File forms/records in appropriate location
- Retrieve and replace files in correct position
- Add, Edit, Verify and Query data in electronic files if applicable
- Verify data prior to entry/storage
- Maintain files

Learning Objectives

- Describe the importance of repair documentation for collision repair facilities
- Demonstrate how electronic data is manipulated such as in a spreadsheet system
- Explain how data & files are backed up
- Identify and explain the role and function of software management systems

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency
9. Remove old decals, stripes, emblems & moldings

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Check automobile manufacturer's recommended procedures
- Mask around removal area to protect finish from damage
- Remove old decals, stripes, moldings or emblems held in place by fasteners or adhesives using appropriate tools & solutions
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation.

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe how to remove tape pinstripes, painted pinstripes, and decals
- Explain how to use chemical strippers, heat guns and mechanical removal tools
- Describe when you would use specifics removal tools to remove specific items
- List common exterior trim that should be removed prior to body work or paniting
- Explain removal procedures for exterior parts, trim, and moldings

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency
10. Apply decals, tapes, stripes, emblems & moldings

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Check automobile manufacturer's recommended procedure
- Clean the painted surface
- Position the attachment
- Apply decals, stripes, moldings or emblems using appropriate fasteners or adhesives
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation.

Learning Objectives

- Summarize uses of chemical fasteners
- Describe safety practices related to personal protection, equipment & materials for this process
- Describe how to install tape pinstripes, painted pinstripes, and decals
- Describe methods for properly positioning attachments
- Compare adhesives used in application processes and when to use them
- List the strength and cure times of adhesives
- Explain the importance of using one product line throughout the repair
- List the specifications for urethane adhesives
- Compare wet versus dry overlay methods

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency

11. Remove exterior dirt, grease, wax and coatings from surfaces

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Wash the vehicle with soap & water
- Clean the area to be prepped with wax and grease remover
- Assist a worksite professional to correct any surface defects mask the vehicle
- Tack off the vehicle using a tack rag
- Clean surfaces and remove corrosion protection using appropriate tools and solutions
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe the process of vehicle cleaning
- Explain the importance of pH in cleaning surfaces
- Explain how to use wax & grease remover
- Describe the cleaning techniques & solutions needed for removing grease, wax, & corrosion protection
- Describe the cleaning techniques for cleaning the engine compartment, vehicle exterior, vinyl tops, and wheels and tires
- Demonstrate mechanical and chemical methods of surface cleaning available in collision repair
- Demonstrate use of surface preparation chemicals
- Identify types and locations of seam sealers, undercoating, and sound deadening
- Describe the proper methods to protect electrical parts and connectors prior to cleaning
- Demonstrate proper tacking off of a surface

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency
12. Clean interior, exterior, body openings and glass

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Cover & protect electrical parts & connectors
- Clean carpet, glass, upholstery, vents, instrument panel & trunk
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain the importance of pH in cleaning surfaces
- Describe the cleaning techniques for cleaning carpet stains, vehicle glass, upholstery, vents, instrument controls, conditioned interior parts, the trunk, removing odors
- Describe the proper methods to protect electrical parts and connectors prior to cleaning
- Explain the materials to clean a vehicle following air bag deployment
- Compare finesse finishing and detailing

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency

13. Mask exterior/interior panels & parts adjacent to repair areas

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Clean surface dirt, grease, wax, and corrosion protection
- Dry surface
- Place masking paper over large areas; cut paper to fit
- Hold and peel masking tape with one hand
- Use other hand to guide and secure tape to vehicle
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Define the purpose of masking
- Define overspray
- List materials used in masking
- Explain when to use foam or liquid masking materials
- Identify types of masking and specialty tapes
- Explain factors to consider to mask or remove a part
- Demonstrate proper tape, reverse, and fine-line masking techniques
- Describe proper removal of masking

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency
14. Remove over-spray

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Use a wet abrasive to lightly sand the overspray until the overspray is removed
- Buff & polish as needed
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Discuss methods to remove over-spray
- Describe the cleaning techniques & solutions needed for removing overspray
- Explain why light sand is required to remove overspray
- Discuss the precautions to take when removing overspray

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency

15. Apply anti-corrosion primers

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Clean, dry & degrease surface depending on type of surface
- Stir primer well
- Apply primer with brush roller or spray evenly
- Spread evenly
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Define corrosion
- Explain causes of corrosion
- List the environmental conditions that affect the rate of corrosion
- Define the relationship between corrosion and structural integrity
- Describe the corrosion protection areas
- Explain how to protect vehicle bodies from corrosion
- Describe the function of vehicle coatings
- List common corrosive hot spots
- Identify vehicle body areas which involve exposed interior surfaces
- List products used in collision repair to restore corrosion protection
- Compare primers characteristics
- Demonstrate use of primers to restore corrosion protection

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency
16. Apply corrosion protection to surfaces

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Prepare corrosion protection substances
- Apply topcoat and sealer to primed areas
- Apply corrosion protection system to enclosed interior surfaces
- Apply corrosion protection system to exposed exterior surface
- Apply corrosion protection system to interior surfaces
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- List the types of metal coatings used to protect sheet metal
- Compare anti-corrosion compounds
- Describe different types of corrosion protection applications
- Identify procedures to restore corrosion protection to surfaces
- Compare corrosion protection for bolted- on versus welded-on interior areas
- Discuss corrosion protection principles for vehicle underbody
- Explain how to use metal conditioner and conversion coating
- Describe different types of seam sealers
- Define galvanic corrosion
- Explain how to prevent galvanic corrosion
- List the vehicle parts to avoid with corrosion protection
- Describe self-etching undercoats and how it affects panel preparation

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency

17. Apply corrosion protection to joints, seams & weld areas

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Thoroughly clean the joint or seam
- Apply primer and seam sealers
- Apply final primer coat(s)
- Apply topcoat
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Discuss characteristics of seam sealers
- Explain the characteristics and uses of chip-resistant coatings
- List treatments required in weld areas
- Plan and complete corrosion protection in weld areas
- Identify external seams which require protection by seam sealer
- Compare types of seam sealer
- Demonstrate techniques used to apply seam sealer

Comments:

Unit 3: Auto Collision Pathway
Collision Repair Basics

Competency

18. Sand and buff polish with appropriate compounds

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect the finished surface for any imperfections per paint, product and automobile manufacturers' specifications
- Determine if any contamination or painting errors exist
- Determine cause of condition
- Assist worksite professional to correct imperfections (e.g., runs, dirt nibs, fish eyes, die backs, texture, shrink, swelling, etc.)
- Apply appropriate polish to vehicle and pad
- Buff polish evenly using polisher correctly
- Clean area
- Perform final wash, removing all residue (e.g., compound, overspray, etc.) from repair process
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Identify and distinguish between finish systems
- Compare finish systems and system parts
- Identify possible contaminants on a painted surface and how to correct
- Describe tools and materials used to correct common imperfections
- Explain the use of a paint thickness gauge
- Demonstrate the proper methods and materials to buff and polish finish

Comments:

Appendix L

TRANSPORTATION, DISTRIBUTION AND LOGISTICS
YOUTH APPRENTICESHIP

AUTO COLLISION PATHWAY
NON-STRUCTURAL ANALYSIS & REPAIR (UNIT 4)

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

1. Remove undamaged body panels & components

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Assist to assess the damage to determine what can be repaired and what will need to be replaced
- Based on the damage, determine an organized plan for removal
- Obtain equipment & materials needed
- Review safety & service procedures
- Position vehicle to remove components if necessary
- Remove undamaged, non-structural body panels and components that may interfere with or be damaged during repair
- Remove large external panels first
- Remove the fasteners and parts as required
- Remove parts & fasteners carefully to prevent additional repair or paint touch up
- Take notes, sketches or photos to help ensure proper re-assembly
- Store undamaged parts & fasteners as they removed in an ordered manner
- Store components in appropriate manner depending on their disposition, i.e., for disposal, for re-assembly, for repair, etc.
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain why a removal plan is necessary prior to removing parts & fasteners
- List common vehicle components and how they are attached to the vehicle
- Identify various fasteners used in vehicle construction
- Explain how to remove & install nuts and bolts properly
- Explain when specific fasteners are used in vehicle construction
- Describe fastener grading systems
- Explain how to measure thread pitch, length, & diameter of fasteners
- Compare fastener, molding replacement parts and accessory items (e.g., wide adhesive moldings, molding retainers, exterior hardware, door handles)
- Compare tools required to remove fasteners
- Explain the methods used to fasten components
- Discuss nut & bolt torque values
- Identify hose clamps
- Explain why it is a good rule of thumb to keep all parts until the repair is completely finished
- Compare full and partial panel replacement

- Describe how to properly remove non-structural body panels
- List vehicle body items that are recommended for off-vehicle repair

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

2. Remove mechanical and electrical components

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position vehicle to remove components if necessary
- Remove mechanical and electrical components that may interfere with or be damaged during repair by disconnecting any wires or cables attached to electric window controls, locks or mirrors
- Store components in appropriate manner depending on their disposition, i.e., for disposal, for re-assembly, for repair, etc.
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain how to properly and safely disconnect wires and cables attached to mechanical or electrical components
- Explain how to retrieve vehicle codes
- List vehicle mechanical & electrical components that are recommended for off-vehicle repair

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

3. Rough straighten damaged metal panels

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Prepare the surface
- Select appropriate tools and equipment
- Rough straighten damaged metal panels
- Restore contours of damaged panel to a surface condition suitable for metal finishing or body filling
- Straighten panels with dollies, hammers, spoons and picks
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe different metals used in vehicle construction
- Explain strength ratings of metals
- Summarize deformation effects of steel impacts
- Identify high & low areas in a damaged panel
- Demonstrate how to use metal straightening tools
- Compare removing dents with various tools such as a suction cup, hammer, dolly, spoon, pick & pry bar, pull rods, etc.
- Explain the process of shrinking metal for straightening

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

4. Remove damaged sections of metal body panels

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove damaged body panels and components safely
- Remove the fasteners as required
- Remove bolted, riveted, adhesive/bonded, and welded panels or panel assemblies
- Assist to determine the extent of damage to substrate (aluminum, magnesium, and composite) body panels
- Remove damaged sections of metal body panels
- Store damage sections in appropriate manner depending on their disposition, i.e., for disposal, for repair, etc.
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe how to remove broken bolts and studs
- Compare full and partial panel replacement
- Describe how to properly remove non-structural body panels

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

5. Remove door and all components

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove decorative plugs and screws that hold armrest and other trim pieces

WINDOW CRANK

- Locate the manual window crank if applicable
- Look behind the window crank and slide the pick under the edge of the metal clip that holds the crank in place
- Remove the clip and pull the crank off

DOOR HANDLE

- Remove the door handle by unscrewing the small screw located in the center
- Gently pull the door handle out until you see the back of the handle
- Unclip the rod from the door handle or unclip the rod from the door lock and remove them both together.
- Unscrew the cap off rear upper corner door panel locks

PANEL

- Locate the panel screws and bolts are before starting
- Roll down the vehicle door window
- Remove all screws and bolts that hold the door panel onto the vehicle
- For snap-in fittings, pry gently on bottom corner of the door panel until the fittings pop out
- Pry up power locks, windows, and mirror adjustment mechanism
- Disconnect plugs
- Pop the door panel off by gently prying on bottom edge of the door panel until it releases
- Pull out and up to completely remove the door panel
- Peel back the paper or water shield to access window regulator if needed
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Compare door construction designs
- Locate and identify parts of a door
- Describe the components of typical vehicle doors
- Point out the locations of typical door panel attachments
- Explain how most car door panels are attached to the car

- Describe the tools to use to remove panels attached with screws, bolts or snap-in fittings
- Discuss when the door needs to be replaced vs. just replacing the door skin

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

6. Check door fit & function

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Check door fit and function
- Inspect the car door when it's open
- Make sure the rubber seal is intact and that it hasn't bunched up causing the door to be out of alignment
- Close the door
- Run your finger all the way around the door jamb and look for gaps
- Step away from the car and visually inspect the way the car door aligns with the car's body
- Open the door again & inspect the striker plate
- Inspect all of the bolts holding the door in place
- Use a door jack to support the weight of the door
- Loosen the bolts that hold the door in place
- Move the door as needed to align it
- Tighten the bolts again evenly
- Periodically close the door gently to see if this is helping to realign the door
- Check the door striker pin alignment for proper door closing
- Assess if one of the door hinges is bent; straighten or replace if needed
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe what gaps in vehicle doors indicate
- Describe common troubleshooting techniques to realign a car door
- Explain when to replace the door bolts & screws

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

7. Remove & install door lock and handle components

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove interior door handle, door arm rest, mirror control knob, window handle regulator, door trim panel components as needed
- Pull Handle Lock
- Place a drop light inside the door
- Pop off the small clip holding the lock rod
- Pry the clip off the lock
- Slide the lock & washer off outside the door
- Refer to service manual for electric door locks to disengage and re-engage electrical connector switch and lock
- Repair or replace components as needed including manual door lock assembly, power door lock assembly, door lock cylinder, bolt-on door handle assembly, and riveted door handle assembly
- Test operation of door lock assembly after repair or replacement
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Locate & identify parts of a lock assembly
- Describe precaution to take when installing door locks and handles on newly painted body panels
- Compare different types of lock mechanisms
- Explain differences in installation based on the type of lock mechanism

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

8. Assist to diagnose and repair water leaks, dust leaks and wind noise

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Assist to test door leaks & noise
- Inspect the weather stripping
- Replace weather stripping if needed
- Seat the new stripping firmly with weather stripping adhesive
- Slip the stripping over the panel lip if applicable stripping slips over
  Make sure the joins (where the two ends meet, such as between the door top strips and bottom strips) are neat
- Don't stretch the stripping as you apply
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe the different tests that can be used to diagnose leaks- Feel test, sound test, ultrasonic leak detector, chalk test, paper strip test, powder test, water test, soap & water test
- Explain the purpose of weather stripping
- Discuss the components of modern weather stripping
- Describe the characteristics of weather stripping that indicate replacement
- Explain the danger over-stretching weather stripping

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

9. Remove, replace, and align hood, hood hinges, and hood latch/lock

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Obtain assistance from another worksite professional
- Inspect hood latch/lock
- Disconnect any wires and hoses
- Remove cable & replace if needed
- Remove bolts that hold hood to hood hinges
- Inspect bolts & hinges
- If hood is to be replaced, mark hood hinge alignment
- Remove old hood
- Remove damaged hood hinges by unbolting hinges from inner fender panels
- Install new hinges, snug bolts down
- Replace new hood
- Replace hinge bolts, do not tighten
- Align hood to where it needs to be, tighten bolts
- Double check all panels for gaps to assure good alignment
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Compare the different types of hood connectors
- Explain when hinges and latches/locks need to replaced on hoods
- Describe when hood alignment or replacement is needed
- Discuss the mechanisms, operation & connections of the hood latch/lock
- Explain the importance of proper release cable re-assembly

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

10. Remove, replace, and align deck lid, lid hinges, and lid latch/lock

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Obtain assistance from another worksite professional
- Inspect lid latch/lock
- Disconnect any wires and hoses
- Replace if needed
- Remove bolts that hold lid to lid hinges
- Inspect bolts & hinges
- If deck is to be replaced, mark deck hinge alignment
- Remove old deck lid
- Remove damaged deck hinges by unbolting hinges
- Install new hinges, snug bolts down
- Replace new deck lid
- Replace hinge bolts, do not tighten
- Align deck lid to where it needs to be, tighten bolts
- Double check all panels for gaps to assure good alignment
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Compare different types of deck fasteners
- Explain when hinges and latches/locks need to replaced on lids
- Describe when lid alignment or replacement is needed
- Discuss the mechanisms, operation & connections of the lid latch/lock
- Explain the importance of proper release cable re-assembly

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

11. Remove, replace, and align bumpers, reinforcements, guards, absorbers, isolators, and mounting hardware

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove any flexible deflectors
- Remove any wires to fender mounted lights
- Remove all the bolts & fasteners from the bumper/fascia
- Slide bumper/fascia forward & remove
- Locate & remove all fasteners holding the bumper
- In some cases, disconnect the hood release cable & remove the latch assembly
- Remove any additional reinforcements, guards, absorbers, isolators and hardware as needed
- Mask doors or cowl if undamaged
- Install replacement fender
- Hand start the fender bolts; do not tighten
- Shift the fender on its bolts until aligned
- Tighten fender bolts
- Double check all panels for gaps to assure good alignment
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Point out common components and fasteners found on fenders & related components
- Explain the importance of proper release cable re-assembly
- Describe how the fender and related components act to absorb energy in a collision
- Compare fenders today versus fenders on vehicles in the past

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

12. Check and adjust clearances of front fenders, headlight mounting panel, and other panels

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- After the fender is secured on the vehicle, let the hood down gently
- Inspect the fit and alignment of the hood with the fender or other panels
- If gaps exist, loosen or remove the appropriate bolt(s)
- Pull the fender back toward the cowl or adjust the other panels as required
- Tighten or replace the mounting bolt(s)
- Double check all panels for gaps to assure good alignment
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Identify parts and assemblies associated with bumpers & fascias
- Describe types of energy absorbers
- Describe the process of fender shimming in adjustments

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

13. Remove and reinstall interior door trim panels

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect the door trim panel
- If damaged or loose, remove the door trim panel
- Remove the fabric material from the fabric panel
- Peel the fabric off of the shell of the panel
- Use some sandpaper to remove any foam that remains on the shell
- Lay the new fabric on the panel in the correct position; fold half of it back so the shell is visible
- Spray the adhesive glue on the visible side of the shell and on the underside of the fabric
- Allow it to set until it has dried some
- Fold the fabric over slowly onto the shell; smooth out any wrinkles.
- Repeat the gluing procedure for the other half of the shell and fabric
- Reinstall the repaired or new interior door trim panel using the same screws/clips
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain removal procedures for interior door trim
- Explain the precautions to take to ensure that no wrinkles or buckling occurs with the fabric panels
- Compare adhesives used for interior door trim panels
- Explain the functions of the different trim removal tools
- Demonstrate how to use trim removal tools

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

14. Remove and reinstall headliners and other interior panels

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove everything that bolts into the headliner like visors, lights and coat hooks
- Take down the old headliner careful not to rip or bend the headliner
- Slowly move it towards the rear of the car
- Take the headliner out through a door of the car.
- Install the headliner using the opposite steps you took to remove it
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Define headliner
- Describe safety practices related to personal protection, equipment & materials for this process
- Explain removal procedures for interior trim
- Explain the precautions necessary for headliner removal
- Compare bumper moldings, clip-on body side moldings, wheel opening moldings, and side mirror removal processes

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency
15. Remove and install upholstery and related items

Performance Standard Condition
Competence will be demonstrated
- at the worksite

Performance Standard Criteria
Performance will be successful when learners:
- Obtain equipment & materials needed
- Review safety & service procedures
- Peel the fabric off of the shell of the panel
- Use some sandpaper to remove any foam that remains on the shell
- Lay the new fabric on the shell in the correct position; fold half of it back so the shell is visible
- Spray the adhesive glue on the visible side of the shell and on the underside of the fabric
- Allow it to set until it has dried some
- Fold the fabric over slowly onto the shell; smooth out any wrinkles.
- Repeat the gluing procedure for the other half of the shell and fabric
- Trim the left over fabric to 1/4 of an inch long.
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives
- Describe safety practices related to personal protection, equipment & materials for this process
- Explain the precautions to take to ensure that no wrinkles or buckling occurs with the fabric panels
- Compare adhesives used for interior panels
- Explain the functions of the different trim removal tools
- Demonstrate how to use trim removal tools

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

16. Remove & install door glass & lower channel from door glass

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove the door panel & components gently
- Remove the weatherproofing sheet if applicable
- Remove all broken pieces of glass from the door panel if applicable
- Remove the weather stripping
- Remove any other parts preventing the glass from sliding out
- Unbolt the glass from the regulator
- Remove the clips from the lifting arm bracket
- Vacuum all broken glass from inside the door
- Install the new door glass from the outside or slide it in at an angle
- Bolt new glass to the regulator using washers
- Align door glass
- Reattach weather stripping, trim and door panel
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Identify different types of auto glass
- Compare moveable glass to fixed glass pieces in a vehicle
- Identify vehicle glass components and their basic repair/replacement procedures
- Describe precautions to take to avoid breaking glass
- Discuss proper procedures for removing broken glass
- Identify different types of glass defects and repairable breaks
- Compare & contrast tempered & laminated safety glass
- Describe common methods that window glass is held in place
- Demonstrate how to use glass removal tools
- Compare different window channels & runs

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair
Competency
17. Remove & install window regulator

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove door panel & components
- Peel away plastic and loosen window glass clamps
- Disconnect wire to motor, if power windows
- Remove bolts holding guide rails and motor
- Lift rails slightly to release from hangers
- Remove window regulator
- Loosen window glass clamps
- Set guides in place by using hangers
- Bolt guides and motor
- Temporarily connect power window switch and carefully raise window regulator until clamps are resting in place under window glass, tighten clamps
- Test before putting panel back on
- Readjust as needed
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain how to protect glass before repairs
- Describe types of regulators and drive mechanisms for windows
- Define the purpose of the counterbalance spring

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency
18. Align door glass

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Align the bottom of the glass with its window track & riser
- Secure the glass to the riser; do not over-tighten
- Roll the window all the way up
- Loosen regulator mounting fasteners and shift regulator and glass as needed
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- List the different types of adhesives used by the auto glass industry
- Compare glass tinting shades & purpose

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair
Competency
19. Remove & install vent & hinged window assembly & glass

Performance Standard Condition
Competence will be demonstrated
- at the worksite

Performance Standard Criteria
Performance will be successful when learners:
- Obtain equipment & materials needed
- Review safety & service procedures
- Remove the door panel & components if needed
- Remove the trim piece
- Remove the large door glass if needed
- Remove any screw on the door frame holding the vent window in place
- Drop the vent window frame in the door and pull it out through the large window opening
- Pull off window gasket if needed
- Place the vent glass into the plastic/rubber molding
  Unscrew and pull aside the divider on the door between the vent window and main window
- Slide the vent glass assembly (glass and molding) into place
  Put back the divider and screw it at the top
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives
- Describe safety practices related to personal protection, equipment & materials for this process
- Describe precautions to take while removing & installing vent glass
- Describe how glass is coded & identified
- Compare partial versus full cutout removal of fixed glass

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

20. Assist to repair plastic parts

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Determine repairability
- Obtain equipment & materials needed
- Review safety & service procedures
- Remove necessary vehicle components
- Select the appropriate type of repair method (adhesives or welding)
- Clean and prepare the surfaces of plastic parts with the appropriate cleaning materials and methods
- Remove repairable plastics and other parts that are recommended for off-vehicle repair
- Mix the adhesives, if necessary
- Remove excess adhesives or weld material
- Apply filler as necessary
- Retexture plastics to restore original texture
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Identify different types of automotive plastics
- Locate plastic parts on a vehicle
- Identify plastic/composite components and their basic repair/replacement procedures
- Describe types of adhesive best suited for the repair based on the type of damage and plastic composition
- Compare plastic surface preparation for repair depending on the type of plastic (e.g., thermoplastic, thermosetting) being repaired and type of damage (e.g., cuts, tears, punctures)
- Explain the purpose of body filler
- Compare different types of body fillers
- Explain the purpose of hardener
- Describe how to apply body filler

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

21. Assist to reshape and shrink flexible exterior plastic parts

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Thoroughly wash and clean the part with plastic cleaner
- Apply heat directly to the distorted area
- Use tools to reshape the piece as needed
- Quick cool the area with cold water on a sponge or rag
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe how plastic parts are identified
- Compare plastic welding process such as hot-air, tack, airless, speed, melt-flow, and stitch-tamp welding
- Explain the process for repairing vinyl foam dents
- Compare single-sided and two-sided welds

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency

22. Clean metal to be welded

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Use sandpaper or wire brush
- Removing any paint or wax
- Use a small grinder to clean any tough spots
- Apply weld-through primer to bare metal mating surfaces, ungalvanized steel or where zinc has been removed
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe when to use and when not use certain welding processes for collision repair
- Describe weldable, weld-bonded, and non-weldable materials used in vehicle construction

Comments:

Unit 4: Auto Collision Pathway
Non-Structural Analysis & Repair

Competency
23. Assist to weld metal

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Identify the type of material (e.g., steel, aluminum, plastic) to be cut or welded
- Clean metal to be welded
- Check automobile manufacturer's information regarding the welding process and equipment recommended
- Determine correct welding process
- Adjust the welding equipment for proper operation
- Perform test welds and inspect
- Identify proper welding technique (push, pull, & gun angle)
- Protect surrounding panels, glass and interior
- Protect computers and electronic components
- Perform welding using appropriate type of weld joint
- Perform recommended procedure for type of weld
- Remove damaged structural steel and aluminum components, and weld in replacements
- Remove and install welding/weld-bonded panels
- Inspect for weld defects and make necessary adjustments
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain the difference between welding, soldering, and brazing
- Compare welding processes such as GMAW (MIG), compression/ resistance spot (STRSW), GTAW (TIG), electrode, wire type, diameter, gas and bonding material
- Explain why extra caution is needed for magnesium parts
- Compare types of welding equipment
- Compare types of welding techniques
- Compare types of welding joints (butt joint, t-joint or lap joint)
- Compare types of welding procedures (continuous, plug, stitch, spot, lap spot or tack)
- Identify the causes of welding defects (burn through, cracks in metal, cratering, porosity, improper penetration, excessive spatter, distortion, and waviness of bead) and how to correct them

- Identify proper cutting processes (abrasive, mechanical, plasma arc) for different materials and locations

Comments:

Appendix M

TRANSPORTATION, DISTRIBUTION AND LOGISTICS
YOUTH APPRENTICESHIP

AUTO COLLISION PATHWAY
PAINTING & REFINISHING (UNIT 5)

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency

1. Sand area to be painted/refinished

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect and identify substrate, substrate condition, type of finish, film thickness and surface condition
- Assist to determine method to remove finish
- Clean surface to be sanded
- Mask areas to be protected
- Power grind or sand the surface to remove the old paint/finish
- Replace the sandpaper when the paint begins to “ball up” on the paper
- Rinse off any residue and clean using proper cleaning solutions
- Remove or protect from dust/lint particles
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain how sanding prepares the surface for painting
- Describe different types of abrasives
- Distinguish between grit and numbering systems
- Explain how to select grit abrasive materials for sanding tasks
- Compare power sanding to power grinding to remove paint/finish
- Compare types of sanding and sandpaper
- Compare types of sanding methods
- Describe the proper use of a sanding respirator
- Explain how to inspect the condition, fit, and operation of a sanding respirator

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency

2. Strip finish or other protective coatings

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect and identify substrate, substrate condition, type of finish, film thickness and surface condition
- Assist to determine method to remove finish
- Clean surface to be stripped
- Mask areas to be protected
- Slightly sand the surface
- Strip finish and paint with a chemical remover or air-powered blasting equipment
- Apply a thick coat of stripper in one direction using a soft bristle brush
- Allow stripper time to soak until paint/finish is softened
- Scrape softened paint/finish with a scraper or scuff grinder
- Rinse off any residue and clean using proper cleaning solutions
- Remove small patches left with a scraper or scuffing disc or wheel
- Remove or protect from dust/lint particles
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe the process for evaluating the surface for paint/finish condition
- Compare advantages and disadvantages of finish removal methods
- Explain when stripping is indicated to remove paint/finish
- Compare methods of stripping finish and paint
- Discuss the purpose & process of the paint adhesion check
- Explain the purpose and process for air-powered (blasting)
- Discuss when air-blasting versus chemical stripping is indicated
- Describe appropriate measures to eliminate static electricity and dust from resettling on vehicle

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency

3. Featheredge adjacent areas for blending

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Start over the chipped area and work outward
- Rough cut down the edges of the broken areas with a course sandpaper with a sanding block or air sander
- Follow with a smoother grit
- Complete the taper of the featheredge with a fine grit paper and water
- Check the edges frequently for rough edges
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Define featheredging and blending as it applies to panel paint/finish
- Discuss why the angle of the sander is so important in this process
- Explain how to sand and scuff adjacent panels
- Demonstrate proper featheredge sanding

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency

4. Prepare undercoating

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Select the appropriate primer(s) and/or sealer(s) based on the surface condition and size of the job
- Select the proper solvent for weather conditions
- Mix materials thoroughly
- After preparation, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- List the purpose of the undercoat
- Discuss types of undercoats
- Define substrate
- Define topcoat
- Explain the difference between sealers and primers
- Compare primers, sealers, primer-sealers, and primer-surfacers
- Describe types of sealers and primer-sealers
- Explain how to select the right type of undercoating
- Indicate when sealers are to be used as opposed to primers

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency
5. Apply undercoating

Performance Standard Condition
Competence will be demonstrated
- at the worksite

Performance Standard Criteria
Performance will be successful when learners:
- Obtain equipment & materials needed
- Review safety & service procedures
- Remove, with a tack rag, any dust or lint particles from the area to be refinished
- Treat the bare metal substrate with metal conditioner
- Plan the order of priming/sealing
- Apply the first coat of undercoat and allow it to flash dry
- Apply 2 or 3 more medium wet coats for build up; allow flash time between each coat
- Apply stone chip-resistant coating primers if indicated
- Allow undercoat to dry thoroughly
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives
- Describe safety practices related to personal protection, equipment & materials for this process
- Explain how to properly apply primer
- Explain how to properly apply sealers and primer-sealers
- List common areas treated with chip-resistant coatings
- Explain how to properly apply chip-resistant coatings
- Compare waterborne and solvent based chip resistant primer application
- Compare chip-resistant coatings to conventional primers
- Demonstrate proper treatment of enclosed interior surfaces, exposed interior surfaces and exposed exterior surfaces
- Explain how to determine what seams and joints are to be sealed
- Identify types of seam sealer
- Demonstrate proper application of thin-bodied, heavy-bodied, solid, and brushable sealer
- List factors that determine dry time of sealers

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency

6. Smooth undercoating

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Allow undercoat to dry thoroughly
- Once dry, smooth the undercoating by sanding
- Inspect surface
- Remove imperfections from undercoating
- Apply two-component glazing putty to minor surface imperfections
- Block sand area to which primer-surfacer and/or two-component glazing putty have been applied
- Block sand area until smooth
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Demonstrate dry sanding with & without a block, wet sanding and scuff-sanding
- Demonstrate proper block sanding techniques including application of a guide coat

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency

7. Prepare painting and drying areas

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Clean paint booth
- Remove all scrap and trash
- Clean floors and walls
- Clean equipment used
- Drain oil and water filters and traps
- Clean air hoses by wiping
- Vacuum booth
- Examine and replace paint booth filter if needed or required
- Examine paint booth seals
- Set temperature as required
- Set lighting to daylight-corrected lighting
- Turn air circulation system on to ensure it is working properly
- Close off painting area
- Allow air circulation system to purge booth of debris
- Monitor manometer readings
- After cleaning, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain the purpose of a separate paint area
- List regulations concerning low VOC and refinish technology
- Explain the process for cleaning prior to painting
- Describe the importance of not touching the surface to be painted with your skin
- Describe specific daily, weekly, monthly and yearly maintenance tasks required for booth cleaning
- Explain the purpose of the manometer and the information it provides
- Describe the physical processes that are occurring when a surface is drying
- Define drying versus curing
- Define flash time
- List methods used to accelerate drying times

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency

8. Prepare paint mixing area

Performance Standard Condition
Competence will be demonstrated

- at the worksite

Performance Standard Criteria
Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Clean area of dirt & dust
- Check painting suits
- Straighten and organize personal safety equipment
- Check emergency equipment such as eye washes and first aid equipment
- Stock materials such as sanding blocks & abrasive paper, wiping cloths, tack rags, paint paddles, strainers, mixing buckets, masking materials, squeegees, reducers, activators, & cleaning solvents
- Clean & check mixing equipment if applicable
- After cleaning, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain the purpose of the paint mixing room
- Describe typical building, fire, & electrical codes applicable to a paint mixing area
- List common mixing equipment typically found in the mixing area
- Identify body repair and refinishing materials and supplies

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency
9. Prepare air supply equipment

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Check and replace oil & water filters & traps on air supply system as required
- Drain moisture from the system each morning
- Replace hoses as needed
- Check that air lines slope away from compressor
- After preparation, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe the eye & lung precautions necessary when painting
- Explain the purpose of the air supply system
- Describe the typical parts and operation of an air supply system
- List common problems associated with air supply systems
- Explain the rationale for morning moisture draining
- Explain the rationale for air lines that slope away from the compressor

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency

10. Clean spray guns

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Clean spray equipment as required for type of spray gun
- Set up spray equipment with proper fluid needle, fluid nozzle, and air cap for the material to be sprayed
- Adjust the air pressure
- After cleaning, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- List the typical components & function of a spray gun
- Define a captive gun system
- Explain the importance of proper cleaning of spray equipment
- Discuss common problems associated with defective or dirty spray equipment

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency

11. Test spray guns

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Verify temperature of spray booth
- Verify or adjust air pressure
- Set the pattern control knob to for the size of the spray pattern
- Set the fluid control knob for volume of paint
- Hold the gun 4-6 inches away from the paper
- Pull the trigger all the way back & release immediately
- Assist to inspect the burst pattern
- Adjust the control knobs accordingly
- Check uniformity of distribution by loosening the air cap
- Pull the trigger until the paint begins to run
- Assist to inspect the run lengths
- Adjust the control knobs accordingly
- Re-test until satisfactory test results are achieved
- After testing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Summarize atomization and how it relates to spray gun operation
- Explain the purpose of the spray pattern test
- Explain the elements of a good spray pattern
- Discuss the requirement for optimum spraying pressure
- Explain the appearance of a good spray pattern
- Describe common spray pattern problems and how to adjust for them
- Explain the appearance of a good distribution pattern
- Describe common spray distribution problems and how to adjust for them
- Demonstrate the set up, adjustment, and use of spray gun

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency

2. Assist to determine type, color & formula of paint

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Determine type and color of paint already on vehicle
- Locate paint code information and color chip using the color directory
- Identify paint color formula using the basecoat patch, spectrophotometer and/or computerized color matching system
- After locating information, complete appropriate documentation

Learning Objectives

- Describe color theory and how it relates to refinishing
- Define terms relating to color
- Explain the purpose of repair finish systems
- Identify and distinguish between finish systems
- Compare types of paint
- Compare lacquer and enamel paints
- Describe contents of paints
- Compare various paint materials
- Explain how to find and read a vehicle's paint code
- Describe the resources to use to determine the mixing formula
- Describe the purpose and function of the spectrophotometer
- Explain the use of a computerized color matching system
- Describe how spray methods can affect color
- Locate vehicle body plates and the type of paint on the vehicle

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency

13. Assist to mix and strain paint or primer

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Obtain a can, pail or container with straight sides
- Place the correct graduated mixing stick, cup or scale for the type of material to be mixed in the container
- Pour the amount of paint or primer into the container
- Stop pouring at the precise marking corresponding to the amount and column on the mixing stick, cup or scale
- Pour the hardener to the precise marking corresponding to the correct amount & column on the mixing stick, cup or scale
- Pour the final ingredient, such as solvent, until it aligns with the correct amount & column on the mixing stick, cup or scale
- Mix thoroughly
- Check viscosity
- Pour mixed material through the paint strainer prior to filling the sprayer cup
- After mixing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain how to mix paint by percentage or by part
- Calculate amounts based on percentages and parts for mixing
- Explain the purpose and use of the graduated mixing stick
- Describe how to use the mixing stick for pouring required amounts
- Compare the use of mixing sticks with cups and computerized mixing scales
- Define viscosity
- Describe how to make paint thickness measurements
- Describe how to use a viscosity cup
- Compare types of viscosity cups
- Describe how to adjust the color mixture to the correct viscosity
- Explain the function of the formula base, tint and reducer
- Explain the purpose of additives such as retarders, accelerators, and catalysts/hardeners as additives in paint curing
- Identify the correct foundation for topcoat

- Explain when adhesion promoter is used
- Explain how to apply hand-rubbing and machine-rubbing compounds and adhesion promoter
- Compare factory-packaged topcoats and intermixes

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency

14. Assist to apply paint on test panel or let-down panel

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Obtain a test panel or let-down panel
- Apply primer(s) that match the primer(s) on the vehicle
- Apply basecoat to full hiding; allow proper flash time between coats
- Apply clearcoat to half the panel OR split panel into equal sections for a let-down panel
- Apply increasing coats of midcoat color in each section of the let-down panel
- Allow to dry completely
- Assist to check color match
- After testing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain the purpose of the test or let-down panel
- Explain when to use a test panel or a let-down panel
- Describe appropriate painting techniques for painting basecoats, single-stage top coats, multi-stage coats, blending, spot painting, etc.

Comments:

Unit 5: Auto Collision Pathway
Painting & Refinishing

Competency
15. Assist to check color match; tint as necessary

Performance Standard Condition
Competence will be demonstrated
- at the worksite
- while assisting a worksite professional

Performance Standard Criteria
Performance will be successful when learners:
- Obtain equipment & materials needed
- Review safety & service procedures
- Test paint mixture on a test panel or let-down panel
- Compare panel to vehicle
- Assist to evaluate color match
- Run through possible reasons for a mismatch; tint only as a last resort
- Verify the paint code was correct, proper paint was mixed, test panel was made correctly, and that the panel was compared in the proper light, on a clean vehicle using the correct views
- Check manufacturer variance formulas
- If there is no variance formula, tint to a blendable match
- Verify formula
- Plot color on color plotting chart
- Use only half the can of paint
- Using one tinting base within the color formula at a time
- Check color after every adjustment
- Keep records of tinting process in case more needs to be mixed
- After tinting, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives
- Describe safety practices related to personal protection, equipment & materials for this process
- Discuss the differences between matching solid colors, metallic finishes, & multi-stage finishes
- List possible reasons for a color mismatch
- Define tinting
- Explain how to use a kill chart to tint
- Explain how to tint solid & metallic colors
- Describe the difference between tinting and blending
- Identify the following common paint/finish imperfections and how to correct them:
    - excessive or lack of texture (orange peel)
    - overspray
    - sags and runs
    - sandscratch swelling
    - color mismatch

- delamination (poor adhesion, peeling)
- cracking (crows feet or line-checking, micro-checking, etc.)
- water spotting, damage caused by bird droppings, tree sap and other natural causes
- damage caused by airborne contaminants, (acids, soot, rail dust, chemicals and other industrial-related causes)
- damage caused by buffing/polishing painted surfaces and improper topcoat blend

Comments:

Appendix N

TRANSPORTATION, DISTRIBUTION AND LOGISTICS
YOUTH APPRENTICESHIP

AUTO COLLISION PATHWAY
DAMAGE ANALYSIS & ELECTRICAL REPAIR (UNIT 6)

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

1. Prepare vehicle for inspection

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Mask and protect edges of broken glass
- Wipe up any leaking fluids
- Identify programmable electrical/electronic components; record data for reprogramming before disconnecting battery
- With the ignition off, disconnect the battery
- Remove battery if indicated; check battery case for cracks
- Assist to attach anchoring and support devices

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe the rationale for disconnecting the battery
- Explain the purpose of the Damage Report
- List the customer information required on a damage report
- Explain how to read a Damage Report
- Describe methods of determining repairability of a damaged vehicle

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

2. Assist to determine structural damage

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Determine direction and point(s) of impact
- Check alignment of doors, hood & deck lid
- Check for gaps between panels
- Verify opening and closing of doors, hood, & deck lid
- Check door handles & door locks for proper operation
- Inspect for ripples in roof, fenders, or quarter panels away from direct impact
- Check seam sealers
- Check glass and operation of windows
- Check damage to interior
- Assist to measure common structural damage points
- After inspection, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe collision information needed to help determine damage analysis
- Define factors assessed to determine structural damage
- Compare types of vehicle construction & frame designs such as space frame, unibody, body over frame, modular assembly
- Compare types of vehicle construction materials
- Review different manufacturing processes to build cars such as welding, mechanical fasteners, adhesives, etc.
- Define & locate crush zones
- Describe types of damage such as direct, indirect, pre-existing
- Explain the difference between direct and indirect damage
- Explain how to identify pre-existing damage or repairs through inspection
- Describe the different damage characteristics of space frame, unibody, and body over frame vehicles
- Identify impact energy absorbing components and their basic repair/replacement procedures
- Define dimensional frame points of reference- datum, body zero, and centerline
- Describe features of different types of frame damage such as mash/collapse, sag/kickup, sway, twist, and diamond

- Explain measurements needed in collision repair
- Describe how to take linear, angle, pressure, volume and other measurements
- Compare SAE and metric measuring systems
- Identify basic measuring tools common in collision repair
- Compare and contrast structural damage measuring systems (tram & self-centering gauges, dedicated fixture measuring systems, and universal measuring systems (mechanical, electronic, laser)
- Explain the common methods used to straighten damaged frames
- Identify steel components and their basic repair/replacement procedures
- Identify aluminum/magnesium components and their basic repair/replacement procedures

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

3. Assist to determine suspension, mechanical, and electrical damage

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Check wheels and tires including the spare
- Check under the vehicle for fluid leaks
- Inspect parts in the engine compartment for damage
- Perform a steering wheel center check
- Perform a jounce/rebound steering gear check
- Perform a strut position check
- Perform a wheel run-out check
- Select any other appropriate testing equipment to identify mechanical problems
- Assist to diagnose required mechanical/electrical repairs
- Plan for mechanical and electrical component repairs
- After inspection, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Define factors assessed to determine non-structural damage and component damage
- Describe different types of suspension, mechanical & electrical damage related to direct, indirect and inertia damage
- Compare structural and non-structural parts
- Identify tests and equipment to check suspension & steering problems
- Identify tests and equipment to check general electric problems
- Identify tests and equipment to check brake problems
- Identify tests and equipment to check engine cooling problems
- Identify tests and equipment to check engine performance problems
- Identify add-on accessories and modifications and their basic repair/replacement procedures

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

4. Assist to determine if refinishing is required

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Review type and condition of finish
- Look for cracked or stressed paint
- Assist to determine if refinishing is required and in what areas
- After inspection, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Define factors assessed to determine finish damage

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

5. Assist to plan repair work

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Determine structural repair requirements
- Determine suspension, mechanical & electrical repair requirements
- Determine refinishing requirements
- Prepare a plan for work and repairs based on customer decision
- Collect necessary information to determine parts and materials required
- Locate and interpret vehicle and component identification numbers such as make, model, year, VIN, vehicle certification labels, calibration decals
- Identify and record vehicle options, including trim level, paint code, transmission, accessories, and modifications
- Determine if OEM, aftermarket, recycled, or remanufactured/rebuilt/reconditioned parts could or should be used
- Assist to order required OEM, aftermarket, recycled/used, rebuilt, reconditioned parts and materials based on estimate
- Verify availability, compatibility, and condition of parts and materials upon receipt

Learning Objectives

- Explain how damage repair estimates are determined
- Explain aspects of insurance claim estimates (e.g., deductible, total loss, betterment, depreciation, adjustments, diminished value and prior damage)
- Discuss the required authorizations needed in order to proceed with repairs
- Outline the customer claims-insurance-repair shop process for vehicle damage
- Compare flat rate and overlap labor rate when making a cost estimation
- Identify common abbreviations in collision estimating guides
- Compare manual and computerized estimating
- Identify key operating features of manual and computerized estimating systems
- Apply appropriate estimating and parts nomenclature (terminology)
- Describe contractual and warranty obligations in collision repair
- Discuss the legal obligation to restore the vehicle to manufacturer specifications
- Compare OEM, aftermarket, recycled, and remanufactured/rebuilt/reconditioned components
- Describe when to use OEM components
- Describe when to use aftermarket components
- Describe when to use recycled (used) components
- Describe when to use remanufactured/rebuilt/reconditioned components

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

6. Inspect, clean, and replace battery

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect the condition of the support tray, hold-down, posts, cables and clamps

TOP

- If the battery top is dirty, test the top of the battery with a voltmeter; if leaking voltage then clean
- Clean top with baking soda & water

TERMINALS

- Perform a battery terminal test with a voltmeter with the ignition disabled
- If disconnecting battery, use a memory saver to keep programmable information intact
- Clean battery terminals by removing the cables and cleaning with baking soda & water
- Coat terminals with white grease
- Tighten fasteners to secure cable

ELECTROLYTE LEVEL

- In older NON maintenance free batteries, check electrolyte level
- Remove vent cap
- Check electrolyte level
- Fill cells to correct level with distilled water if needed

REMOVE/INSTALL

- Disconnect the cables
- Loosen the battery hold-down
- Carefully lift the battery out using a battery strap
- Gently place the battery into its try or box
- Ensure the battery fits properly
- Tighten the hold-down and reconnect the cables
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe the basic parts of an automotive battery
- Explain how temperature & other factors affect battery performance
- Describe the function of a baking soda mixture for cleaning
- Explain how to clean a battery top on a NON maintenance free battery
- Explain how to perform a battery terminal test
- Discuss when to use pliers to remove battery cables

- Discuss precautions to take around battery fill openings
- Explain why only distilled water can be used in batteries
- Explain why over-tightening terminals is a problem
- Discuss how size of battery relates to motor performance & battery service life

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

7. Perform battery state-of-charge test

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures

NON-SLA

- On NON-SLA (sealed lead acid) batteries, perform a hydrometer state of charge test
- If specific gravity is at or above acceptable level, do capacity test
- If specific gravity for all cells is below acceptable level, charge & retest battery
- If specific gravity between cells varies by more than acceptable amount, replace the battery

SLA

- Remove surface charge
- Perform open circuit voltage test
- Measure the open circuit voltage
- Refer to voltage chart to determine state of charge on battery
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify safety precautions when performing battery service
- Explain the operating principles of a lead-acid battery
- Compare conventional & maintenance-free batteries
- Explain how to remove surface charge from a battery
- Define specific gravity and how it indicates battery charge
- Describe how to do the hydrometer test
- Describe how to do the capacity test
- Describe how to do the open circuit voltage test
- Explain how to use the voltage chart to determine charge
- List levels which require a new battery vs. re-charging

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

8. Perform battery charge

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Disconnect the negative battery cable
- Check the battery casing for damage
- Check the water level; add water if needed
- Loosen the vent caps, if so equipped
- Attach charger clamps to battery
- Connect charger according to manufacturer instructions
- Connect the red charger lead to the positive terminal
- Connect the black charger lead to the negative terminal
- Set the charger to the appropriate current for the type of charging
- Turn charger on
- Turn charger off when charging is complete
- Remove charger clamps, negative first
- Replace vent caps if applicable
- Attach negative battery cable
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify safety precautions when performing battery service
- Describe how a battery charger works to charge a battery
- List battery charging precautions to prevent damage
- Compare advantages & disadvantages for slow & fast battery charging
- Describe the temperature and charging rates for slow & fast charging
- Discuss what would happen if a charger was on when it is connected to the battery

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

9. Retrieve codes and settings and disconnect the battery if needed

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Verify malfunction indicator light trouble codes using the scan tool
- Obtain the appropriate scan tool and program cartridge for the vehicle, system and/or date
- Locate the data link connector (DLC) in the vehicle
- Attach the scan tool cable into the DLC; use an adaptor if needed
- Connect the scan tool to battery power if needed
- Follow the prompts to access the trouble codes
- Consult the trouble code chart or scan tool code conversion
- Consult worksite professional to determine further tests, inspections or repairs
- Erase diagnostic trouble codes when applicable
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Discuss the purpose and operation of on-board diagnostic systems
- Explain the use of scan tools to simplify reading of trouble codes
- Compare OBD I and OBD II system capabilities and procedures
- Locate the data link connector on most makes and models of cars
- Activate on-board diagnostics and read trouble codes with and without a scan tool
- Describe how to use a trouble code chart in a service manual or code conversion by a scan tool
- Describe the importance of running all OBDII monitors for repair verification

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

10. Assist to diagnose electrical circuits, wiring, and connectors

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Locate the wiring diagram for the component of concern to see how the circuit is supposed to operate
- Identify all components, connectors, wires, related to that component
- Inspect the switches, connectors, relays, solenoid devices for proper connection and wearing, burning or pitting
- Inspect the wires for proper connection and wearing, rubbing or fraying
- Test devices & wires for voltage, voltage drop, current flow, resistance, continuity, & shorts
- Line-out parts of the circuit on the diagram that are working as each point is tested
- From the lined out circuit trace, narrow down possible causes
- Given measured and calculated values throughout a given circuit, identify some common cause that could result in the vehicle concern
- Determine additional testing or repairs required with worksite professional
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain the principles of electricity
- Describe the action of basic electric circuits
- Compare voltage, current, and resistance
- Describe the principles of magnetism and magnetic fields
- Identify basic electric and electronic terms and components
- Describe fundamental electrical tests
- Identify factors that will determine how much current will flow in a circuit
- Define Ohm's Law and how to determine circuit resistance, current flow and voltage drop
- State the relationships between voltage, current & resistance in a simple circuit
- Identify sources of AC/DC voltages & their automotive applications
- Explain how to use the following testing instruments: Voltmeter, Test Light, Ammeter, & Ohmmeter
- Describe how to check for module communication errors using a scan tool
- Describe how to check voltages in electrical wiring circuits with a DMM (digital multimeter)

- Describe how to check for voltage drop and/or current flow in electrical wiring circuits and components with a DMM (digital multimeter)
- Identify series & parallel circuits as they apply to typical lighting circuits
- Describe characteristics of a series circuit
- Describe characteristics of a parallel circuit
- Describe characteristics of a series/parallel circuit
- Identify common causes of electrical circuit or component failures
- List electrical systems in a vehicle
- List types of common automotive wiring
- Explain common causes of wire damage
- Identify types of wire damage
- List common types of insulation damage
- List common types of wiring connectors used in vehicles
- Define an open circuit, short circuit, & high resistance in a circuit
- Identify the effect of an open circuited component on voltage & amperage measured at various points in the circuit
- Identify the effect of a short circuited component on voltage & amperage measured at various points in the circuit
- Identify common electrical schematic symbols
- Identify electrical components on schematic drawings
- Read & interpret electrical schematic drawings
- Describe wire repair procedures
- Explain how to terminate primary wires

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

11. Assist to inspect, test, and replace fusible links, circuit breakers, and fuses

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect the fuses, breakers & links for tripping or breaks
- Check fuses with a circuit tester or multimeter
- Inspect fuse links for bubbled insulation, replace as indicated or perform continuity check
- Reset the breaker or replace the fuse as needed
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Identify types of circuit protection devices used in an electrical circuit
- Define the functions of a fuse, fuse box, fusible link, circuit breaker
- Compare circuit breakers to fuses
- Explain the common functions & locations of fuses & breakers in a vehicle
- Describe types of circuit faults

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency
12. Assist to check & repair exterior lighting & wires

Performance Standard Condition
Competence will be demonstrated
- at the worksite
- while assisting a worksite professional

Performance Standard Criteria
Performance will be successful when learners:
- Obtain equipment & materials needed
- Review safety & service procedures
- Check lights for operation
- Use wiring diagrams to check for electrical circuit problems

INSPECT
- Test the power at the bulb socket
- Check the ground circuit
- Look for any shorted or open circuits
- Check for corrosion of the connector terminals
- Check the fuse
- Check the switch

REPLACE BULB
- Remove the bulb assembly
- Remove small rings or screws
- Remove the lens
- Replace with new bulb
- Reinstall lens, screw, rings, and bulb assembly

REPAIR WIRING
- Assist to repair wiring and connections if needed
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives
- Describe safety practices related to personal protection, equipment & materials for this process
- Identify safety precautions when performing wire repair
- Explain the components & operating principles of automotive light systems
- Identify safety precautions when handling halogen bulbs
- Discuss the diagnostic questions to determine problems in light systems
- Define the functions of a switch, connector, relay, solenoid device, & wire
- List common methods of wire repair
- Describe wire size and wire gauge
- Compare & contrast types of automotive wiring

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

13. Aim headlamp assemblies and fog/driving lamps

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Use headlight aimers, aiming screen or bubble levelers according to equipment specification
- Mount headlight aimers over vehicle headlights
- Observe leveling bulbs in the aimers
- Turn headlight aiming screws as needed on the headlights to adjust beams correctly in front of the vehicle
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Describe headlight aiming screw types and operation
- Describe how to mount and use a headlight aimer
- Describe how to load a vehicle prior to aiming headlights
- Explain the purpose of the bubble level

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency
14. Check & replace horn

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Check operation of horn
- Use wiring diagrams to check for electrical circuit problems
- Test the power at the horn terminal
- Look for any shorted or open circuits
- Check for corrosion of the connector terminals
- Check the fuse
- Check the switch
- Check the relay
- Push horn while another tech reads the current between the feed wire and the horn terminal
- If current is not within specification, turn the amp screws until the readings is appropriate
- Assist to remove & replace horn if needed
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain the components & operating principles of automotive horn systems
- Discuss the diagnostic questions to determine problems in horn systems
- Describe how to prevent meter damage when checking amp draw

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency
15. Check & replace wiper/washer system motors & pumps

Performance Standard Condition
Competence will be demonstrated
- at the worksite

Performance Standard Criteria
Performance will be successful when learners:
- Obtain equipment & materials needed
- Review safety & service procedures
- Check wipers for cuts or splits; replace if needed
- Use wiring diagrams to check for electrical circuit problems

WIPER SYSTEM
- Check fuses & electrical connections of wiper system
- Check power to wiper motor
- Check to ensure motor is properly grounded
- Check wiper switch & circuit connections for openings

WINDSHIELD WASHER SYSTEM
- Check fuses & electrical connections of washer system
- Check power to washer motor
- Check pump operation
- Assist to replace motors or pump as needed
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives
- Describe safety practices related to personal protection, equipment & materials for this process
- Explain the components & operating principles of automotive wiper systems
- Discuss the diagnostic questions to determine problems in wiper systems
- Explain how to remove & replace a wiper motor and washer pump

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

16. Check & replace power window system switches & motors

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Check operation of power windows
- Use wiring diagrams to check for electrical circuit problems
- Check fuse or circuit breaker for whole system
- If only one window affected, check power to switches & motor at that window
- If a humming sound, check motor gear box for stripped teeth; replace gear box
- Check fuses, switches & relays along circuit if problems still exist
- Replace bad switches or motors
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain the components & operating principles of automotive power window systems
- Discuss the diagnostic questions to determine problems in power window systems

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency

17. Check operation of electrically heated mirrors, windshields, back lights, panels, etc

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Check operation of heated window, mirror or panel
- Use wiring diagrams to check for electrical circuit problems
- Check fuse or circuit breaker for whole system
- Check voltage
- Test circuit for openings
- Test rear window defogger grid
- Test windshield control module
- Assist to determine needed repairs or replacements
- After testing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe safety practices related to personal protection, equipment & materials for this process
- Explain the components & operating principles of automotive electrical heated mirrors, windshields, & panel systems
- Discuss the diagnostic questions to determine problems in heated mirror, windshield, & panel systems

Comments:

Unit 6: Auto Collision Pathway
Damage Analysis & Electrical Repair

Competency
18. Inspect, remove and replace components of power antenna circuits

Performance Standard Condition
Competence will be demonstrated
- at the worksite

Performance Standard Criteria
Performance will be successful when learners:
- Obtain equipment & materials needed
- Review safety & service procedures
- Check operation of power antenna
- Use wiring diagrams to check for electrical circuit problems
- Test the power at the antenna gear
- Look for any shorted or open circuits
- Check for corrosion of the connector terminals
- Check the fuse
- Check the switch
- Check voltage to motor windings
- Replace unit if needed
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives
- Describe safety practices related to personal protection, equipment & materials for this process
- Explain the components & operating principles of power antenna systems
- Discuss the diagnostic questions to determine problems in power antenna systems

Comments:

Appendix O

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

AUTO TECHNICIAN PATHWAY VEHICLE BASICS & GENERAL SERVICE (UNIT 7)

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency

1. Obtain and apply basic vehicle and servicing knowledge

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- in the classroom

Performance Standard Criteria

Performance will be successful when learners:

- Demonstrate vehicle systems knowledge based on current understanding
- Comply with personal safety practices concerning clothing, hand and power tool usage, proper ventilation of fumes and lifting and securing of vehicles
- Comply with environmental safety standards concerning handling, storage and disposal of hazardous materials and chemicals in accordance with local, state and federal regulations
- Identify approved service procedure prior to completing any work on a vehicle
- Perform all procedures according to manufacturer and regulatory requirements

Learning Objectives

- Identify and locate the most important parts of a vehicle
- Describe the purpose of the fundamental automotive systems
- Explain the interaction of automotive systems
- Identify commonly used automotive fasteners
- Explain common broken fastener removal techniques
- Describe basic automotive engine classifications
- Compare gasoline and diesel engines
- Contrast combustion chamber designs
- Discuss alternative engine types
- Compare two- and four-stroke cycle engines

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency

2. Operate tools and equipment safely

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- in the classroom

Performance Standard Criteria

Performance will be successful when learners:

- Operates only equipment that he/she is trained on
- Chooses correct tool or equipment for the task
- Verifies tool/equipment is available for use and in working order
- Verifies tool/equipment is current for preventative maintenance and/or calibration
- Verifies safety equipment and any Personal Protective Equipment (PPE) needed for tool/equipment use
- Operates tool/equipment safely with guarding devices if applicable in the manner required for the job task
- Monitors tool/equipment for safe operation while operating
- Follows procedures for clean up and shut down after use
- Performs any required preventative maintenance procedures
- Investigates and promptly reports abnormal tool/equipment conditions
- Properly shuts down and labels any tool/equipment that is not operating as expected, if applicable
- Follows Lock Out/Tag Out procedures as applicable
- Documents use and maintenance as required

Learning Objectives

- Describe how to properly & safely position a vehicle for different types of service
- Identify common automotive hand tools
- List the most commonly used power tools and equipment
- List commonly used measuring tools
- Describe the uses for power tools and equipment
- Explain the advantages of one type of tool over another
- Describe and demonstrate the safety requirements for each tool and equipment
- Discuss start up and shut down procedures for each tool/equipment you will operate
- Explain the purpose of preventative maintenance
- Describe emergency shutdown procedures for the tool/equipment you will operate
- Explain how to recognize and address malfunctions for the tool/equipment you will operate
- Describe how to recognize wear and tear on equipment components
- List the OSHA and other regulatory requirements as they apply to the equipment that you operate
- Describe proper techniques for lifting loads
- List the safeguards that apply to the equipment used in your facility for tools, automated machines, material handling equipment, and lifts

- List which tools and equipment require safety certification
- Explain Lock Out/Tag Out indications and procedures in your facility

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency

3. Maintain work area

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- in the classroom

Performance Standard Criteria

Performance will be successful when learners:

- Maintain shop manuals and/or electronic retrieval systems
- Organize tools
- Sweep work area
- Put shop equipment away
- Clean work area and work bench
- Dispose of old parts properly

Learning Objectives

- Describe the typical layout and sections of an auto shop
- Explain the importance of proper housekeeping in the shop
- List the types of accidents that can occur in an auto shop
- Explain how to prevent auto shop accidents
- Describe general safety rules for the auto shop

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency

4. Process work order

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Verify customer complaint (concern)
- Obtain customer information, vehicle identifying information, customer concern, and related service history
- Document customer concern and complaint information on repair order
- Obtain customer signature(s) when required
- Handle complaints tactfully without insult or conflict
- Prepare vehicle for service with floor mat, steering wheel cover, etc.

Learning Objectives

- Define the purpose & use of the vehicle identification number (VIN), engine numbers, and date codes
- Identify references that are used to estimate vehicle repair charges
- Identify an auto repair business' internal & external customers
- Define customer service
- Describe how customer service affects a company's "bottom line"
- List strategies to maximize customer satisfaction
- List the steps to follow when handling complaints

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency

5. Acquire parts

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Collect necessary information to determine part required
- Locate and interpret vehicle and component identification numbers such as make, model, year, VIN, vehicle certification labels, calibration decals
- Check part price
- Check part availability
- Obtain part
- Verify correct part upon receipt

Learning Objectives

- Explain how to use service manuals to locate component part information
- Identify sources available for replacement parts
- List requirements of replacement parts
- Explain the information needed to in order to obtain the correct replacement part
- Describe how parts are purchased & charged to the customer
- Compare and contrast new, used, rebuilt & remanufactured automotive parts
- Describe situations in which one type of part is desirable over new parts
- Define OEM and how this affects automotive servicing

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency
6. Assist to diagnose vehicle problems

Performance Standard Condition
Competence will be demonstrated
- at the worksite
- while assisting a worksite professional

Performance Standard Criteria
Performance will be successful when learners:
- Consult with worksite professional to determine appropriate inspections and test(s) to perform based on customer concern
- Retrieve shop manuals and/or electronic retrieval systems
- Research applicable vehicle and service information, normal system operation specifications, vehicle service history, service precautions, and applicable technical service bulletins
- Assist worksite professional to complete diagnostic tests necessary to identify cause of customer concern

Learning Objectives
- Explain the 3 Cs (concern, cause, correction) of automotive service
- Describe the different types of service manuals
- Find and use the service manual index and contents sections
- Explain the different kinds of information and illustrations used in a service manual
- Describe the three basic types of troubleshooting charts found in service manuals
- Explain how to use computer-based service information

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency

7. Check & adjust fluid levels

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Check & adjust engine oil level
- Check & adjust engine coolant level
- Check & adjust power steering fluid level
- Check & adjust brake fluid level
- Check & adjust transmission fluid
- Locate fluid leaks
- Inspect for general problems with hoses, belts, and other components
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Determine fluid type requirements and identify fluids
- Explain the importance of vehicle maintenance
- Explain safe practices while working with vehicle fluids
- Describe the typical difference between a minor tune-up and a major tune-up
- List the basic steps for an engine tune-up
- Explain service operations commonly performed during a tune-up
- List the safety precautions that should be remembered during a tune-up

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency
8. Inspect & replace air filter

Performance Standard Condition
Competence will be demonstrated
- at the worksite

Performance Standard Criteria
Performance will be successful when learners:
- Obtain equipment & materials needed
- Review safety & service procedures
- Locate the air-filter housing
- Remove the screws or clamps that hold on the top of the housing
- Take out the old air filter
- Clean any dirt and debris from the housing with a clean rag
- Put the new air filter in
- Screw or clamp the lid of the air-filter housing back on
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives
- Describe the function and main components of a vehicles heating and ventilation system
- Describe the construction and action of air filters
- Explain the importance of a clean air filter
- Summarize the operation and interaction of heating, ventilation, and air conditioning systems

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency

9. Perform oil & filter change

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position vehicle
- Locate the oil drain plug on the underside of the engine
- Place the oil drain pan under the plug
- Remove the plug
- Let the oil drain into the pan
- Wipe off the drain plug and the plug opening when the oil finishes draining
- Replace the drain plug gasket
- Reinstall and tighten the plug
- Locate the existing oil filter
- Position the oil pan underneath the filter to catch any remaining oil
- Unscrew the old oil filter
- Wipe the area where the filter mounts to the engine
- Lightly coat the rubber seal of the new filter with new oil
- Screw the new filter into place
- Remove the oil filler cap on top of the engine
- Place the funnel in the opening and pour in the new oil
- Replace the oil filler cap
- Run the engine for a minute, then check the dipstick
- Add more oil if necessary
- Check the area around the oil drain plug and the filter for oil leaks
- Tighten the plug or oil filter if you find leakage
- Wipe away excess oil
- Pour the used oil into a plastic container after the used oil cools
- Dispose the used oil properly
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain why it is best to run the vehicle prior to changing oil
- Describe possible hazards associated with this procedure
- Identify different types of engine oils and their purposes
- Explain how to determine correct oil capacity
- Discuss the disposal procedures for engine oil
- List the basic parts of a lubrication system

- Summarize the operation of a lubrication system
- Describe the construction of lubrication system parts
- Compare different lubrication system designs
- Discuss safety procedures that should be followed when working with the lubrication system

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency
10. Replace fuel filter

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Disconnect the negative battery cable
- Locate the fuel filter
- Let the pressure out of the fuel system by gradually unscrewing the fuel tank fill cap
- Loosen and remove the clip near where the fuel line and filter meet
- Pull the fuel lines off of both ends of the filter
- Loosen the filter-retaining clamp
- Remove the fuel filter
- Replace it with the new filter
- Check to make sure the arrow on the fuel filter points toward the engine
- Tighten the filter-retaining clamp
- Put the fuel lines back on the filter
- Put the clip back on the fuel line and snap it into place
- Tighten the fuel tank cap
- Connect the negative battery cable
- Start vehicle and check for fuel leaks
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Summarize how crude oil is converted into gasoline, diesel fuel, liquefied petroleum gas, and other products
- Describe properties of gasoline and diesel fuel
- Explain octane and octane ratings
- Describe normal and abnormal combustion of gasoline and diesel fuel
- Summarize the properties of alternative fuels
- Define the major parts of a fuel supply system
- Describe the operation of mechanical and electric fuel pumps
- Explain the tests used to diagnose problems with fuel pumps, fuel filters, and fuel lines
- State safety rules for working on fuel supply systems

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency
11. Replace cabin filter

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Locate the air cabin filter housing
- Determine if the cabin filter needs to be changed
- Remove the filter housing retainer clips or screws
- Remove the filter
- Gently tap the filter
- If dust falls from the air cleaner it is filled to capacity and needs to be replaced
- Remove the main access cover
- Undo the cover fasteners to remove cover and side cover if needed
- Locate and undo retainer clip to remove air cabin filter
- Compare the filter size to the replacement filter
- Reassemble the filter housing with the new filter
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe the common location for air cabin filters
- Compare common air filters to automobile air cabin filters
- List common reasons for clogged air filters
- Describe the importance of a clean air filter

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency

12. Drain, recover, flush & refill cooling system

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position vehicle
- Allow engine to cool
- Place large catch pan underneath radiator drain plug
- Remove radiator drain plug and collect all old coolant
- Remove radiator fill cap to expedite draining process
- Remove all coolant from your radiator reservoir
- Inspect drained coolant as it exits the system
- Dispose of the coolant as required
- Replace the radiator drain plug
- Fill system with water to dilute remaining antifreeze in the engine block
- Replace radiator fill cap and run the engine allowing it to reach operating temperature
- Run engine for few minutes after engine's cooling fan turns on
- Shut off and cool engine
- Repeat draining process; collect and dispose of all waste coolant
- Replace radiator drain plug and refill the cooling system with distilled water only
- Once the cooling system has been completely filled, start the engine to allow the water to circulate
- Remove the radiator drain plug
- As the engine runs, pour fresh distilled water into the radiator fill hole at the same rate that it exits the system
- Continue until water being drained from the radiator appears to be clear and free of debris
- Stop engine and allow all remaining water to drain out
- Replace radiator drain plug
- Mix distilled water and coolant in recommended ratio
- Funnel fresh coolant into radiator fill hole
- Fill radiator at recommended rate until coolant reaches bottom of fill neck
- Fill the radiator reservoir to the full mark
- With the radiator fill cap still off, start the car and allow it to idle
- Continue to add coolant as air escapes the engine and cooling system
- Bleed air from cooling system as needed
- Once unable to fill the radiator any further, replace radiator fill cap and stop the engine
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- List common cooling system problems and their symptoms
- Describe the most common causes of system leakage, overheating, and overcooling
- Describe safe working practices to use when testing, maintaining, or repairing a cooling system
- Explain the importance of antifreeze
- Discuss the hazards & dangers of ethylene glycol in antifreeze coolant
- Explain the required disposal methods for all stages of drain material
- Discuss the importance of cooling the engine first
- Explain what debris in drained coolant means
- Discuss why 2 cycles of water are used for draining
- Explain the purpose of the distilled water

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency
13. Lubricate suspension & steering systems

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position vehicle for service
- Determine the type of lubricant recommended
- Inspect all steering & suspension joint grease seals
- Replace any torn or missing seals
- Wipe grease from each grease fitting
- Install plugs are used, install temporary fittings
- Apply grease to each fitting until grease begins to flow out of the bleed area or until the seal swells
- Apply a heavy film of grease to the steering stops on the steering knuckle and control arms
- Wipe excessive grease from all joints & reinstall plugs
- Lower vehicle
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Summarize the operation of a lubrication system
- Describe the construction of lubrication system parts
- Compare different lubrication system designs
- Explain the characteristics and ratings of engine oil
- Discuss safety procedures that should be followed when working with the lubrication system
- Locate the areas of typical joint grease seals
- Describe the safe & proper operation of a grease gun
- Compare & contrast different types of grease used for lubrication

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency
14. Rotate tires

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Verify tire rotation recommended by the manufacturer
- Secure vehicle on even surface
- Safely jack or hoist the vehicle up
- Remove right rear tire
- Inspect tires for wear with each tire removal
- Inspect brake pads for wear with each tire removal
- Place tire to the left front of the vehicle
- Remove left front tire and place to the right rear of the vehicle
- Re-install the tire from right rear to the left front
- Re-install the left front tire on the right rear
- Remove left rear tire and place tire to the right front of the vehicle
- Remove right front tire and place tire to the left rear
- Re-install tires
- Adjust tire pressure
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain the purpose of tire rotation
- Identify the recommended frequency of tire rotation
- Discuss how tire rotation depends on tire wear
- List specific hazards associated with changing tires
- List common tire, wheel, and wheel bearing problems
- Describe tire inflation and rotation procedures
- Measure tire and wheel runout

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency

15. Inspect, replace, adjust drive belts, tensioners, & pulleys

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety &service procedures
- Locate your vehicle drive belts
- Inspect the belts by turning them sideways and looking for cracks, glazing or visible signs of fraying
- Replace the belts by loosening the mounting and retaining bolts or nuts on the accessory that it drives
- Pry the accessory towards the belt, allowing the belt to loosen enough to come off the pulley
- Remove the belt from the crankshaft pulley
- Install the new belt by positioning it on the crankshaft pulley and then slipping it over the pulley of the accessory
- Pry the accessory from the belt to tighten the slack
- Adjust the belt tension so that there is no more than 1/2" deflection, up or down
- Reinstall any other belts you removed and adjust them
- Start the engine and turn on the accessory run by the belt that you just changed
- Check that the belt or belts that you removed are not slipping under the engine load
- If there is a slipping belt, turn off the engine, readjust the belt and check again
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe the purpose of a vehicle's engine drive belts
- Discuss the composition of drive belts and common wear tear
- Locate common accessory drive belts and what they run
- Describe the issues with stretched belts
- Explain why belts should not be over-tightened

Comments:

Unit 7: Auto Technician Pathway
Vehicle Basics & General Service

Competency

16. Inspect, replace transmission fluid & filters

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Warm up car so transmission is at normal operating temperature
- Check transmission fluid
- Select the correct filter replacement
- prepare a large pan to catch the fluid
- Loosen each pan bolt a turn or two and loosen one corner more than rest. Drain mostly from this corner.
- Finish removing the pan and any gasket material from the pan or case.
- Inspect the pan's gasket surface for damage
- Remove the old filter.
- Install new filter; Use the clips or bolts from the old filter
- Inspect the drain pan for metal shavings
- Position gasket on pan
- Hand-tighten pan bolts
- tighten bolts to proper specifications
- refill the transmission pan to "refill capacity" per vehicle specification
- replace the fluid in the torque converter and oil cooler also
- Determine total system capacity per vehicle specification
- Disconnect the oil cooler line from the oil cooler
- With another tech, be prepared to add fluid to the fill area as it is being pumped out of the oil cooler line
- Start the engine, and as the old fluid is pumped out, add fresh fluid to the pan.
- When either the fluid color brightens or the total capacity has been replaced, shut the engine off and re-attach the oil cooler line.
- Recheck the fluid level
- With the vehicle on level ground, idle the engine idle for a few minutes & then shift the transmission into different positions before returning to "Park" or "Neutral"
- Check the fluid level again and check for leaks
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify the basic components of an automatic transmission
- Describe the function and operation of the major parts of an automatic transmission
- Trace the flow of power through an automatic transmission

- Explain how an automatic transmission shifts gears
- Compare the different types of automatic transmissions
- Compare normal versus abnormal color/odor of transmission fluid

Comments:

Appendix P

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

AUTO TECHNICIAN PATHWAY BRAKE SYSTEMS (UNIT 8)

Unit 8: Auto Technician Pathway
Brake Systems

Competency

1. Assist to diagnose common brake problems

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Consult with worksite professional to determine appropriate inspections and test(s) to perform based on customer concern
- Retrieve shop manuals and/or electronic retrieval systems
- Research applicable vehicle and service information, normal system operation specifications, vehicle service history, service precautions, and applicable technical service bulletins
- Assist worksite professional to complete diagnostic tests necessary to identify cause of customer concern

Learning Objectives

- Explain how friction, force, inertia, momentum, speed, power, work & torque apply to automotive brake systems
- Define basic brake requirements
- Explain the effects of weight & speed on braking & stopping distance
- Define Pascal's Law
- Explain thermal expansion of fluids, gases, & solids
- Explain energy conversion of motion changed to heat energy
- Identify the major parts of an automotive brake system
- Define the basic functions of the major parts of a brake system
- Explain pressure concerns in a brake system using hydraulic principles
- Identify external conditions that affect brake performance
- Explain common poor stopping, pulling or dragging concerns caused by problems in the hydraulic system
- Explain common causes of wheel bearing noises, wheel shimmy, and vibration
- Discuss wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system
- Cite the safety rules that should be followed when servicing brake systems

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency

2. Measure brake pedal height, travel, & free play as applicable

Performance Standard Condition

Competence will be demonstrated

- at the worksite

- Performance Standard Criteria
- **Performance will be successful when learners:**
- Obtain equipment & materials needed
- Review safety & service procedures
- Determine if the brake pedal height can be adjusted
- Determine the brake pedal free height and travel
- Pump the brake pedal with the engine off to release the vacuum in the power booster
- Place a ruler against the car floor in the line with the arc of the brake pedal travel
- Move the pedal by hand to remove any pedal free play
- Moving the pedal, measure the pedal height at the top or bottom of the pedal
- Compare to vehicle specification
- After measuring, verify adjustments needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify the parts of the brake pedal assembly
- Describe the operation & function of the brake pedal assembly

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency

3. Check master cylinder for leaks & proper operation

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position the vehicle
- Inspect the housing for leaks or cracks
- Check the fluid level in the master cylinder reservoir
- Check for unequal fluid levels in the master cylinder reservoir chambers on front disc or rear drum systems
- Inspect the condition of the fluid
- Add fluid if needed
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe basic procedures for servicing a master cylinder and a brake booster
- Identify the parts of a basic master cylinder & their function
- Describe possible causes and conditions of brake fluid in the master cylinder

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency

4. Inspect brake lines, flexible hoses, & fittings

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position the vehicle
- Inspect all brake lines, hoses & connections for leaks on the floor, under the vehicle or at the wheels
- Check the brake lines for kinks or dents
- Check the brake hoses for cuts, cracks, bulges & wear
- Inspect the backing plates for fluid & grease
- Tighten loose fittings and supports
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe the construction of brake lines
- Explain brake line flaring techniques
- Explain how to verify brake fluid leakage versus another type of fluid
- Describe the proper procedures for tightening fittings
- Identify the major parts of a typical anti-lock brake system
- Describe the operation of anti-lock brake systems
- Compare anti-lock brake design variations
- Describe the purpose and operation of traction control and stability control systems

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency
5. Bleed &/or flush brake system

Performance Standard Condition
Competence will be demonstrated
- at the worksite

Performance Standard Criteria
Performance will be successful when learners:
- Obtain equipment & materials needed
- Review safety & service procedures

BLEED- MANUAL
- Attach one end of a hose to the bleeder screw
- Place the other end submerged in a jar partially filled with clean brake fluid
- Gently have another tech depress the brake pedal
- Open the bleed screw or fitting on the caliper or wheel cylinder while watching for air bubbles in the hose
- Close the bleeder screw or fitting; tell the tech release the brake pedal
- Repeat until no more bubbles come out of the hose
- Repeat procedure on the other brake assemblies or brake line connectors if needed

BLEED- PRESSURE
- Pour enough brake fluid in the bleeder ball to reach the prescribed level
- Charge the ball with 10 to 15 psi of air pressure
- Fill the master cylinder with brake fluid
- Install the adapter and hose on the master cylinder
- Open the valve on the hose
- Attach a bleeder hose to the farthest wheel cylinder bleed screw
- Submerge the free end of the hose in a glass container halfway filled with brake fluid
- Loosen the bleed screw
- Close off the bleed screw and remove the bleeder hose when fluid coming from the submerged end of the hose is free of air bubbles
- Repeat bleeding operation on the other wheel cylinders in proper order
- Close the valve at the bleeder ball hose
- Disconnect the bleeder from the master cylinder
- Check the brake fluid level in the reservoir

FLUSH
- Pressure bleed all of the old brake fluid out of the system
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives
- Compare bleeding vs. flushing
- Describe special precautions for master cylinders with plastic reservoirs

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency

6. Remove & inspect caliper assembly

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position the vehicle
- Remove the wheels of the caliper to be serviced
- Mark the wheels for re-insertion
- Compress caliper piston(s)
- Remove the bolts from the caliper to the steering knuckle
- Lift the caliper away from the rotor
- Hang the caliper with a cord
- Replace worn or rusted retaining hardware
- Inspect the caliper housing for leaks or cracks
- Inspect the piston & bore for pitting, nicks, scrapes
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify the parts & functions of the caliper assembly & calipers
- Explain the operation of drum/disk brakes and power-assist units
- Compare drum and disc brakes
- Explain how to service a disc brake assembly
- Explain how to service a drum brake assembly

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency

7. Remove, inspect & replace brake pads & retaining hardware

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position the vehicle
- Remove the wheels of the caliper to be serviced
- Mark the wheels for re-insertion
- Compress caliper piston(s)
- Remove the bolts from the caliper to the steering knuckle
- Lift the caliper away from the rotor
- Hang the caliper with a cord
- Remove the clips (if applicable) and old pads from the caliper
- Fit the new pads into the calipers
- Compress the piston over the new brake pads in the caliper assembly with a C clamp
- Slide the caliper assemblies over the new pads
- Mount the caliper assembly
- Torque all bolts properly
- Install wheel and tighten lug nuts or bolts to specification
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe the recommended intervals for brake pad inspections
- Define the purpose & operation of the brake pads

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency

8. Reassemble, lubricate, & reinstall calipers, pads, & related hardware

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Check the caliper cylinder wall for wear, scoring, or pitting
- Check the caliper piston for wear; replace with a new piston if needed
- Inspect all hoses; replace any that are leaking or show deterioration
- Clean all the caliper parts with an approved cleaner
- Lubricate all parts liberally with clean brake fluid
- Work the new seal into the cylinder bore groove
- Compress the piston back into the caliper
- Reassemble the caliper halves using new gaskets and seals if needed
- Clean & lubricate caliper attachment hardware
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain the importance of lubricant on sliding surfaces
- Explain the importance of methodical bench cleaning and inspection for this procedure

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency

9. Clean, inspect, & measure rotor thickness, lateral runout, & thickness variation

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position the vehicle
- Remove wheel and caliper assembly
- Inspect the disc surface for warpage, cracks or scoring
- Inspect the disc thickness for variation
- Measure thickness using an outside micrometer in several places around the disc
- Measure runout using a dial indicator
- Compare readings to disc specifications
- Consult with worksite professional to determine if new disc or resurfacing is indicated
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Define the purpose & operation of the rotor
- Describe when a rotor should be replaced
- Define runout
- Explain how to measure disc thickness
- Discuss complications of a thin or warped disc

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency
10. Install wheel

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position the vehicle
- Re-attach wheel
- Torque lug nuts or bolts to specification
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify the parts of a tire and wheel
- Describe different methods of tire construction
- Explain tire and wheel sizes
- Describe tire ratings

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency

11. Check parking brake cables & components

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position the vehicle
- Remove the wheel
- Screw one lug to keep rotor in place
- Loosen parking brake cable at the equalizer
- Apply parking brake to determine movement
- Inspect the cables & linkages for wear, binding & corrosion
- Replace cables & linkages if needed
- Release the parking brake or engage one notch only
- Clean & lubricate the cable & linkages
- Turn the cable adjuster to remove excess slack
- Apply & release the parking brake to check for brake dragging
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe the operation of parking brakes
- Describe lubricant procedures for metal vs. plastic coated cables
- Explain what excessive heavy drag could mean
- Identify traction control/vehicle stability control system components
- Describe the operation of a regenerative braking system

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency
12. Check brake & indicator light system

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Check the indicator light system
- Use a DMM to locate electric circuit problems
- Replace the bulb if needed
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain the function of the DMM
- Describe how the DMM works to measure voltage, voltage drop, current flow & resistance
- Describe the purpose of the ground lead in using the DMM

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency
13. Inspect, replace wheel studs

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position the car
- Remove wheel and caliper assembly
- Remove the rotor
- Inspect the stud for damage
- Force the old stud out with a pressing tool
- Push the new stud through
- Thread a wheel bolt on & tighten; add more bolts as the stud is pulled through the hub
- Remove the bolts
- Replace the parking cable brake, rotor, caliper assembly, and wheel
- Torque lug nuts or bolts to specification
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Compare lug nuts to lug studs to lug bolts
- Explain how studs are marked if they are left-hand threads

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency
14. Service wheel bearings & race

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove wheel and brake caliper
- Gently pry the bearing grease cup away from hub by turning the wheel a little each time
- Remove the cotter pin, retaining ring, and spindle nut
- Remove hub or rotor-hub assembly
- Inspect the bearing and race for scoring, flat spots, or broken rollers
- Knock the outer race from the hub
- Flip over the hub and knock out the inner race, bearing, and seal
- Pack the new inner and outer wheel bearings by either pressing grease into each roller by hand or using a bearing packer and grease gun
- Remove old grease from inside hub
- Use the wheel-bearing tool to seat inner race into hub
- Place the bearing in the race and use the tool again to seat the grease seal
- Flip over the hub and repeat for the outer race
- Pack a good amount, but do not completely fill inside the hub with grease
- Clean all excess grease from outside the hub
- Place the hub on the spindle
- Tighten the nut just enough to seat the whole assembly while spinning the hub
- Loosen the nut then re-tighten to specifications
- Pack more grease into the bearing and bearing cup
- Replace retaining ring and secure with a new cotter pin
- Gently replace the bearing grease cup being careful not to dent it
- Remove all grease from the outer surface of the hub or rotor
- Grab the top and bottom of the hub and check for play
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain service procedures for wheel bearings
- Identify the parts of driving and nondriving hub and wheel bearing assemblies
- Explain the purpose of greasing each roller
- Describe how to choose the drift for the wheel bearing tool
- Demonstrate the torque needed to re-tighten the nut
- Describe the dangers of over-tightening the spindle nut

Comments:

Unit 8: Auto Technician Pathway
Brake Systems

Competency

15. Remove, inspect, or replace sealed wheel bearing assembly

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position the vehicle
- Remove wheel
- Insert tool into caliper & rotor to prevent rotor from turning
- Remove wheel drive shaft nut
- Remove rotor
- Remove speed sensor & dust shield
- Remove wheel bearing assembly & hub retaining bolts
- Separate the wheel bearing assembly & hub from the drive axle
- Remove the wheel bearing assembly & hub
- Inspect the wheel bearing assembly & hub for damage
- Press the new hub & bearing assembly into the steering knuckle
- Re-install the steering knuckle, rotor, caliper and wheel
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe common tire, wheel, and wheel bearing problems
- Explain service procedures for wheel bearings
- Identify the parts of driving and nondriving hub and wheel bearing assemblies

Comments:

Appendix Q

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

AUTO TECHNICIAN PATHWAY ELECTRICAL/ELECTRONICS (UNIT 9)

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

1. Assist to diagnose electrical/electronic integrity of series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law)

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Locate the wiring diagram for the component of concern
- Determine the circuit characteristic pattern
- Given 2 of 3 measured values, calculate the remaining value (voltage, current, resistance)
- Verify calculations with worksite professional
- Given measured and calculated values throughout a given circuit, identify some common cause that could result in the vehicle concern
- Determine additional testing or repairs required with worksite professional

Learning Objectives

- Explain the principles of electricity
- Describe the action of basic electric circuits
- Compare voltage, current, and resistance
- Describe the principles of magnetism and magnetic fields
- Identify basic electric and electronic terms and components
- Describe fundamental electrical tests
- Identify factors that will determine how much current will flow in a circuit
- Define Ohm's Law and how to determine circuit resistance, current flow and voltage drop
- State the relationships between voltage, current & resistance in a simple circuit
- Identify sources of AC/DC voltages & their automotive applications
- Explain how to use the following testing instruments: Voltmeter, Test Light, Ammeter, & Ohmmeter
- Identify series & parallel circuits as they apply to typical lighting circuits
- Describe characteristics of a series circuit
- Describe characteristics of a parallel circuit
- Describe characteristics of a series/parallel circuit
- Identify common causes of electrical circuit or component failures
- List electrical systems in a vehicle

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

2. Demonstrate proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems, including source voltage, voltage drop, current flow, and resistance

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety procedures
- Set the DMM to the correct voltage scale
- Connect the red lead to the appropriate point in the circuit to be measured
- Connect the black lead to the appropriate position on the circuit depending on the function to be measured
- Measure voltage, voltage drop, current flow and resistance
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain the function of the DMM
- Define voltage, voltage drop, current flow and resistance & their common units of measurement
- Describe how the DMM works to measure voltage, voltage drop, current flow & resistance
- Describe the purpose of the ground lead in using the DMM

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

3. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Locate & read the circuit system outline to see how circuit is supposed to operate using the wiring diagram
- Determine if the problem affects all or part of the circuit by testing at various points in the circuit
- Line Out parts of the circuit on the diagram that are working as each point is tested
- Identify all components, connectors, wires, related to that component
- Trace the circuit to verify how it works
- From the lined out circuit trace, narrow down possible causes
- Perform tests to quickly identify or rule out the possibilities
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Define an open circuit, short circuit, & high resistance in a circuit
- Describe what an intermittent problem in a circuit is
- Identify the effect of an open circuited component on voltage & amperage measured at various points in the circuit
- Identify the effect of a short circuited component on voltage & amperage measured at various points in the circuit
- Identify common electrical schematic symbols
- Identify electrical components on schematic drawings
- Read & interpret electrical schematic drawings
- Identify the differences between electrical and electronic components
- Identify common electronic components such as transistors, diodes, & integrated circuits

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

4. Inspect, test fusible links, circuit breakers, & fuses

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety procedures
- Inspect the fuses, breakers & links for tripping or breaks
- Reset the breaker or replace the fuse as needed
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify types of circuit protection devices used in an electrical circuit
- Define the functions of a fuse, fuse box, fusible link, circuit breaker
- Compare circuit breakers to fuses
- Explain the common functions & locations of fuses & breakers in a vehicle
- Describe types of circuit faults

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

5. Inspect, test switches, connectors, relays, solenoid devices, & wires of electrical/electronic circuits

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety procedures
- Inspect the switches, connectors, relays, solenoid devices for proper connection and wearing, burning or pitting
- Inspect the wires for proper connection and wearing, rubbing or fraying
- Test devices & wires for voltage, voltage drop, current flow, and resistance
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify safety precautions when performing wire repair
- Define the functions of a switch, connector, relay, solenoid device, & wire
- List common methods of wire repair
- Describe wire size and wire gauge
- Compare & contrast types of automotive wiring

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

6. Remove/replace terminal end from connector; replace connectors & terminal ends

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety procedures
- Unscrew/unplug the wire with terminal end
- Remove terminal end
- Replace new terminal end onto end of wire by soldering or crimping into place

Learning Objectives

- List types of common automotive wiring
- Explain common causes of wire damage
- Identify types of wire damage
- Describe wire repair procedures
- List common types of insulation damage
- List common types of wiring connectors used in vehicles
- Explain how to terminate primary wires

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

7. Perform battery state-of-charge test

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures

NON-SLA

- On NON-SLA (sealed lead acid) batteries, perform a hydrometer state of charge test
- If specific gravity is at or above acceptable level, do capacity test
- If specific gravity for all cells is below acceptable level, charge & retest battery
- If specific gravity between cells varies by more than acceptable amount, replace the battery

SLA

- Remove surface charge
- Perform open circuit voltage test
- Measure the open circuit voltage
- Refer to voltage chart to determine state of charge on battery
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify safety precautions when performing battery service
- Explain the operating principles of a lead-acid battery
- Compare conventional & maintenance-free batteries
- Explain how to remove surface charge from a battery
- Define specific gravity and how it indicates battery charge
- Describe how to do the hydrometer test
- Describe how to do the capacity test
- Describe how to do the open circuit voltage test
- Explain how to use the voltage chart to determine charge
- List levels which require a new battery vs. re-charging

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

8. Perform battery load (capacity) test

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Ensure battery is charged
- Select the appropriate load (capacity) tester
- Calculate the load (capacity) rating, how much current draw should be applied to the battery
- Remove surface charge from the battery
- Connect the 2 large positive and negative clamps to the battery positive and negative terminals
- Connect the induction clamp around the negative tester lead if applicable
- Apply the calculated battery load for 15 seconds
- Turn off the load
- Compare reading to service information
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify safety precautions when performing battery service
- Compare inductive and non-inductive capacity testers
- Explain how to calculate battery load values
- Describe the purpose of the battery load test

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

9. Inspect, clean, fill, &/or replace battery, battery cables, connectors, clamps, & hold-downs

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect the condition of the support tray, hold-down, posts, cables and clamps

TOP

- If the battery top is dirty, test the top of the battery with a voltmeter; if leaking voltage then clean
- Clean top with baking soda & water

TERMINALS

- Perform a battery terminal test with a voltmeter with the ignition disabled
- If disconnecting battery, use a memory saver to keep programmable information intact
- Clean battery terminals by removing the cables and cleaning with baking soda & water
- Coat terminals with white grease
- Tighten fasteners to secure cable

ELECTROLYTE LEVEL

- In older NON maintenance free batteries, check electrolyte level
- Remove vent cap
- Check electrolyte level
- Fill cells to correct level with distilled water if needed

REMOVE/INSTALL

- Disconnect the cables
- Loosen the battery hold-down
- Carefully lift the battery out using a battery strap
- Gently place the battery into its try or box
- Ensure the battery fits properly
- Tighten the hold-down and reconnect the cables
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify safety precautions when performing battery service
- Describe the basic parts of an automotive battery
- Explain how temperature & other factors affect battery performance
- Describe the function of the baking soda mixture for cleaning
- Explain how to clean a battery top on a NON maintenance free battery
- Explain how to perform a battery terminal test

- Discuss when to use pliers to remove battery cables
- Discuss precautions to take around battery fill openings
- Explain why only distilled water can be used in batteries
- Explain why over-tightening terminals is a problem
- Discuss how size of battery relates to motor performance & battery service life

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

10. Perform battery charge

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Install the battery terminal adapters if required
- Connect charger according to manufacturer instructions
- Connect the red charger lead to the positive terminal
- Connect the black charger lead to the negative terminal
- Set the charger to the appropriate current for the type of charging
- Turn charger on
- Turn charger off when charging is complete
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe how a battery charger works to charge a battery
- List battery charging precautions to prevent damage
- Compare advantages & disadvantages for slow & fast battery charging
- Describe the temperature and charging rates for slow & fast charging
- Discuss what would happen if a charger was on when it is connected to the battery

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

11. Start a vehicle using jumper cables or auxiliary power supply

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Connect one end of the red jumper cable to the positive terminal on the dead battery
- Connect the other end of the red jumper cable to the positive terminal of the power source or good battery
- Connect the other end of the black jumper cable to negative terminal of the power source or good battery
- Connect other end of the black jumper cable to a good ground away from the dead battery
- Run the engine or activate the power source while starting the vehicle with the dead battery
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe problems that can occur if jumper cables are not connected properly

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

12. Perform starter current draw tests

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Determine starter type & main starter components
- Disable the ignition system to prevent the vehicle from starting
- Connect a DMM across the battery
- Measure battery voltage
- Crank the engine for no more than 15-30 seconds
- Note the voltage & current readings
- If values are not within specifications, further tests are needed
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe common starting system troubles
- Explain the purpose of the current draw test on a starter
- Define the order for starting system tests
- Explain typical procedures for a starting motor rebuild
- Adjust a neutral safety switch
- Describe the safety practices that should be followed when testing or repairing a starting system
- Describe the function of major ignition system components
- Explain vacuum, centrifugal, and electronic ignition timing advance
- Sketch the primary and secondary sections of an ignition system

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

13. Perform starter circuit voltage drop tests

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Determine starter type & main starter components
- Disable the ignition system to prevent the vehicle from starting
- Connect the DMM leads correctly
- Check voltage drop across different parts of the starter control circuit using the wiring diagram
- Note voltage drop readings
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain the purpose of the voltage drop test
- Define the order for doing voltage drop testing using a wiring diagram
- Cite the safety practices for testing and repairing a starter system

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

14. Remove, install starter in a vehicle

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures

REMOVAL

- Disconnect the battery
- Remove any shielding that covers the starter or its bolts
- Disconnect any accessible wires on the starter
- If needed, lower exhaust pipes by carefully loosening the bolt/studs
- Support the starter & remove the starter retaining bolts
- Check for shims
- Lower the starter & disconnect any wiring not yet removed
- Inspect the flywheel teeth for chipping & breakage

TO INSTALL:

- Reverse the steps taken to remove the starter; return shims to the same place if applicable
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain the principles of an electric motor
- Describe the construction and operation of a starting motor
- Sketch a simple starting system circuit
- Explain the operation of solenoids
- List the functions of the main starter drive parts
- Describe starter drive operation
- Compare different types of starting motors
- Describe starting system safety features
- Explain when it is best to repair vs. replace a starter motor

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

15. Perform charging system output test

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Connect the load tester leads as required for inductive or non-inductive testers
- Set load tester controls to proper positions
- Start the engine
- Adjust idle to speed to test specifications
- Adjust the load control on the tester until the ammeter displays the maximum current output without letting the voltage drop (about 12 v)
- Compare the readings to specifications
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- List the basic parts of a charging system
- Explain charging system operation
- Describe the construction of major charging system components
- Compare alternator and voltage regulator design differences
- Explain charging system indicators
- Describe safety practices to follow when working with charging systems
- List charging system tests and their purpose
- Describe the causes of charging system noises

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

16. Remove, inspect, install generator (alternator)

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Disconnect the battery

REMOVE

- Loosen the bolts and remove the fan belt
- Remove the wires from the generator, note their location
- Remove the generator

INSPECT

- Check for battery problems
- Check the condition of the generator belt. Replace if needed

INSTALL

- Connect the wires back on the generator in the proper locations with insulating washers, if applicable
- Hand screw in the bolts without tightening
- Slip the belt over the engine and generator pulley
- Align belt properly
- Adjust belt tension correctly
- Tighten the bolts
- Reconnect the battery
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- List common problems with charging systems
- Describe the importance of proper belt tightening
- Describe common wear that require belt replacement

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

17. Inspect, replace, aim headlights & bulbs

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures

INSPECT

- Test the power at the bulb socket
- Check the ground circuit
- Look for any shorted or open circuits
- Check for corrosion of the connector terminals
- Check the fuse
- Check the switch

REPLACE

- Remove the bulb assembly
- Remove small rings or screws
- Remove the lens
- Replace with new bulb
- Reinstall lens, screw, rings, and bulb assembly

AIM HEADLIGHTS

- Use headlight aimers, aiming screen or bubble levelers according to equipment specification
- Adjust headlights using the vertical & horizontal adjusting screws
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain the operating principles of automotive light, wiper, and horn systems
- Discuss the diagnostic questions to determine problems in light, wiper, and horn systems
- Summarize automatic light and wiper systems
- Explain how to aim headlights
- Describe the safety practices to follow when working with light, wiper, and horn systems
- Explain both analog and digital instrumentation
- Summarize how to remove and service an instrument cluster
- Identify safety precautions when handling halogen bulbs
- Describe how to load a vehicle prior to aiming headlights
- Explain the purpose of the bubble level

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

18. Inspect, test gauges & gauge sending units for cause of abnormal gauge readings

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- If one gauge is not functioning, check the sending unit

ONE WIRE SENDING UNITS

- Disconnect the wire
- Ground the wire ONLY if required
- Check the gauge with the ignition ON
- If gauge moves, replace sending unit
- If gauge doesn't work, check wiring between instrument & sending unit
- If wiring is good, replace gauge or instrument cluster

TWO WIRE SENDING UNITS (TEMPERATURE SENSORS)

- Use scan tool or thermometer/ohmmeter
- Replace bulbs, inoperative gauges or sending units
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe the different types of gauges and sending units
- Explain how different types of gauges and sending units work
- Compare & contrast warning lights, sending units, switches, & basic display systems
- Explain both analog and digital instrumentation

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

19. Remove, reinstall door panel

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove all screws that hold the door panel to the frame
- Unscrew & remove the door lock button
- Remove the inner door handle and window crank, if applicable
- Pop out the spring clips around the outside of the door panel
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe the importance of proper door removal
- Describe the parts of the door panel

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

20. Check for module communication (including CAN/BUS systems) errors using scan tool

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Turn the vehicle ON but do not start the engine
- Connect the scan tool cable to the vehicle's data link connector
- Ensure the pins match up
- If needed, power the scan tool to the cigarette lighter adapter
- Follow the onscreen instructions to check for trouble codes
- Use scan tool snapshot and data-stream values to find problems not tripping trouble codes
- Record codes
- Use codes with worksite professional to determine testing or servicing required
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Summarize where computers, control modules, sensors, and actuators are typically located
- Summarize the flow of data through a computer
- Explain how a computer uses sensor inputs to determine correct outputs
- Discuss the purpose & operation of on-board diagnostic systems
- Compare & contrast OBD I & OBD II diagnostic systems
- Describe what could happen if the scan tool is forced into a connector or connected to the wrong connector
- Distinguish between computer system failure types
- Explain the importance of checking the ECM for stored diagnostic codes first
- Describe common locations of data link connectors
- Discuss precautions for scan tool program cartridges
- Identify the instrumentation used to monitor engine operating condition and fluid levels
- Explain the operation of components required to monitor engine operating conditions

Comments:

Unit 9: Auto Technician Pathway
Electrical/Electronics

Competency

21. Diagnose electronic transmission control systems using a scan tool

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Turn the vehicle ON but do not start the engine
- Connect the scan tool cable to the vehicle's data link connector
- Ensure the pins match up
- If needed, power the scan tool to the cigarette lighter adapter
- Follow the onscreen instructions to check for trouble codes
- Use scan tool snapshot and data-stream values to find problems not tripping trouble codes
- Record codes
- Use codes with worksite professional to determine testing or servicing required
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify the basic components of an automatic transmission
- Describe the function and operation of the major parts of an automatic transmission
- Trace the flow of power through an automatic transmission
- Explain how an automatic transmission shifts gears
- Define the functions of the transmission control unit

Comments:

Appendix R

TRANSPORTATION, DISTRIBUTION AND LOGISTICS
YOUTH APPRENTICESHIP

AUTO TECHNICIAN PATHWAY
SUSPENSION & STEERING (UNIT 10)

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

1. Assist to diagnose common suspension & steering problems

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Consult with worksite professional to determine appropriate inspections and test(s) to perform based on customer concern
- Retrieve shop manuals and/or electronic retrieval systems
- Research applicable vehicle and service information, normal system operation specifications, vehicle service history, service precautions, and applicable technical service bulletins
- Assist worksite professional to complete diagnostic tests necessary to identify cause of customer concern

Learning Objectives

- Define characteristics of liquids
- Identify the fundamental laws of hydraulics
- Explain how hydraulics laws apply to power steering pump operation
- Identify the major parts of a steering system
- Describe the basic function of each steering system component
- Explain the operating principles of steering systems
- Identify the role of between steering systems and handling or tire wear
- Identify types of body-chassis design
- Identify the major parts of a suspension system
- Compare types of suspension systems
- Describe the basic function of each suspension system component
- Identify the role of suspension in tire wear, ride, handling, braking & acceleration force control
- Cite the safety rules that should be followed when servicing steering & suspension systems
- Discuss common problems relating to a suspension system
- Describe special issues related to electronically-controlled suspension systems
- Discuss common problems due to short and long arm suspension systems, body sway, and uneven ride height
- Explain common causes for steering column noises, looseness, & binding concerns
- Explain common problems that cause wheel/tire vibration, shimmy, and noise
- Describe common causes of vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns
- Discuss power steering fluid leakage and effects on steering
- Discuss the function of electronically controlled steering systems (including sensors, switches, and actuators)

- Identify hybrid vehicle power steering system electrical circuits, service and safety precautions

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

2. Disable, enable supplemental restraint system (SRS)

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Turn the steering wheel so the wheels are straight
- Turn ignition to OFF & remove key
- Disable
- Locate fuse center
- Remove SIR fuse
- Remove the insulator panel
- Remove the connector position assurance (CPA) from the steering wheel module coil connector
- Disconnect the steering wheel module coil connector from the vehicle harness connector
- Install the insulator panel
- Enable
- Turn the steering wheel so the wheels are straight
- Turn ignition to OFF & remove key
- Connect the steering wheel module coil connector to the vehicle harness connector
- Install the CPA to the steering wheel module coil connector
- Remove the insulator panel
- Install the SIR fuse into the body control module fuse center
- Install the insulator panel
- Turn ignition to ON

Learning Objectives

- Explain how vehicle body and frame construction works with restraint systems to protect a vehicle's occupants
- Identify and locate the most important parts of vehicle restraint systems
- Describe the purpose for restraint systems
- Describe restraint system design variations
- Summarize the operation of restraint system sensors, inflator modules, and electronic control modules
- Explain Enabling zones
- Describe different air bag systems

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

3. Determine proper power steering fluid type; inspect fluid level & condition

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Warm up vehicle so power steering is at normal operating temperatures
- Turn engine off
- Locate power steering reservoir
- Remove cap
- Check fluid level with dipstick or by looking at the reservoir
- Inspect fluid for contamination
- Top fluid only to correct mark
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify the function of the components of a power steering system
- Identify components of electrically controlled power steering systems
- Compare types of power steering fluid
- Discuss the dangers of adding the wrong power steering fluid
- Discuss signs of low power steering fluid
- Describe how to determine if fluid is contaminated
- Explain the meaning of milky or metal contaminants in power steering fluid
- Describe why low power steering fluid indicates a leak

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

4. Flush, fill, bleed power steering system

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures

FLUSH

- Position vehicle
- Place large container under fluid return hose
- Remove fluid return hose at the power steering pump
- Run engine at idle while another tech maintains the fluid level at FULL COLD in the reservoirs using fresh power steering fluid
- Turn off engine
- Turn wheel fully to the left and right
- Remove pump reservoir inlet connection plug
- Install fluid return hose to pump reservoir
- Maintain fluid level at FULL COLD and operate engine at idle for 15 minutes
- Repeat & inspect fluid for contamination
- If contaminated repeat flush again

BLEED

- Start the engine
- Turn the steering wheel fully from side to side
- Check the fluid level often
- Add fluid as needed
- If excessive buzzing noise is apparent repeat the bleed procedure
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain basic steering column repair operations
- Describe service and repair procedures for a rack-and-pinion steering gear
- Explain how to complete basic power steering tests

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

5. Remove, inspect, replace, adjust power steering pump belt

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Loosen the bolts holding the pump to its brackets
- Push inward on the pump to release tension
- Remove old belt
- Obtain correct belt & install in reverse order of removal
- Adjust belt tension to specifications
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe how to pry to tighten a power steering belt
- Explain how to test the power steering belt tension

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

6. Inspect, replace, adjust tie rod ends (sockets), tie rod sleeves, & clamps

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures

REMOVE

- Separate the tie rod end form the steering knuckle or center link using a fork or puller
- Measure or mark tie rod end length
- Loosen the adjustment sleeve
- Unscrew the tie rod end
- Inspect for wear & damage

REPLACE

- Turn the new tie rod end into the sleeve until it is the exact length of the old tie rod
- Install the tie rod ball stud in the center link or steering knuckle
- Tighten the fasteners to specification
- Install new cotter pins & bend correctly
- Tighten the adjustment sleeve
- Check steering action
- Check toe for proper adjustment
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain why it is important to mark the tie rod end length
- Compare the differences between a linkage steering and a rack-and-pinion steering system
- Describe the operation of hydraulic and electric-assist power steering systems
- Explain the operation of four-wheel steering systems

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

7. Remove, inspect, install upper & lower control ball joints

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect the ball joint wear indicator or measure play in the joint by physically moving the control arm & joint
- Position the vehicle
- Remove the shock absorber
- Install a spring compressor on the coil spring
- Remove the nut securing the ball joint to the steering knuckle
- Separate the knuckle & the joint
- Press, screw or drill out the worn ball joint
- Clean the threads in the control arm if applicable
- Install new ball joints into the control arm
- Torque the ball joint properly
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Compare compression versus tension ball joints
- Discuss removal methods for removing worn pressed, bolted or screwed ball joints

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

8. Remove, inspect, install strut cartridge or assembly, strut coil spring, insulators (silencers), & upper strut bearing mount

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Unbolt the steering knuckle or bearing support, the brake lines and upper strut assembly- to- body fasteners
- Mark the cam bolt for later camber re-adjustment
- Remove the strut assembly (coil spring & chock) as a single unit
- Inspect for wear & damage
- Install in reverse order
- Adjust camber & toe when replacing
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain the operation of the four common types of springs
- Compare the various types of suspension systems

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

9. Inspect, remove, replace shock absorbers

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove the strut cartridge or assembly
- Apply a strut spring compressor to the strut coil spring
- Remove the upper damper assembly after the coil spring has been squeezed together
- Release spring tension
- Lift spring off strut
- Inspect parts for wear & damage
- Remove shock cartridge
- Replace with new shock cartridge into strut assembly
- Compress the coil spring
- Install the upper spring seat and related components
- Release the spring compressor
- Install strut cartridge back onto vehicle
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain automatic suspension leveling systems
- Describe common signs of wear & tear on shock absorbers
- Explain the importance of properly functioning shock absoprbers

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

10. Perform pre-alignment inspection & measure vehicle ride height

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect all steering & suspension related parts are in good working condition
- Check for loose wheel bearings, wheel or tire runout, worn tires, and tires of varied types & sizes, proper tire inflation
- Measure curb height & weight
- Check cradle alignment

Learning Objectives

- Explain the principles of wheel alignment
- List the purpose of each wheel alignment setting
- Describe the use of different types of wheel alignment equipment

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

11. Perform four wheel alignment by checking and adjusting front & rear wheel caster, camber, and toe as required

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect & correct tire, steering & suspension problems first

CASTER

- Move the upper or lower control arm so the ball joint moves to the front or rear

CAMBER

- Move the control arm in or out without moving the ball joint
- Recheck caster

TOE

- Lengthen or shorten the tie rod
- Check rear wheels caster, camber, & toe if needed
- Check tracking if needed
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe the commonly adjusted wheel alignment angles
- Explain how alignment angles are changed using alignment equipment
- Explain the proper order of wheel alignment
- Describe different methods to change caster or camber settings
- Explain how moving the upper control arm forward affects caster
- Explain how moving the upper control arm rearward affects caster
- Discuss how camber is adjusted at the connection between the knuckle & the strut
- Discuss the change to toe-in or toe-out when the steering knuckle arms face forward
- Discuss the change to toe-in or toe-out when the steering knuckle arms face rearward

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

12. Center steering wheel

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Shorten or lengthen each tie rod the same amount to keep the steering wheel spokes centered
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain toe-out on turns, steering axis inclination, and tracking

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

13. Inspect tire condition & tire wear patterns; check air pressure

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect the outer side wall, tread area, inner side wall
- Check tires for bulges, splits, cracks, chunking, cupping of the tread
- Check for punctures, cuts, tears and other physical injuries

AIR PRESSURE

- Remove valve stem cap
- Press tire gauge squarely over valve stem
- Read air pressure
- Compare reading to specification
- If tire pressure is low, add air
- If tire pressure is high, press on the valve core pin to release some air
- Recheck tire pressure and add or release air as needed
- Replace valve stem cap
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Define tire wear pattern
- Describe common tire wear patterns and the problems they indicate
- Identify the parts of a tire and wheel
- Describe different methods of tire construction
- Explain tire and wheel sizes
- Describe tire ratings
- Describe tire inflation and rotation procedures

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

14. Measure wheel, tire, axle flange, & hub runout

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Place the dial indicator against the side rim and on the tire side wall
- Turn the tire by hand
- Note the indicator reading
- Place the dial indicator on the tire tread and on the inner part of the rim
- Turn the tire by hand
- Note the indicator reading
- Compare readings to specification
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Define tire runout, wheel runout, lateral runout, and radial runout
- Describe common tire, wheel, and wheel bearing problems

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

15. Dismount, inspect, remount tire on wheel; balance wheel & tire assembly (static & dynamic)

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove wheels
- Dismount tires from wheel using tire changing machine
- Inspect tires for wear & tear

STATIC BALANCE

- Add wheel weights opposite the heavy area of the wheel

DYNAMIC BALANCE

- Add weights exactly where they are needed using a dynamic balancing machine
- Remount tire on the wheel
- Install tires on the vehicle
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain static and dynamic wheel balance
- Explain what is happening to the tire and steering when tires are imbalanced
- Summarize different methods of balancing wheels and tires
- Compare and contrast on-vehicle and off-vehicle balancing methods
- Compare different types of balancing machines
- Discuss how rear wheel drive or limited slip differential impacts on-car balancing procedures
- Explain the operation of the tire changing machine

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

16. Inspect tire & wheel assembly for air loss; repair tire using internal patch

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Fill tire with air
- Place tire in a drum of water or wet tire with hose
- Look for air bubbles
- Mark the leak
- Remove tire from the wheel
- Inspect the inside surface for the puncture
- Fill injury with recommended plug or sealant
- Select patch of correct size and material
- Scuff the area the patch will cover
- Apply adhesive to inner liner
- Place patch on inner liner
- Use stitching tool to tightly bond patch
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Discuss why tires are no longer recommended to be patched without dismounting
- Explain why areas larger than 13 mm or punctures in sidewalls should not be repaired or patched

Comments:

Appendix S

TRANSPORTATION, DISTRIBUTION AND LOGISTICS
YOUTH APPRENTICESHIP

AUTO TECHNICIAN PATHWAY
ENGINE PERFORMANCE & REPAIR (UNIT 11)

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

1. Assist to diagnose common engine performance problems

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Consult with worksite professional to determine appropriate inspections and test(s) to perform based on customer concern
- Retrieve shop manuals and/or electronic retrieval systems
- Research applicable vehicle and service information, normal system operation specifications, vehicle service history, service precautions, and applicable technical service bulletins
- Assist worksite professional to complete diagnostic tests necessary to identify cause of customer concern

Learning Objectives

- Explain the basic function of the major parts of an automotive engine
- Identify the major parts of a typical automotive engine
- Describe the four-stroke cycle
- Define common engine terms
- Compare types of engine systems such as gasoline, diesel, hybrid, etc.
- Describe the design and construction of an engine cylinder head
- Explain umbrella and O-ring type oil seals
- Explain the purpose of valve spring shims, rotators, stem caps, and spring shields
- Explain hydraulic and mechanical lifters
- Describe different types of rocker arm assemblies
- Explain the construction of engine bearings
- Cite the safety rules that should be followed when servicing engine systems
- List the most common engine performance problems
- Describe the symptoms for common engine performance problems
- Explain typical causes of engine performance problems
- Discuss common problems relating to abnormal engine noise or vibration concerns, unusual exhaust color, odor, and sound, and fuel, & ignition concerns
- Describe common driveability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM-installed accessories, or similar systems)
- Describe the function and use of a thermometer, pyrometer, manometer
- Describe the function and use of an oscilloscope or GMM to diagnose engine concerns
- Explain why a structured approach to engine diagnosis is essential
- Identify the major parts of a hybrid drive system
- Explain the construction and operation of hybrid drive assemblies

- Explain the principles of operation of energy storage devices such as capacitors and different battery types
- List the safety measures that must be followed when working on high-voltage hybrid drive systems
- Identify the most common problems that occur in a hybrid vehicle drive system
- Describe future technology developments in hybrid motor vehicles including new cell technologies

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

2. Inspect engine assembly for fuel, oil, coolant, & other leaks

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Start the vehicle
- Inspect engine for external problems such as leaks, part damage, contaminated oil
- Smell fluid from leaks
- Listen for unusual noises
- Increase engine speed while listening & watching
- Listen carefully to abnormal engine noises using a stethoscope or other listening device
- Consult worksite professional to determine further tests, inspections or repairs
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe coolant in oil appearance and possible causes
- Describe the appearance and possible causes of oil in coolant, engine oil leaks, external coolant leaks, engine blowby, engine vacuum leaks, engine exhaust leaks, & engine smoking
- Describe basic problem colors of exhaust smoke
- Describe basic problem colors of diesel exhaust smoke
- Describe how to use a stethoscope or listening device to pinpoint & interpret engine noises

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

3. Perform cranking & running compression tests

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove all spark plugs
- Block open the throttle
- Disable the ignition system
- Disable the electronic fuel injection if applicable
- Screw the compression gauge into one of the spark plug holes
- Crank the engine to rotate about 4-6 compression strokes
- Record gauge readings
- Repeat for each cylinder
- Repeat while engine is running
- Compare gauge readings to specifications
- Consult worksite professional to determine further tests, inspections or repairs
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe engine size measurements based on bore, stroke, displacement, and number of cylinders
- Explain engine compression ratio and how it affects engine performance
- Explain engine torque and horsepower ratings
- Describe the different methods used to measure and rate engine performance
- Explain volumetric efficiency, thermal efficiency, mechanical efficiency, and total engine efficiency
- Cite safe practices when making engine performance measurements
- Explain the purpose & procedure of the compression test
- Compare compression testing for gasoline versus diesel engines
- Describe the use and purpose of a compression gauge
- Explain when an engine compression test is indicated

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

4. Perform cylinder leakage test

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove crankcase filler cap
- Remove radiator filler cap
- Ensure radiator is filled to prescribed level
- Locate TDC using a whistle tester adaptor on the tester in the cylinder spark plug hole
- Rotate engine until cylinder to be tested is at TDC
- Remove whistle and connect leak tester
- Check cylinder leakage tester reading
- Look for air leaking noise or air bubbles
- Consult worksite professional to determine further tests, inspections or repairs
- Unblock the throttle valve
- Reconnect the ignition system
- Reinstall the spark plugs and air filter
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain the purpose & procedure of the cylinder leakage test
- Describe the use and purpose of a cylinder leakage tester
- Explain the use of the whistle adaptor on the leakage tester
- Explain when a cylinder leakage test is indicated

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

5. Perform cooling system pressure tests; check coolant condition; inspect & test radiator, pressure cap, coolant recovery tanks, & hoses

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove the radiator cap once the engine is sufficiently cooled
- Check the coolant's condition and color
- Visually inspect the cooling system for leaks, loose or missing fan belts, low coolant level, abnormal water pump noises, coolant in the oil, combustion leakage into the coolant
- Determine the coolant's freezing point using a coolant hydrometer
- Look down the radiator neck while the engine is running up to operating temperature to observe circulation
- Check thermostat if circulation is poor
- Connect a cooling system pressure tester to the radiator fill neck
- Pump the pressure tester until the pressure reaches the release pressure marked on the cap
- Leave the tester connected and watch for leaks
- Check for signs of heater core leaks on the ground under the engine
- Check for leaks at the pump drive shaft
- Check for leaks at all hose fittings, gaskets, and engine freeze (core) plugs
- Tighten, repair or replace parts as needed
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Summarize the functions of a cooling system
- Explain the operation and construction of major cooling system components
- Compare cooling system design variations
- Explain the importance of antifreeze
- List common cooling system problems and their symptoms
- Describe the most common causes of system leakage, overheating, and overcooling
- Perform a combustion leak test and a system pressure test
- Describe safe working practices to use when testing, maintaining, or repairing a cooling system

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

6. Retrieve, record diagnostic trouble codes, OBD monitor status & freeze frame data

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Verify malfunction indicator light trouble codes using the scan tool
- Obtain the appropriate scan tool and program cartridge for the vehicle, system and/or date
- Locate the data link connector (DLC) in the vehicle
- Attach the scan tool cable into the DLC; use an adaptor if needed
- Connect the scan tool to battery power if needed
- Follow the prompts to access the trouble codes
- Consult the trouble code chart or scan tool code conversion
- Consult worksite professional to determine further tests, inspections or repairs
- Erase diagnostic trouble codes when applicable

Learning Objectives

- Discuss the purpose and operation of on-board diagnostic systems
- Explain the use of scan tools to simplify reading of trouble codes
- Compare OBD I and OBD II system capabilities and procedures
- Locate the data link connector on most makes and models of cars
- Activate on-board diagnostics and read trouble codes with and without a scan tool
- Describe how to use a trouble code chart in a service manual or code conversion by a scan tool
- Describe the importance of running all OBDII monitors for repair verification

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

7. Inspect, test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, & circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO)

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Connect the oscilloscope to the circuit or output signal
- Set the scope to read the pattern desired
- Evaluate the scope patterns displayed
- Inspect the waveform for abnormal shapes
- Consult reference patterns to determine normal waveforms
- Consult worksite professional to determine further tests, inspections or repairs
- After testing, prepare for or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe the input, processing, and output sections of a basic computer system
- Explain input sensor and output device classifications and operation
- Summarize computer system signal classifications
- Sketch a block diagram for a computer system
- Summarize where computers, control modules, sensors, and actuators are typically located
- Summarize the flow of data through a computer
- Explain how a computer uses sensor inputs to determine correct outputs
- Explain the principles of an oscilloscope
- Summarize how to use waveforms to analyze the operation of sensors, actuators, ECU outputs, and other electrical-electronic devices
- Evaluate ignition system waveforms
- Summarize how to use an engine analyzer

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

8. Inspect, test fuel pumps & pump control systems for pressure, regulation & volume

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Visually inspect for restricted fuel filters, kinked fuel lines or hoses, intake air leaks, and low engine compression

PUMP PRESSURE

- Connect pressure gauge to output line or test fitting on fuel pump
- For mechanical fuel pumps, start engine & idle at specified rpm
- For electric fuel pumps, activate supply voltage to pump motor or start engine
- Compare pressure readings to specification
- If pressure is not within specification, isolate fuel pressure regulator from the pump by pinching the fuel hose going to the fuel return line OR taking the regulator out of the system

FUEL REGULATION

- Connect pressure gauge to fuel pressure test fitting on fuel rail
- Start the engine
- Note reading
- Compare pressure to specification

PUMP VOLUME

- Route output line from fuel pump into a graduated cylinder
- Clip line into cylinder for control of flow
- Start engine & idle at specified speed
- Allow fuel to pour into container for prescribed amount of time
- Close off valve and shut off engine
- Compare volume output to specification
- Consult worksite professional to determine further tests, inspections or repairs
- After testing, prepare for or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Define the major parts of a fuel supply system
- Explain the relationship between engine performance and fuel economy
- Describe the operation of mechanical and electric fuel pumps
- Describe the construction and action of air filters
- Explain the tests used to diagnose problems with fuel pumps, fuel filters, and fuel lines
- State safety rules for working on fuel supply systems

- Explain common causes of hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

9. Inspect, test fuel injectors

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Verify fuel pressure

TBI

- Remove the air cleaner
- Crank or start engine
- Observe fuel spray pattern in the throttle body
- Test power to injector solenoid

EFI MULTIPORT

- Start engine
- Listen to each injector with a listening device/stethoscope
- Test the injector solenoid, wiring harness and control module circuits
- Perform noid light tests to check feed circuit

BALANCE TEST

- Connect pressure gauge to test fitting on fuel rail
- Close valve for measuring fuel volume on fuel gauge assembly
- Connect balance tester wiring to injector in question & to battery
- Turn on ignition to pressure system, then turn off
- Press injector balance tester button & watch pressure drop
- Record drop in pressure
- Repeat on other fuel injectors
- Compare pressure drop readings between injectors
- Consult worksite professional to determine further tests, inspections or repairs
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- List some of the possible advantages of gasoline injection
- Describe the classifications of gasoline injection
- Explain the operation of electronic multiport gasoline injection
- Summarize the operation of air flow sensing, hydraulic-mechanical (continuous), and pressure-sensing gasoline injection systems
- Compare the various types of gasoline injection systems
- Discuss typical gasoline injection system problems
- Explain the operating principles of a diesel injection system
- Summarize the differences between gasoline and diesel engines

- Explain OBD II testing features used on late model fuel injection systems
- Cite safety rules for injection system service
- Describe procedure to perform noid light test
- Explain purpose & procedure for injector balance test

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

10. Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s) & heat shield(s)

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Position vehicle
- Use a light to closely inspect the exhaust system components for leaks, rust, and loose connections
- Focus attention on muffler, pipe connections, gaskets and pipe bends
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain the relationship between engine performance and exhaust emission
- Explain the construction and design of intake and exhaust manifolds
- Describe the basic parts of an exhaust system
- Explain the most common reasons for exhaust system failures
- Describe the appearance of exhaust leaks on components
- Compare exhaust system design differences
- Explain the fundamental parts of a turbocharging system
- Summarize the construction and operation of a supercharging system
- Cite safety procedures for working on exhaust systems

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

11. Perform exhaust system back-pressure test

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove an oxygen sensor located before the catalytic converter
- Install a pressure gauge into the sensor hole
- Start the engine
- Read the pressure gauge at idle and at higher speeds
- Compare pressure reading to specification
- Isolate exhaust system restriction by disconnecting the parts one at a time until the back pressure drops
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain the purpose and procedures of the back-pressure test
- List common causes of catalytic converter problems
- Describe the pressure readings which indicate exhaust system restriction

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

12. Inspect, test, replace components of the EGR system including EGR tubing, exhaust passages, vacuum pressure controls, filters & hoses

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect passages, hoses, tubing and filters for clogs, damage. Leaks and wear
- Replace as needed

VACUUM EGR VALVES

- Warm engine to operating temperature
- Increase engine speed to 2000-3000 rpm quickly using the accelerate linkage by hand
- Inspect valve stem movement
- Test EGR valve by connecting hand vacuum pump to EGR valve at idle
- Apply vacuum to pump, engine should stall or miss
- If not, remove and clean valve or replace

ELECTRONIC EGR VALVES

- Use scan tool to isolate trouble codes
- Test electronic EGR valves according to manual
- To pinpoint test a digital EGR connect scope to wires goint to valve
- Check scope waveform
- If no voltage, check for electrical connection
- Consult with worksite professional for valve replacement
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Define the fundamental terms relating to automotive emission control systems
- Explain the sources of air pollution
- Identify sources and causes of CO, CO_2, Hydrocarbon, & nitrogen oxide emissions
- Identify types of gasoline and their effect on performance and emissions
- Describe the function of the carburetor to meet the engine's fuel mixture requirements
- Explain emissions inspections tests
- Describe the operating principles of emission control systems
- Compare design differences in emission control systems
- Identify the components that act as outputs to control air/fuel ratios & emission control systems
- Explain how a computer or engine control module can be used to operate emission control systems

- Summarize how OBD II systems use multiple oxygen sensors to check air-fuel mixture and catalytic converter efficiency
- Explain the purpose of the EGR in conjunction with the ECM
- List common causes of EGR system malfunctions

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

13. Remove, replace timing belt; verify correct camshaft timing

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Set the number 1 cylinder to TDC
- Remove the timing belt cover & timing belt
- Line up timing marks on the camshaft and crankshaft sprockets
- Slip the belt over the sprockets
- Move the tensioner into the belt to hold the belt on its sprockets
- Adjust belt tension to specification
- Install timing belt cover
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe the construction and operation of a camshaft
- Compare the three types of camshaft drives
- Explain the construction of a timing gear, timing chain, and timing belt assembly
- Explain the importance of regular timing belt maintenance
- Cite safety procedures to follow when servicing engine front ends

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

14. Inspect, test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, & fan control devices

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect fan for bent blades, cracks, and other problems; replace fan if damaged
- Inspect the fan clutch for excessive play or oil leakage
- Start the engine to test the thermostatic fan clutch
- Observe the action of the fan clutch; if locked, replace fan clutch
- Observe electric cooling fan when engine is warm
- If fan does not function properly, check fuse, electrical connections, relay, and supply voltage to the fan motor
- Replace fan motor if it fails to operate with voltage applied
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- List common engine fan problems and their symptoms
- Describe safe working practices to use when testing, maintaining, or repairing a cooling system.
- Explain the basic function and construction of each major part of a typical heating and air conditioning system
- Summarize the operation and interaction of heating, ventilation, and air conditioning systems
- Explain the principles of refrigeration
- Identify how to recover A/C system refrigerant
- Explain how refrigerant is recycled and stored

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

15. Install gaskets, seals, & sealers as required

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect for leaks prior to disassembly
- Clean old gaskets carefully
- Match holes and sealing surfaces perfectly
- Apply appropriate sealer type
- Align and hand screw all bolts
- Tighten all fasteners in steps
- Use crisscross tightening pattern to specified torque
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify commonly used automotive fasteners
- Summarize safety rules relating to fasteners, gaskets, seals, and sealants
- Explain the reason for tightening the bolts a little at a time in a crisscross pattern

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

16. Perform oil pressure tests

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Check oil level
- Install pressure gauge into the hole for the oil sending unit or one of the line sto the oil cooler
- Run the engine at specified speed for testing
- Read the pressure gauge and compare to specification
- If the oil pressure indicator is implicated, test electrical connection, circuit wiring and gauge
- Consult worksite professional to determine further tests, inspections or repairs
- After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- List common lubrication system problems and symptoms
- Describe common causes of low oil pressure
- Describe common causes of high oil pressure

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

17. Inspect, replace engine cooling & heater system hoses

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect hoses visually for swelling, cracks, and leaks
- Check for hardened hoses by hand
- Flex or bend the hoses, watch for surface cracks
- Replace hoses if problems
- Loosen hose clamps
- Twist and pull hose from fittings
- Clean metal hose fittings
- Seal fittings if corroded or pitted
- Slide on new hose and clamp
- Fit the hose clamps over the hose fittings
- Tighten the clamp and check for leaks
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Discuss common problems and wear for cooling and heating hoses
- Explain common problems associated with worn cooling & heating system hoses

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

18. Inspect, test, replace thermostat housing, gasket, & seal

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Observe the coolant through the opening in the radiator neck as the engine warms
- Use a temperature probe to touch the thermostat outlet hose
- Unscrew bolts holding thermostat housing to engine
- Tap housing free
- Lift off housing and thermostat
- Scrape old gasket material off housing
- Check for gaps between housing and sealing surface
- File or sand surface flat if warped
- Remove thermostat and test in water on a hot plate
- Replace thermostat if it does not open at correct temperature
- Install new thermostat centered in housing with pellet toward inside of engine
- Position new gasket with approved sealer
- Torque thermostat bolts to specification
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe common problems associated with the thermostat
- Explain procedures for replacing a rubber thermostat housing seal instead of a gasket
- List precautions to take with combined plastic housings

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

19. Inspect, remove, replace water pump

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures

INSPECT

- Wiggle the fan or pump pulley up and down to check for worn pump bearings
- Warm engine and then shut off
- Squeeze top of radiator hose while another technician restarts the engine to check for pump operation
- Observe coolant in radiator with engine at operating temperature

REMOVE

- Unbolt all brackets and components (air conditioning compressor, power steering pump, alternator, etc)
- Unscrew ALL bolts holding pump to engine
- Lightly tap pump housing to free pump
- Scrape off old gasket or sealer material

REPLACE

- Install water pump gasket using approved sealer
- Work o-ring seal into bottom of groove if applicable
- Fit pump onto the engine straight into place
- Start all bolts be hand
- Check all bolt lengths are the same
- Torque all fasteners a little at a time in a pattern
- Install the other components
- Tighten pulley properly
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe common problems associated with the water pump

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency
20. Remove, replace radiator

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Cool radiator
- INSPECT
- Inspect the outside for debris
- Inspect radiator shroud for breaks
- Spray water from back of radiator to push debris out the front
- Inspect radiator cap and filler neck for cracks, tears, nick or dents
- Have neck repaired as needed
- REMOVE
- Place catch pan under radiators petcock
- Drain radiator
- Disconnect hoses, oil cooler lines, and wires to sensors and fans
- Remove brackets or bolts to remove radiator from its mounting
- REPLACE
- Ensure rubber mounts are in place in their brackets
- Carefully lower radiator into place without hitting and damaging it
- Connect all hoses, lines and wires
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe common problems associated with the radiator

Comments:

Unit 11: Auto Technician Pathway
Engine Performance & Repair

Competency

21. Inspect, service, replace shafts, yokes, boots, & CV joints

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures

SHAFT

- Scribe mark each component
- Clamp the shaft in a vise
- Inspect, clean, grease and re-assemble as needed

CV JOINT SERVICE

- Place the half shaft in a vise
- Cut through the swage rings without damaging the outer race
- Compress the seal on the halfshaft and away from the CV joint outer race
- Wipe away grease from the CV joint face
- Spread the halfshaft retaining snap rings apart
- Pull the CV joint from the halfshaft
- Discard the old seal
- Place the brass drift against the cage
- Tap gently on the brass drift to tilt the cage
- Remove the first ball when the cage tilts
- Repeat to remove all of the balls
- Pivot the cage and align the cage windows with the lands of the outer race
- Lift out the cage and the inner race
- Remove the inner race from the cage
- Thoroughly degrease all CV joint parts
- Check outer CV joint assembly for wear, cracks, or other damage; replace damaged parts
- Clean halfshaft bar
- Lightly grease inner & outer race grooves
- Reassembly
- Insert inner race into cage
- Align inner race lands with cage windows
- Insert cage & inner race into outer race
- Place brass drift against cage
- Tap gently on brass drift to tilt cage; install first ball when cage tilts; reinstall all balls
- Pack CV joint seal & assembly with grease
- Place new small swag clamp onto CV joint seal
- Place large retaining clamp on seal
- Position CV joint small end into joint seal groove on halfshaft bar

- Position outboard end of halfshaft assembly
- Align seal, halfshaft bar, swage clamp
- Place retaining snap ring into CV joint inner race
- Slide CV joint onto halfshaft bar
- Slide large diameter of CV joint seal with retaining ring in place over outside of CV joint outer race
- Position lip of CV join seal into groove of CV joint outer race
- Remove excess air
- Secure large retaining clamp & toque to specification
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify and describe the parts of a modern drive shaft assembly
- Explain the functions of a drive shaft
- Describe the different types of universal joints
- List the different types of drivelines
- Describe the most common drive shaft problem
- List the basic parts of an automotive clutch
- Explain the operation of a clutch
- Describe gear operating principles
- Explain the fundamental operation of a manual transmission
- Identify the basic components of an automatic transmission
- Describe the function and operation of the major parts of an automatic transmission
- Explain how an automatic transmission shifts gears
- Identify the major parts of a rear drive axle assembly
- List the functions of a rear axle assembly
- Describe the operation of a differential
- Compare different types of axles
- Identify the major parts of a transaxle assembly
- Explain the operation of a manual transaxle
- Explain the operation of an automatic transaxle
- Identify the parts of constant velocity drive axles
- Compare design differences in CV-joints

Comments:

Appendix T

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

LOGISTICS/SUPPLY CHAIN MANAGEMENT (SCM) PATHWAY PLANNING & PURCHASING (UNIT 12)

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

1. Respond to customer inquiries

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Collect information from records or customer
- Respond to customer comments and questions
- Update information accurately as applicable
- Process physical documents of service
- Solicit supervisor or co-worker support and advice when necessary to meet customer needs
- Follow up to ensure customer's needs were met
- Handle complaints tactfully without insult or conflict

Learning Objectives

- List the variety and range of services that your facility offers
- Identify the internal and external customers in your facility
- Compare needs of internal and external customers
- Define customer service
- Describe how customer service affects a company's "bottom line"
- List strategies for maximizing customer satisfaction
- Describe the functions of other departments or units to serve the customer
- Describe facility issues that may impact customer needs being met

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

2. Provide product and service information

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Contact current and/or potential customers to market services
- Distribute product and service information to current and/or potential customers
- Assist worksite professional to keep internal and external customers informed of service progress and decisions that may affect them
- Input customer information and print documents as required

Learning Objectives

- List the variety and range of services that your facility offers
- Explain the components of a marketing plan
- Identify the steps of the selling process
- Relate marketing to distribution
- List the groups or demographics of the groups to be targeted
- Identify reasons customers would be interested in your product/service
- Compare product features and pricing of products/services offered at other like facilities
- Compare advantages and disadvantages of sales promotion methods and advertising media
- List methods to announce a new service
- Research to determine viability of global ventures
- Evaluate internal/external, local/global environments for threats or opportunities (economic, geography, history, political, competition, regulatory, cultural, technological)

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

3. Assist to process claims

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Work with claimant to assess responsibility
- Address overage, shortage and damage claims
- Research cause of claim
- Communicate findings
- Resolve claims
- Track and monitor claims by customer or on carrier

Learning Objectives

- Describe the steps to follow when dealing with complaints
- Explain the purpose of freight claims
- Explain the difference between common and contract carrier liability
- Explain the elements of claims tracking
- Identify exceptions to common carrier liability

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

4. Collect and maintain data & files

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Select appropriate forms/records
- Code documents as required
- File forms/records in appropriate location
- Retrieve and replace files in correct position
- Add, Edit, Verify and Query data in electronic files if applicable
- Use appropriate computer codes, formatting, macros, charts, spreadsheets, etc.
- Verify data prior to entry/storage
- Maintain files

Learning Objectives

- Demonstrate how electronic data is manipulated such as in a spreadsheet system
- Explain how data & files are backed up
- Identify and explain the role and function of software management systems
- Explain how planning software and systems (ERP, MRP, DRP, WMS) are utilized to manage logistics planning

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

5. Process documentation & prepare reports

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Determine required data and documentation needed
- Use the correct format to generate accurate reports
- Prepare reports as required
- Produce reports in a timely fashion
- Maintain record log
- Maintain electronic filing system
- Maintain security and confidentiality

Learning Objectives

- Describe the function of specific documents and forms in your company
- List typical documentation files necessary in planning & purchasing
- Discuss the need importance of security & confidentiality of records

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

6. Compile customer & order information

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Collect information from records or customer
- Record order information
- Verify order information with customer
- Solicit supervisor or co-worker support and advice when necessary to meet customer needs

Learning Objectives

- List the elements of a valid contract
- Compare contract elements with purchase order customer requests
- Describe methods for determining customer needs and requirements
- Explain the importance of customer service in the order process
- Describe how logistics process requirements are determined from customer expectations and requests
- Discuss the importance of accurate order taking

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

7. Process customer sales order

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Receive sales order from customer
- Review order for proper codes, authorizations, etc.
- Document sales order
- Assist to develop plan for customer order

Learning Objectives

- Identify the sales order process
- Identify your range of services that meet customer requirements
- Explain how estimating and forecasting are used to determine the demand for services
- Describe special logistics accommodations customers may request

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

8. Assist to plan for customer order using production and logistics documents

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Estimate the size, quantity, time, cost, and/or materials needed from customer order requirements
- Review production and logistics documents such as facility site constraints, production schedules, work orders, staffing tables, inventory levels, distribution routes, etc to plan for customer order
- Arrange for delivery and distribution of supplies and parts to meet production schedules

Learning Objectives

- Describe the purpose of a master production schedule
- Relate the master production schedule to the customer order plan
- Compare and contrast the different types of production process flow design advantages, constraints, and costs
- Compare production strategies make to stock vs. make to order
- Compare costs related to materials, structure issues, capacity, and staff performance and training
- Define common components of an exported or imported price
- Explain how production timetables are developed from planning for required tools, materials, equipment, numbers of workers needed, and cost projections
- Describe facility design issues and their impact on resource planning
- Describe how new order requests are planned
- Define and explain the major measures used by a logistics organization to manage and improve performance
- Explain the impact of global trade on the logistics industry
- Explain some of the global market trends your facility faces and the company's position in that market place
- Explain effects of currencies on movement of goods and services in the logistics industry
- Name four major components of logistics
- Explain supply chain management
- Summarize differences between logistics and supply chain management
- Define basic logistics terminology
- Discuss/evaluate logistics industry trends
- Explain the functions of each department or unit within the larger organization
- Describe the role of sales and marketing operations in your facility

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

9. Purchase raw materials/services

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Determine if inventory quantities are sufficient for needs
- Use re-order points to minimize back-orders
- Order more materials from qualified suppliers when necessary

Learning Objectives

- Describe the supplier qualification process at the worksite
- List basic ways purchase orders are transmitted to vendors
- Explain the process used to manage, order, receive, and delivery externally and internally within your facility
- Maintain knowledge of all organizational and governmental rules affecting purchases, and provide information about these rules to organization staff members and to vendors.
- Describe how to read bills of lading and routing sheets
- Explain how automated purchasing systems work to minimize waste
- Describe how purchasing costs are negotiated

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

10. Track and maintain order and receipt schedules

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Compare customer order status with receipt of raw materials
- Verify receipt of raw materials and distribution to production

Learning Objectives

- Discuss the purpose of tracking order receipt
- Describe organizational methods used to track orders and supply receipt
- Explain how order receipt and verification is commonly communicated

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

11. Review requisition orders

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Review requisition orders to verify accuracy, terminology, and specifications
- Verify that all required information is completed on the requisition order
- Prepare purchase order

Learning Objectives

- Describe the function of the requisition order
- List common elements required on a requisition order

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

12. Prepare purchase orders

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Prepare purchase orders
- File copies of order as applicable
- Send purchase order to supplier
- Process or forward billing information

Learning Objectives

- Describe the function of the purchase order
- List common elements required on a purchase order
- Explain common methods used to send purchase orders
- Describe how purchase orders are linked to requisitions and payment

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

13. Contact suppliers to verify shipment details

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Contact suppliers to verify shipment details
- Verify shipment arrival and order correctness
- Report receipt of supply goods to correct parties
- Contact suppliers in order to schedule or expedite deliveries and to resolve shortages, missed or late deliveries, and other problems

Learning Objectives

- Discuss how shipment details are communicated
- Discuss the importance of frequent communication with suppliers

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

14. Process supplier invoices

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Receive invoice
- Compare invoice to purchase order copy
- Verify receipt of goods/services
- Contact suppliers to resolve discrepancies due to shortages, overages, damaged materials, and other problems
- Document and process invoices
- Forward to appropriate parties for payment

Learning Objectives

- Describe the role of the accounting department in processing purchase orders and invoices
- Explain how the warehouse communicates receipt, shipment, and discrepancies or problems with inventory
- List documentation critical to approval for payment
- Outline types of problems relating to invoicing and how they are solved

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

15. Monitor customer order status

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Respond to customer and supplier inquiries about order status, changes, or cancellations
- Update records as required
- Communicate changes in a timely manner to applicable parties for changes or cancellations

Learning Objectives

- Explain the importance of tracking and documentation for inventory control and production processing
- Explain common methods used to track customer order production & progress
- Discuss the importance of timely communications for customer order changes or cancellations

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

16. Inform internal & external customers of order status

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Coordinate production and shipping activities to resolve complaints or eliminate delays
- Track customer satisfaction data

Learning Objectives

- Identify common internal and external customers in a production facility
- Discuss the importance of frequent customer communication
- Describe processes used to inform customer of order status
- Explain how to inform a customer about order delays
- Describe how to maintain good customer relations in the vent of order problems
- Describe how plans are made to improve organizational performance including customer satisfaction and service/operations performance

Comments:

Unit 12: Logistics/Supply Chain Management (SCM) Pathway Planning & Purchasing

Competency

17. Compile purchasing, production, & shipping information for status reports

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Monitor in-house inventory movement
- Complete inventory transfer forms for bookkeeping purposes
- Compile information, such as production rates and progress, materials inventories, materials used, and customer information, so that status reports can be completed
- Record production data, including volume produced, consumption of raw materials, and quality control measures
- Compile and prepare documentation related to production sequences, transportation, personnel schedules, and purchase, maintenance, and repair orders
- Provide documentation and information to account for delays, difficulties, and changes to cost estimates

Learning Objectives

- Describe quality tools and methods used to monitor the logistics/supply chain process
- Evaluate movement of goods to maximize value and minimize costs
- Define the roles and parties involved in logistics communication and coordination of activities
- Explain the importance of measuring and managing the reliability and performance of logistics systems
- Discuss the company's commercial risk with customers as indicated by credit history and payment capacity of buyer/partner
- Discuss the impact of global marketing and servicing on a company's logistics activities
- Describe additional requirements when a company is engaged in international/global logistics such as documentation, harmonized codes, payment methods, import/export, international sourcing, legal and trade agreements
- Explain how ethical and cultural issues impact in global activities
- Determine legal and regulatory compliance to support global activities
- Discuss political economic risks involved in global logistics
- Determine impacts of foreign currency exchange on company risk

Comments:

Appendix U

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

LOGISTICS/SUPPLY CHAIN MANAGEMENT (SCM) PATHWAY INVENTORY MANAGEMENT & PRODUCTION (UNIT 13)

Unit 13: Logistics/Supply Chain Management (SCM) Pathway Inventory Management & Production

Competency

1. Respond to customer inquiries

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Collect information from records or customer
- Respond to customer comments and questions
- Update information accurately as applicable
- Process physical documents of service
- Solicit supervisor or co-worker support and advice when necessary to meet customer needs
- Follow up to ensure customer's needs were met
- Handle complaints tactfully without insult or conflict

Learning Objectives

- List the variety and range of services that your facility offers
- Identify the internal and external customers in your facility
- Compare needs of internal and external customers
- Define customer service
- Describe how customer service affects a company's "bottom line"
- List strategies for maximizing customer satisfaction
- Describe the functions of other departments or units to serve the customer
- Describe facility issues that may impact customer needs being met
- Describe how plans are made to improve organizational performance including customer satisfaction and service/operations performance

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway Inventory Management & Production

Competency

2. Collect and maintain data & files

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Select appropriate forms/records
- Code documents as required
- File forms/records in appropriate location
- Retrieve and replace files in correct position
- Add, Edit, Verify and Query data in electronic files if applicable
- Use appropriate computer codes, formatting, macros, charts, spreadsheets, etc.
- Verify data prior to entry/storage
- Maintain files

Learning Objectives

- Demonstrate how electronic data is manipulated such as in a spreadsheet system
- Explain how data & files are backed up
- Identify and explain the role and function of software management systems
- Explain how planning software and systems (ERP, MRP, DRP, WMS) are utilized to manage logistics planning

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway
Inventory Management & Production

Competency

3. Process documentation & prepare reports

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Determine required data and documentation needed
- Use the correct format to generate accurate reports
- Prepare reports as required
- Produce reports in a timely fashion
- Maintain record log
- Maintain electronic filing system
- Maintain security and confidentiality

Learning Objectives

- Describe the function of specific documents and forms in your company
- List typical documentation files necessary in inventory management & production
- Discuss the need importance of security & confidentiality of records

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway Inventory Management & Production

Competency

4. Gather qualified supplier information for materials to be ordered

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Locate suppliers using sources such as catalogs and the internet
- Gather supplier information about materials to be ordered

Learning Objectives

- Classify vendors by type
- Describe the function of the supplier qualification process
- Describe factors to consider when evaluating suppliers
- Explain the importance of assessing a vendor's financial status to the ability to supply
- Discuss the contract and negotiation process for supplier bids

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway Inventory Management & Production

Competency

5. Assist to determine prices, specifications, and delivery dates from potential suppliers

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Obtain supplier information/bids in order to make purchase decision
- Compare prices, specifications, and delivery dates from potential suppliers.
- Communicate to internal/external customers on supplier information and performance
- Maintain supplier contact
- Assist to inform suppliers of winning bid

Learning Objectives

- Compare quality and pricing structures for vendors offering the same type of service or product
- Discuss factors considered when ordering from one supplier versus another
- Describe how production schedules and customer order priorities influence choice of supplier

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway Inventory Management & Production

Competency

6. Gather and organize data for demand forecasting

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Research to determine viability of ventures for sources of materials and services
- Evaluate internal/external, local/global environments for threats or opportunities (economic, geography, history, political, competition, regulatory, cultural, technological)
- Compare costs/benefits of utilizing local, national and/or international markets

Learning Objectives

- Identify major local, national and international trade regions
- Define terms associated with trade regions
- Construct an import flowchart
- Construct an export flowchart
- Determine ports of entry/export for a selected product
- Describe types of payment methods used in international transactions

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway
Inventory Management & Production

Competency

7. Assist to develop forecasts

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Gather and organize data for demand forecasting
- Develop forecasts
- Set lot sizes, inventory levels and order lead-time
- Document forecasts using graphs and charts in written reports or master file for ordering levels

Learning Objectives

- Explain the purpose and function of an inventory forecast
- List the types of data needed for inventory forecasting
- Define lot size, inventory level, re-order point and lead-time
- Explain the importance of the maintaining inventory levels to minimize inventory value
- Identify factors/variables for what, when and how much to order
- Describe the costs involved for excess inventory, back orders, etc.
- Discuss factors used to determine order lead-time
- Determine most appropriate demand forecasting method

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway Inventory Management & Production

Competency

8. Assist to develop production & inventory solutions based on production and logistics plan

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Determine selection criteria for warehousing services (e.g., loading, storing, consolidating) based on production and logistics plan
- Identify possible warehousing providers
- Assist to evaluate bids and select provider(s)
- Document (e.g., report, memo, tables) warehousing solution

Learning Objectives

- Identify the elements of a supply chain
- Define methods of inventory management
- Explain the purpose of an inventory plan
- Define the functions that inventories perform
- Identify costs relevant to inventory decisions
- Calculate the costs of ordering and carrying inventory
- Discuss the contract and negotiation process for warehousing/storage bids
- Compare and contrast the different types of inventory designs based on flow of materials
- Describe facility design issues and their impact on inventory & production planning
- Describe the steps in forecasting, planning, scheduling and inventory control that are used to ensure optimum use of capacity and resources
- Research and identify areas of waste
- Compare and contrast advantages and disadvantage of owning and operating facilities versus out-sourcing
- Name four major components of logistics
- Explain supply chain management
- Summarize differences between logistics and supply chain management
- Define basic logistics terminology
- Discuss/evaluate logistics industry trends
- Explain the functions of each department or unit within the larger organization
- Describe the role of sales and marketing operations in your facility

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway Inventory Management & Production

Competency

9. Assist to develop packaging and material handling requirements based on production and logistics plan

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Determine packaging, storage, and handling requirements based on production and logistics plan
- Identify alternative solutions
- Assist to evaluate alternative solutions
- Assist to select most cost-effective solution
- Document (e.g., report, memo, tables) evaluation process and selection decision

Learning Objectives

- Define the functions of packaging
- Describe packing material
- Explain how customer shipping instructions determine packing requirements
- Identify costs relevant to packaging decisions
- Compare different types of packaging solutions
- Compare packing materials to determine the safest and most cost-effective method of shipping

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway Inventory Management & Production

Competency

10. Verify receipt of goods/services

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Review procedures for materials movement between storage, customer and production
- Receive goods/services
- Ensure receipt matches original order for good/services
- Reconcile any discrepancies with worksite professional and supplier or department
- Communicate in a timely and accurate manner to the correct parties

Learning Objectives

- Discuss the reason for the distribution network of the inventory plan
- Describe different inventory systems

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway Inventory Management & Production

Competency

11. Complete inventory transfer forms for bookkeeping purposes

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Complete required forms/computer entry for inventory movement
- Review accuracy of forms/computer entry
- Forward forms to necessary departments or personnel

Learning Objectives

- Discuss the use of records and documentation to track inventory movement
- Describe the importance of tracking inventory movement
- Explain the process of inventory movements from raw materials receipt to production to shipping of final product

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway Inventory Management & Production

Competency

12. Assist to coordinate schedules for materials/product/services movement

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Ensure movement of materials/product/services, & equipment meet established deadlines
- Track, and report back product, production, material and/or delivery issues to original communicator
- Communicate in a timely and accurate manner to the correct parties

Learning Objectives

- Explain how to read a production schedule and manufacturing work order
- List methods of productivity measurement and just-in-time inventory control
- Describe how priority planning and capacity planning are linked
- Define the purpose of production activity control and inventory management in a made to order vs. made to stock facility
- Evaluate movement of goods to maximize value and minimize costs

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway Inventory Management & Production

Competency

13. Assist to perform physical inventory

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Carry out inventory activities safely
- Do physical count for each item
- Use correct unit of measure to record inventory results
- Keep inventory movement to a minimum

Learning Objectives

- Explain the purpose of a physical inventory
- Explain methods and reasons for monitoring inventory accuracy
- Discuss the timing of inventory audits to production requirements
- Describe your facility's policy in the event of inventory shortage

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway Inventory Management & Production

Competency

14. Report inventory shortage

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Compare physical count to perceived count
- Adjust and update inventory count
- Follow company policy in the event of inventory shortage.
- Make sure that inventory corrections are accurate
- Report inaccuracies to the proper parties

Learning Objectives

- Explain the costs of inventory shortages
- Describe common reasons for inventory shortages or overages
- Describe methods that are used to minimize inventory movement errors

Comments:

Unit 13: Logistics/Supply Chain Management (SCM) Pathway Inventory Management & Production

Competency

15. Assist with inventory inaccuracies investigations

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Evaluate the amount and type of inaccuracy to be investigated
- List internal and external factors that could have contributed to the type of inaccuracy noted
- Compile necessary company documents to evaluate factors identified
- Audit processes and staff to evaluate potential losses
- Create solutions based on audit results
- Monitor implementation of solutions for effectiveness

Learning Objectives

- Discuss how inventory shortages are investigated
- List common reasons for inventory loss
- Identify factors that affect the costs of replenishing inventory
- Describe factors that affect the costs of shortages
- Define and explain the major measures used by a logistics organization to manage and improve performance

Comments:

Appendix V

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

LOGISTICS/SUPPLY CHAIN MANAGEMENT (SCM) PATHWAY STORAGE & WAREHOUSING (UNIT 14)

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

1. Operate tools and equipment safely

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Operate only equipment trained on
- Choose correct tool or equipment for the task
- Verify tool/equipment is available for use and in working order
- Verify tool/equipment is current for preventative maintenance and/or calibration
- Verify safety equipment and any Personal Protective Equipment (PPE) needed for tool/equipment use
- Operate tool/equipment safely with guarding devices if applicable in the manner required for the job task
- Monitor tool/equipment for safe operation while operating
- Follow facility procedures for clean up and shut down after use
- Perform any required preventative maintenance procedures
- Investigate and promptly reports abnormal tool/equipment conditions
- Properly shut down and label any tool/equipment that is not operating as expected, if applicable
- Follow Lock Out/Tag Out procedures as applicable
- Document use and maintenance as required

Learning Objectives

- List the various tools and equipment used at your worksite
- Outline applications of each tool and equipment
- Describe and demonstrate the safety requirements for each tool and equipment
- Discuss start up and shut down procedures for each tool/equipment you will operate
- Explain the purpose of preventative maintenance
- Describe emergency shutdown procedures for the tool/equipment you will operate
- Explain how to recognize and address malfunctions for the tool/equipment you will operate
- Describe how to recognize wear and tear on equipment components
- List the OSHA and other regulatory requirements as they apply to the equipment that you operate
- Describe proper techniques for lifting loads
- List the safeguards that apply to the equipment used in your facility for tools, automated machines, material handling equipment, and lifts
- List which tools and equipment require safety certification
- Explain Lock Out/Tag Out indications and procedures in your facility

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

2. Assist to plan for customer order using production and logistics documents

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Estimate the space, quantity to store, cost, and/or materials needed for storage
- Map the production flow of the materials and inventory
- Review documents such as facility site constraints, production schedules, work orders, staffing tables, inventory levels, etc.
- Discuss solutions to meet customer order including transportation and inventory costs
- Set schedule for acquisition and deadline dates of inbound materials

Learning Objectives

- Analyze a supply and distribution system
- Compare and contrast the different types of production process flow design advantages, constraints, and costs
- Describe facility design issues and their impact on resource planning
- Describe the steps in forecasting, planning, scheduling and inventory control that are used to ensure optimum use of capacity and resources
- List types of data used in forecasting the need for goods and services such as data on current and future global/domestic market conditions, data from benchmarking, and data on Industry Trends
- Develop supply forecasts in light of economic, competitive, technology and market and currency trends and conditions that affect procurement
- Describe costs associated with providing a customer service such as labor, materials, & manufacturing.
- Research and identify areas of waste
- Compare and contrast advantages and disadvantage of owning and operating facilities versus out-sourcing

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

3. Unload materials

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Unload materials safely and according to regulations
- Use loading equipment safely and according to regulations
- Record materials received
- Stage materials received for inspection

Learning Objectives

- Demonstrate how to recognize, handle, and store hazardous materials
- List the regulations pertaining to loading/unloading of materials and supplies
- Describe different kinds of loading equipment and their applicable safety and regulatory use standards
- Identify safety features of loading/unloading equipment

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

4. Inspect package for integrity, damage, quality specifications

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Handle materials according to regulations
- Check label(s) to ensure that they meet all requirements
- Inspect package for leaks, rips, tears, holes, etc.
- Record any damage
- Report damage to worksite professional

Learning Objectives

- Become familiar with common hazardous materials labeling and packaging requirements
- Describe how special handling packages are labeled
- List common reasons for materials damage

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

5. Check order accuracy against packing slip/purchase order

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain purchase order
- Locate packing slip
- Compare accuracy of order received against packing slip and purchase order
- Verify quality of materials received against specifications
- Report material and/or quality deviations to appropriate parties
- Deliver materials to appropriate staging/storage location according to disposition

Learning Objectives

- Define the purpose of the packing slip, purchase order, requisition
- Discuss the purpose of order reconciliation and receipt
- Explain how order inaccuracies are communicated to appropriate parties
- Identify costs associated with inaccurate or damaged orders

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

6. Deliver materials to staging/storage location

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Determine location for item storage or staging
- Move items received safely using equipment properly
- Use good body mechanics when lifting and moving materials

Learning Objectives

- Explain how goods returned to storage are processed for reuse, resale or storage
- Define palletizing
- Describe different methods of warehouse storage and identification
- Discuss bar coding and other warehouse storage solutions
- Discuss the importance of proper shelving procedures when loading in newer items

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

7. Store or discard packaging materials as required

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Remove delivery packaging as required prior to final storage
- Store or discard delivery packaging according to procedures

Learning Objectives

- Identify common types of packaging
- Explain costs associated with discarding versus recycling packaging materials
- Discuss legal and compliance issues with recycling packaging materials
- List common types of items that remain in delivery packaging until final disposition

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

8. Pull items from warehouse storage location

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Determine location of item needed
- Pull items from warehouse storage location
- Verify item pulled matches description and location of item required
- Notify appropriate worksite professional of any discrepancies

Learning Objectives

- Demonstrate the use of scanners and scales for inventory management and counting
- List common markings found on cartons/containers
- Explain basic guidelines for labeling
- Highlight differences in labeling for dangerous goods

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

9. Store orders for transporting

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Move items to staging area to ready for packaging & delivery
- Store orders in appropriate locations as required

Learning Objectives

- List common storage environments
- Describe common labels used on materials to be readied for packaging
- Compare different areas of the warehouse and their function

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

10. Check container and packing materials for labeling

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Prioritize orders to be filled based on management plan
- Use packaging methods that keep returns and claims for damage to a minimum
- Verify that outgoing labels have all relevant information
- Check container and packaging materials to verify that they meet regulatory requirements for order
- Check container to verify that packing has proper labeling and meets shipping and safety regulations
- Handle orders according to regulations
- Notify worksite professional when defective contents are identified

Learning Objectives

- Explain how packing materials determine packing requirements
- Describe packing material
- Explain how customer shipping instructions determine packing requirements
- Describe methods of export packing
- Describe advantages and disadvantages of intermodal containers
- Demonstrate how to recognize, handle, and package hazardous materials
- List the regulations pertaining to loading/unloading of materials and supplies
- Describe different kinds of loading equipment and their applicable safety and regulatory use standards
- Identify safety features of loading/unloading equipment

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

11. Verify contents match order and description

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Prepare packing slip
- Compare packing slip to order to materials to be shipped
- Resolve any discrepancies

Learning Objectives

- List common types of information on a packing slip
- Discuss the function of verification at the loading/shipping stage

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

12. Isolate defective contents prior to packing

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Inspect packages prior to loading
- Remove any defective, leaking, damaged, or torn items
- Isolate the contents
- Obtain replacement items for shipment
- Inform worksite professional of defects

Learning Objectives

- Describe the purpose of isolating defective items from the warehouse
- List safety regulations to take if leaks are noted
- Discuss the costs involved if defective items were shipped

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

13. Load orders

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Load orders safely and according to regulations
- Use loading equipment safely and according to regulations
- Load transportation equipment according to loading plan
- Pack transportation vehicles to ensure no damage to shipment

Learning Objectives

- Demonstrate how to load and store hazardous materials
- List the regulations pertaining to loading of materials and supplies
- Explain how loading plans are created for different types of transportation equipment

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

14. Perform cycle counts

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Assist worksite professional to implement monitoring activities to prevent disruption and to ensure movement of inventory in an efficient and cost-effective way
- Monitor transaction of materials and orders
- Perform cycle counts
- Check that cycle counts for raw and finished goods meet established standards
- Monitor inventory accuracy

Learning Objectives

- Describe the methods and importance of monitoring inventory accuracy
- Compare inventory systems
- Identify the main types of inventory
- Identify the costs of maintaining inventory
- Define buffer management
- Describe how production efficiencies related to inventory are maintained
- Explain how proper storage levels are monitored and maintained
- Explain the purpose and function of recalls

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

15. Check stock for outdated or damaged supplies

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain computerized listing of outdated supplies if applicable
- Regularly check shelves for outdated or damaged supplies
- Isolate defective supplies from the main inventory
- Assist to investigate possible causes of inventory damage

Learning Objectives

- Discuss how warehouses manage expired supplies/materials
- Explain the importance of regular and periodic checks of supplies
- Discuss possible causes for damage to supplies while in the warehouse & storage facility

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

16. Rotate raw materials and stock to minimize old and outdated inventory

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Regularly check inventory for outdated or expired supplies according to the warehouse schedule
- Rotate items on shelves/storage spaces so that older items are used first

Learning Objectives

- Describe common methods for regular and periodic shelf/storage space checks
- Explain the costs associated with not rotating stock
- Describe common systems used by warehouses to manage stock rotation

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

17. Respond to recall procedures by removing and discarding inventory according to regulations

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Receive recall notice
- Verify items still in house and items that are shipped
- Notify worksite professional of recalled items already shipped
- Pull recalled items from main inventory
- Dispose of items as required
- Make inventory adjustments

Learning Objectives

- List items that are commonly recalled
- List the federal agencies that commonly initiate recalls
- Describe the purpose of a recall
- Discuss steps that are initiated for recalled items that have been shipped

Comments:

Unit 14: Logistics/Supply Chain Management (SCM) Pathway Storage & Warehousing

Competency

18. Assist to examine loss, damage & returns reports for trends

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Examine warehouse layout for efficiency
- Examine data pertaining to rotation of materials and orders
- Review store level solutions for risks and opportunities
- Verify inventory rotation data for inefficiencies
- Examine loss, damage & returns reports for trends

Learning Objectives

- Describe floor plans and layouts that make the most efficient use of safe location and position
- Explain how lay out and product codes are used to locate materials
- Describe how storage space available constrains lots sizes and reorder points
- Discuss space utilization monitoring and history as a means to adjust warehouse layouts
- Define and explain the major measures used by a logistics organization to manage and improve performance

Comments:

Appendix W

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

LOGISTICS/SUPPLY CHAIN MANAGEMENT (SCM) PATHWAY DISTRIBUTION & TRANSPORTATION OPERATIONS (UNIT 15)

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

1. Assist to plan distribution of products

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Estimate types of containers, quantity, weight, storage requirements, etc., of items to be distributed
- Plan loads based on types of transportation vehicles or carriers
- Review flow of products for consolidation of freight
- Determine mode of transportation

Learning Objectives

- Identify the three basic elements of a transportation system
- Identify the main methods of transporting products
- Analyze transportation trends
- Compare and contrast intermodal and auxiliary carriers (carriers all modes, 3rd party logistics providers (3PLs), forwarders, brokers, contract carriers)
- Describe the role of the government in transportation of goods
- Describe special compliance considerations for different types of goods and services
- Define distribution
- Relate distribution to marketing
- Analyze global distribution strategies for products
- Lists specific international transportation regulatory and compliance documents
- Explain how loads are estimated and compared with legal limits
- List basic categories of hazardous materials that are shipped
- Define special considerations for hazardous material transportation
- Compare the advantages and disadvantages of contracting transportation services
- Compare packing materials to determine the safest and most cost-effective method of shipping
- Compare and contrast advantages and disadvantage of owning and operating facilities versus out-sourcing
- Explain the impact of global trade on the logistics industry
- Explain some of the global market trends your facility faces and the company's position in that market place
- Explain effects of currencies on movement of goods and services in the logistics industry
- Name four major components of logistics
- Explain supply chain management
- Summarize differences between logistics and supply chain management
- Define basic logistics terminology
- Discuss/evaluate logistics industry trends

- Explain the functions of each department or unit within the larger organization
- Describe the role of sales and marketing operations in your facility

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

2. Compile transportation documentation

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Determine documentation and other requirements for transportation
- Compare prices, specifications, time limitations, and delivery dates
- Communicate to internal/external customers on distributor performance
- Maintain distributor contact

Learning Objectives

- List common types of transportation documents
- Define the purpose of common shipping documents such as shipping manifest, bill of lading, purchase order, packing slip, etc.
- Describe documents necessary when shipping outside of the United States
- Interpret payment documentation (letters of credit)
- Describe types of payment methods used in international transactions
- List the elements of a valid contract
- Compare contract elements with purchase order customer requests

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

3. Assist to schedule transportation of products and materials

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Review forecasts to estimate peak delivery periods and to coordinate deliveries
- Schedule transportation of products and materials to meet customer needs
- Select the most cost-effective method to ship products
- Verify that appropriate carrier or method is used to ship product
- Verify that health, safety, environmental, and government regulations are met for product shipment
- Coordinate line haul or load plan
- Arrange for storage facilities or other special product accommodations along route if needed

Learning Objectives

- Discuss how to schedule delivery functions with respect to production requirements and production levels
- Explain the process used to manage order, receipt, and delivery with a facility
- Identify basic transportation operations and costs related to freight classification, tariffs, carrier pricing schedules, rates, etc.
- List common elements of shipping costs
- Distinguish between freight forwarders, non-vessel operating common carriers (NVOCCs), and customs brokers

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

4. Ensure product is shipped on time

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Contact shipping & distribution to verify order shipment
- Update customer order status
- Monitor shipment through all phases until customer delivery

Learning Objectives

- Discuss the purpose of tracking order shipping
- Describe organizational methods used to track orders and final customer shipment
- Explain how order receipt, production, & shipment is commonly communicated
- Define factors that impact the scheduling of pick-ups and deliveries

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway
Distribution & Transportation Operations

Competency

5. Prepare invoice for products and shipment

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Prepare a billing invoice for products shipped to customers
- File copies of invoice as applicable
- Send invoice to customer with order or separately
- Record invoice distribution

Learning Objectives

- Describe the function of the invoice
- List common elements required on an invoice
- Explain common methods used to send invoices
- Describe how invoices are linked to requisitions, purchase orders, shipments, and payment
- Explain the purpose and uses of transportation tariffs
- List different tariff classifications
- Interpret tariffs
- Estimate duties, tariffs and levies
- Outline types of problems relating to invoicing and how they are solved

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

6. Operate tools and equipment safely

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Operates only equipment that he/she is trained on
- Chooses correct tool or equipment for the task
- Verifies tool/equipment is available for use and in working order
- Verifies tool/equipment is current for preventative maintenance and/or calibration
- Verifies safety equipment and any Personal Protective Equipment (PPE) needed for tool/equipment use
- Operates tool/equipment safely with guarding devices if applicable in the manner required for the job task
- Monitors tool/equipment for safe operation while operating
- Follows facility procedures for clean up and shut down after use
- Performs any required preventative maintenance procedures
- Investigates and promptly reports abnormal tool/equipment conditions
- Properly shuts down and labels any tool/equipment that is not operating as expected, if applicable
- Follows Lock Out/Tag Out procedures as applicable
- Documents use and maintenance as required

Learning Objectives

- List the various tools and equipment used at your worksite
- Outline applications of each tool and equipment
- Describe and demonstrate the safety requirements for each tool and equipment
- Discuss start up and shut down procedures for each tool/equipment you will operate
- Explain the purpose of preventative maintenance
- Describe emergency shutdown procedures for the tool/equipment you will operate
- Explain how to recognize and address malfunctions for the tool/equipment you will operate
- Describe how to recognize wear and tear on equipment components
- List the OSHA and other regulatory requirements as they apply to the equipment that you operate
- Describe proper techniques for lifting loads
- List the safeguards that apply to the equipment used in your facility for tools, automated machines, material handling equipment, and lifts
- List which tools and equipment require safety certification
- Explain Lock Out/Tag Out indications and procedures in your facility

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

7. Inspect outgoing product packaging and labeling

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Inspect outgoing products for compliant packaging and labeling
- Ensure proper storage conditions of products during staging, loading and shipping
- Check container and packing materials to verify that they meet regulatory requirements for order
- Check container to verify that packaging has proper labeling and meets shipping and safety regulations
- Handle orders according to regulations
- Notify worksite professional when defective contents are identified

Learning Objectives

- Describe methods of export packaging
- Describe advantages and disadvantages of intermodal containers
- Demonstrate how to recognize, handle, and package hazardous materials
- Describe the labeling for specific material hazards
- Discuss compliance requirements for domestic, international and hazardous material shipping
- State what must be listed on the documentation that accompanies a hazardous materials shipment

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

8. Verify packing list against actual shipment

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Verify packing slip & shipping documents against actual shipment
- Segregate and document overages, shortages, damaged or non-conforming
- Resolve any discrepancies

Learning Objectives

- List common types of information on a packing slip
- Discuss the function of verification at the loading/shipping stage

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

9. Load vehicles OR stage for courier transportation

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Load orders safely and according to regulations
- Use loading equipment safely and according to regulations
- Load transportation equipment according to loading plan
- Pack transportation vehicles to ensure no damage to shipment

Learning Objectives

- Demonstrate how to load and store hazardous materials
- List the regulations pertaining to loading of materials and supplies
- Explain how loading plans are created for different types of transportation equipment
- Describe different kinds of loading equipment and their applicable safety and regulatory use standards
- Identify safety features of loading/unloading equipment

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

10. Complete required shipping documents

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Complete required shipping documents such as packing slips, trailer manifests, hazardous materials information, bills of lading, etc.
- Organize documents for transportation workers
- Examine invoices and shipping manifests for conformity to tariff and custom regulations

Learning Objectives

- List common shipping documents and their purpose
- Outline the shipping documentation process
- Explain the use and function of cargo and shipping documents such as packing slips, trailer manifests, hazardous materials information, bills of lading, etc.
- Explain how shipping forms document compliance activities
- Describe special customs forms for international shipping
- List common international freight terms (INCO terms) and their meanings
- Research foreign and domestic government regulations for packaging and labeling
- Determine ports of entry/exit using guides
- Define international freight terms (INCO)

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

11. Assist to plan and route shipments

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Plan and route shipments
- Monitor internal fleet movement and location
- Follow forecasted plan to maximize efficiency of deliveries and pick ups
- Maintain master schedule for traffic functions based on movement of transportation

Learning Objectives

- Define the traffic management function
- Describe the following: rate activities, carrier selection, carrier routing, tracing and expediting, consolidating shipments, diversion and reconsignment, transit insurance, private carriage
- Discuss the factors to consider when planning transportation routes
- Read maps
- Describe how routing information is managed to ensure that delivery times and locations are coordinated
- Explain the role and impact of international security on product integrity and shipment movement
- Discuss issues pertaining to the Foreign Corrupt Practices Act
- Explain time zones and in the US and globally
- Convert between standard and military time

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

12. Assist to coordinate and schedule drivers, pickups, deliveries

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Schedule pickups and deliveries according to forecasted plan
- Schedule transportation couriers or drivers

Learning Objectives

- Examine the characteristics of distributing with rail, truck, air, ship
- List cost considerations for motor carrier equipment including Department of Transportation (DOT) regulations, driver training and hours of service, fuel tax, licensing, etc.
- Discuss the legal scheduling of drivers and other transportation drivers regarding hours to work
- Explain factors that must be taken into consideration when planning & coordinating specific deliveries

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

13. Determine shipment status

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Track and trace shipments through supply chain
- Expedite shipments when necessary
- Determine shipment status
- Coordinate special handling requirements

Learning Objectives

- Identify key locations for domestic and international distribution networks for your facility's product distribution system
- List circumstances requiring follow-up and/or expediting
- Describe the importance of follow up or expediting inbound supplies
- Identify common causes of loss
- Define and explain the major measures used by a logistics organization to manage and improve performance

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

14. Maintain shipping and customs records/documentation

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Manage transportation and documentation functions to ensure compliance with all regulatory import, export, hazardous materials and air regulations
- Enter records into databases
- Retrieve records
- Produce reports
- File records

Learning Objectives

- List common reports and records maintained by shipping companies
- Explain the technical systems utilized in shipping and distribution companies
- Explain the customs processes for shipping out of the United States

Comments:

Unit 15: Logistics/Supply Chain Management (SCM) Pathway Distribution & Transportation Operations

Competency

15. Follow up with customer regarding shipment receipt

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Contact customer to verify order receipt
- Follow up with customer to verify that no customer complaints are received about late, partial, or damaged shipments
- Respond to customer comments and questions
- Update information accurately as applicable
- Solicit supervisor or co-worker support and advice when necessary to meet customer needs
- Handle complaints tactfully without insult or conflict

Learning Objectives

- Identify the internal and external customers in your facility
- Compare needs of internal and external customers
- Define customer service
- Describe how customer service affects a company's "bottom line"
- List strategies for maximizing customer satisfaction
- Describe the functions of other departments or units to serve the customer
- Describe facility issues that may impact customer needs being met
- Describe how plans are made to improve organizational performance including customer satisfaction and service/operations performance

Comments:

Appendix X

TRANSPORTATION, DISTRIBUTION AND LOGISTICS
YOUTH APPRENTICESHIP

MOBILE EQUIPMENT MAINTENANCE PATHWAY
DIESEL TECHNICIAN
UNIT 16

Diesel Technician Unit

PM = Preventive Maintenance

Competency (Work Tasks)	Performance Standards What employer checks for while doing task. **Train YA Student on.** YA student will ...	Learning Objectives What to know/learn to do this task. **Content Suggested** for Class/Reading/On-the-Job Training.
GENERAL SKILLS		
1. Obtain & apply basic diesel servicing knowledge	Demonstrate diesel vehicle/engine systems knowledge based on current understanding Comply with personal safety practices concerning clothing, hand and power tool usage, proper ventilation of fumes and lifting and securing of vehicles Comply with environmental safety standards concerning handling, storage and disposal of hazardous materials and chemicals in accordance with local, state and federal regulations Identify approved service procedure prior to completing any work on a vehicle Perform all procedures according to manufacturer and regulatory requirements	VEHICLE/DIESEL ENGINE SYSTEMS Describe the purpose of the fundamental diesel vehicle systems and components including brake systems, electrical/electronic systems, suspension and steering systems, transmission systems, engine performance systems and heating/air conditioning systems Explain the interaction of vehicle systems List and describe basic components of vehicle systems Identify commonly used vehicle fasteners Explain common broken fastener removal techniques Describe basic diesel engine classifications Compare gasoline and diesel engines Discuss alternative engine types Compare two- and four-stroke cycle engines MOTORS Explain the principles of an electric motor Explain the operation of solenoids MOTION Explain how friction, force, inertia, momentum, speed, power, work and torque apply to brake systems Explain the effects of weight and speed on braking and stopping distance FLUIDS and PRESSURE Define characteristics of liquids Identify the fundamental laws of hydraulics Define Pascal's Law Explain thermal expansion of fluids, gases, and solids Explain energy conversion of motion changed to heat energy Compare lubricants used in various medium/heavy truck systems

		ELECTRICITY Explain the principles of electricity Describe the action of basic electric circuits Compare voltage, current, and resistance Describe the principles of magnetism and magnetic fields Identify basic electric and electronic terms and components Describe fundamental electrical tests Identify factors that will determine how much current will flow in a circuit Discuss electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law) Identify sources of AC(alternating current)/DC (direct current) voltages and their applications Identify series and parallel circuits as they apply to typical lighting circuits Describe characteristics of a series circuit Describe characteristics of a parallel circuit Describe characteristics of a series/parallel circuit Define voltage, voltage drop, current flow and resistance and their common units of measurement Explain the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.)
2. Operate tools & equipment safely	Operate only equipment that he/she is trained on Choose correct tool or equipment for the task Verify tool/equipment is available for use and in working order Verify tool/equipment is current for preventative maintenance and/or calibration Verify safety equipment and any Personal Protective Equipment (PPE) needed for tool/equipment use Operate tool/equipment safely with guarding devices if applicable in the manner required for the job task Monitor tool/equipment for safe operation while operating Follow procedures for cleanup and shut down after use Perform any required preventative maintenance	Identify tools and their usage in diesel vehicle repair applications Describe how to properly and safely position a truck for different types of service Describe and demonstrate the safety requirements for each tool and equipment Discuss start up and shut down procedures for each tool/equipment you will operate Explain the purpose of preventative maintenance Describe emergency shutdown procedures for the tool/equipment you will operate Explain how to recognize and address malfunctions for the tool/equipment you will operate Describe how to recognize wear and tear on

	procedures Investigate and promptly report abnormal tool/equipment conditions Properly shut down and label any tool/equipment that is not operating as expected, if applicable Follow Lock Out/Tag Out procedures as applicable Document use and maintenance as required Demonstrate safe handling and use of appropriate tools Demonstrate proper cleaning, storage, and maintenance of tools and equipment Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dial-caliper) Utilize safe procedures for handling of tools and equipment Identify and use proper placement of floor jacks and jack stands Identify and use proper procedures for safe lift operation	equipment components List the Occupational Safety and Health Administration (OSHA) and other regulatory requirements as they apply to the equipment that you operate Describe proper techniques for lifting loads List the safeguards that apply to the equipment used in your facility for tools, automated machines, material handling equipment, and lifts Explain Lock Out/Tag Out indications and procedures in your facility Describe the function and use of a thermometer, pyrometer, manometer Describe the function and use of an oscilloscope or DMM (digital multimeter) to diagnose engine concerns
3. Maintain work area	Identify general shop safety rules and procedures Identify marked safety areas Utilize proper ventilation procedures for working within the lab/shop area 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 Identify the location and use of eye wash stations Identify the location of the posted evacuation routes Maintain shop manuals and/or electronic retrieval systems Organize tools Sweep work area Put shop equipment away Clean work area and work bench Dispose of parts properly	Describe the typical layout and sections of a diesel engine or trucking maintenance shop Explain the importance of proper housekeeping in the shop List the types of accidents that can occur in a shop Explain how to prevent shop accidents Describe general safety rules for the shop
4. Assist to process work order	Verify customer complaint ***Research information*** Review service history Document customer concern and complaint	Identify a repair business' internal and external customers Define customer service Describe how customer service affects a company's

	information on repair order Complete work order to include customer information, truck identifying information, customer concern, related service history, cause, and correction Handle complaints tactfully without insult or conflict	"bottom line" List strategies to maximize customer satisfaction List the steps to follow when handling complaints
5. Research information	Locate and find resources for service information and history, service precautions, and technical service bulletins Retrieve shop manuals and/or electronic retrieval systems Locate and identify information necessary to the task	Explain the basic truck classifications Classify a truck by the number of axles it has Define Gross Vehicle Weight (GVW) Define the purpose and use of the vehicle identification number (VIN), engine numbers, and date codes Identify references that are used to estimate vehicle repair charges Describe the different types of service manuals Explain how to use computer-based service information Discuss basic structure and information found in shop manuals, online manuals, and technical service bulletins Define the role of the Federal Motor Carrier Safety Administration (FMSCA) in commercial carrier safety Explain the requirements for annual inspections of commercial motor vehicles
6. Acquire parts	Collect necessary information to determine part required Locate and interpret vehicle and component identification numbers such as make, model, year, vehicle identification number (VIN), vehicle certification labels, calibration decals Check part price Check part availability Obtain part Verify correct part upon receipt ***NOTE: Driving to get parts CANNOT be part of student's <u>regular job tasks</u> per Child Labor Laws***	Explain how to use service manuals to locate component part information Identify sources available for replacement parts List requirements of replacement parts Explain the information needed to in order to obtain the correct replacement part Describe how parts are purchased and charged to the customer Compare and contrast new, used, rebuilt and remanufactured automotive parts Describe situations in which one type of part is desirable over new parts Define original equipment manufacturer (OEM) and how this affects automotive servicing
7. Assist to diagnose common concerns & determine action	Consult with worksite professional to determine appropriate inspections and test(s) to perform based on customer concern ***Research information***	Explain the 3 Cs (concern, cause, correction) of mobile equipment service Describe the basic types of troubleshooting charts found in service manuals

	Assist worksite professional to complete diagnostic tests necessary to identify cause of customer concern	Explain how to use the following testing instruments: Voltmeter, Test Light, Ammeter, and Ohmmeter List the most common engine performance problems Describe the symptoms for common engine performance problems Explain typical causes of engine performance problems Discuss common problems relating to abnormal engine noise or vibration concerns, unusual exhaust color, odor, and sound, and fuel, and ignition concerns Explain common poor stopping, pulling or dragging concerns caused by problems in the hydraulic system Explain common causes of wheel bearing noises, wheel shimmy, and vibration Discuss wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system Identify common causes of electrical circuit or component failures Discuss common problems relating to a suspension system Describe special issues related to electronically-controlled suspension systems Discuss common problems due to short and long arm suspension systems, body sway, and uneven ride height Explain common causes for steering column noises, looseness, and binding concerns Explain common problems that cause wheel/tire vibration, shimmy, and noise Describe common causes of vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns
8. Assist to retrieve, record, interpret diagnostic codes	Obtain equipment and materials needed Review safety and service procedures Activate on-board diagnostics and read trouble codes with and without a scan tool Verify malfunction indicator light trouble codes using the scan tool Obtain the appropriate scan tool and program cartridge	Discuss the purpose and operation of on-board diagnostic systems Explain the use of scan tools to simplify reading of trouble codes Compare on-board diagnostics (OBD) I and II systems Describe the different types of gauges and sending units

	for the vehicle, system and/or date Locate the data link connector (DLC) in the vehicle Attach the scan tool cable into the DLC; use an adaptor if needed Connect the scan tool to battery power if needed Follow the prompts to access the trouble codes Consult the trouble code chart or scan tool code conversion Consult worksite professional to determine further tests, inspections or repairs Erase diagnostic trouble codes when applicable	Explain how different types of gauges and sending units operate Locate the data link connector on most makes and models of trucks Describe how to use a trouble code chart in a service manual or code conversion by a scan tool Describe the importance of running all OBDII monitors for repair verification
DIESEL ENGINE SYSTEM		
9. Perform engine lubrication PM	Obtain equipment and materials needed Review safety and service procedures Check engine oil level Fill oil to appropriate level if needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and their functions in a diesel engine List common engine maintenance functions and services List common problems associated with faulty engine components Discuss safety precautions required before servicing diesel engines List the basic parts of a lubrication system Summarize the operation of a lubrication system Explain the importance of lubrication fluids
10. Perform oil & filter change	Obtain equipment and materials needed Review safety and service procedures Place oil container under drain spot Remove drain plug Drain engine oil Take oil sample if needed for condition testing Clean plug Torque drain plug to specification Replace oil filter Refill to recommended amount Run engine and check for leaks After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain why it is best to run the vehicle prior to changing oil Identify different types of engine oils and their purposes Explain how to determine correct oil capacity Discuss the disposal procedures for engine oil Explain the characteristics and ratings of engine oil
11. Perform fuel system checks	Obtain equipment and materials needed Review safety and service procedures	Summarize how crude oil is converted into gasoline, diesel fuel, liquefied petroleum gas, and other products

	Check fuel tanks, mounts, lines, caps, and fittings for damage and deterioration- Refer to worksite professional for repair/replacement Check fuel level Draw off fuel sample if needed for condition testing After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe properties of gasoline and diesel fuel Explain octane and octane ratings Describe normal and abnormal combustion of gasoline and diesel fuel Identify common components and functions of fuel systems List common preventive maintenance functions and services for fuel systems List common problems associated with faulty fuel systems Discuss alternative fuels
12. Perform air induction & exhaust PM	Obtain equipment and materials needed Review safety and service procedures Check air induction piping, hoses, clamps and mountings for looseness, leaks, and damage- Refer to worksite professional for repair/replacement Assist to remove air filter Check for dust Assist to replace air filter or install new air filter as needed Check exhaust manifold, piping, mufflers, and mounts Check and replace the diesel particulate filter (DPF) Assist to repair and replace manifold if needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of air induction and exhaust systems List common preventive maintenance functions and services for air induction and exhaust systems List common problems associated with faulty air induction and exhaust systems Discuss safety precautions required before servicing air induction and exhaust systems Describe the construction and action of air filters Summarize the operation and interaction of heating, ventilation, and air conditioning systems Describe basic problem colors of diesel exhaust smoke Explain the relationship between engine performance and exhaust emission Compare emission systems Describe the basic parts of an exhaust system Explain the construction and design of intake and exhaust manifolds Discuss the purpose of diesel exhaust fluid (DEF) and exhaust gas recirculation (EGR) Explain the most common reasons for exhaust system failures Describe the appearance of exhaust leaks on components Explain the fundamental parts of a turbocharging system Summarize the construction and operation of a supercharging system

13. Perform cooling system PM	Obtain equipment and materials needed Review safety and service procedures Inspect radiator and mountings o Check air flow through radiator core, o For leaks, o Mountings Inspect fan assembly and shroud Inspect coolant hoses and clamps Check engine coolant type and level o Fill to appropriate level if needed o Check coolant for contamination, additive concentration, freeze point Replace coolant filter Assist to test coolant temperature Check operation of temperature and level sensors, gauges, sending unit Inspect water pump for leaks Check belts, tensioners, and pulleys o Assist to replace if needed Check belt tension and alignment o Assist to adjust if needed Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of a cooling system List common preventive maintenance functions and services for a cooling system List common problems associated with faulty cooling system Discuss safety precautions required before servicing a cooling system Describe the most common causes of system leakage, overheating, and overcooling Explain the importance of antifreeze Discuss the hazards and dangers of ethylene glycol in antifreeze coolant Explain the required disposal methods for all stages of drain material Discuss the importance of cooling the engine first Explain what debris in drained coolant means Describe the purpose of a vehicle's engine drive belts Discuss the composition of drive belts and common wear tear Locate common accessory drive belts and what they run Describe the issues with stretched belts Explain why belts should not be over-tightened Describe the purpose and common components associated with the water pump Describe common problems associated with the water pump Discuss common safety precautions for servicing water pumps
14. Pressure test cooling system	Obtain equipment and materials needed Review safety and service procedures Pressure test radiator cap Pressure test radiator system Checks for leaks Compare results to recommendations Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper	Explain the purpose and common components associated with the radiator Describe common problems associated with the radiator Discuss common safety precautions for servicing a radiator

	location, complete appropriate documentation	
15. Assist to bleed cooling system	Obtain equipment and materials needed Review safety and service procedures Obtain adequate size container Drain coolant Assist to flush cooling system Refill cooling system with recommended coolant Run the engine Shut down and check coolant level Assist to bleed the cooling system After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	List reasons for bleeding a cooling system Discuss common safety precautions for bleeding a cooling system Describe the appearance and possible causes of oil in coolant: engine oil leaks, external coolant leaks, engine blowby, engine vacuum leaks, engine exhaust leaks, and engine smoking
16. Assist to perform engine brake PM	Obtain equipment and materials needed Review safety and service procedures Inspect engine compression/exhaust brakes Assist to adjust engine compression/exhaust brakes After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of engine brakes List common preventive maintenance functions and services for engine brakes List common problems associated with faulty engine brakes Discuss safety precautions required before servicing engine brakes
CAB & HOOD SYSTEM		
17. Perform instrument checks	Obtain equipment and materials needed Review safety and service procedures Check warning indicators Check instruments Check operation of accessories Check operation of power take off and engine idle speed controls Check phone systems and GPS units Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain both analog and digital instrumentation Explain the operating principles of automotive light, wiper, and horn systems Discuss the diagnostic questions to determine problems in light, wiper, and horn systems Summarize automatic light and wiper systems Compare and contrast warning lights, sending units, switches, and basic display systems Discuss the purpose and operation of the vehicle on board radar (VORAD) and electronic data recording (EDR) systems Discuss the use of accessory systems such as phones and global positioning system (GPS) units
18. Perform safety equipment checks	Obtain equipment and materials needed Review safety and service procedures Check operation of horns Check safety equipment- triangles, fire extinguishers, decals	Identify common components and functions of safety equipment List common problems associated with faulty safety equipment Discuss safety precautions required before servicing

	Inspect seat belts and sleeper restraints Inspect wiper blades and arms Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	safety equipment Compare types and sizes of typical wiper blades Discuss checks required for fire extinguishers
19. Perform hardware checks	Obtain equipment and materials needed Review safety and service procedures Check wiper and washer operation Inspect windshield glass for cracks or discoloration Check sun visor Check seat condition, operation and mounting Check door glass and window operation Inspect steps and grab handles Inspect mirrors, mountings, brackets, glass Inspect door and hood hinges, latches, strikers, lock cylinders, safety latches, linkages and cables Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss safety precautions required before servicing truck hardware including cracked glass Describe the components of a typical wiper/washer system Trace the flow of solution Discuss components of washer solutions Compare the types of pumps used in washer systems
20. Check HVAC operation	Obtain equipment and materials needed Review safety and service procedures Check heating, ventilation, and air conditioning (HVAC) controls Check that all vent outlet louvres are free to move Check air flow at each fan speed control Check air conditioning (A/C) temperature at lowest setting and fan speed Check A/C temperature at highest setting and fan speed Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of a heating, ventilation, and air conditioning (HVAC) system List common preventive maintenance functions and services for an HVAC system List common problems associated with faulty HVAC systems Discuss safety precautions required before servicing HVAC systems Describe the common location for air cabin filters List common reasons for clogged air filters Describe the importance of a clean air filter Identify the source of heating and air conditioning (A/C) system odors Explain the purpose and function of an auxiliary power unit (APU)
21. Lubricate grease fittings	Obtain equipment and materials needed Review safety and service procedures Lubricate all cab and hood grease fittings	Demonstrate proper use of lubrication equipment Compare types of vehicle grease and when each type is used

	Lubricate door and hood hinges, latches, strikers, lock cylinders, safety latches, linkages, and cables as needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
DRIVE TRAIN SYSTEM		
22. Perform transmission PM	Obtain equipment and materials needed Review safety and service procedures Check transmission oil level and condition o Fill with correct fluid to recommended level o Collect a sample if needed for testing Inspect transmission case, seals, vents, hoses for cracks and leaks o Replace transmission cover plates, gaskets, seals, and cap bolts if needed Inspect transmission breather and mounts Lubricate all drive train grease fittings Refer to worksite professional for other types of repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of transmission systems List common preventive maintenance functions and services for transmission systems List common problems associated with faulty transmission systems Discuss safety precautions required before servicing transmission systems Compare basic components and operation of automatic transmissions to manual transmissions Trace the flow of power through an automatic transmission Explain how an automatic transmission shifts gears Explain the relationship between speed and torque to different gear arrangements Describe the shift mechanisms used in medium/heavy truck transmissions Explain the role of torque convertors Demonstrate proper use of lubrication equipment Compare types of vehicle grease and when each type is used
23. Change transmission oil & filter	Obtain equipment and materials needed Review safety and service procedures Position adequate size drain pan Remove plug and gasket Collect sample for testing if needed Drain oil Clean magnetic plugs Remove and discard old filter Lubricate new seal ring Install new filter and seal Install plug, gasket and pan Fill transmission fluid to recommended level	Describe the function of transmission fluid Discuss common characteristics of transmission fluid Compare types of transmission fluid Explain how to clean and lubricate a seal

	Recheck oil level After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
24. Perform clutch PM	Obtain equipment and materials needed Review safety and service procedures Assist to check operation of clutch, clutch brake, gearshift Check clutch linkage/cable for looseness or binding Inspect (throw out) bearing and crop shafts Adjust, lubricate, release bearing and crop shafts Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of clutches List common preventive maintenance functions and services for clutches List common problems associated with faulty clutches Discuss safety precautions required before servicing clutches Explain the difference between pull- and push-type clutches Describe the function of the clutch brake
25. Perform drive axle PM	Obtain equipment and materials needed Review safety and service procedures Check drive axle fluid level o Fill with correct fluid to recommended level o Collect a sample if needed for testing Inspect axle housing for cracks and leaks Lubricate all drive train grease fittings Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of drive axles List common preventive maintenance functions and services for drive axles List common problems associated with faulty drive axles Discuss safety precautions required before servicing drive axles Identify the components of a truck driveline Identify types of axles used on trucks and trailers Describe the operation of various drive axle configurations Demonstrate proper use of lubrication equipment Compare types of vehicle grease and when each type is used Demonstrate proper use of lubrication equipment Compare types of vehicle grease and when each type is used
26. Change drive axle oil & filter	Obtain equipment and materials needed Review safety and service procedures Position adequate size drain pan Remove plug Collect sample for testing if needed Drain oil Clean magnetic plugs	Describe the function of drive axle oil Discuss common characteristics of drive axle oil Discuss the function of the magnetic plugs

	Remove and discard old filter Clean axle filler plugs Install new filter Install plug Fill drive axle oil to recommended level After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
27. Inspect driveshaft	Obtain equipment and materials needed Review safety and service procedures Inspect driveshaft, slip joints, universal joints, boots and seals, and retaining hardware Inspect driveshaft center support bearings and mounts Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of the driveshaft List common preventive maintenance functions and services for the driveshaft List common problems associated with a faulty driveshaft Discuss safety precautions required before servicing driveshaft Discuss joint inspection and indications for replacement Explain how to measure driveline angles
ELECTRICAL/ELECTRONICS SYSTEM		
28. Use wiring diagrams	Obtain equipment and materials needed Review safety and service procedures Locate the parts to be tested for electrical problems Follow the lines to show how wiring is attached into each component of the circuit Look for faulty relays and wires in the faulty part After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain the purpose and use of wiring diagrams Describe common components and symbols used on wiring diagrams Identify types of circuit protection devices used in an electrical circuit Outline the purpose and properties of conductors, insulators, and semiconductors Compare circuit breakers to fuses Define the functions of a fuse, fuse box, fusible link, circuit breaker Explain the common functions and locations of fuses and breakers in a vehicle Define the role of gates in electronic circuits Describe types of circuit faults Discuss common safety precautions for servicing fuses and breakers
29. Properly use a digital mulimeter (DMM)	Obtain equipment and materials needed Review safety and service procedures Set the digital mulitmeter (DMM) to the correct voltage scale	Discuss causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits Explain the use of wiring diagrams during the

	Connect the red lead to the appropriate point in the circuit to be measured Connect the black lead to the appropriate position on the circuit depending on the function to be measured Measure voltage, voltage drop, current flow and resistance After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	diagnosis (troubleshooting) of electrical/electronic circuit problems Explain the function of the digital multimeter (DMM) Describe how the DMM works to measure voltage, voltage drop, current flow and resistance Describe the purpose of the ground lead in using the DMM Identify the function codes on a typical DMM Identify common components and functions of instrument control systems List common preventive maintenance functions and services for instrument control systems List common problems associated with faulty instrument control systems Discuss safety precautions required before servicing instrument control systems
30. Perform battery PM	Obtain equipment and materials needed Review safety and service procedures Inspect battery box(es), cover(s), and mountings Inspect battery hold-downs, connections, cables, and cable routing Clean battery box(es), mounts, hold downs, cables and connectors with appropriate solution Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the basic parts of a battery Identify safety precautions when performing battery service Explain how temperature and other factors affect battery performance Describe the components of mixtures used for cleaning Discuss when to use pliers to remove battery cables Discuss precautions to take around battery fill openings Explain why over-tightening terminals is a problem Discuss how size of battery relates to motor performance and battery service life Compare battery power ratings Identify electronic modules, security systems, radios, and other accessories that require re-initialization or code entry after reconnecting vehicle battery.
31. Perform battery load test	Obtain equipment and materials needed Review safety and service procedures Confirm battery capacity for vehicle Select appropriate battery load tester Test load as required Record readings Refer to worksite professional for repair/replacement	List common problems associated with a faulty battery Describe the purpose of the battery load test Identify safety precautions when performing battery load testing Compare inductive and non-inductive capacity testers Explain how to calculate battery load values Identify and explain the operation of the auxiliary

	After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	power unit (APU)
32. Determine battery state of charge test	Obtain equipment and materials needed Review safety and service procedures Select appropriate battery tester Make sure engine is off and battery stabilized Check voltage at rest Verify battery cables are not chafing on chassis or potential grounding point Record readings Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify safety precautions when performing battery state of charge tests Explain the operating principles of a lead-acid battery Compare conventional and maintenance-free batteries Explain how to remove surface charge from a battery Define specific gravity and how it indicates battery charge Describe how to do the hydrometer test Describe how to do the capacity test Describe how to do the open circuit voltage test Explain how to use the voltage chart to determine charge List levels which require a new battery vs. re-charging
33. Jump start a vehicle	Obtain equipment and materials needed Review safety and service procedures Verify vehicle manufacturer allows jump starting Connect jumper cables as required Start engine Remove cables in reverse order as they were installed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	List the components and operation of jumper cables Discuss common safety precautions when using jumper cables Describe problems that can occur if jumper cables are not connected properly
34. Engage starter	Obtain equipment and materials needed Review safety and service procedures Inspect starter is fully secure to engine block and mounting bolts tight Check connections and connector With vehicle out of gear, start the engine to assess concerns Refer to worksite professional for issues or repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain the function of a starter List the components and operation of a starter List common problems associated with a faulty starter Discuss common safety precautions for servicing a starter system Explain the purpose of the current draw test on a starter Define the order for starting system tests Explain typical procedures for a starting motor rebuild Describe the function of major ignition system components Explain vacuum, centrifugal, and electronic ignition timing advance
35. Perform charging	Obtain equipment and materials needed	Identify common components and functions of

system PM	Review safety and service procedures Inspect instrument panel mounted volt meters and/or indicator lamps Inspect cables, wires, connections in the charging circuit Repair/replace cables, wires, connectors if needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	charging systems List common preventive maintenance functions and services for charging systems List common problems associated with faulty charging systems Discuss safety precautions required before servicing charging systems Identify charging circuit components Trace a charging circuit schematic
36. Assist to remove & replace alternator	Obtain equipment and materials needed Review safety and service procedures Access alternator Remove alternator as required by manufacturer Replace with correct size alternator Install as required by manufacturer After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain the function of the alternator List the components and operation of an alternator List common problems associated with a faulty alternator Discuss common safety precautions for servicing an alternator Describe the importance of proper belt tightening
37. Perform lighting system PM	Obtain equipment and materials needed Review safety and service procedures Check operation of interior lights Check operation of exterior lights Check exterior light lenses, reflectors, conspicuity tape, headlight alignment Assist to inspect and test tractor to trailer multi-wire connectors, cables, holders Assist to replace bulbs and headlights if needed Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of lighting systems List common preventive maintenance functions and services for lighting systems List common problems associated with faulty lighting systems Discuss safety precautions required before servicing lighting systems Describe how a truck light bulb functions Explain the operation of the power and switch for lights Explain the principles of halogen and high density discharge (HID) lamps Describe how to check and change light bulbs/lamps Explain how to aim headlights Identify safety precautions when handling halogen bulbs Describe how to load a vehicle prior to aiming headlights Explain how a trailer electrical plug and connector are connected

BRAKES & HYDRAULICS SYSTEM		
38. Perform air brake PM	Obtain equipment and materials needed Review safety and service procedures Check low air pressure warning devices o With engine off, apply and release brake pedal until air pressure drops and low pressure warning device is activated Check air governor cut-in pressure; check air system safety valves o Drain air pressure from reservoir; start and run engine; record cut-out pressure Inspect air compressor inlet Check brake chambers and air lines for secure mounting and damage Check and adjust air brakes with slack adjusters Inspect coupling air lines, holders, gladhands Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of air brakes including s-cams, shoes, anchor pins, slack adjustors, chambers, bushings List common preventive maintenance functions and services for air brakes List common problems associated with faulty air brakes Discuss safety precautions required before servicing air brakes Explain the operation of an air compressor and air brake chamber Explain the importance of checking and adjusting air brakes Compare manual and automatic air brake adjustment Define pushrod travel
39. Perform hydraulic brake PM	Obtain equipment and materials needed Review safety and service procedures Check master cylinder fluid level o Collect sample if needed for testing Inspect brake lines, fittings, flexible hoses, valves for leaks and damage Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of hydraulic brakes List common preventive maintenance functions and services for hydraulic brakes List common problems associated with faulty hydraulic brakes Discuss safety precautions required before servicing hydraulic brakes Describe the function of pumps, valves, actuators, and motors Identify the parts and operation of the brake pedal assembly Describe the construction of brake lines Explain how to verify brake fluid leakage versus another type of fluid Describe the proper procedures for tightening fittings List common problems associated with faulty brake lines Discuss common safety precautions for servicing

		brake lines Describe the function and component of brake fluid Discuss common characteristics of brake fluid-viscosity, corrosion, compressibility Compare types of brake fluids Identify the parts of a basic master cylinder and their function Describe possible causes and conditions of brake fluid in the master cylinder Describe basic procedures for servicing a master cylinder and a brake booster Discuss common safety precautions for servicing a master cylinder
40. Check ABS & ATC warning lights	Obtain equipment and materials needed Review safety and service procedures Observe anti-lock brake system (ABS) warning light operation Observe automatic traction control (ATC) warning light operation Turn on vehicle ignition and follow confirmation checks for ABS and ATC Refer to worksite professional for further testing After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of an ABS (anti-lock brake system) and ATC (automatic traction control) system List common preventive maintenance functions and services for an ABS and ATC system List common problems associated with faulty ABS and ATC systems Discuss safety precautions required before servicing ABS and ATC systems Explain how ABS and ATC works to prevent wheel lock up Explain what is meant by the number of channels of an ABS system Describe how trailer ABS is managed
41. Read & interpret hydraulic system diagrams	Reference the manual for the correct schematic of component Study the diagram Interpret the circuit and symbols Outline the circuit, power flow and action of each actuator	Explain the mechanics of hydraulic machinery including seals, filters, fittings, hoses, pumps, actuators, reservoirs, and fluids Discuss the purpose of hydraulic system diagrams Describe common components and symbols used on hydraulic system diagrams Discuss the
42. Service filtration/reservoirs (tanks)	Obtain equipment and materials needed Review safety and service procedures Service filters and breathers according to manufacturer Check reservoir fluid level o Clean dirt and dust first o Take sample for contamination inspection	Identify common components and functions of hydraulic reservoirs List common preventive maintenance functions and services for hydraulic reservoirs List common problems associated with faulty hydraulic reservoirs

	Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss safety precautions required before servicing hydraulic reservoirs Identify types of hydraulic filtration systems Discuss causes of system contamination
43. Check hoses, fittings, connections	Obtain equipment and materials needed Review safety and service procedures Inspect hoses for cracks and deterioration Inspect hoses for correct length and size Inspect hoses for correct routing, bends, and radii Inspect hoses for protection Assist to assemble and replace hoses and connections After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of hydraulic hoses, fittings and connections List common preventive maintenance functions and services for hydraulic hoses, fittings and connections List common problems associated with faulty hydraulic hoses, fittings and connections Discuss safety precautions required before servicing hydraulic hoses, fittings and connections Identify common sizes for hydraulic hoses and fittings
SUSPENSION & STEERING SYSTEM		
44. Perform suspension & steering PM	Obtain equipment and materials needed Review safety and service procedures Inspect springs, pins, bushings, bolts and insulators Check power steering pump, mounting and hoses for leaks, condition Check power steering fluid level Check oil level in all non-drive hubs; check for leaks Lubricate all suspension and steering grease fittings Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify common components and functions of suspension and steering systems List common preventive maintenance functions and services for suspension and steering systems List common problems associated with faulty suspension and steering systems Discuss safety precautions required before servicing suspension and steering systems List the components and function of leaf and multi-leaf spring suspensions Identify the function of the components of a power steering system Identify components of electrically controlled power steering systems Explain how hydraulics laws apply to power steering pump operation Compare types of power steering fluid Discuss signs of low power steering fluid Describe how to determine if fluid is contaminated Demonstrate proper use of lubrication equipment Compare types of vehicle grease and when each type is used
45. Perform steering linkage PM	Obtain equipment and materials needed Review safety and service procedures Inspect steering arms, levers and linkages	Identify common components and functions of steering assemblies List common preventive maintenance functions and

	Lubricate as needed Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	services for steering assemblies List common problems associated with faulty steering assemblies Discuss safety precautions required before servicing steering assemblies
46. Perform tire checks	Obtain equipment and materials needed Review safety and service procedures Inspect tires for wear patterns Inspect tires for cuts, cracks, bulges, sidewall damage Inspect valves and caps Measure and record tread depth Check and record air pressure Check for loose lugs and hardware condition Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify the parts of a tire and wheel Describe different methods of tire construction Explain tire and wheel sizes Describe tire ratings Identify wheel configurations used on medium/heavy trucks Explain how toe, camber, caster, axle inclination, turning radius, and axle alignment affect tire wear, stability and handling Define tire wear pattern Describe common tire wear patterns and the problems they indicate List common tire, wheel, and wheel bearing problems List common causes of tire air loss List common problems associated with underinflated or overinflated tires Discuss common safety precautions for servicing tires Describe the safe removal and handling of large vehicle tires
47. Assist to remove & install steering & drive axle wheel/tire assemblies	Obtain equipment and materials needed Review safety and service procedures Chock the rear wheels Position the vehicle Remove the dust/grease cap from the hub assembly Clean any oil Remove the locking device from the retaining nut Remove the retaining nut Remove the locking nut Remove the wheel bearings o Replace wheel seal if needed o Clean and inspect parts Remove the steering axle wheel/tire assembly Inspect the assembly Lubricate parts as required Reinstall repaired or new assembly	Identify common components and functions of steering and drive axle assemblies List common preventive maintenance functions and services for steering and drive axle assemblies List common problems associated with faulty steering and drive axle assemblies Discuss safety precautions required before servicing steering and drive axle assemblies Identify common components and the purpose of the wheel seal and bearings Discuss safety precautions required before servicing wheel seals and bearings Demonstrate proper use of lubrication equipment Compare types of vehicle grease and when each type is used

	Replace components in reverse order o Mount wheel o Adjust brakes with slack adjuster After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
48. Perform fifth wheel, frame, trailer PM	Obtain equipment and materials needed Review safety and service procedures Clean fifth wheel and locking mechanism Inspect fifth wheel mounting bolts, air lines, locks Lubricate all fifth wheel grease fittings and plate Check mud flaps and brackets Refer to worksite professional for repair/replacement After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the chassis frame of medium/heavy trucks Describe characteristics of frame and trailer materials Explain the elements of frame and trailer construction Compare semi-trailers and full trailers Compare hitching mechanisms Outline basic frame and trailer welding techniques Describe locking principles for types of fifth wheels Define high hitch and how to avoid it Demonstrate proper use of lubrication equipment Compare types of vehicle grease and when each type is used Compare welding torches and their uses with truck frames Compare types of metals and their qualities for trucks and welding Compare welding and cutting processes used with truck frames

Appendix Y

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

MOBILE EQUIPMENT MAINTENANCE PATHWAY AUTO TECHNICIAN- GENERAL AUTO SERVICE UNIT 17

Auto Technician - General Auto Service

Competency (Work Tasks)	**Performance Standards** What employer checks for while doing task. **Train YA Student on.** YA student will ...	**Learning Objectives** What to know/learn to do this task. **Content Suggested** for Class/Reading/On-the-Job Training.
1. Obtain & apply basic vehicle & servicing knowledge	Demonstrate vehicle systems knowledge based on current understanding Comply with personal safety practices concerning clothing, hand and power tool usage, proper ventilation of fumes and lifting and securing of vehicles Comply with environmental safety standards concerning handling, storage and disposal of hazardous materials and chemicals in accordance with local, state and federal regulations Identify approved service procedure prior to completing any work on a vehicle Perform all procedures according to manufacturer and regulatory requirements	AUTO SYSTEMS Describe the purpose of the fundamental automotive systems and components including brake systems, electrical/electronic systems, suspension and steering systems, transmission systems, engine performance systems and heating/air conditioning (AC) systems Explain the interaction of automotive systems List and describe basic components of automotive systems Identify commonly used automotive fasteners Explain common broken fastener removal techniques Describe basic automotive engine classifications Compare gasoline and diesel engines Contrast combustion chamber designs Discuss alternative engine types Compare two- and four-stroke cycle engines HYBRIDS Identify the major parts of a hybrid drive system Explain the construction and operation of hybrid drive assemblies Describe future technology developments in hybrid motor vehicles including new cell technologies and alternative fuels Identify high-voltage circuits of electric or hybrid electric vehicle and related safety precautions MOTORS Explain the principles of an electric motor Explain the operation of solenoids MOTION Explain how friction, force, inertia, momentum, speed, power, work and torque apply to brake systems Explain the effects of weight and speed on braking and stopping distance

		FLUIDS & PRESSURE Define characteristics of liquids Identify the fundamental laws of hydraulics Define Pascal's Law Explain thermal expansion of fluids, gases, and solids Explain energy conversion of motion changed to heat energy ELECTRICITY Explain the principles of electricity Describe the action of basic electric circuits Compare voltage, current, and resistance Describe the principles of magnetism and magnetic fields Identify basic electric and electronic terms and components Describe fundamental electrical tests Identify factors that will determine how much current will flow in a circuit Discuss electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law) Identify sources of alternating current (AC)/direct current (DC) voltages and their automotive applications Identify series and parallel circuits as they apply to typical lighting circuits Describe characteristics of a series circuit Describe characteristics of a parallel circuit Describe characteristics of a series/parallel circuit Define voltage, voltage drop, current flow and resistance and their common units of measurement Explain the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.)
2. Operate tools & equipment safely	Operate only equipment that he/she is trained on Choose correct tool or equipment for the task Verify tool/equipment is available for use and in working order Verify tool/equipment is current for preventative maintenance and/or calibration Verify safety equipment and any Personal Protective Equipment (PPE) needed for tool/equipment use Operate tool/equipment safely with guarding devices if	Identify tools and their usage in automotive applications Describe how to properly and safely position a vehicle for different types of service Describe and demonstrate the safety requirements for each tool and equipment Discuss start up and shut down procedures for each tool/equipment you will operate Explain the purpose of preventative maintenance Describe emergency shutdown procedures for the

	applicable in the manner required for the job task Monitor tool/equipment for safe operation while operating Follow procedures for cleanup and shut down after use Perform any required preventative maintenance procedures Investigate and promptly report abnormal tool/equipment conditions Properly shut down and label any tool/equipment that is not operating as expected, if applicable Follow Lock Out/Tag Out procedures as applicable Document use and maintenance as required Demonstrate safe handling and use of appropriate tools Demonstrate proper cleaning, storage, and maintenance of tools and equipment Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dial-caliper Utilize safe procedures for handling of tools and equipment Identify and use proper placement of floor jacks and jack stands Identify and use proper procedures for safe lift operation	tool/equipment you will operate Explain how to recognize and address malfunctions for the tool/equipment you will operate Describe how to recognize wear and tear on equipment components List the Occupational Safety and Health Administration (OSHA) and other regulatory requirements as they apply to the equipment that you operate Describe proper techniques for lifting loads List the safeguards that apply to the equipment used in your facility for tools, automated machines, material handling equipment, and lifts Explain Lock Out/Tag Out indications and procedures in your facility Identify hybrid vehicle internal combustion engine service precautions Describe the function and use of a thermometer, pyrometer, manometer Describe the function and use of an oscilloscope or GMM to diagnose engine concerns
3. Maintain work area	Identify general shop safety rules and procedures Identify marked safety areas Utilize proper ventilation procedures for working within the lab/shop area 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 Identify the location and use of eye wash stations Identify the location of the posted evacuation routes Maintain shop manuals and/or electronic retrieval systems Organize tools Sweep work area Put shop equipment away Clean work area and work bench Dispose of parts properly	Describe the typical layout and sections of an auto shop Explain the importance of proper housekeeping in the shop List the types of accidents that can occur in an auto shop Explain how to prevent auto shop accidents Describe general safety rules for the auto shop
4. Assist to process work order	Verify customer complaint (concern) ***Research information***	Identify an auto repair business' internal and external customers

	Review vehicle service history Document customer concern and complaint information on repair order Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction Prepare vehicle for service with floor mat, steering wheel cover, etc. Obtain customer signature(s) when required Handle complaints tactfully without insult or conflict	Define customer service Describe how customer service affects a company's "bottom line" List strategies to maximize customer satisfaction List the steps to follow when handling complaints
5. Research information	Locate and find resources for vehicle service information and history, service precautions, and technical service bulletins Retrieve shop manuals and/or electronic retrieval systems Locate and identify information necessary to the task	Define the purpose and use of the vehicle identification number (VIN), engine numbers, and date codes Identify references that are used to estimate vehicle repair charges Describe the different types of service manuals Explain how to use computer-based service information Discuss basic structure and information found in shop manuals, online manuals, and technical service bulletins
6. Acquire parts	Collect necessary information to determine part required Locate and interpret vehicle and component identification numbers such as make, model, year, VIN, vehicle certification labels, calibration decals Check part price Check part availability Obtain part Verify correct part upon receipt ***NOTE: Driving to get parts CANNOT be part of student's <u>regular job tasks</u> per Child Labor Laws***	Explain how to use service manuals to locate component part information Identify sources available for replacement parts List requirements of replacement parts Explain the information needed to in order to obtain the correct replacement part Describe how parts are purchased and charged to the customer Compare and contrast new, used, rebuilt and remanufactured automotive parts Describe situations in which one type of part is desirable over new parts Define original equipment manufacturer (OEM) and how this affects automotive servicing
7. Assist to diagnose common concerns & determine action	Consult with worksite professional to determine appropriate inspections and test(s) to perform based on customer concern ***Research information*** Assist worksite professional to complete diagnostic tests necessary to identify cause of customer concern	Explain the 3 Cs (concern, cause, correction) of automotive service Describe the basic types of troubleshooting charts found in service manuals Explain how to use the following testing instruments: Voltmeter, Test Light, Ammeter, and Ohmmeter List the most common engine performance problems Describe the symptoms for common engine performance

		problems Explain typical causes of engine performance problems Discuss common problems relating to abnormal engine noise or vibration concerns, unusual exhaust color, odor, and sound, and fuel, and ignition concerns Explain common poor stopping, pulling or dragging concerns caused by problems in the hydraulic system Explain common causes of wheel bearing noises, wheel shimmy, and vibration Discuss wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system Identify common causes of electrical circuit or component failures Discuss common problems relating to a suspension system Describe special issues related to electronically-controlled suspension systems Discuss common problems due to short and long arm suspension systems, body sway, and uneven ride height Explain common causes for steering column noises, looseness, and binding concerns Explain common problems that cause wheel/tire vibration, shimmy, and noise Describe common causes of vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns Identify the most common problems that occur in a hybrid vehicle drive system
ENGINE		
8. Perform engine oil & filter change	Obtain equipment and materials needed Review safety and service procedures Position vehicle Locate the oil drain plug on the underside of the engine Place the oil drain pan under the plug Remove the plug Let the oil drain into the pan Replace the drain plug gasket Reinstall and tighten the plug Locate the existing oil filter	Discuss common engine maintenance functions and services Explain why it is best to run the vehicle prior to changing oil Identify different types of engine oils and their purposes Explain how to determine correct oil capacity Discuss the disposal procedures for engine oil List the basic parts of a lubrication system Summarize the operation of a lubrication system Explain the characteristics and ratings of engine oil

	Position the oil pan underneath the filter to catch any remaining oil Unscrew the old oil filter Lightly coat the rubber seal of the new filter with new oil Screw the new filter into place Remove the oil filler cap on top of the engine Place the funnel in the opening and pour in the new oil Run the engine for a minute, then check the dipstick Add more oil if necessary Check the area around the oil drain plug and the filter for oil leaks Tighten the plug or oil filter if you find leakage Wipe away excess oil Dispose the used oil properly After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
9. Replace fuel filter	Obtain equipment and materials needed Review safety and service procedures Disconnect the negative battery cable Locate the fuel filter Let the pressure out of the fuel system Loosen and remove the clip near where the fuel line and filter meet Pull the fuel lines off of both ends of the filter Loosen the filter-retaining clamp Remove the fuel filter Replace it with the new filter Tighten the filter-retaining clamp Put the fuel lines back on the filter Put the clip back on the fuel line and snap it into place Tighten the fuel tank cap Connect the negative battery cable Start vehicle and check for fuel leaks After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Summarize how crude oil is converted into gasoline, diesel fuel, liquefied petroleum gas, and other products Describe properties of gasoline and diesel fuel Explain octane and octane ratings Describe normal and abnormal combustion of gasoline and diesel fuel Define the major parts of a fuel supply system
10. Check, drain, recover, flush, refill cooling	Obtain equipment and materials needed Review safety and service procedures	List common cooling system problems and their symptoms

system	Position vehicle Allow engine to cool Place large catch pan underneath radiator drain plug Remove radiator drain plug and collect all old coolant Remove radiator fill cap to expedite draining process Remove all coolant from your radiator reservoir Inspect drained coolant as it exits the system Dispose of the coolant as required Replace the radiator drain plug Fill system with water to dilute remaining antifreeze in the engine block Replace radiator fill cap and run the engine allowing it to reach operating temperature Run engine for few minutes after engine's cooling fan turns on Shut off and cool engine Repeat draining process; collect and dispose of all waste coolant Replace radiator drain plug and refill the cooling system with distilled water only Once the cooling system has been completely filled, start the engine to allow the water to circulate Remove the radiator drain plug As the engine runs, pour fresh distilled water into the radiator fill hole at the same rate that it exits the system Continue until water being drained from the radiator appears to be clear and free of debris Stop engine and allow all remaining water to drain out Replace radiator drain plug Mix distilled water and coolant in recommended ratio Funnel fresh coolant into radiator fill hole Fill radiator at recommended rate until coolant reaches bottom of fill neck Fill the radiator reservoir to the full mark With the radiator fill cap still off, start the car and allow it to idle Continue to add coolant as air escapes the engine and cooling system Bleed air from cooling system as needed Once unable to fill the radiator any further, replace	Describe the most common causes of system leakage, overheating, and overcooling Explain the importance of antifreeze Discuss the hazards and dangers of ethylene glycol in antifreeze coolant Explain the required disposal methods for all stages of drain material Discuss the importance of cooling the engine first Explain what debris in drained coolant means Explain the purpose of the distilled water

	radiator fill cap and stop the engine After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
11. Assist to inspect engine assembly for leaks	Obtain equipment and materials needed Review safety and service procedures Start the vehicle Inspect engine for external problems such as leaks, part damage, contaminated oil Check for fuel, oil, coolant, and other types of leaks Smell fluid from leaks Listen for unusual noises Increase engine speed while listening and watching Listen carefully to abnormal engine noises using a stethoscope or other listening device Consult worksite professional to determine further tests, inspections or repairs After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe coolant in oil appearance Describe the appearance and possible causes of oil in coolant: engine oil leaks, external coolant leaks, engine blowby, engine vacuum leaks, engine exhaust leaks, and engine smoking Describe basic problem colors of exhaust smoke Describe basic problem colors of diesel exhaust smoke
12. Inspect, replace air filter	Obtain equipment and materials needed Review safety and service procedures Locate the air-filter housing Remove the screws or clamps that hold on the top of the housing Take out the old air filter Clean any dirt and debris from the housing with a clean rag Put the new air filter in Screw or clamp the lid of the air-filter housing back on After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the function and main components of a vehicles heating and ventilation system Describe the construction and action of air filters Summarize the operation and interaction of heating, ventilation, and air conditioning systems
13. Retrieve, record, interpret diagnostic codes	Obtain equipment and materials needed Review safety and service procedures Verify malfunction indicator light trouble codes using the scan tool Obtain the appropriate scan tool and program cartridge for the vehicle, system and/or date Locate the data link connector (DLC) in the vehicle	Discuss the purpose and operation of on-board diagnostic systems Explain the use of scan tools to simplify reading of trouble codes Compare on-board diagnostic (OBD) I and OBD II system capabilities and procedures Locate the data link connector on most makes and

	Attach the scan tool cable into the DLC; use an adaptor if needed Connect the scan tool to battery power if needed Follow the prompts to access the trouble codes Consult the trouble code chart or scan tool code conversion Consult worksite professional to determine further tests, inspections or repairs Erase diagnostic trouble codes when applicable	models of cars Activate on-board diagnostics and read trouble codes with and without a scan tool Describe how to use a trouble code chart in a service manual or code conversion by a scan tool Describe the importance of running all OBDII monitors for repair verification
MANUAL DRIVE TRAINS & AXLES		
14. Check for leaks & fluid conditions	Obtain equipment and materials needed Review safety and service procedures Position vehicle Check for leaks Locate and remove the transmission plug Check the oil level Check the fluid condition Reinstall the fill plug; check for leaks again After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe common causes of manual transmission leaks Explain the color, smell, and feel of manual transmission fluid Discuss the importance of fluid level Compare automatic and manual transmission components and operation
15. Check & adjust differential housing fluid level	Obtain equipment and materials needed Review safety and service procedures Position vehicle Remove the fill plug Check level of the fluid Fill housing with appropriate fluid to correct level After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain problems associated with using the wrong fluid Explain the color, smell, and feel of differential fluid Discuss the importance of fluid level Describe level of fluid when hot vs. cold
AUTOMATIC TRANSMISSION & TRANSAXLE		
16. Check fluid level in a transmission/transaxle	Obtain equipment and materials needed Review safety and service procedures Check and adjust transmission fluid Check with or without a dip-stick Locate fluid leaks Inspect for general problems with hoses, belts, and other components After servicing, verify service and make adjustments as	Describe the function and operation of the major parts of an automatic transmission Compare basic components and operation of automatic transmissions to manual transmissions Describe the operational characteristics of a hybrid vehicle drive train Describe the function and component of transmission fluid

	needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss common characteristics of transmission fluid
17. Inspect, replace, flush transmission fluid & filters	Obtain equipment and materials needed Review safety and service procedures Warm up car so transmission is at normal operating temperature ***Check transmission fluid*** Select the correct filter replacement Prepare a large pan to catch the fluid Loosen each pan bolt Finish removing the pan and any gasket material from the pan or case Inspect the pan's gasket surface for damage Remove the old filter Install new filter Inspect the drain pan for metal shavings Position gasket on pan Hand-tighten pan bolts Refill the transmission pan to "refill capacity" per vehicle specification Replace the fluid in the torque converter and oil cooler Determine total system capacity per vehicle specification Disconnect the oil cooler line from the oil cooler With another tech, be prepared to add fluid to the fill area as it is being pumped out of the oil cooler line Start the engine, and as the old fluid is pumped out, add fresh fluid to the pan When either the fluid color brightens or the total capacity has been replaced, shut the engine off and re-attach the oil cooler line Recheck the fluid level With the vehicle on level ground, idle the engine idle for a few minutes and then shift the transmission into different positions before returning to "Park" or "Neutral" Check the fluid level again and check for leaks After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Trace the flow of power through an automatic transmission Explain how an automatic transmission shifts gears Compare the different types of automatic transmissions Compare normal versus abnormal color/odor of transmission fluid Compare automatic to manual transmission systems
BRAKES		
18. Test brake fluid for	Obtain equipment and materials needed	Discuss the look, smell, feel of brake fluid

contamination	Review safety and service procedures Position the vehicle Access the mast cylinder housing Remove the master cylinder cover Pry off the spring clip or unbolt the cover Test the fluid with a refractometer, chemical test strips, or electronic testers Report results to worksite professional Replace the master cylinder cover After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	List common contaminants of brake fluid Describe problems associate with contaminated brake fluid Compare methods to test brake fluid Discuss common safety precautions for servicing brake fluids
SUSPENSION & STEERING		
19. Inspect power steering fluid level & condition	Obtain equipment and materials needed Review safety and service procedures Warm up vehicle so power steering is at normal operating temperatures Turn engine off Locate power steering reservoir Remove cap Check fluid level with dipstick or by looking at the reservoir Inspect fluid for contamination Top fluid only to correct mark After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify the function of the components of a power steering system Identify components of electrically controlled power steering systems Compare types of power steering fluid Discuss signs of low power steering fluid Describe how to determine if fluid is contaminated Explain the meaning of milky or metal contaminants in power steering fluid
20. Flush, fill, bleed power steering system	Obtain equipment and materials needed Review safety and service procedures Determine proper power steering fluid type FLUSH Position vehicle Place large container under fluid return hose Remove fluid return hose at the power steering pump with engine at idle while another tech maintains the fluid level at FULL COLD in the reservoirs using fresh power steering fluid Turn off engine Turn wheel fully to the left and right Remove pump reservoir inlet connection plug	Explain how hydraulics laws apply to power steering pump operation Explain the operating principles of steering systems Identify the role of between steering systems and handling or tire wear Describe service and repair procedures for a rack-and-pinion steering gear Explain how to complete basic power steering tests

	Install fluid return hose to pump reservoir Maintain fluid level at FULL COLD and operate engine at idle for 15 minutes Repeat and inspect fluid for contamination If contaminated repeat flush again BLEED Start the engine Turn the steering wheel fully from side to side Check the fluid level often Add fluid as needed If excessive buzzing noise is apparent repeat the bleed procedure After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
21. Inspect for power steering fluid leakage	Obtain equipment and materials needed Review safety and service procedures Inspect power steering assembly for leaks Check for overflowing, power steering pump, right type of fluid, and holes in fittings and hoses After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation Identify tire wear patterns	Discuss implications for power steering leaks from overflow, pump problems, fluid type, and loose or broken fittings and hoses Discuss power steering fluid leakage and effects on steering Discuss the function of electronically controlled steering systems (including sensors, switches, and actuators)
22. Lubricate suspension & steering systems	Obtain equipment and materials needed Review safety and service procedures Position vehicle for service Determine the type of lubricant recommended Inspect all steering and suspension joint grease seals Replace any torn or missing seals Wipe grease from each grease fitting Install plugs, install temporary fittings Apply grease to each fitting until grease begins to flow out of the bleed area or until the seal swells Apply a heavy film of grease to the steering stops on the steering knuckle and control arms Wipe excessive grease from all joints and reinstall plugs Lower vehicle After servicing, verify service and make adjustments as	Identify types of body-chassis design Identify the major parts of a suspension system Compare types of suspension systems Describe the basic function of each suspension system component Identify the role of suspension in tire wear, ride, handling, braking and acceleration force control Summarize the operation of a suspension lubrication system Locate the areas of typical joint grease seals Describe the safe and proper operation of a grease gun Compare and contrast different types of grease used for lubrication

	needed, cleanup work area, return tools to proper location, complete appropriate documentation	
23. Inspect tire condition & adjust air pressure	Obtain equipment and materials needed Review safety and service procedures Inspect the outer side wall, tread area, inner side wall Check for correct tire size and application (load and speed ratings) Check tires for bulges, splits, cracks, chunking, cupping of the tread Check for punctures, cuts, tears and other physical injuries AIR PRESSURE Remove valve stem cap Press tire gauge squarely over valve stem Read air pressure Compare reading to specification If tire pressure is low, add air If tire pressure is high, press on the valve core pin to release some air Recheck tire pressure and add or release air as needed Replace valve stem cap After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation Identify tire wear patterns	Define tire wear pattern Describe common tire wear patterns and the problems they indicate Identify the parts of a tire and wheel Describe different methods of tire construction Explain tire and wheel sizes Describe tire ratings
24. Rotate tires	Obtain equipment and materials needed Review safety and service procedures Verify tire rotation recommended by the manufacturer Position vehicle Remove right rear tire Inspect tires for wear with each tire removal Inspect brake pads for wear with each tire removal Place tire to the left front of the vehicle Remove left front tire and place to the right rear of the vehicle Re-install the tire from right rear to the left front Re-install the left front tire on the right rear Remove left rear tire and place tire to the right front of the vehicle Remove right front tire and place tire to the left rear	Explain the purpose of tire rotation Identify the recommended frequency of tire rotation List common tire, wheel, and wheel bearing problems

	Re-install tires Adjust tire pressure After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
ELECTRICAL/ELECTRONIC		
25. Verify, replace, refill wiper & washer operation	Obtain equipment and materials needed Review safety and service procedures Check wiper solution reservoir level Fill reservoir with wiper solution if needed Inspect wiper blades for cuts, splits, hardening Remove and replace wiper blades with correct size Verify operation of wiper and washer system Verify hose connection from system to hood/washers Check wiring diagram, fuses, and connections on wiper system with worksite professional if needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the components of a typical wiper/washer system Trace the flow of solution Discuss components of washer solutions Compare the types of pumps used in washer systems Compare types and sizes of typical wiper blades
26. Check brake lights	Obtain equipment and materials needed Review safety and service procedures With car power on and in park, press the brake pedal and have someone verify the light indicator If the light does not come on, work with worksite professional to check lamp, fuse and switch in the brake pedal After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain the function of a brake system List the components and operation of brake systems Compare disc and drum brake systems Describe the purpose and operation of anti-lock brakes Describe the purpose and operation of traction control and stability control systems Identify components of brake warning light system Describe the operation of a regenerative braking system. Describe the function of the brake light Explain the operation of the power and switch for the brake light Describe how to check and change brake light bulbs/lamps
27. Test, replace, aim lights	Obtain equipment and materials needed Review safety and service procedures INSPECT Test the power at the bulb socket Check the ground circuit Look for any shorted or open circuits Check for corrosion of the connector terminals	Explain the operating principles of automotive light, wiper, and horn systems Discuss the diagnostic questions to determine problems in light, wiper, and horn systems Summarize automatic light and wiper systems Explain how to aim headlights Explain both analog and digital instrumentation

	Check the fuse Check the switch REPLACE Remove the bulb assembly Remove small rings or screws Remove the lens Replace with new bulb Reinstall lens, screw, rings, and bulb assembly AIM HEADLIGHTS Use headlight aimers, aiming screen or bubble levelers according to equipment specification Adjust headlights using the vertical and horizontal adjusting screws After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify safety precautions when handling halogen bulbs Describe how to load a vehicle prior to aiming headlights Explain the purpose of the bubble level
28. Inspect, check, replace battery	Obtain equipment and materials needed Review safety and service procedures Inspect the condition of the support tray, hold-down, posts, cables and clamps Check battery, battery cables, connectors, clamps, and hold-downs TOP If the battery top is dirty, test the top of the battery with a voltmeter; if leaking voltage then clean Clean top with required solution TERMINALS Perform a battery terminal test with a voltmeter with the ignition disabled If disconnecting battery, use a memory saver to keep programmable information intact Clean battery terminals by removing the cables and cleaning with required solution Coat terminals with white grease Tighten fasteners to secure cable ELECTROLYTE LEVEL In older NON maintenance free batteries, check electrolyte level Remove vent cap	Identify safety precautions when performing battery service Describe the basic parts of an automotive battery Explain how temperature and other factors affect battery performance Describe the components of mixtures used for cleaning Explain how to clean a battery top on a NON maintenance free battery Explain how to perform a battery terminal test Discuss when to use pliers to remove battery cables Discuss precautions to take around battery fill openings Explain why only distilled water can be used in batteries Explain why over-tightening terminals is a problem Discuss how size of battery relates to motor performance and battery service life Compare battery power ratings Identify electronic modules, security systems, radios, and other accessories that require re-initialization or code entry after reconnecting vehicle battery. Identify hybrid vehicle auxiliary (12 volt) battery service, repair, and test procedures.

	Check electrolyte level Fill cells to correct level with distilled water if needed REPLACE Disconnect the cables Loosen the battery hold-down Use strap to carefully lift battery out Gently place the new battery into the tray/box Check fit Tighten the hold-down Install the cables After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
29. Perform battery capacity test	Obtain equipment and materials needed Review safety and service procedures Ensure battery is charged Select the appropriate load (capacity) tester Calculate the load (capacity) rating, how much current draw should be applied to the battery Remove surface charge from the battery Connect the 2 large positive and negative clamps to the battery positive and negative terminals Connect the induction clamp around the negative tester lead if applicable Apply the calculated battery load for 15 seconds Turn off the load Compare reading to service information After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	List the components and operation of a battery List common problems associated with a faulty battery Identify safety precautions when performing battery service Compare inductive and non-inductive capacity testers Explain how to calculate battery load values Describe the purpose of the battery load test
30. Perform slow/fast battery charge	Obtain equipment and materials needed Review safety and service procedures Install the battery terminal adapters if required Connect charger according to manufacturer instructions Connect the red charger lead to the positive terminal Connect the black charger lead to the negative terminal Set the charger to the appropriate current for the type of charging Turn charger on	List the components and operation of a battery List common problems associated with a faulty battery Describe how a battery charger works to charge a battery List battery charging precautions to prevent damage Compare advantages and disadvantages for slow and fast battery charging Describe the temperature and charging rates for slow and fast charging Discuss what would happen if a charger was on when it is connected to the battery

	Turn charger off when charging is complete After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
31. Perform battery state-of-charge test	Obtain equipment and materials needed Review safety and service procedures NON-SLA On NON-SLA (sealed lead acid) batteries, perform a hydrometer state of charge test If specific gravity is at or above acceptable level, do capacity test If specific gravity for all cells is below acceptable level, charge and retest battery If specific gravity between cells varies by more than acceptable amount, replace the battery SLA Remove surface charge Perform open circuit voltage test Measure the open circuit voltage Refer to voltage chart to determine state of charge on battery After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify safety precautions when performing battery service Explain the operating principles of a lead-acid battery Compare conventional and maintenance-free batteries Explain how to remove surface charge from a battery Define specific gravity and how it indicates battery charge Describe how to do the hydrometer test Describe how to do the capacity test Describe how to do the open circuit voltage test Explain how to use the voltage chart to determine charge List levels which require a new battery vs. re-charging
32. Verify panel gauges & lights; rest maintenance indicators	Obtain equipment and materials needed Review safety and service procedures ***Retrieve, record, interpret diagnostic codes*** Look up trouble code chart in service manual Refer problems to worksite professional o If gauge is not functioning, assist with worksite professional to check the sending unit and replace bulbs or wiring or sending units After repairs, reset maintenance code using scan tool Verify maintenance codes are cleared and a new one was not activated After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss the purpose of on board diagnostics Compare on-board diagnostics (OBD) I and II systems Describe the different types of gauges and sending units Explain how different types of gauges and sending units work Compare and contrast warning lights, sending units, switches, and basic display systems Explain both analog and digital instrumentation
33. Jump start a vehicle	Obtain equipment and materials needed Review safety and service procedures	Describe problems that can occur if jumper cables are not connected properly

	Connect one end of the red jumper cable to the positive terminal on the dead battery Connect the other end of the red jumper cable to the positive terminal of the power source or good battery Connect the other end of the black jumper cable to negative terminal of the power source or good battery Connect other end of the black jumper cable to a good ground away from the dead battery Run the engine or activate the power source while starting the vehicle with the dead battery After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	List the components and operation of jumper cables Discuss common safety precautions when using jumper cables
HEATING & A/C		
34. Replace cabin filter	Obtain equipment and materials needed Review safety and service procedures Locate the air cabin filter housing Determine if the cabin filter needs to be changed Remove the filter housing retainer clips or screws Remove the filter Gently tap the filter If dust falls from the air cleaner it is filled to capacity and needs to be replaced Remove the main access cover Undo the cover fasteners to remove cover and side cover if needed Locate and undo retainer clip to remove air cabin filter Compare the filter size to the replacement filter Reassemble the filter housing with the new filter After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the common location for air cabin filters List common reasons for clogged air filters Describe the importance of a clean air filter Identify heating and air conditioning (A/C) Components Identify the source of heating and A/C system odors
35. Inspect engine cooling & heater systems hoses, ducts, doors, filters	Obtain equipment and materials needed Review safety and service procedures Inspect hoses visually for swelling, cracks, and leaks Check for hardened hoses by hand Flex or bend the hoses, watch for surface cracks Replace hoses if problems Loosen hose clamps Twist and pull hose from fittings	Identify common components of cooling and heating systems- hoses, ducts, doors, filters, etc. Discuss common problems and wear for cooling and heating hoses Explain common problems associated with worn cooling and heating system hoses

	Clean metal hose fittings Seal fittings if corroded or pitted Slide on new hose and clamp Fit the hose clamps over the hose fittings Tighten the clamp and check for leaks After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	

Appendix Z

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

MOBILE EQUIPMENT MAINTENANCE PATHWAY AUTO/LIGHT TRUCK SYSTEMS UNIT 18

Auto Technician – Auto/Light Truck Systems

Competency (Work Tasks)	Performance Standards What employer checks for while doing task. **Train YA Student on.** YA student will ...	Learning Objectives What to know/learn to do this task. **Content Suggested** for Class/Reading/On-the-Job Training.
ENGINE REPAIR & PERFORMANCE (NATEF A1 & A8)		
1. Install engine covers using gaskets, seals, & sealers	Obtain equipment and materials needed Review safety and service procedures Inspect for leaks prior to disassembly Clean old gaskets carefully Match holes and sealing surfaces perfectly Apply appropriate sealer type Align and hand screw all bolts Tighten all fasteners in steps Use crisscross tightening pattern to specified torque After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify commonly used automotive fasteners Summarize safety rules relating to fasteners, gaskets, seals, and sealants Explain the reason for tightening the bolts a little at a time in a crisscross pattern
2. Assist to remove & replace timing belt, verify camshaft timing	Obtain equipment and materials needed Review safety and service procedures Set the number 1 cylinder to TDC Remove the timing belt cover and timing belt Line up timing marks on the camshaft and crankshaft sprockets Slip the belt over the sprockets Move the tensioner into the belt to hold the belt on its sprockets Adjust belt tension to specification Install timing belt cover After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the construction and operation of a camshaft Compare the types of camshaft drives Explain the importance of regular timing belt maintenance Cite safety procedures to follow when servicing engine front ends
3. Perform cooling system pressure tests to identify leaks	Obtain equipment and materials needed Review safety and service procedures Remove the radiator cap once the engine is sufficiently cooled Check the coolant's condition and color	Summarize the functions of a cooling system Explain the operation and construction of major cooling system components Compare cooling system design variations Explain the importance of antifreeze

	Visually inspect the cooling system for leaks, loose or missing fan belts, low coolant level, abnormal water pump noises, coolant in the oil, combustion leakage into the coolant Determine the coolant's freezing point using a coolant hydrometer Look down the radiator neck while the engine is running up to operating temperature to observe circulation Check thermostat if circulation is poor Connect a cooling system pressure tester to the radiator fill neck Pump the pressure tester until the pressure reaches the release pressure marked on the cap Leave the tester connected and watch for leaks Check for signs of heater core leaks on the ground under the engine Check for leaks at the pump drive shaft Check for leaks at all hose fittings, gaskets, and engine freeze (core) plugs Tighten, repair or replace parts as needed After testing, prepare for service or cleanup work area, return tools to proper location, complete appropriate documentation	List common cooling system problems and their symptoms Describe the most common causes of system leakage, overheating, and overcooling Discuss common safety precautions for servicing cooling systems
4. Inspect, replace, adjust drive belts, tensioners, & pulleys	Obtain equipment and materials needed Review safety and service procedures Locate your vehicle drive belts Inspect the belts by turning them sideways and looking for cracks, glazing or visible signs of fraying Replace the belts by loosening the mounting and retaining bolts or nuts on the accessory that it drives Pry the accessory towards the belt, allowing the belt to loosen enough to come off the pulley Remove the belt from the crankshaft pulley Install the new belt by positioning it on the crankshaft pulley and then slipping it over the pulley of the accessory Pry the accessory from the belt to tighten the slack Adjust the belt tension so that there is no more than 1/2" deflection, up or down Reinstall any other belts you removed and adjust them	Describe the purpose of a vehicle's engine drive belts Discuss the composition of drive belts and common wear tear Locate common accessory drive belts and what they run Describe the issues with stretched belts Explain why belts should not be over-tightened

	Start the engine and turn on the accessory run by the belt that you just changed Check that the belt or belts that you removed are not slipping under the engine load If there is a slipping belt, turn off the engine, readjust the belt and check again After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
5. Remove, inspect, replace thermostat & gasket/seal	Obtain equipment and materials needed Review safety and service procedures Observe the coolant through the opening in the radiator neck as the engine warms Use a temperature probe to touch the thermostat outlet hose Unscrew bolts holding thermostat housing to engine Tap housing free Lift off housing and thermostat Scrape old gasket material off housing Check for gaps between housing and sealing surface File or sand surface flat if warped Remove thermostat and test in water on a hot plate Replace thermostat if it does not open at correct temperature Install new thermostat centered in housing with pellet toward inside of engine Position new gasket with approved sealer Torque thermostat bolts to specification After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the purpose and common components associated with the thermostat Describe common problems associated with the thermostat Explain procedures for replacing a rubber thermostat housing seal instead of a gasket List precautions to take with combined plastic housings
6. Inspect, remove, replace water pump	Obtain equipment and materials needed Review safety and service procedures INSPECT Wiggle the fan or pump pulley up and down to check for worn pump bearings Warm engine and then shut off Squeeze top of radiator hose while another technician restarts the engine to check for pump operation Observe coolant in radiator with engine at operating	Describe the purpose and common components associated with the water pump Describe common problems associated with the water pump Discuss common safety precautions for servicing water pumps

	temperature REMOVE Unbolt all brackets and components (air conditioning compressor, power steering pump, alternator, etc.) Unscrew ALL bolts holding pump to engine Lightly tap pump housing to free pump Scrape off old gasket or sealer material REPLACE Install water pump gasket using approved sealer Work o-ring seal into bottom of groove if applicable Fit pump onto the engine straight into place Start all bolts be hand Check all bolt lengths are the same Torque all fasteners a little at a time in a pattern Install the other components Tighten pulley properly After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
7. Perform cylinder cranking & running compression tests	Obtain equipment and materials needed Review safety and service procedures Remove all spark plugs Block open the throttle Disable the ignition system Disable the electronic fuel injection if applicable Screw the compression gauge into one of the spark plug holes Crank the engine to rotate about 4-6 compression strokes Record gauge readings Repeat for each cylinder Repeat while engine is running Compare gauge readings to specifications Consult worksite professional to determine further tests, inspections or repairs After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe engine size measurements based on bore, stroke, displacement, and number of cylinders Explain engine compression ratio and how it affects engine performance Explain engine torque and horsepower ratings Describe the different methods used to measure and rate engine performance Explain volumetric efficiency, thermal efficiency, mechanical efficiency, and total engine efficiency Cite safe practices when making engine performance measurements Explain the purpose and procedure of the compression test Compare compression testing for gasoline versus diesel engines Describe the use and purpose of a compression gauge Explain when an engine compression test is indicated
8. Perform cylinder leakage tests	Obtain equipment and materials needed Review safety and service procedures	Explain the purpose and procedure of the cylinder leakage test

	Remove crankcase filler cap Remove radiator filler cap Ensure radiator is filled to prescribed level Locate TDC using a whistle tester adaptor on the tester in the cylinder spark plug hole Rotate engine until cylinder to be tested is at TDC Remove whistle and connect leak tester Check cylinder leakage tester reading Look for air leaking noise or air bubbles Consult worksite professional to determine further tests, inspections or repairs Unblock the throttle valve Reconnect the ignition system Reinstall the spark plugs and air filter After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the use and purpose of a cylinder leakage tester Explain the use of the whistle adaptor on the leakage tester Explain when a cylinder leakage test is indicated
9. Remove, replace spark plugs	Obtain equipment and materials needed Review safety and service procedures Check spark plug wires number and location Remove ignition coils if necessary Grasp the spark plug wire boot and pull the wire off the plug o Twist the boot back and forth if needed Use compressed air to clean debris Unscrew each plug and remove with tools Inspect plugs Install new or serviced spark plugs with correct gap o Thread head by hand then use ratchet o Tighten according to spec Re-attach wires and coils correctly After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain the purpose and common problems associated with bad spark plugs Describe methods for testing spark plugs Discuss safety precautions removing and replacing spark plugs
10. Inspect exhaust manifold, pipes, muffler, catalytic converter, resonator, & heat shields	Obtain equipment and materials needed Review safety and service procedures Position vehicle Use a light to closely inspect the exhaust system components for leaks, rust, and loose connections	Explain the relationship between engine performance and exhaust emission Explain the construction and design of intake and exhaust manifolds Describe the basic parts of an exhaust system Explain the most common reasons for exhaust system

	Focus attention on muffler, pipe connections, gaskets and pipe bends After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	failures Describe the appearance of exhaust leaks on components Compare exhaust system design differences Explain the fundamental parts of a turbocharging system Summarize the construction and operation of a supercharging system Cite safety procedures for working on exhaust systems
11. Remove, replace radiator	Obtain equipment and materials needed Review safety and service procedures Cool radiator INSPECT Inspect the outside for debris Inspect radiator shroud for breaks Spray water from back of radiator to push debris out the front Inspect radiator cap and filler neck for cracks, tears, nick or dents Have neck repaired as needed REMOVE Place catch pan under radiators petcock Drain radiator Disconnect hoses, oil cooler lines, and wires to sensors and fans Remove brackets or bolts to remove radiator from its mounting REPLACE Ensure rubber mounts are in place in their brackets Carefully lower radiator into place without hitting and damaging it Connect all hoses, lines and wires After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain the purpose and common components associated with the radiator Describe common problems associated with the radiator Discuss common safety precautions for servicing a radiator
AUTOMATIC TRANSMISSION & TRANSAXLE (NATEF A2)		
12. Inspect, replace external seals, gaskets, bushings	Obtain equipment and materials needed Review safety and service procedures Inspect transmission for leakage Replace seals, gaskets, bushings as required After servicing, verify service and make adjustments as	List problems associated with worn transmission bushings, seals and gaskets Explain where to locate bushings

	needed, cleanup work area, return tools to proper location, complete appropriate documentation	
13. Inspect powertrain mounts	Obtain equipment and materials needed Review safety and service procedures Visually inspect each mount for breakdown, oil soaked, separation Assist worksite professional to replace mounts if needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	List problems associated with damaged power train mounts Describe how to replace powertrain mounts
MANUAL DRIVE TRAINS & AXLES (NATEF A3)		
14. Drain/refill differential or transfer case housings	Obtain equipment and materials needed Review safety and service procedures Position vehicle Remove the drain plug; drain fluid Replace drain plug Fill housing with appropriate fluid to correct level After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss the components and purpose of the transfer case Define differentials and their purpose Explain when transfer case service is indicated List common problems associated with faulty differentials or transfer cases Discuss common safety precautions for servicing differentials and transfer cases
15. Remove & replace drive axle shafts	Obtain equipment and materials needed Review safety and service procedures Loosen lug nuts Position vehicle Remove the wheel, brake calipers, and rotor Remove the knuckle bolts Remove the hub, axle nut and dust shield Remove the axle shaft carefully Insert the new axle shaft Replace the items removed in reverse order After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss the purpose and components of the drive axle Explain common problems associated with a faulty drive axle Discuss precautions to take when removing and replacing a drive axle
SUSPENSION & STEERING (NATEF A4)		
16. Assist to disable & enable supplemental restraint system (SRS)	Obtain equipment and materials needed Review safety and service procedures Turn the steering wheel so the wheels are straight Turn ignition to OFF and remove key DISABLE	Explain how vehicle body and frame construction works with restraint systems to protect a vehicle's occupants Identify and locate the most important parts of vehicle restraint systems Describe the purpose for restraint systems

	Locate fuse center Remove supplemental inflatable restraint (SIR) fuse Remove the insulator panel Remove the connector position assurance (CPA) from the steering wheel module coil connector Disconnect the steering wheel module coil connector from the vehicle harness connector Install the insulator panel ENABLE Turn the steering wheel so the wheels are straight Turn ignition to OFF and remove key Connect the steering wheel module coil connector to the vehicle harness connector Install the CPA to the steering wheel module coil connector Remove the insulator panel Install the SIR fuse into the body control module fuse center Install the insulator panel Turn ignition to ON After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe restraint system design variations Summarize the operation of restraint system sensors, inflator modules, and electronic control modules Explain Enabling zones Describe different air bag systems
17. Assist to remove, inspect, replace, adjust power steering pump drive belt	Obtain equipment and materials needed Review safety and service procedures Loosen the bolts holding the pump to its brackets Push inward on the pump to release tension Remove old belt Obtain correct belt and install in reverse order of removal Adjust belt tension to specifications After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the purpose and components associated with power steering Describe how to pry to tighten a power steering belt Explain how to test the power steering belt tension Discuss common safety precautions for servicing a pump drive belt
18. Assist to remove, reinstall power steering pump	Obtain equipment and materials needed Review safety and service procedures Remove nuts, bolts, hoses and brackets attached to power steering pump Remove pump Replace with new pump Re-attach nuts, bolts, hoses and brackets as required	Describe the purpose and components associated with power steering Discuss common problems associated with a faulty power steering pump Discuss common safety precautions for servicing a power steering pump

	After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
19. Inspect, replace, adjust tie rod ends (sockets), tie rod sleeves, & clamps	Obtain equipment and materials needed Review safety and service procedures REMOVE Separate the tie rod end form the steering knuckle or center link using a fork or puller Measure or mark tie rod end length Loosen the adjustment sleeve Unscrew the tie rod end Inspect for wear and damage REPLACE Turn the new tie rod end into the sleeve until it is the exact length of the old tie rod Install the tie rod ball stud in the center link or steering knuckle Tighten the fasteners to specification Install new cotter pins and bend correctly Tighten the adjustment sleeve Check steering action Check toe for proper adjustment After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain why it is important to mark the tie rod end length Compare the differences between a linkage steering and a rack-and-pinion steering system Describe the operation of hydraulic and electric-assist power steering systems Explain the operation of four-wheel steering systems
20. Assist to inspect, remove, install upper &/or lower ball joints	Obtain equipment and materials needed Review safety and service procedures Position the vehicle Remove the shock absorber Inspect the ball joint wear indicator or measure play in the joint by physically moving the control arm and joint Install a spring compressor on the coil spring Remove the nut securing the ball joint to the steering knuckle Separate the knuckle and the joint Press, screw or drill out the worn ball joint Clean the threads in the control arm if applicable Install new ball joints into the control arm Torque the ball joint properly After servicing, verify service and make adjustments as	Explain the purpose of upper and lower joints in a suspension and steering system Compare compression versus tension ball joints Discuss removal methods for removing worn pressed, bolted or screwed ball joints List common problems associated with faulty joints Discuss common safety precautions for servicing joints

	needed, cleanup work area, return tools to proper location, complete appropriate documentation	
21. Inspect, remove, install front stabilizer bar bushings, brackets, links	Obtain equipment and materials needed Review safety and service procedures Position the vehicle Inspect the bar for damage and loose fittings Remove bushings, bracket and links Remove damaged bar Re-attach bar with links, brackets and bushings After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss the purpose of the stabilizer bar Describe common problems associated with a faulty stabilizer bar Discuss common safety precautions for servicing the stabilizer bar
22. Assist to inspect, remove, install strut cartridge or assembly, strut coil spring, insulators, & upper strut bearing mount	Obtain equipment and materials needed Review safety and service procedures Position the vehicle Unbolt the steering knuckle or bearing support, the brake lines and upper strut assembly- to- body fasteners Mark the cam bolt for later camber re-adjustment Remove the strut assembly (coil spring and chock) as a single unit Inspect for wear and damage Install in reverse order Adjust camber and toe when replacing After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain the purpose and components of struts Explain the operation of the four common types of springs Compare the various types of suspension systems List common problems associated with faulty struts Discuss common safety precautions for servicing struts
23. Inspect rear suspension system leaf springs, bushings, center pins/bolts, & mounts	Obtain equipment and materials needed Review safety and service procedures Position the vehicle Inspect springs, bushings, pins/bolts, mounts for springs sticking out, wear, tear and missing parts Notify worksite professional if replacement is indicated After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain the purpose and components of struts Explain the operation of the four common types of springs Compare the various types of suspension systems List common problems associated with faulty rear suspension Discuss common safety precautions for servicing rear suspension
24. Perform pre-alignment inspection & measure vehicle ride height	Obtain equipment and materials needed Review safety and service procedures Inspect all steering and suspension related parts are in good working condition	Explain the principles of wheel alignment List the purpose of each wheel alignment setting Describe the use of different types of wheel alignment equipment

	Check for loose wheel bearings, wheel or tire run-out, worn tires, and tires of varied types and sizes, proper tire inflation Measure curb height and weight Check cradle alignment After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	List common problems associated with a faulty alignment Discuss common safety precautions for alignments
25. Dismount, inspect, balance, remount tire on wheel	Obtain equipment and materials needed Review safety and service procedures Remove wheels Dismount tires from wheel using tire changing machine Inspect tires for wear and tear STATIC BALANCE Add wheel weights opposite the heavy area of the wheel DYNAMIC BALANCE Add weights exactly where they are needed using a dynamic balancing machine Remount tire on the wheel Install tires on the vehicle After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain static and dynamic wheel balance Explain what is happening to the tire and steering when tires are imbalanced Summarize different methods of balancing wheels and tires Compare and contrast on-vehicle and off-vehicle balancing methods Compare different types of balancing machines Discuss how rear wheel drive or limited slip differential impacts on-car balancing procedures Explain the operation of the tire changing machine List common problems associated with a faulty wheel balance Discuss common safety precautions for servicing wheels
26. Inspect tire for air loss; Repair tire using internal patch	Obtain equipment and materials needed Review safety and service procedures Fill tire with air Place tire in a drum of water or wet tire with hose Look for air bubbles Mark the leak Remove tire from the wheel Inspect the inside surface for the puncture Fill injury with recommended plug or sealant Select patch of correct size and material Scuff the area the patch will cover Apply adhesive to inner liner Place patch on inner liner Use stitching tool to tightly bond patch After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	List common causes of tire air loss Discuss why tires are no longer recommended to be patched without dismounting Explain why areas larger than 13 millimeter or punctures in sidewalls should not be repaired or patched List common problems associated with underinflated or overinflated tires Discuss common safety precautions for servicing tires

27. Assist to test & calibrate power steering pressure monitoring system for operation	Obtain equipment and materials needed Review safety and service procedures Connect the pressure gauge and shutoff valve into the high pressure hose Follow manufacturer procedure Torque hose fittings properly Ensure system is full of fluid Start engine and idle with test valve open Turn steering wheel back and forth Close test valve only for a few seconds and check pressure If readings are abnormal, check and adjust pressure relief valve and pump After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss the purpose and components of the power steering pressure monitoring system Explain problems associated with power steering pressure malfunction Explain how to conduct the power steering pressure test Discuss common safety precautions preforming pressure tests
BRAKES (NATEF A5)		
28. Inspect brake lines, hoses, fittings for leaks kinks, rust, cracks, bulging, wear, loose fittings	Obtain equipment and materials needed Review safety and service procedures Position the vehicle Inspect all brake lines, hoses and connections for leaks on the floor, under the vehicle or at the wheels Check the brake lines for kinks or dents Check the brake hoses for cuts, cracks, bulges and wear Inspect the backing plates for fluid and grease Tighten loose fittings and supports After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the construction of brake lines Explain brake line flaring techniques Explain how to verify brake fluid leakage versus another type of fluid Describe the proper procedures for tightening fittings List common problems associated with faulty brake lines Discuss common safety precautions for servicing brake lines
29. Select, handle, store, fill brake fluids	Obtain equipment and materials needed Review safety and service procedures Check brake fluid level Select, handle, store, and fill to proper level Locate fluid leaks Inspect for general problems with hoses, belts, and other components After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the function and component of brake fluid Discuss common characteristics of brake fluid- viscosity, corrosion, compressibility Compare types of brake fluids

30. Bleed &/or flush brake system	Obtain equipment and materials needed Review safety and service procedures BLEED- MANUAL Attach one end of a hose to the bleeder screw Place the other end submerged in a jar partially filled with clean brake fluid Gently have another tech depress the brake pedal Open the bleed screw or fitting on the caliper or wheel cylinder while watching for air bubbles in the hose Close the bleeder screw or fitting; tell the tech release the brake pedal Repeat until no more bubbles come out of the hose Repeat procedure on the other brake assemblies or brake line connectors if needed BLEED- PRESSURE Pour enough brake fluid in the bleeder ball to reach the prescribed level Charge the ball with 10 to 15 pounds per square inch (psi) of air pressure Fill the master cylinder with brake fluid Install the adapter and hose on the master cylinder Open the valve on the hose Attach a bleeder hose to the farthest wheel cylinder bleed screw Submerge the free end of the hose in a glass container halfway filled with brake fluid Loosen the bleed screw Close off the bleed screw and remove the bleeder hose when fluid coming from the submerged end of the hose is free of air bubbles Repeat bleeding operation on the other wheel cylinders in proper order Close the valve at the bleeder ball hose Disconnect the bleeder from the master cylinder Check the brake fluid level in the reservoir FLUSH Pressure bleed all of the old brake fluid out of the system After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper	Compare bleeding vs. flushing Describe special precautions for master cylinders with plastic reservoirs List the components and operation of a brake system List common problems associated with a faulty brake system Discuss common safety precautions for servicing a brake system

	location, complete appropriate documentation	
31. Measure brake pedal height, travel, free play	Obtain equipment and materials needed Review safety and service procedures Determine if the brake pedal height can be adjusted Determine the brake pedal free height and travel Pump the brake pedal with the engine off to release the vacuum in the power booster Place a ruler against the car floor in the line with the arc of the brake pedal travel Move the pedal by hand to remove any pedal free play Moving the pedal, measure the pedal height at the top or bottom of the pedal Compare to vehicle specification After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify the parts of the brake pedal assembly Describe the operation and function of the brake pedal assembly
32. Check master cylinder for leaks & operation	Obtain equipment and materials needed Review safety and service procedures Position the vehicle Inspect the housing for leaks or cracks Check the fluid level in the master cylinder reservoir Check for unequal fluid levels in the master cylinder reservoir chambers on front disc or rear drum systems Inspect the condition of the fluid Add fluid if needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe basic procedures for servicing a master cylinder and a brake booster Identify the parts of a basic master cylinder and their function Describe possible causes and conditions of brake fluid in the master cylinder Discuss common safety precautions for servicing a master cylinder
33. Remove, clean, inspect, measure brake drum diameter	Obtain equipment and materials needed Review safety and service procedures Remove the tire and wheel assemblies Remove the brake drum Remove parts from the backing plate Inspect and clean parts Measure brake drum diameter using brake drum micrometer Reinstall shoes and drum After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss common components and operation of brake drum systems Explain common problems associated with faulty brake drums Discuss common safety precautions for servicing brake drums

34. Assist to remove, clean, inspect, lubricate, reassemble brake shoes, springs, pins, clips, levers, adjusters, etc.	Obtain equipment and materials needed Review safety and service procedures Remove the tire and wheel assemblies Remove the brake drum Remove parts from the backing plate Inspect and clean parts Clean the wheel bearings Pack, grease, and install new seal Lubricate and check fit Reinstall shoes and drum After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss common components of brake drum systems Explain common problems associated with faulty brake drums Discuss common safety precautions for servicing brake drums
35. Remove, clean, inspect, caliper assembly	Obtain equipment and materials needed Review safety and service procedures Position the vehicle Remove the wheels of the caliper to be serviced Mark the wheels for re-insertion Compress caliper piston(s) Remove the bolts from the caliper to the steering knuckle Lift the caliper away from the rotor Hang the caliper with a cord Replace worn or rusted retaining hardware Inspect the caliper housing for leaks or cracks Inspect the piston and bore for pitting, nicks, scrapes After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify the parts and functions of the caliper assembly and calipers Explain the operation of drum/disk brakes and power-assist units Explain how to service a disc brake assembly Explain how to service a drum brake assembly List common problems associated with a faulty caliper assembly Discuss common safety precautions for servicing a caliper assembly
36. Clean, inspect caliper mounting & slides/pins	Obtain equipment and materials needed Review safety and service procedures Position the vehicle Remove the wheels of the caliper to be serviced Mark the wheels for re-insertion Inspect the caliper mounting, slides and pins for cracks, breaks, missing pieces Check rotor for heat checking, cracks, and scorings After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper	Discuss components of a disc brake system Discuss common indications of disc brake system problems Define heat checking Discuss common safety precautions for servicing disc brakes

	location, complete appropriate documentation	
37. Remove, inspect, replace pads & retaining hardware	Obtain equipment and materials needed Review safety and service procedures Position the vehicle Remove the wheels of the caliper to be serviced Mark the wheels for re-insertion Compress caliper piston(s) Remove the bolts from the caliper to the steering knuckle Lift the caliper away from the rotor Hang the caliper with a cord Remove the clips (if applicable) and old pads from the caliper Fit the new pads into the calipers Compress the piston over the new brake pads in the caliper assembly with a C clamp Slide the caliper assemblies over the new pads Mount the caliper assembly Torque all bolts properly Install wheel and tighten lug nuts or bolts to specification After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss components of a disc brake system Discuss common indications of disc brake system problems Describe the recommended intervals for brake pad inspections Define the purpose and operation of the brake pads Describe importance of operating a vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations Discuss common safety precautions for servicing disc brakes
38. Lubricate, reinstall caliper, pads, & related hardware	Obtain equipment and materials needed Review safety and service procedures Check the caliper cylinder wall for wear, scoring, or pitting Check the caliper piston for wear; replace with a new piston if needed Inspect all hoses; replace any that are leaking or show deterioration Clean all the caliper parts with an approved cleaner Lubricate all parts liberally with clean brake fluid Work the new seal into the cylinder bore groove Compress the piston back into the caliper Reassemble the caliper halves using new gaskets and seals if needed Clean and lubricate caliper attachment hardware After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper	Discuss components of a disc brake system Discuss common indications of disc brake system problems Explain the importance of lubricant on sliding surfaces Explain the importance of methodical bench cleaning and inspection for this procedure Discuss common safety precautions for servicing disc brakes

	location, complete appropriate documentation	
39. Clean, inspect, measure rotor, rotor thickness, variation, & lateral run-out	Obtain equipment and materials needed Review safety and service procedures Loosen the wheel lug nuts Position the vehicle Remove wheel and caliper assembly Inspect the disc surface for warp age, cracks or scoring Inspect the disc thickness for variation Measure thickness using an outside micrometer in several places around the disc Measure run-out using a dial indicator Compare readings to disc specifications Consult with worksite professional to determine if new disc or resurfacing is indicated After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss components of a disc brake system Discuss common indications of disc brake system problems Define the purpose and operation of the rotor Describe when a rotor should be replaced Define run-out Explain how to measure disc thickness Discuss complications of a thin or warped disc Discuss common safety precautions for servicing rotors
40. Remove, reinstall rotor	Obtain equipment and materials needed Review safety and service procedures Loosen the wheel lug nuts Position the vehicle Remove wheel and caliper assembly Remove the rotor Reinstall new rotor After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss the components brake disc systems Explain common problems associated with brake disc systems Define the purpose and operation of the rotor Describe when a rotor should be replaced Discuss common safety precautions for servicing rotors
41. Check brake pad wear indicator	Obtain equipment and materials needed Review safety and service procedures Remove the wheel Check the thickness of the brake pads Check the location of the wear indicator Service brake pads as needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the function of the brake pad wear indicator Discuss components of a disc brake system Discuss common indications of disc brake system problems Describe the recommended intervals for brake pad inspections Define the purpose and operation of the brake pads Describe importance of operating a vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations Discuss common safety precautions for servicing disc brakes

42. Remove, clean, inspect, repack, install wheel bearings, seals, hub	Obtain equipment and materials needed Review safety and service procedures Partially loosen the lug nuts Raise and secure the vehicle NON DRIVING WHEELS Remove the wheel, grease cap, cotter pin, nut lock, adjusting nut and safety washer Wiggle the hub and pull out the outer wheel bearing Unbolt brake caliper and secure Slide hub outward Inspect and wipe bearing and race clean Re-grease and pack bearings Re-install bearings and race DRIVING WHEELS Remove the lug nuts, axle nut and wheel Remove the caliper to the side Unbolt the brake disc from the hub if needed Remove steering knuckle and hub from vehicle Pack new bearings with grease Press new bearings into place Install new grease seal Press seal into hub; hub into steering knuckle Install steering knuckle, brake disc, caliper, other components SEALED BEARINGS Remove bearing bolts and hub Install new bearing assembly After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss the purpose and basic components of wheel bearings and hubs Discuss common problems associated with failed bearings Compare serviceable bearings to non-serviceable sealed units Discuss common safety precautions for servicing bearings and hubs
43. Check parking brake cables & components	Obtain equipment and materials needed Review safety and service procedures Position the vehicle Remove the wheel Screw one lug to keep rotor in place Loosen parking brake cable at the equalizer Apply parking brake to determine movement Inspect the cables and linkages for wear, binding and corrosion	Describe the operation and components of parking brakes Describe lubricant procedures for metal vs. plastic coated cables Explain what excessive heavy drag could mean Identify traction control/vehicle stability control system components Describe the operation of a regenerative braking system List common problems associated with a faulty parking brakes

	Replace cables and linkages if needed Release the parking brake or engage one notch only Clean and lubricate the cable and linkages Turn the cable adjuster to remove excess slack Apply and release the parking brake to check for brake dragging After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss common safety precautions for servicing parking brakes
44. Check parking brake operation & indicator lights	Obtain equipment and materials needed Review safety and service procedures Check the indicator light system Use a digital multimeter (DMM) to locate electric circuit problems Replace the bulb if needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain the function of the digital multimeter (DMM) Describe how the DMM works to measure voltage, voltage drop, current flow and resistance Describe the purpose of the ground lead in using the DMM Describe the operation and components of parking brakes List common problems associated with a faulty parking brakes Discuss common safety precautions for servicing parking brakes
45. Assist to replace wheel bearing & race	Obtain equipment and materials needed Review safety and service procedures Remove wheel and brake caliper Gently pry the bearing grease cup away from hub by turning the wheel a little each time Remove the cotter pin, retaining ring, and spindle nut Remove hub or rotor-hub assembly Inspect the bearing and race for scoring, flat spots, or broken rollers Knock the outer race from the hub Flip over the hub and knock out the inner race, bearing, and seal Pack the new inner and outer wheel bearings by either pressing grease into each roller by hand or using a bearing packer and grease gun Remove old grease from inside hub Use the wheel-bearing tool to seat inner race into hub Place the bearing in the race and use the tool again to seat the grease seal	Explain service procedures for wheel bearings Identify the parts of driving and non-driving hub and wheel bearing assemblies Explain the purpose of greasing each roller Describe how to choose the drift for the wheel bearing tool Demonstrate the torque needed to re-tighten the nut Describe the dangers of over-tightening the spindle nut

	Flip over the hub and repeat for the outer race Pack a good amount, but do not completely fill inside the hub with grease Clean all excess grease from outside the hub Place the hub on the spindle Tighten the nut just enough to seat the whole assembly while spinning the hub Loosen the nut then re-tighten to specifications Pack more grease into the bearing and bearing cup Replace retaining ring and secure with a new cotter pin Gently replace the bearing grease cup being careful not to dent it Remove all grease from the outer surface of the hub or rotor Grab the top and bottom of the hub and check for play After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
ELECTRICAL/ELECTRONIC SYSTEMS (NATEF A6)		
46. Properly use a digital multimeter (DMM)	Obtain equipment and materials needed Review safety procedures Set the digital multimeter (DMM) to the correct voltage scale Connect the red lead to the appropriate point in the circuit to be measured Connect the black lead to the appropriate position on the circuit depending on the function to be measured Measure voltage, voltage drop, current flow and resistance After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits Explain the use of wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems Explain the function of the digital multimeter (DMM) Describe how the DMM works to measure voltage, voltage drop, current flow and resistance Describe the purpose of the ground lead in using the DMM
47. Use wiring diagrams	Obtain equipment and materials needed Review safety and service procedures Locate the parts to be tested for electrical problems Follow the lines to show how wiring is attached into each component of the circuit Look for faulty relays and wires in the faulty part After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper	Explain the purpose and use of wiring diagrams Describe common components of wiring diagrams

	location, complete appropriate documentation	
48. Inspect, test fusible links, breakers, fuses	Obtain equipment and materials needed Review safety procedures Inspect the fuses, breakers and links for tripping or breaks Reset the breaker or replace the fuse as needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify types of circuit protection devices used in an electrical circuit Define the functions of a fuse, fuse box, fusible link, circuit breaker Compare circuit breakers to fuses Explain the common functions and locations of fuses and breakers in a vehicle Describe types of circuit faults Discuss common safety precautions for servicing fuses and breakers
49. Replace electrical connectors & terminal ends	Obtain equipment and materials needed Review safety procedures Unscrew/unplug the wire with terminal end Remove terminal end Replace new terminal end onto end of wire by soldering or crimping into place After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	List types of common automotive wiring Explain common causes of wire damage Identify types of wire damage Describe wire repair procedures List common types of insulation damage List common types of wiring connectors used in vehicles Explain how to terminate primary wires Discuss common safety precautions for servicing connectors
50. Perform starter current draw tests	Obtain equipment and materials needed Review safety and service procedures Determine starter type and main starter components Disable the ignition system to prevent the vehicle from starting Connect a digital multimeter (DMM) across the battery Measure battery voltage Crank the engine for no more than 15-30 seconds Note the voltage and current readings If values are not within specifications, further tests are needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain the function of a starter List the components and operation of a starter List common problems associated with a faulty starter Discuss common safety precautions for servicing a starter system Explain the purpose of the current draw test on a starter Define the order for starting system tests Explain typical procedures for a starting motor rebuild Describe the function of major ignition system components Explain vacuum, centrifugal, and electronic ignition timing advance
51. Perform starter circuit voltage drop tests	Obtain equipment and materials needed Review safety and service procedures Determine starter type and main starter components Disable the ignition system to prevent the vehicle from starting Connect the digital multimeter (DMM) leads correctly	Explain the function of a starter List the components and operation of a starter List common problems associated with a faulty starter Discuss common safety precautions for servicing a starter system Explain the purpose of the voltage drop test

	Check voltage drop across different parts of the starter control circuit using the wiring diagram Note voltage drop readings After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Define the order for doing voltage drop testing using a wiring diagram
52. Remove, install starter	Obtain equipment and materials needed Review safety and service procedures REMOVAL Disconnect the battery Remove any shielding that covers the starter or its bolts Disconnect any accessible wires on the starter If needed, lower exhaust pipes by carefully loosening the bolt/studs Support the starter and remove the starter retaining bolts Check for shims Lower the starter and disconnect any wiring not yet removed Inspect the flywheel teeth for chipping and breakage INSTALL Reverse the steps taken to remove the starter; return shims to the same place if applicable After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain the function of a starter List the components and operation of a starter List common problems associated with a faulty starter Discuss common safety precautions for servicing a starter Compare different types of starting motors Explain when it is best to repair vs. replace a starter motor
53. Remove, inspect, reinstall generator (alternator)	Obtain equipment and materials needed Review safety and service procedures Disconnect the battery REMOVE Loosen the bolts and remove the fan belt Remove the wires from the generator, note their location Remove the generator INSPECT Check for battery problems Check the condition of the generator belt; Replace if needed INSTALL Connect the wires back on the generator in the proper locations with insulating washers, if applicable Hand screw in the bolts without tightening	Explain the function of the alternator List the components and operation of an alternator List common problems associated with a faulty alternator Discuss common safety precautions for servicing an alternator Describe the importance of proper belt tightening

	Slip the belt over the engine and generator pulley Align belt properly Adjust belt tension correctly Tighten the bolts Reconnect the battery After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
54. Remove, reinstall door panel	Obtain equipment and materials needed Review safety and service procedures Remove all screws that hold the door panel to the frame Unscrew and remove the door lock button Remove the inner door handle and window crank, if applicable Pop out the spring clips around the outside of the door panel After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the importance of proper door removal Describe the parts of the door panel