

Steel Center Career and Technical Center
Course Name: Automotive Mechanics Technology



Unit Name: 100 - ORIENTATION

Unit Number: 100

Dates: Fall 2019 **Hours:**

Unit Description/Objectives:

Student will know and be able to demonstrate basic knowledge of safety practices including theory and practical laboratory organization, basic shop management including explaining and following all lab rules, and understand career opportunities available in the automotive industry.

Tasks:

PA101 - Explain and follow all lab rules.

PA102 - Participate in basic shop management.

PA103 - Participate in parts ordering.

PA104 - Demonstrate auto shop safety and hygiene.

PA105 - Demonstrate the use of service information.

PA106 - Demonstrate proper telephone courtesy.

PA107 - Identify vehicle by: sight, V.I.N. and/or ID tag.

PA108 - Identify career paths within the career and technical education program.

Standards / Assessment Anchors

Focus Standard/Anchor #1

CC.3.5.11-12.D. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

Supporting Standards/Anchors

13.1.11A Relate careers to individual interests, abilities and aptitudes

CC.3.6.11-12.H. Draw evidence from informational texts to support analysis, reflection, and research.

13.2.11 E Demonstrate, in the career acquisition process, the application of essential workplace skills/knowledge, such as, but not limited to: commitment, communication, dependability, health/safety, laws and regulations (that is Americans with Disabilities Act, Child Labor Law, Fair Labor Standards Act, OSHA, Material Safety Data Sheets), personal initiative, Self-advocacy, scheduling/time management, team building, technical literacy and technology.

Connecting Standard/Anchor

CC.3.5.11-12.B.

Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Supporting Standards/Anchors

CC.3.5.11-12.D.

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

CC.1.2.11–12.G

Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

Instructional Activities:

Knowledge:

- Participate in lecture and discussion and respond to questions.
- Complete reading assignments.
- Complete written assignments.
- Participate with the group activities.
- Complete Task Sheet Assignment.
- View and answer questions using interactive shopware video.
- Understand and identify common chemicals using material worksheets (MSDS).
- Participate in group discussions on safety concerns related to industry.
- Prepare work stations and check for safety requirements.

- Describe the type of skills needed to be an auto technician.
- Explain the tasks completed by each type of auto technician.
- Summarize the ASE certification program.
- Describe the different types of on line 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.
- Correctly answer ASE certification test questions concerning service information.

- Identify and locate the most important parts of a vehicle.
- Describe the purpose of the fundamental automotive systems.
- Explain the interaction of automotive systems.
- Describe major automobile design variations.
- Comprehend later lessons with a minimum amount of difficulty.
- Correctly answer ASE certification test questions that require knowledge of the major parts and systems of a vehicle.

Skill:

- Complete assigned projects.
- Shop Layout Poster.
- Shop Safety Signs.
- Inventory large equipment.
- Identify by sight vehicle VIN or ID.
- Complete a parts ordering form.
- Participate in parts ordering.
- Identify career pathways for job specialties.

Remediation:

Re-teach major concepts
Review with teacher assistance
Study group
Worksheet
Study groups
Reading comprehension packets

Placing events in a time line
Create a chart
Retest or alternative assessment
Study guides
Computer assisted instruction
Checklists

Enrichment:

Student will work on NATEF required tasks from student workbook.
Working on skills for SkillsUSA, for local and state competitions.
Mentorship opportunities
ASE Practice tests
On-line Web Training
Job-shadow.
Co-op education.

Safety:

Student Must:
Handle material in a safe manner.
Use protective clothing and equipment.
Use hand tools and air tools in a safe manner.
Use adequate ventilation when working in enclosed area.
Follow manufacturer's directions when using any product, tool, equipment, etc.
Use proper safety precautions when using /operating hand tools.
Use tools and equipment in a professional work like manner according to OSHA standards and EPA regulations.
Know and follow the established safety rules at all times.

Assessment:

Written test
Oral activity test
Activity worksheets
Workbooks
Quizzes
Pre/Post Tests
Homework

Writing Activities
quizlet
Check Lists
Role-play Activities
Oral Presentation
Current Events
Portfolio

Resources/Equipment:

"Comprehensive Online Light Vehicle Training | CDX Automotive." Comprehensive Online Light Vehicle Training | CDX Automotive. Web. 16 Nov. 2015.

Stockel, Martin W., and Martin T. Stockel. Auto Diagnosis, Service, and Repair. Tinley Park, Ill.: Goodheart Willcox, 2003. Print.

Stockel, Martin W. Workbook for Auto Diagnosis, Service, and Repair. Tinley Park, Ill.: Goodheart-Willcox, 2003. Print.

"Your Single Source for OE Repair Information." ALLDATA Repair. Web. 16 Nov. 2015. <<http://repair.edu.alldata.com/>>

Assorted Parts Ordering Vendors
Steel Center Technical Institute:Material Safety Data Worksheets
Telephone
Safety Equipment
Cleaning Supplies
Shop Vehicles
Laptops and Desktops

Steel Center Career and Technical Center

Course Name: Automotive Technology



Unit Name: PA200 - SAFETY

Unit Number: PA200

Dates: Fall 2019 **Hours:**

Unit Description/Objectives:

Student will know and be able to demonstrate basic knowledge of safety practices including theory and practical laboratory organization including all EPA and OSHA Regulations.

Tasks:

PA201 - Identify and follow all safety rules.

PA202 - Demonstrate the ability to secure vehicles on jack stands and hydraulic lifts.

PA203 - Demonstrate the ability to safely set-up/shut-down oxygen acetylene welding equipment.

PA204 - Identify chemical safety, 'Right-To-Know Laws' and Materials Safety Data Sheets (MSDS).

PA205 - Identify and demonstrate the safe use of hand tools.

PA206 - Identify and demonstrate the safe use of power tools.

PA207 - Identify and demonstrate the safe use of protective clothing and equipment.

PA208 - Identify and demonstrate the safe use of fire protection equipment.

PA209 - Identify and demonstrate the safe use of shop equipment.

PA210 - Explain EPA and OSHA regulations.

Standards / Assessment Anchors

Focus Standard/Anchor #1

- 13.2.11 E Demonstrate, in the career acquisition process, the application of essential workplace skills/knowledge, such as, but not limited to: commitment, communication, dependability, health/safety, laws and regulations (that is Americans with Disabilities Act, Child Labor Law, Fair Labor Standards Act, OSHA, Material Safety Data Sheets), personal initiative, Self-advocacy, scheduling/time management, team building, technical literacy and technology.

Supporting Standards/Anchors

CC.3.5.11-12.C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

3.4.10.E7 Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.

3.4.12.E5 Explain how the design of intelligent and non-intelligent transportation systems depends on many processes and innovative techniques.

Connecting Standard/Anchor

CC.2.4.5.A.1 Solve problems using conversions within a given measurement system.3.4.12.B1 Analyze ethical, social, economic, and cultural considerations as related to the development, selection, and use of technologies.

Supporting Standards/Anchors

CC.2.3.6.A.1 Apply appropriate tools to solve real-world and mathematical problems involving area, surface area, and volume.

CC.2.1.HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems.

Instructional Activities:

Knowledge:

Identify common automotive hand tools.

List safety rules for hand tools.

Select the right tool for a given job.

Maintain and store tools properly.

Use hand tools safely.

Correctly answer ASE certification test questions referring to hand tools.

Participate in lecture and discussion and respond to questions.

Complete reading assignments.

Complete written assignments.

Participate with the group activities.

Complete Task Sheet Assignment.

View and answer questions using interactive shopware video.

Understand and identify common chemicals using material worksheets (MSDS).

Read MSDS Sheet.

Participate in group discussions on safety concerns related to industry.

Fill out personal forms.

Prepare work stations and check for safety requirements.

Describe the typical layout and sections of an auto 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.

Correctly answer ASE certification test questions referring to hand tools.

Identify common automotive hand tools.

List safety rules for hand tools.

List the most commonly used power tools and equipment.

Describe the uses for power tools and equipment.

Explain the advantages of one type of tool over another.

Explain safety rules that pertain to power tools and equipment.

Correctly answer ASE certification test questions that require a knowledge of power tools and equipment.

Define OSHA and its major functions.

Identify the hazardous waste produced from automobiles.

Define and illustrate common safety equipment used in the automobile service area.

Complete assigned project.

Create chart on hand tool.

Create chart on power tools.

List the safety rules used in the automobile service area.

Develop proper attitudes concerning safety in the automobile service area.
List the possible danger areas or common chemicals and accidents in the automobile service area.

Describe both customary and metric measuring systems.
Identify basic measuring tools.
Describe the use of common measuring tools.
Use conversion charts.
List safety rules relating to measurement.
Summarize basic math facts.
Correctly answer ASE certification test questions that require a basic understanding of measurement and math.

Use jack stands and jacks appropriately.
Use electric hydraulic lift appropriately.
Complete hand tool work stations activity.
Complete power tool work stations activity.
Complete activities on various shop large equipment.
Demonstrate safe use of tools during every activity.
Role playing activity related to MSDS.
Role playing activity related to fire safety procedures and clothing.
Practical activity on identifying unsafe tool
Identify common automotive hand tools.
List safety rules for hand tools.
Select the right tool for a given job.
Maintain and store tools properly.
Use hand tools safely.

Skill:

Select the right tool for a given job.
Maintain and store tools properly.
Use hand tools safely.
Use air tools safely.

Remediation:

Re-teach major concepts
Review with teacher assistance
Study group
Worksheets
Group tutoring
Study groups
Review games
Reading comprehension packets

Placing lessons in a time line
Create a chart
Retest or alternative assessment
Technology integration
Study guides
Computer assisted instruction
Checklists

Enrichment:

Student will work on NATEF required tasks from student workbook.
Working on skills for SkillsUSA , for local and state competition.
Job shadowing.
Mentorship opportunities
ASE Practice tests
On-line Web Training

Safety:

Student Must:
Handle material in a safe manner.
Use protective clothing and equipment.
Use hand tools in a safe manner.
Use adequate ventilation when working in enclosed area.

Follow manufacturer's directions when using any product, tool, equipment, etc.
Use proper safety precautions when using /operating hand tools.
Use tools and equipment in a professional work like manner according to OSHA standards and EPA regulations.
Know and follow the established safety rules at all times.

Assessment:

Written test
Oral activity test
Activity worksheets
Workbooks
Quizzes
Pre/Post Tests
Homework
Summaries
Log/Journal
Writing Activities
Video/DVD Worksheets
Rubrics

Check Lists
Role-play Activities
Debates
Oral Presentation
Diagrams
Individual Projects
Group Projects
Research Papers
Current Events
Portfolio
Question & Answer

Resources/Equipment:

Auto Diagnosis Service, and Repair (2003) The Goodhearth-Willcox Company, Inc.

CDX on line Modern Automotive Service Technician (MAST) On-line Training . (2008)).Tinley Park:
IL: The Goodhearth-Willcox Company, Inc.

All-Data on line shop Management Solutions.

Steel Center Material Safety Data Worksheet

CDX and PDE Task Assessment Worksheet

Laptops and Desktop Computers

Exhaust Hoses
Ear Protectors
Safety Glasses
Respirator
Protective gloves
First Aid Kit
Fire extinguisher
Waste Can
Eye Wash Station
Stationary
Mobile
Shop Uniform
Steel Toed Boots

Steel Center Career and Technical Center

Course Name: Automotive Technology



Unit Name: PA300 - TOOLS/FASTENERS

Unit Number: PA300

Dates: Fall 2019 **Hours:**

Unit Description/Objectives:

Student will know and be able to demonstrate basic knowledge on the use of measuring, re-threading tools, and identifying fasteners according to industry standards.

Tasks:

PA301 - Identify and use fasteners and bolts.

PA302 - Demonstrate the ability to correctly drill and use re-threading tools.

PA303 - Demonstrate the ability to correctly read and interpret precision automotive measuring tools.

PA304 - Demonstrate the ability to correctly use automotive tools.

PA305 - Perform common fastener and thread repairs, to include: remove broken bolt, restore internal and external threads, and repair internal threads with a threaded insert.

Standards / Assessment Anchors

Focus Standard/Anchor #1

- CC.3.5.11-12.C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards/Anchors

- CC.2.1.HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems.
- CC.2.1.HS.F.5 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- CC.3.5.9-10.D. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Connecting Standard/Anchor

CC.2.1.6.E.2 Identify and choose appropriate processes to compute fluently with multi-digit numbers.

Supporting Standards/Anchors

- CC.2.4.5.A.1 Solve problems using conversions within a given measurement system.
- CC.2.1.6.E.4 Apply and extend previous understandings of numbers to the system of rational numbers.

Instructional Activities:

Knowledge:

Participate in lecture and discussion and respond to questions.
Complete reading assignments.
Complete written assignments.
Participate with the group activities.
Complete Task Sheet Assignment.
View and answer questions using interactive shopware video.
Understand and identify common chemicals using material worksheets (MSDS).
Participate in group discussions on safety concerns related to industry.
Fill out personal forms.
Prepare work stations and check for safety requirements.
Identify commonly used automotive fasteners.
Summarize safety rules relating to fasteners, gaskets, seals, and sealants.
Correctly answer ASE certification test questions that require a knowledge of fasteners, gaskets, seals, and sealants.

Describe both customary and metric measuring systems.
Identify basic measuring tools.
Describe the use of common measuring tools.
Use conversion charts.
List safety rules relating to measurement.
Summarize basic math facts.
Correctly answer ASE certification test questions that require a basic understanding of measurement and math.

Skill:

Complete various work stations activities.
Select and use fasteners properly.
Remove, select, and install gaskets, seals, and sealants correctly.
Repair a variety of damaged threads and chase threads in a bore.
Measure cylinder oversize, taper, and out-of-round.
Hone cylinders.
Measure drum diameter.
Measure rotors with the appropriate micronmeters.
Measure Brake Pads and Brake Shoes

Compare the gauge readings:
Oil Pressure Gauge test.
Compression Gauge test.
Vacuum Gauge test.
Cylinder Leakage Gauge test.
Fuel Pressure Gauge test.
Back Pressure Gauge test.
Gas Analyzer Gauge test.
Evap/smoke Pressure Gauge test.
Refrigerant Gauge test.
Temperature Gauge test.
Alternative Output Gauge test.
Starter motor Output Gauge test.
Power Steering Pressure Gauge test.
Tire Pressure Gauge test.
Cylinder Balance Gauge test.
Coolant System Pressure Gauge test.
Plastic Gauge bearing clearance test.
Feeler Gauge test.
Valve Spring height measurement test.
Cylinder head deck measurement.
Cylinder block deck surface measurement.

Piston ring to groove clearance measurement.
Brake rotor lateral run-out gauge measurement test.
Flywheel lateral run-out gauge measurement test.
End Play measurement gauge test.

Remediation:

Re-teach major concepts
Review with teacher assistance
Study group
Worksheets
Quizlet Worksheets
Quizlet Quizzes and Test
Q and A
Group tutoring
Peer tutoring
Study groups

Review games
Reading comprehension packets
Placing events in a time line
Create a chart
Retest or alternative assessment
Technology integration
Study guides
Computer assisted instruction
Checklists

Enrichment:

Student will work on NATEF required tasks from student workbook.
Working on skills for SkillsUSA, for Local and State Competitions.
Mentorship opportunities
ASE Practice tests
On-line Web Training

Safety:

Student Must:
Handle material in a safe manner.
Use protective clothing and equipment.
Use hand tools in a safe manner.
Use adequate ventilation when working in enclosed area.
Follow manufacturer's directions when using any product, tool, equipment, etc.
Use proper safety precautions when using /operating hand tools.
Use tools and equipment in a professional work like manner according to OSHA standards and EPA regulations.
Know and follow the established safety rules at all times.

Assessment:

Written test
Oral activity test
Activity worksheets
Workbooks
Quizzes
Pre/Post Tests
Essays
Summaries

Writing Activities
Video/DVD Worksheets
Rubrics
Check Lists
Oral Presentation
Diagrams
Individual Projects
Research Papers
Current Events

Resources/Equipment:

Stockel Martin W. Stockel Martin T.(2003). Automotive Technology .Modern Automotive Technology
Goodhearth-Willcox Company, Inc.

Module 1, Lesson 6 & 9 : Measurements and Math / Fasteners, Gaskets,Seals and Sealants. Modern
Automotive Service Technician (MAST) On-Line Training . (2008)).Tinley Park: IL: The Goodhearth-
Willcox Company, Inc.

Stockel Martin W. Stockel Martin T.(2003). Textbook,Workbook and Student Job Manual - Modern
Automotive Technology The Goodhearth-Willcox Company, Inc.

All-Data Shop Management.

Steel Center Technical Institute, Material Safety Data Worksheet.

CDX on line Curriculum.

Laptops and Desktops

Safety equipment:

Safety glasses
Full Face Shields
Engines on Engine Stands
Engine Components on Workbenches
Complete Vehicle in shop bays
Fasteners from Fastenal Supplies
Tap and Die tool set
Dial Indicator Measuring Tool
Caliber Measuring Tool
Two Electric Reversible Drills
Micrometer Measuring Tool
Oil Pressure Gauge
Compression Gauge
Vacuum Gauge
Cylinder Leakage Gauge
Fuel Pressure Gauge
Back Pressure Gauge
Gas Analyzer Gauge
Evap/smoke Pressure Gauge
Refrigerant Gauge
Temperature Gauge

Battery Load Gauge
Alternative Output Gauge
Starter motor Output Gauge
Power Steering Pressure Gauge
Tire Pressure Gauge
Cylinder Balance Gauge
Coolant System Pressure Gauge
Plastic Gauge bearing clearance
Feeler Gauge
Valve Spring height measurement
Cylinder head deck measurement
Cylinder block deck surface
measurement
Piston ring to groove clearance
measurement
Brake rotor lateral run-out gauge
measurement
Flywheel lateral run-out gauge
measurement
End Play measurement gauge

Steel Center Career and Technical Center

Course Name: Automotive Technology



Unit Name: PA400 - CERTIFICATIONS

Unit Number: PA400

Dates: Fall 2019 **Hours:**

Unit Description/Objectives:

Student will know and be able to identify the regulations on Safety Inspections, Emission Inspections, Hazardous Material, Refrigerant Recovery, handling and Recycling of Refrigerant and also to obtain these certifications.

Tasks:

PA401 - Prepare to obtain PA Safety Inspection Certification.

PA402 - Prepare to obtain EPA 609 Refrigerant Recovery, Recycling Certification.

PA403 - Prepare to obtain Emission Inspection Certification.

L404 - Safety Pollution / SP2

Standards / Assessment Anchors

Focus Standard/Anchor #1

CC.3.5.11-12.C.

Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards/Anchors

CC.2.1.HS.F.5 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

CC.2.1.HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems.

CC.2.4.HS.B.1 Summarize, represent, and interpret data on a single count or measurement variable.

Connecting Standard/Anchor

CC.2.3.6.A.1 Apply appropriate tools to solve real-world and mathematical problems involving area, surface area, and volume.

Supporting Standards/Anchors

CC.2.1.6.E.4 Apply and extend previous understandings of numbers to the system of rational numbers.

CC.2.4.5.A.1 Solve problems using conversions within a given measurement system.

Instructional Activities:

Knowledge:

Participate in lecture and discussion and respond to questions

Complete reading assignments

Complete written assignments

Participate with the group activities
Review PA State Guidelines for Passing a Vehicle for State Inspection
Complete documentation paperwork for PA State Inspection
Complete SP/2 on-line course on Handling of Refrigerants

Skill:

Complete Task Sheet Assignment
Perform measurements, checks, and visual inspections on the safety components required by the PA State requirements
Determine if the emissions devices are present on the vehicle and in good working condition
Perform Visual Inspection of Vehicle
Perform Inspection Breakdown:
Brake Systems Inspection
Brake System Measurements
Tire System Inspection
Tire System Measurement
Steering System Inspection
Steering System Measurement
Suspension System Inspection
Suspension System Measurements

Remediation:

Re-teach major concepts	Reading comprehension packets
Review with teacher assistance	Placing events in a time line
Study group	Create a chart
Worksheets	Retest or alternative assessment
Individual tut	Technology integration
Peer tutoring	Study guides
Study groups	Computer assisted instruction
Review games	

Enrichment:

Student will work on NATEF required tasks from student workbook.
Working on skills for Skills-USA , for local and state competitions.

Safety:

Student must:
Handle material in a safe manner.
Use protective clothing and equipment.
Use hand tools in a safe manner.
Use adequate ventilation when working in enclosed area.
Follow manufacturer's directions when using any product, tool, equipment, etc.
Use proper safety precautions when using /operating hand tools.
Use tools and equipment in a professional work like manner according to OSHA standards.
Know and follow the established safety rules at all times.

Assessment:

Written test	Check Lists
Oral activity test	Role-play Activities
Activity worksheets	Debates
Workbooks	Oral Presentation
Quizzes	Diagrams
Pre/Post Tests	Individual Project
Summaries	Research Papers
Writing Activities	Current Events
Video/DVD Worksheets	Portfolio
Rubrics	

Resources/Equipment:

Common hand tools:

Wrenches--open end, box end, and combination

Sockets--shallow, deep, 6-point, 12-point, standard, and impact

Drive size--1/4 inch, 3/8 inch, 1/2 inch.

Socket accessories--speed handle, extensions 3 to 36 inches long, universals, flex handle, and T bar

Screwdrivers--flat blade (standard), Phillips, clutch, and Torx

Pliers--slip joint, water pump, diagonal cutting, vise grip, snap ring, needle nose, battery, and duck bill

Punches--taper, pin, and center

Hammers--ball peen, soft face, and brass

Fluke Digital Volt Ohm Meter

Oscilloscope – Snap-On Vantage Meter

Hunter Digital Alignment Machine.

Deluxe Snap-On Back Pressure Gauge Kit

Coolant Pressure Test Kit

Electronic Stethoscope

Fuel Pressure Line Disconnect Kit

Brake Flaring Tool Kit

Micrometer Measuring Tool

Caliber Measuring Tool

Dial Indicator Measuring Tool

Above the ground vehicle lifts

Drive-On lifts with hydraulic jacks

Tripod Jack Stands

Screw Jack Stand

Standard Jack Stand

Four 2 ½ ton Floor Jacks

Torque Wrenches: 3/8 – ½ inch Drive

Inch Pound Torque Wrench

Stationary AAMCO Brake Lathe

Stockel Martin W. Stockel Martin T.(2003). Automotive Technology .Modern Automotive Technology
Goodhearth-Willcox Company, Inc.

Module 1, Lesson 6 & 9 : Measurements and Math / Fasteners, Gaskets,Seals and Sealants. Modern
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All-Data Shop Management.

Steel Center Technical Institute, Material Safety Data Worksheet.

CDX on line Curriculum.

Laptops and Desktops

Steel Center Career and Technical Center

Course Name: Automotive Technology



Unit Name: PA500 - SUSPENSION AND STEERING

Unit Number: PA500

Dates: Fall 2019 **Hours:**

Unit Description/Objectives:

Student will know and be able to identify components and diagnosis and demonstrate basic knowledge of tires, wheels, steering and suspension systems to industry standards.

Tasks:

- PA501 - Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
- PA502 - Identify and interpret suspension and steering system concerns; determine necessary action.
- PA503 - Research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins.
- PA504 - Locate and interpret vehicle and major component identification numbers.
- PA505 - Disable and enable supplemental restraint system (SRS).
- PA506 - Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).
- PA507 - Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets.
- PA508 - Inspect and replace rack and pinion steering gear inner tie rod ends (sockets) and bellows boots.
- PA509 - Determine proper power steering fluid type; inspect fluid level and condition.
- PA510 - Flush, fill, and bleed power steering system.
- PA511 - Diagnose power steering fluid leakage; determine necessary action.
- PA512 - Remove, inspect, replace, and adjust power steering pump belt.
- PA513 - Remove and reinstall power steering pump.
- PA514 - Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.
- PA515 - Inspect and replace power steering hoses and fittings.
- PA516 - Inspect and replace pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper.
- PA517 - Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps.
- PA518 - Inspect and test electric power assist steering.

PA519 - Remove, inspect, and install upper and lower control arms, bushings, shafts, and rebound bumpers.

PA520 - Remove, inspect and install strut rods and bushings.

PA521 - Remove, inspect, and install upper and/or lower ball joints.

PA522 - Remove, inspect, and install steering knuckle assemblies.

PA523 - Remove, inspect, and install short and long arm suspension system coil springs and spring insulators.

PA524 - Remove, inspect, install, and adjust suspension system torsion bars; inspect mounts.

PA525 - Remove, inspect, and install stabilizer bar bushings, brackets, and links.

PA526 - Remove, inspect, and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.

PA527 - Inspect, remove, and replace shock absorbers.

PA528 - Remove, inspect, and service or replace front and rear wheel bearings.

PA529 - Lubricate suspension and steering systems.

PA530 - Perform pre-alignment inspection and measure vehicle ride height; perform necessary action.

PA531 - Prepare vehicle for wheel alignment on the alignment machine; perform four wheel alignment by checking and adjusting front and rear wheel caster, camber; and toe as required; center steering wheel.

PA532 - Check SAI (steering axis inclination) and included angle; determine necessary action.

PA533 - Check rear wheel thrust angle; determine necessary action.

PA534 - Check for front wheel setback; determine necessary action.

PA535 - Check front and/or rear cradle (subframe) alignment; determine necessary action.

PA536 - Inspect tire condition; identify tire wear patterns; check and adjust air pressure; determine necessary action.

PA537 - Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action.

PA538 - Rotate tires according to manufacturer's recommendations.

PA539 - Measure wheel, tire, axle flange, and hub runout; determine necessary action.

PA540 - Diagnose tire pull problems; determine necessary action.

PA541 - Dismount, inspect, and remount tire on wheel; Balance wheel and tire assembly (static and dynamic).

PA542 - Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor.

PA543 - Reinstall wheel; torque lug nuts.

PA544 - Inspect tire and wheel assembly for air loss; perform necessary action.

PA545 - Repair tire using internal patch.

Standards / Assessment Anchors

Focus Standard/Anchor #1

- CC.3.5.11-12.C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards/Anchors

CC.2.1.HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems.
CC.2.1.HS.F.5 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
CC.3.5.11-12.A. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

Connecting Standard/Anchor

CC.3.6.11-12.B. Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

Supporting Standards/Anchors

CC.3.6.11-12.B. Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
CC.3.6.11-12.C. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Instructional Activities:

Knowledge:

Identify the parts of a tire and wheel.
Describe different methods of tire construction.
Explain tire and wheel sizes.
Describe tire ratings.
Identify the parts of driving and nondriving hub and wheel bearing assemblies
Correctly answer ASE certification test questions requiring a knowledge of tires, wheels, hubs, and wheel bearings.
Diagnose common tire, wheel, and wheel bearing problems. Describe tire inflation and rotation procedures.
Measure tire and wheel runout.
Explain static and dynamic wheel balance.
Summarize different methods of balancing wheels and tires.
Explain service procedures for wheel bearings.
Use safe practices while servicing tires and wheels.
Correctly answer ASE certification test questions requiring knowledge of the service and repair of tires, wheels, and wheel bearings.
Identify the major parts of a suspension system.
Describe the basic function of each suspension system component.
Explain the operation of the four common types of springs.
Compare the various types of suspension systems.
Explain automatic suspension leveling systems.
Correctly answer ASE certification test questions requiring a knowledge of suspension system construction and design.

Skill:

Diagnose problems relating to a suspension system.
Replace shock absorbers and ball joints.
Describe the removal and replacement of springs.
Service a strut assembly.
Replace control arm bushings.
Use safe work procedures while repairing suspension systems.
Diagnose and repair electronically-controlled suspension systems.
Correctly answer ASE certification test questions about the diagnosis and repair of Identify the major parts of a steering system.
Explain the operating principles of steering systems.
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.
Correctly answer ASE certification test questions requiring knowledge of modern steering and suspension system designs.
Describe common steering system problems.
Properly inspect and determine the condition of a steering system.
Explain basic steering column repair operations.
Adjust both worm gears and rack-and-pinion gears.
Describe service and repair procedures for a rack-and-pinion steering gear.
Service power steering belts, hoses, and fluid.
Explain how to complete basic power steering tests.
Use safe work procedures.
Correctly answer ASE certification test questions about the diagnosis and repair of today's steering systems.
Explain the principles of wheel alignment.
List the purpose of each wheel alignment setting.
Perform a prealignment inspection of tires, steering, and suspension systems.
Describe caster, camber, and toe adjustment.
Explain toe-out on turns, steering axis inclination, and tracking.
Describe the use of different types of wheel alignment equipment.
Correctly answer ASE certification test questions requiring a knowledge of wheel alignment angles and procedures.
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 of restraint systems.
Describe restraint system design variations.
Summarize the operation of restraint system sensors, inflator modules, and electronic control modules.
Correctly answer ASE certification test questions requiring a knowledge of restraint system operation and construction.
Explain how to inspect and repair seat belts.
Summarize how to scan restraint systems for problems.
Describe safety rules for working with air bags.
Summarize the procedure for air bag replacement.
Explain how to replace air bag sensors.
Describe how to service an air bag controller.
Correctly answer ASE certification test questions about the diagnosis and repair of restraint systems.

A. General Suspension and Steering Systems Diagnosis

- 1 Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
- 2 Identify and interpret suspension and steering system concerns; determine necessary action.
- 3 Research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins.
- 4 Locate and interpret vehicle and major component identification numbers.

B. Steering Systems Diagnosis and Repair

- 1 Disable and enable supplemental restraint system (SRS).
- 2 Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).
- 3 Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action.
- 4 Diagnose power steering gear (non-rack-and-pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action.
- 5 Diagnose power steering gear (rack-and-pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action. - P-2
- 6 Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action. - P-2
- 7 Adjust non-rack-and-pinion worm bearing preload and sector lash. - P-3
- 8 Remove and replace rack-and-pinion steering gear; inspect mounting bushings and brackets. - P-2
- 9 Inspect and replace rack-and-pinion steering gear inner tie rod ends (sockets) and bellows boots. - P-2
- 10 Determine proper power steering fluid type; inspect fluid level and condition. - P-1
- 11 Flush, fill, and bleed power steering system. - P-2
- 12 Diagnose power steering fluid leakage; determine necessary action. - P-2
- 13 Remove, inspect, replace, and adjust power steering pump belt. - P-1
- 14 Remove and reinstall power steering pump. - P-2
- 15 Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment. - P-2
- 16 Inspect and replace power steering hoses and fittings. -P-2
- 17 Inspect and replace pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper. - P-2
- 18 Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps. -P-1
- 19 Test and diagnose components of electronically controlled steering systems using a scan tool; determine necessary action. P-3
- 20 Inspect and test electric power assist steering. - P-3

A4 Suspension and Steering NATEF Competency Checklist page 3

- 21 Identify hybrid vehicle power steering system electrical circuits, service and safety precautions. - P-3

C. Suspension Systems Diagnosis and Repair

- 1 Diagnose short and long arm suspension system noises, body sway, and uneven ride height concerns; determine necessary action. P-1
- 2 Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine necessary action. P-1
- 3 Remove, inspect, and install upper and lower control arms, bushings, shafts, and rebound bumpers. P-2
- 4 Remove, inspect, and install strut rods and bushings. P-2
- 5 Remove, inspect, and install upper and/or lower ball joints. P-1
- 6 Remove, inspect, and install steering knuckle assemblies. P-2
- 7 Remove, inspect, and install short and long arm suspension system coil springs and spring insulators. P-3
- 8 Remove, inspect, install, and adjust suspension system torsion bars; inspect mounts. P-3
- 9 Remove, inspect, and install stabilizer bar bushings, brackets, and links. P-2
- 10 Remove, inspect, and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount. P-1
- 11 Remove, inspect, and install leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts. P-3

D. Related Suspension and Steering Service

- 1 Inspect, remove, and replace shock absorbers. P-1
- 2 Remove, inspect, and service or replace front and rear wheel bearings. P-1
- 3 Test and diagnose components of electronically controlled suspension systems using a scan

tool; determine necessary action. P-3

A4 Suspension and Steering NATEF

- 4 Diagnose, inspect, adjust, repair or replace components of electronically controlled steering systems (including sensors, switches, and actuators); initialize system as required. P-3
- 5 Describe the function of the idle speed compensation switch. P-3
- 6 Lubricate suspension and steering systems. P-2

E. Wheel Alignment Diagnosis, Adjustment, and Repair

- 1 Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary action. P-1
- 2 Perform prealignment inspection and measure vehicle ride height; perform necessary action. P-1
- 3 Prepare vehicle for wheel alignment on the alignment machine; perform four wheel alignment by checking and adjusting front and rear wheel caster, camber; and toe as required; center steering wheel. P-1
- 4 Check toe-out-on-turns (turning radius); determine necessary action. P-2
- 5 Check SAI (steering axis inclination) and included angle; determine necessary action. P-2
- 6 Check rear wheel thrust angle; determine necessary action. P-1
- 7 Check for front wheel setback; determine necessary action. P-2
- 8 Check front and/or rear cradle (subframe) alignment; determine necessary action. P-3

F. Wheel and Tire Diagnosis and Repair

- 1 Inspect tire condition; identify tire wear patterns; check and adjust air pressure; determine necessary action. P-1
- 2 Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action. P-2
- 3 Rotate tires according to manufacturer's recommendations. P-1
- 4 Measure wheel, tire, axle flange, and hub runout; determine necessary action. P-2
- 5 Diagnose tire pull problems; determine necessary action. P-2

A4 Suspension and Steering NATEF Competency

- 6 Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly (static and dynamic). P-1
- 7 Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor. P-2
- 8 Reinstall wheel; torque lug nuts. P-1
- 9 Inspect tire and wheel assembly for air loss; perform necessary action. P-1
- 10 Repair tire using internal patch. P-1
- 11 Inspect, diagnose, and calibrate tire pressure monitoring system. P-2

Remediation:

Re-teach major concepts
Review with teacher assistance
Study group
Worksheets
Individual tutoring
Group activity
Peer tutoring
Study groups

Review games
Reading comprehension packets
Placing events in a time line
Retest or alternative assessment
Technology integration
Study guides
Computer assisted instruction
Checklists

Enrichment:

Student will work on NATEF required tasks from student workbook.
Working on skills for SkillsUSA, for Local and State competitions.

Safety:

Student Must:

Handle material in a safe manner.

Use protective clothing and equipment.

Use hand tools in a safe manner.

Use adequate ventilation when working in enclosed area.

Follow manufacturer's directions when using any product, tool, equipment, etc.

Use proper safety precautions when using /operating hand tools.

Use tools and equipment in a professional work like manner according to OSHA standards and EPA regulations.

Know and follow the established safety rules at all times.

Assessment:

Written test

Oral activity test

Activity worksheets

Workbooks

Quizzes

Pre/Post Test

Summaries

Log/Journal

Writing Activities

Video/DVD Worksheets

Rubrics

Check Lists

Oral Presentation

Diagrams

Individual Projects

Group Projects

Research Papers

Current Events

Portfolio

Resources/Equipment:

Stockel Martin W. Stockel Martin T. Suspension and Steering: Modern Automotive Technology
Tinley Park: IL: The Goodhearth-Willcox Company, Inc.

Suspension System Fundamentals. Modern Automotive Service Technician (MAST) on-line Training
. (2008)).Tinley Park: IL: The Goodhearth-Willcox Company, Inc.

Stockel Martin W. Stockel Martin T. Textbook, Workbook and Student Job Manual - Modern
Automotive Technology Tinley Park: IL: The Goodheart-Willcox Company, Inc.
All-Data for shop management.

Steel Center Career and Technical School, Material Safety Data Worksheet

Laptops and Desktops

Safety equipment:

Safety glasses

Full Face Shields

Engine Components on Workbenches

Complete Vehicle in shop bays

Fasteners from Fastenal Supplies

Tap and Die tool set

Dial Indicator Measuring Tool

Caliber Measuring Tool

Two Electric Reversible Drills

Micrometer Measuring T

Power Steering Pressure Gauge

Tire Pressure Gauge

Feeler Gauge

End Play measurement gauge



Unit Description/Objectives:

Student will know and be able to check, test, evaluate, diagnose, analyze, service, repair, replace, and interpret all components of the general brake system, electronic brake control system and the traction control system.

Tasks:

- PA601 - Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
- PA602 - Identify and interpret brake system concern; determine necessary action.
- PA603 - Research applicable vehicle and service information, such as brake system operation, vehicle service history, service precautions, and technical service bulletins.
- PA604 - Locate and interpret vehicle and major component identification numbers.
- PA605 - Measure brake pedal height, travel, and free play (as applicable); determine necessary action.
- PA606 - Check master cylinder for internal/external leaks and proper operation; determine necessary action.
- PA607 - Remove, bench bleed, and reinstall master cylinder.
- PA608 - Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports; determine necessary action.
- PA609 - Replace brake lines, hoses, fittings, and supports.
- PA610 - Fabricate brake lines using proper material and flaring procedures (double flare and ISO types).
- PA611 - Select, handle, store, and fill brake fluids to proper level.
- PA612 - Inspect, test, and/or replace components of brake warning light system.
- PA 613 - Bleed and/or flush brake system.
- PA614 - Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action.
- PA615 - Remove, clean, inspect, and measure brake drums; determine necessary action.
- PA616 - Refinish brake drum; measure final drum diameter.
- PA617 - Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.

PA618 - Inspect and install wheel cylinders.

PA619 - Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings.

PA620 - Install wheel, torque lug nuts, and make final checks and adjustments.

PA621 - Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pulsation concerns; determine necessary action.

PA622 - Remove caliper assembly; inspect for leaks and damage to caliper housing; determine necessary action.

PA623 - Clean and inspect caliper mounting and slides/pins for operation, wear, and damage; determine necessary action.

PA624 - Reassemble, lubricate, and reinstall caliper, pads, and related hardware; seat pads, and inspect for leaks.

PA625 - Clean, inspect, and measure rotor thickness, lateral run-out, and thickness variation; determine necessary action.

PA626 - Remove and reinstall rotor.

PA627 - Refinish rotor on vehicle; measure final rotor thickness.

PA628 - Refinish rotor off vehicle; measure final rotor thickness.

PA629 - Install wheel, torque lug nuts, and make final checks and adjustments.

PA630 - Check brake pad wear indicator system operation; determine necessary action.

PA631 - Test pedal free travel; check power assist operation.

PA632 - Check vacuum supply to vacuum-type power booster.

PA633 - Remove, clean, inspect, repack, and install wheel bearings and replace seals; install hub and adjust bearings.

PA634 - Check parking brake cables and components for wear, binding, and corrosion; clean, lubricate, adjust or replace as needed.

PA635 - Check parking brake and indicator light system operation; determine necessary action.

PA636 - Check operation of brake stop light system; determine necessary action.

PA637 - Replace wheel bearing and race.

PA638 - Inspect and replace wheel studs.

PA639 - Remove and reinstall sealed wheel bearing assembly.

PA640 - Identify and inspect electronic brake control system components; determine necessary action.

PA641 - Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine necessary action.

PA642 - Depressurize high-pressure components of the electronic brake control system.

PA643 - Bleed the electronic brake control system hydraulic circuits.

PA644 - Identify traction control/vehicle stability control system components.

Standards / Assessment Anchors

Focus Standard/Anchor #1

- 13.2.11 E Demonstrate, in the career acquisition process, the application of essential workplace skills/knowledge, such as, but not limited to: commitment, communication, dependability, health/safety, laws and regulations (that is Americans with Disabilities Act, Child Labor Law, Fair Labor Standards Act, OSHA, Material Safety Data Sheets), personal initiative, Self-advocacy, scheduling/time management, team building, technical literacy and technology.

Supporting Standards/Anchors

3.4.10.D2 Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it.

3.4.12.C3 Apply the concept that many technological problems require a multi-disciplinary approach.

3.4.12.E7 Analyze the technologies of prefabrication and new structural materials and process as they pertain to constructing the modern world.

Focus Standard/Anchor #2

- CC.3.5.11-12.C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards/Anchors

CC.3.5.11-12.D. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

CC.2.1.HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems.

CC.3.5.11-12.G. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Connecting Standard/Anchor

- CC.2.7.D.1 Analyze proportional relationships and use them to model and solve real-world and mathematical problems.

Supporting Standards/Anchors

CC.2.1.6.E.4 Apply and extend previous understandings of numbers to the system of rational numbers.

C.C.2.3.6.A.1 Apply appropriate tools to solve real-world and mathematical problems involving area, surface area, and volume.

Instructional Activities:

Knowledge:

- Explain the hydraulic and mechanical principles of a brake system.
 - Identify the major parts of an automotive brake system.
 - Define the basic functions of the major parts of a brake system.
 - Compare drum and disc brakes.
 - Describe the operation of parking brakes.
 - Explain the operation of power brakes.
 - Correctly answer ASE certification test questions requiring a knowledge of automotive brake systems.
 - 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.
 - Diagnose problems in anti-lock brake systems.
 - Repair anti-lock brake systems.
 - Describe the purpose and operation of traction control and stability control systems.
 - Diagnose and repair traction control and stability control systems.
 - Correctly answer ASE certification test questions requiring knowledge of anti-lock brake systems, traction control systems, and stability control systems.
-
- Describe basic procedures for servicing a master cylinder and a brake booster.
 - Explain how to service a disc brake assembly.
 - Explain how to service a drum brake assembly.
 - Describe the procedures for both manual and pressure bleeding of a brake system.
 - Cite the safety rules that should be followed when servicing brake systems.
 - Correctly answer ASE certification test questions about the diagnosis and repair of brake systems.
-
- Participate in lecture and discussion and respond to questions.
 - Complete reading assignments.
 - Complete written assignments.
 - Participate with the group activities.
 - Complete Task Sheet Assignment.
 - Identify and interpret brake system concern and determine necessary action.

Skill:

- V. BRAKES
 - A. General Brake Systems Diagnosis
 - 11. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1 94–95
 - 12. Identify and interpret brake system concern; determine necessary action. P-1 1394–1398, 1421
 - 13. Research applicable vehicle and service information, such as brake system operation, vehicle service history, service precautions, and technical service bulletins. P-1 85–95
 - 14. Locate and interpret vehicle and major component identification numbers. P-1 86, 87
 - B. Hydraulic System Diagnosis and Repair
 - 11. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law). P-1 1371, 1372
 - 12. Measure brake pedal height, travel, and free play (as applicable); determine necessary action. P-1 1396
 - 13. Check master cylinder for internal/external leaks and proper operation; determine necessary action. P-1 133, 1395–1397
 - 14. Remove, bench bleed, and reinstall master cylinder. P-1 1400, 1401
 - 15. Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action. P-2 1394–1396
 - 16. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging

- or wear; tighten loose fittings and supports; determine necessary action. P-1 1396, 1397, 1403
17. Replace brake lines, hoses, fittings, and supports. P-2 1403
 18. Fabricate brake lines using proper material and flaring procedures (double flare and ISO types). P-2 1403

NATEF Task List Correlation Chart 45

Task Number and Description Priority Page #s

19. Select, handle, store, and fill brake fluids to proper level. P-1 1378, 1397
10. Inspect, test, and/or replace metering (hold-off), proportioning (balance), pressure differential, and combination valves. P-3 1387, 1388, 1395
11. Inspect, test, and/or replace components of brake warning light system. P-3 1386, 1387
12. Bleed and/or flush brake system. P-1 1401–1403
13. Test brake fluid for contamination. P-1 1397

C. Drum Brake Diagnosis and Repair

11. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action. P-1 1394–1396
12. Remove, clean, inspect, and measure brake drums; determine necessary action. P-1 1410, 1411, 1414–1416
13. Refinish brake drum; measure final drum diameter. P-1 1413, 1414
14. Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble. P-1 1410, 1411, 1414–1416
15. Inspect and install wheel cylinders. P-2 1410–1413
16. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings. P-2 1416
17. Install wheel, torque lug nuts, and make final checks and adjustments. P-1 1260, 1261

D. Disc Brake Diagnosis and Repair

11. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pulsation concerns; determine necessary action. P-1 1394–1395
12. Remove caliper assembly; inspect for leaks and damage to caliper housing; determine necessary action. P-1 1403–1405
13. Clean and inspect caliper mounting and slides/pins for operation, wear, and damage; determine necessary action. P-1 1404
14. Remove, inspect and replace pads and retaining hardware; determine necessary action. P-1 1404
15. Disassemble and clean caliper assembly; inspect parts for wear, rust, scoring, and damage; replace seal, boot, and damaged or worn parts. P-3 1405
16. Reassemble, lubricate, and reinstall caliper, pads, and related hardware; seat pads, and inspect for leaks. P-1 1405, 1408
17. Clean, inspect, and measure rotor thickness, lateral run-out, and thickness variation; determine necessary action P-1 1405–1408
18. Remove and reinstall rotor. P-1 1268–1272
19. Refinish rotor on vehicle; measure final rotor thickness. P-1 1406–1407
10. Refinish rotor off vehicle; measure final rotor thickness. P-1 1406–1407
11. Retract caliper piston on an integrated parking brake system. P-3 1388, 1416
12. Install wheel, torque lug nuts, and make final checks and adjustments. P-1 1260, 1261

E. Power Assist Units Diagnosis and Repair

11. Test pedal free travel; check power assist operation. P-2 1396, 1399
12. Check vacuum supply to vacuum-type power booster. P-1 1398, 1399
13. Inspect the vacuum-type power booster unit for leaks; inspect the check valve for proper operation; determine necessary action. P-1 1398, 1399
14. Inspect and test hydraulically assisted power brake system for leaks and proper operation; determine necessary action. P-3 1399

F. Miscellaneous (Wheel Bearings, Parking Brakes, Electrical, Etc.) Diagnosis and Repair

11. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action. P-1 1259, 1260, 1394, 1395
12. Remove, clean, inspect, repack, and install wheel bearings and replace seals; install hub and adjust bearings. P-1 1268–1273
13. Check parking brake cables and components for wear, binding, and corrosion; clean, lubricate, adjust or replace as needed. P-2 1393, 1398, 1416, 1417
14. Check parking brake and indicator light system operation; determine necessary action. P-1 1397, 1398
15. Check operation of brake stop light system; determine necessary action. P-1 639–640, 644
16. Replace wheel bearing and race. P-2 1268–1273
17. Inspect and replace wheel studs. P-1 1261–1262
18. Remove and reinstall sealed wheel bearing assembly. P-1 1268–1273

G. Electronic Brake, Traction and Stability Control Systems Diagnosis and Repair

11. Identify and inspect electronic brake control system components; determine necessary action. P-1 1422–1440
12. Diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system; determine necessary action. P-2 1444
13. Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine necessary action. P-1 1433–1439
14. Depressurize high-pressure components of the electronic brake control system. P-3 1433
15. Bleed the electronic brake control system hydraulic circuits. P-1 1433
16. Remove and install electronic brake control system electrical/ electronic and hydraulic components. P-3 1434–1439
17. Test, diagnose, and service electronic brake control system speed sensors (digital and analog), toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data). P-1 1434–1439
18. Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.). P-3 1433
19. Identify traction control/vehicle stability control system components. P-3 1430–1433, 1439–1441
10. Describe the operation of a regenerative braking system.

Remediation:

Re-teach major concepts	Reading comprehension packets
Review with teacher assistance	Placing events in a time line
Study group	Retest or alternative assessment
Worksheets	Technology integration
Individual tutoring	Study guides
Group tutoring	Computer assisted instruction
Study groups	Checklists
Review games	

Enrichment:

Student will work on NATEF required tasks from student workbook.
Working on skills for SkillsUSA, for local and state competitions.

Safety:

Student Must:
Handle material in a safe manner.
Use protective clothing and equipment.
Use hand tools in a safe manner.
Use adequate ventilation when working in enclosed area.

Follow manufacturer's directions when using any product, tool, equipment, etc.
Use proper safety precautions when using /operating hand tools.
Use tools and equipment in a professional work like manner according to OSHA standards.
Know and follow the established safety rules at all times.

Assessment:

Written test
Activity worksheets
Workbooks
Quizzes
Pre/Post Tests
Writing Activities
Video/DVD Worksheets
Rubrics

Check List
Oral Presentation
Diagrams
Individual Projects
Group Projects
Research Papers
Current Events

Resources/Equipment:

Stockel Martin W. Stockel Martin T.(2003).Module 1, Lesson 2: Automotive Careers and Required Skills. 22-33.Modern Automotive Technology Tinley Park: IL: The Goodhearth-Willcox Company, Inc.

Module 7, Lesson 8: Brake System Fundamentals,Modern Automotive Service Technician (MAST) . (2008)).Tinley Park: IL: The Goodhearth-Willcox Company, Inc.

Stockel Martin W. Stockel Martin T.(2003).Chapter 34; Automotive Careers and ASE Certification.. 15-18.. Workbook - Modern Automotive Technology (7th ed). Tinley Park: IL: The Goodheart-Willcox Company, Inc.

Snap-on Incorporated. (2008). All-Data 2017

Web base training software:
Automotive Technology Workbooks
MSDS handbook
NATEF Task Assessment Worksheet
Computers
Text book: Service Information (ShopKey 5)

Common hand tools:

Wrenches--open end, box end, and combination
Sockets--shallow, deep, 6-point, 12-point, standard, and impact
Drive size--1/4 inch, 3/8 inch, 1/2 inch, and 3/4 inch
Socket accessories--speed handle, extensions 3 to 36 inches long, universals, flex handle, and T bar
Screwdrivers--flat blade (standard), Phillips, clutch, and Torx
Pliers--slip joint, water pump, diagonal cutting, vise grip, snap ring, needle nose, battery, and duck bill
Punches--taper, pin, and center
Hammers--ball peen, soft face, and brass
Electronic Stethoscope
Brake Flaring Tool Kit
Micrometer Measuring Tool
Caliber Measuring Tool
Dial Indicator Measuring Tool
Above the ground vehicle lifts
Drive-On lifts with hydraulic jacks
Tripod Jack Stands
Screw Jack Stand
Standard Jack Stand
Four 2 1/2 ton Floor Jacks
Torque Wrenches: 3/8 - 1/2 inch Drive
Inch Pound Torque Wrench
Stationary AAMCO Brake Lathe
Hunter On-Vehicle Brake Lathe

Two Electric Reversible Drills
1/2 Inch Drive Impact Wrench – battery operated
1/2 Inch Drive Impact Air Wrench
3/8 Drive Air Impact Ratchet
1/4 Air Impact Ratchet
Air Powered Cut-Off Wheel Tool
Air Powered Hammer / Chisel Tool
Air Powered Grinder Tool Kit
Bench Grinder / Wire Wheel Tool
Oxy/acetylene cutting torch
Drain pans and funnels
School –Owned Shop Vehicles

Course Name: Automotive Technology

Unit Name: PA700 - ELECTRICAL/ELECTRONIC
SYSTEMS

Unit Number: PA700

Dates: Fall 2019 **Hours:**



Unit Description/Objectives:

Student will know and be able to test, repair, and replace electrical and electronics systems.

Tasks:

- PA701 - Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
- PA702 - Identify and interpret electrical/electronic system concern; determine necessary action.
- PA703 - Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins.
- PA704 - Locate and interpret vehicle and major component identification numbers.
- PA705 - Use wiring diagrams during diagnosis of electrical circuit problems.
- PA706 - Check electrical circuits with a test light; determine necessary action.
- PA707 - Check electrical circuits using fused jumper wires; determine necessary action.
- PA708 - Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
- PA709 - Measure and diagnose the cause(s) of excessive parasitic draw; determine necessary action.
- PA710 - Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.
- PA711 - Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; perform necessary action.
- PA712 - Remove and replace terminal end from connector; replace connectors and terminal ends.
- PA713 - Repair wiring harness (including CAN/BUS systems).
- PA714 - Perform solder repair of electrical wiring.
- PA715 - Identify location of hybrid vehicle high voltage circuit disconnect (service plug) location and safety procedures.
- PA716 - Perform battery state-of-charge test; determine necessary action.
- PA717 - Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action.
- PA718 - Maintain or restore electronic memory functions.
- PA719 - Inspect, clean, fill, and/or replace battery, battery cables, connectors, clamps, and hold-downs.
- PA720 - Perform battery charge.

PA721 - Start a vehicle using jumper cables or an auxiliary power supply.

PA722 - Identify electronic modules, security systems, radios, and other accessories that require re-initialization or code entry following battery disconnect.

PA723 - Perform starter current draw tests; determine necessary action.

PA724 - Perform starter circuit voltage drop tests; determine necessary action.

PA725 - Inspect and test starter relays and solenoids; determine necessary action.

PA726 - Remove and install starter in a vehicle.

PA727 - Inspect and test switches, connectors, and wires of starter control circuits; perform necessary action.

PA728 - Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition.

PA729 - Perform charging system output test; determine necessary action.

PA730 - Diagnose charging system for the cause of undercharge, no-charge, and overcharge conditions.

PA731 - Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners; check pulley and belt alignment.

PA732 - Remove, inspect, and install generator (alternator).

PA733 - Perform charging circuit voltage drop tests; determine necessary action.

PA734 - Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action.

PA735 - Inspect, replace, and aim headlights and bulbs.

PA736 - Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action.

PA737 - Inspect and test gauges and gauge sending units for cause of abnormal gauge readings; determine necessary action.

PA738 - Inspect and test connectors, wires, and printed circuit boards of gauge circuits; determine necessary action.

PA739 - Diagnose the cause of incorrect operation of warning devices and other driver information systems; determine necessary action.

PA740 - Diagnose incorrect horn operation; perform necessary action.

PA741 - Diagnose incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action.

PA742 - Diagnose incorrect washer operation; perform necessary action.

PA743 - Diagnose incorrect operation of motor-driven accessory circuits; determine necessary action.

PA745 - Disarm and enable the airbag system for vehicle service.

PA746 - Remove and reinstall door panel.

Standards / Assessment Anchors

Focus Standard/Anchor #1

- 13.2.11 E Demonstrate, in the career acquisition process, the application of essential workplace skills/knowledge, such as, but not limited to: commitment, communication, dependability, health/safety, laws and regulations (that is Americans with Disabilities Act, Child Labor Law, Fair Labor Standards Act, OSHA, Material Safety Data Sheets), personal initiative, Self-advocacy, scheduling/time management, team building, technical literacy and technology

Supporting Standards/Anchors

- 3.4.10.A2 Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems..
- 4.10.D2 Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it..
- 3.2.10.B4 Describe quantitatively the relationships between voltage, current, and resistance to electrical energy and power. Describe the relationship between electricity and magnetism as two aspects of a single electromagnetic force.

Focus Standard/Anchor #2

- CC.3.5.11-12.C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards/Anchors

- CC.2.1.HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems.
- CC.3.5.9-10.D. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
- CC.3.5.11-12.D. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

Connecting Standard/Anchor

- CC.2.2.7.B.3 Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations.

Supporting Standards/Anchors

- CC.2.1.6.E.2 Identify and choose appropriate processes to compute fluently with multi-digit numbers.
- CC.2.1.6.E.4 Apply and extend previous understandings of numbers to the system of rational numbers.
- CC.2.1.7.D.1 Analyze proportional relationships and use them to model and solve real-world and mathematical problems.

Instructional Activities:

Knowledge:

- 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.
Explain different kinds of automotive wiring.
Perform fundamental electrical tests.
Correctly answer ASE certification test questions that require a basic understanding of electricity and electronics.
Explain the operating principles of a lead-acid battery.
Describe the basic parts of an automotive battery.
Compare conventional and maintenance-free batteries.
Explain how temperature and other factors affect battery performance.
Describe safety practices that should be followed when working with batteries.
Correctly answer ASE certification test questions that require a basic knowledge of automotive –batteries.
Visually inspect a battery for obvious problems.
Describe safety practices to follow when testing and servicing batteries.
Correctly answer ASE certification test questions on battery service.
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.
Correctly answer ASE Certification test questions that require knowledge of starting system fundamentals.
Explain typical procedures for a starting motor rebuild.
Describe the safety practices that should be followed when testing or repairing a starting system.
Correctly answer ASE certification test questions on starting system diagnosis, service, and repair.

Explain the operating principles of automotive 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.
Correctly answer ASE certification test questions on light, instrumentation, wiper, and horn systems.

Describe the operating principles of a radio.
Explain the basic difference between AM and FM radios.
Explain the operation and service of power windows.
Sketch a rear window defogger circuit.
Describe and repair a power lock system.
Summarize the operation and testing of a speed control system.
Describe safety practices that must be followed when working with electrical accessory circuits.
Correctly answer ASE certification test questions on the service of sound systems and power accessories.

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.
Correctly answer ASE certification test questions that require a knowledge of charging system fundamentals.
Describe safety practices to follow when testing or repairing a charging system.
Correctly answer ASE certification test questions on charging system diagnosis and repair.

Identify the major parts of a hybrid drive system.

Explain the construction and operation of hybrid drive assemblies.
List the safety measures that must be followed when working on high-voltage hybrid drive systems.
Use on-board diagnostics to find the source of problems in a hybrid vehicle propulsion system.
Identify the most common problems that occur in a hybrid vehicle drive system.
Perform basic tests to verify hybrid drive trouble codes.
Safely remove and replace a hybrid battery pack, power control module, power cables, ECUs, and motor-generator assemblies.

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 of restraint systems.
Describe restraint system design variations.
Summarize the operation of restraint system sensors, inflator modules, and electronic control modules.
Correctly answer ASE certification test questions requiring a knowledge of restraint system operation and construction.

Explain how to inspect and repair seat belts.
Summarize how to scan restraint systems for problems.
Describe safety rules for working with air bags.
Summarize the procedure for air bag replacement.
Explain how to replace air bag sensors.
Describe how to service an air bag controller.
Correctly answer ASE certification test questions about the diagnosis and repair of restraint systems.

Explain the operation of vehicle security systems.
Explain the operation of vehicle navigation systems.
Compare security system design variations.
Summarize the operation of alternate power sources for vehicles.
Discuss how engineers might change vehicle designs in the future to increase safety, comfort, dependability, and environmental control of our planet.

Participate in lecture and discussion and respond to questions.
Complete reading assignments.
Complete written assignments.
Participate with the group activities.
Complete Task Sheet Assignment.
List and describe the troubleshooting steps.
Demonstrate the usage of a DVOM measuring tool.
Read wiring schematics.

Skill:

Perform common battery tests.
Clean a battery case and terminals.
Charge a battery.
Jump-start a car using a second battery.
Replace a defective battery.
Diagnose common starting system troubles.
Make orderly starting system tests.
Remove and replace a starting motor.
Explain typical procedures for a starting motor rebuild.
Adjust a neutral safety switch.
Diagnose charging system troubles.
Inspect a charging system.
Test charging system output with a voltmeter or a load tester.
Remove, test, repair, and replace an alternator.
Adjust an alternator belt.
Remove and replace a voltage regulator
Diagnose problems in light, wiper, and horn systems.

Replace burned-out bulbs.
Diagnose basic sound system problems.
Test and evaluate electrical systems.
Disassemble, test, and reassemble components.
Demonstrate use of AVR Battery/Alternator/Starter Tester.
Demonstrate use of test light.
Solder and repair wiring.
Disable and re-enable Supplemental Inflatable Restraint System.

VI. ELECTRICAL/ELECTRONIC SYSTEMS

A. General Electrical System Diagnosis

11. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1 94–95
12. Identify and interpret electrical/electronic system concern; determine necessary action. P-1 641–642, 657–662, 665, 666
13. Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service recaptions, and technical service bulletins. P-1 85–95
14. Locate and interpret vehicle and major component identification numbers. P-1 86, 87
15. Diagnose electrical/electronic integrity of series, parallel and series parallel circuits using principles of electricity (Ohm's Law). P-1 99, 659–662
16. Use wiring diagrams during diagnosis of electrical circuit problems. P-1 661
17. Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems, including: source voltage, voltage drop, current flow, and resistance. P-1 106
18. Check electrical circuits with a test light; determine necessary action. P-2 102–103
19. Check electrical/electronic circuit waveforms; interpret readings and determine needed repairs. P-2 880–891
10. Check electrical circuits using fused jumper wires; determine necessary action. P-2 105–106
11. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action. P-1 659–661
12. Measure and diagnose the cause(s) of excessive parasitic draw; determine necessary action. P-1 488, 489
13. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action. P-1 100, 660, 661
14. Inspect and test switches, connectors, relays, solenoid solid-state devices, and wires of electrical/electronic circuits; perform necessary action. P-1 102–107, 641–642, 659–661
15. Remove and replace terminal end from connector; replace connectors and terminal ends. P-1 104–105
16. Repair wiring harness (including CAN/BUS systems). P-1 103–105
17. Perform solder repair of electrical wiring. P-1 104, 105
18. Identify location of hybrid vehicle high voltage circuit disconnect (service plug) location and safety procedures P-2 710–711

B. Battery Diagnosis and Service

11. Perform battery state-of-charge test; determine necessary action. P-1 486–488
12. Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action. P-1 487, 488, 492, 493
13. Maintain or restore electronic memory functions. P-1 277
14. Inspect, clean, fill, and/or replace battery, battery cables, connectors, clamps, and hold-downs. P-1 134, 483–486, 494, 517
15. Perform battery charge. P-1 489–492
16. Start a vehicle using jumper cables or an auxiliary power supply. P-1 491, 492
17. Identify high voltage circuits of electric or hybrid electric vehicle and related safety precautions. P-3 698–706, 709–711

C. Starting System Diagnosis and Repair

11. Perform starter current draw tests; determine necessary action. P-1 514–517

12. Perform starter circuit voltage drop tests; determine necessary action. P-1 492, 493, 517, 518
13. Inspect and test starter relays and solenoids; determine necessary action. P-2 517, 518
14. Remove and install starter in a vehicle. P-1 520–521, 527
15. Inspect and test switches, connectors, and wires of starter control circuits; perform necessary action. P-2 518, 519, 1119–1122
16. Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition. P-2 513–519

D. Charging System Diagnosis and Repair

11. Perform charging system output test; determine necessary action. P-1 551
12. Diagnose charging system for the cause of undercharge, no-charge, and overcharge conditions. P-1 548–556
13. Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners; check pulley and belt alignment. P-1 548–550, 557, 560
14. Remove, inspect, and install generator (alternator). P-1 556–562
15. Perform charging circuit voltage drop tests; determine necessary action. P-1 553–555

E. Lighting Systems Diagnosis and Repair

11. Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action. P-1 632–635, 641–642
12. Inspect, replace, and aim headlights and bulbs. P-2 641, 642–647
13. Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action. P-2 635–639, 642–644
14. Identify system voltage and safety precautions associated with high intensity discharge headlights. P-2 634

F. Gauges, Warning Devices, and Driver Information Systems Diagnosis and Repair

11. Inspect and test gauges and gauge sending units for cause of abnormal gauge readings; determine necessary action. P-1 285–288, 647–653, 762–763, 798
12. Inspect and test connectors, wires, and printed circuit boards of gauge circuits; determine necessary action. P-3 651, 652, 653
13. Diagnose the cause of incorrect operation of warning devices and other driver information systems; determine necessary action. P-1 653–654, 683, 688
14. Inspect and test sensors, connectors, and wires of electronic (digital) instrument circuits; determine necessary action. P-3 285–288, 651, 652, 659–662

G. Horn and Wiper/Washer Diagnosis and Repair

11. Diagnose incorrect horn operation; perform necessary action. P-1 658, 659
12. Diagnose incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action. P-1 657, 658
13. Diagnose incorrect washer operation; perform necessary action. P-2 658

H. Accessories Diagnosis and Repair

11. Diagnose incorrect operation of motor-driven accessory circuits; determine necessary action. P-1 674–681
12. Diagnose incorrect heated glass, mirror, or seat operation; determine necessary action. P-3 682, 683
13. Diagnose incorrect electric lock operation (including remote keyless entry); determine necessary action. P-1 678
14. Diagnose incorrect operation of cruise control systems; determine necessary action. P-3 684–687
15. Diagnose supplemental restraint system (SRS) concerns; determine necessary action. P-1 1535–1540
16. Disarm and enable the airbag system for vehicle service. P-1 1535
17. Diagnose radio static and weak, intermittent, or no radio reception; determine necessary action. P-3 669
18. Remove and reinstall door panel. P-1 680, 681
19. Diagnose body electronic system circuits using a scan tool; determine necessary action. P-2 268–271
10. Check for module communication (including CAN/BUS systems) errors using a scan tool. P-2 268, 269, 270
11. Diagnose the cause of false, intermittent, or no operation of anti-theft systems. P-3 1544–1547
13. Perform software transfers, software updates, or flash reprogramming on electronic modules.

Remediation:

Re-teach major concepts
Review with teacher assistance
Study group
Worksheets
Individual tutoring
Group tutoring
Study groups
Review games
Reading comprehension packets
Placing events in a time line
Retest or alternative assessment
Technology integration
Study guides
Computer assisted instruction

Enrichment:

Student will work on NATEF required tasks from student workbook.
Working on skills for SkillsUSA, for local and state competition.

Safety:

Student Must:
Handle material in a safe manner.
Use protective clothing and equipment.
Use hand tools in a safe manner.
Use adequate ventilation when working in enclosed area.
Follow manufacturer's directions when using any product, tool, equipment, etc.
Use proper safety precautions when using /operating hand tools.
Use tools and equipment in a professional work like manner according to OSHA standards.
Know and follow the established safety rules at all times.

Assessment:

Written test
Activity worksheets
Workbooks
Quizzes
Pre/Post Tests
Writing Activities
Video/DVD Worksheets

Rubrics
Check Lists
Oral Presentation
Diagrams
Individual Projects
Group Projects
Current Events

Resources/Equipment:

Stockel Martin T.(2003).Module 1, Lesson 2: Automotive Careers and Required Skills. 22-33.Modern Automotive Technology (7th ed). Tinley Park: IL: The Goodheart-Willcox Company, Inc.
Stockel Martin T.(2003).Chapter 13; Automotive Careers and ASE Certification.. 15-18.. Workbook - Modern Automotive Technology Tinley Park: IL: The Goodheart-Willcox Company, Inc.

All- Data shop Management Solutions
Automotive Technology Workbooks
CDX on line curriculum
Computers

Common hand tools:

Wrenches--open end, box end, and combination
Sockets--shallow, deep, 6-point, 12-point, standard, and impact
Drive size--1/4 inch, 3/8 inch, 1/2 inch, and 3/4 inch
Socket accessories--speed handle, extensions 3 to 36 inches long, universals, flex handle, and T bar
Screwdrivers--flat blade (standard), Phillips, clutch, and Torx
Pliers--slip joint, water pump, diagonal cutting, vise grip, snap ring, needle nose, battery, and duck bill
Punches--taper, pin, and center
Hammers--ball peen, soft face, and brass
Fluke Digital Volt Ohm Meter
Oscilloscope – Snap-On Vantage Meter
Torque Wrenches: 3/8 – 1/2 inch Drive
Inch Pound Torque Wrench
AVR Snap-On Battery /Starter/ Charging System Station
Two Battery Chargers
Two Battery Booster Packs
School –Owned Shop Vehicles



Unit Name: PA800 - ENGINE PERFORMANCE

Unit Number: PA800

Dates: Fall 2019 **Hours:**

Unit Description/Objectives:

Student will know and be able to check, test, evaluate, diagnose, analyze, service, repair, replace, and interpret all components of engine performance.

Student will demonstrate maintenance procedures, identify the purpose of the cooling system, lubrication system, fuel system and components.

Tasks:

PA801 - Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.

PA802 - Identify and interpret engine performance concern; determine necessary action.

PA803 - Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins.

PA804 - Locate and interpret vehicle and major component identification numbers.

PA805 - Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.

PA806 - Diagnose abnormal engine noise or vibration concerns; determine necessary action.

PA807 - Diagnose abnormal exhaust color, odor, and sound; determine necessary action.

PA808 - Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action.

PA809 - Perform cylinder power balance test; determine necessary action.

PA810 - Perform cylinder cranking and running compression tests; determine necessary action.

PA811 - Perform cylinder leakage test; determine necessary action.

PA812 - Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action.

PA813 - Verify engine operating temperature; determine necessary action.

PA814 - Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.

PA815 - Verify correct camshaft timing.

PA816 - Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable.

PA817 - Diagnose the causes of emissions or drivability concerns with stored or active diagnostic trouble codes; obtain, graph, and interpret scan tool data.

PA818 - Access and use service information to perform step-by-step diagnosis.

- PA819 - Perform active tests of actuators using a scan tool; determine necessary action.
- PA820 - Describe the importance of running all OBDII monitors for repair verification.
- PA821 - Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor drivability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action.
- PA822 - Inspect and test ignition primary and secondary circuit wiring and solid state components; test ignition coil(s); perform necessary action.
- PA823 - Inspect and test crankshaft and camshaft position sensor(s); perform necessary action.
- PA824 - Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram as necessary.
- PA825 - Diagnose hot or cold no-starting, hard starting, poor drivability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems; determine necessary action.
- PA826 - Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action.
- PA827 - Replace fuel filters.
- PA828 - Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.
- PA829 - Inspect and test fuel injectors.
- PA830 - Verify idle control operation.
- PA831 - Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action.
- PA832 - Diagnose oil leaks, emissions, and drivability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action.
- PA833 - Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action.
- PA834 - Diagnose emissions and drivability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action.
- PA835 - Inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action.
- PA836 - Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action.
- PA837 - Inspect and test mechanical components of secondary air injection systems; perform necessary action.
- PA838 - Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action.
- PA839 - Inspect and test catalytic converter efficiency.

PA840 - Diagnose emissions and drivability concerns caused by the evaporative emissions control system; determine necessary action.

PA841 - Inspect and test components and hoses of the evaporative emissions control system; perform necessary action.

PA842 - Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action.

PA843 - Remove and replace timing belt; verify correct camshaft timing.

PA844 - Remove and replace thermostat and gasket/seal.

PA845 - Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action.

PA846 - Perform engine oil and filter change.

Standards / Assessment Anchors

Focus Standard/Anchor #1

- 13.2.11 E Demonstrate, in the career acquisition process, the application of essential workplace skills/knowledge, such as, but not limited to: commitment, communication, dependability, health/safety, laws and regulations (that is Americans with Disabilities Act, Child Labor Law, Fair Labor Standards Act, OSHA, Material Safety Data Sheets), personal initiative, Self-advocacy, scheduling/time management, team building, technical literacy and technology.

Supporting Standards/Anchors

3.4.10.D2 Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it.

3.4.10.E7 Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.

3.2.12.B1 Analyze the principles of rotational motion to solve problems relating to angular momentum and torque.

Focus Standard/Anchor #2

- CC.3.5.11-12.C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards/Anchors

CC.2.1.HS.F.2 Apply properties of rational and irrational numbers to solve real world or mathematical problems.

CC.2.1.HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems.

CC.3.5.11-12.D. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

Connecting Standard/Anchor

CC.2.3.6.A.1 Apply appropriate tools to solve real-world and mathematical problems involving area, surface area, and volume

Supporting Standards/Anchors

CC.2.4.5.A.1 Solve problems using conversions within a given measurement system.

CC.2.3.7.A.1 Solve real-world and mathematical problems involving angle measure, area, surface area, circumference, and volume.

Instructional Activities:

Knowledge:

Participate in lecture and discussion and respond to questions.

Complete reading assignments.

Complete written assignments.

Participate with the group activities.

Complete Task Sheet Assignment.

List all the parts of the cylinder head, engine oiling system, and cooling system.

Analyze the purposes of valve guides, seals, seats, springs, keepers, retainers, rotators.

Identify the parts in the valve operating mechanism including lifters, pushrods, rocker-arms, camshaft, oil gauges.

Explain the importance of vehicle maintenance.

Correctly answer ASE certification test questions on fluid service and vehicle maintenance.

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.

Discuss safety procedures to follow when working with cooling systems.

Correctly answer ASE certification test questions on cooling system construction and operation.

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.

Correctly answer ASE certification test questions on cooling system troubleshooting and repair.

Explain why proper diagnosis methods are important to engine repair.

List the common symptoms of engine mechanical problems.

Discuss how to find abnormal engine noises.

Summarize procedures for gasoline and diesel engine compression testing.

Explain when and how to do a wet compression test.

Summarize common causes of engine mechanical problems.

Discuss safety practices to follow while performing engine inspections.

Correctly answer ASE certification test questions on engine mechanical problems.

Determine if engine removal is needed to make specific engine repairs.

List the preparations for engine removal.

Describe the general safety rules pertaining to engine removal, disassembly, and parts cleaning.

Explain the use of an engine lifting fixture or chain, and an engine crane.

Summarize how to properly disassemble an engine.

Describe typical inspections that should be made during engine disassembly and cleaning.

List various methods for cleaning engine parts.

Describe safety practices to follow when cleaning parts.

Correctly answer ASE certification test questions on engine removal, disassembly, and cleaning procedures.

Compare computer systems to the human body's nervous system.

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.

Correctly answer ASE certification test questions that require knowledge of automotive computer system fundamentals.

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.
Correctly answer ASE certification test questions concerning late-model on-board diagnostics and scan tool use.
Correctly answer ASE certification test questions on servicing computer system components.

Define the major parts of a fuel supply system.
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.
Correctly answer ASE certification test questions on fuel tanks, fuel pumps, fuel lines, fuel filters, and air filters.

List some of the possible advantages of gasoline injection.
Describe the classifications of gasoline injection.
Explain the operation of electronic throttle body gasoline injection.
Explain the operation of electronic multiport gasoline injection.
Summarize the operation of airflow-sensing, hydraulic-mechanical (continuous), and pressure-sensing gasoline injection systems.
Compare the various types of gasoline injection systems.
Correctly answer ASE certification test questions on gasoline injection systems..
Explain OBD II testing features used on late-model fuel injection systems.
Cite safety rules for injection system service.
Correctly answer ASE certification test questions about fuel injection system diagnosis, service, and repair.

Explain the operating principles of an automotive ignition system.
Compare contact point, electronic, and computer-controlled ignition systems.
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.
Compare ignition coil, spark plug, and distributor design variations.
Describe the safety practices that must be followed when working with ignition systems.
Correctly answer ASE certification test questions that require a knowledge of ignition system fundamentals.
List the symptoms produced by faulty ignition system components.
Describe common tests used to find ignition system troubles.
Explain how to replace or repair ignition system parts.
Summarize contact point and pickup coil adjustments.

Define the fundamental terms relating to automotive emission control systems.
Explain the sources of air pollution.
Describe the operating principles of emission control systems.
Compare design differences in 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.
Correctly answer ASE certification test questions that require knowledge of emission control system operation and construction.

Describe the basic parts of an exhaust system.
Compare exhaust system design differences.
Explain the fundamental parts of a turbocharging system.
Describe the construction and operation of a turbocharger and waste gate.
Summarize the construction and operation of a supercharging system.
Demonstrate an understanding of safety procedures for working on exhaust systems, turbochargers, and superchargers.

Correctly answer ASE certification test questions on exhaust system, turbocharger, and supercharger operation and service.

List the most common engine performance problems.

Describe the symptoms for common engine performance problems.

Explain typical causes of engine performance problems.

Use a systematic approach when diagnosing engine performance problems.

Correctly answer ASE certification test questions on problems affecting engine performance.

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.

Describe the typical difference between a minor 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.

Correctly answer ASE certification test questions on engine tune-up and engine problem diagnosis.

Skills:

Check a car's fluid levels.

Locate fluid leaks.

Replace engine oil and filter.

Change automatic transmission fluid and filter.

Perform a grease job.

Inspect for general problems with hoses, belts, and other components.

Demonstrate safe practices while working with vehicle fluids.

Perform a combustion leak test and a system pressure test.

Check the major parts of a cooling system for proper operation.

Replace faulty cooling system components.

Drain, flush, and refill a cooling system.

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.

Use a trouble code chart in a service manual or code conversion by a scan tool.

Erase diagnostic trouble codes.

Perform a visual inspection of the engine, its sensors, actuators, and the systems they monitor and control.

Test sensors and their circuits.

Remove and replace sensors.

Test and replace actuators.

Remove and replace a computer.

Remove and replace a computer PROM.

Program an EEPROM.

Demonstrate safe working practices when servicing automotive computers.

Repair a fuel line or replace a fuel hose.

Locate and replace fuel filters in both gasoline and diesel fuel systems.

Diagnose typical gasoline injection system problems.

Test a fuel pressure regulator.

Test both electronic and continuous fuel injectors.

Use a service manual when making basic adjustments on gasoline injection systems.

Diagnose typical ignition system problems.

Adjust ignition timing.

Inspect and troubleshoot emission control systems.

Perform periodic service operations on emission control systems.

Test individual emission control components.
Replace or repair major emission control components.
Demonstrate and practice safe work procedures.

Perform exhaust system repairs.
Remove and replace a turbocharger and waste gate.

Use advanced diagnostic techniques to troubleshoot difficult problems.
Use scan tool snapshot and datastream values to find problems not tripping trouble codes.
Use a breakout box to measure circuit values.

I. ENGINE REPAIR

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

Task Number and Description Priority Page #s

11. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1 94-95
12. Identify and interpret engine concern; determine necessary action. P-1 137, 138-139, 871-896, 913-926
13. Research applicable vehicle and service information, such as internal engine operation, vehicle service history, service precautions, and technical service bulletins. P-1 85-95
14. Locate and interpret vehicle and major component identification numbers. P-1 86, 87, 269, 1072, 1110
15. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. P-1 746, 786-788, 915
16. Diagnose engine noises and vibrations; determine necessary action. P-2 138, 139, 916
17. Diagnose the cause of excessive oil consumption, coolant consumption, unusual engine exhaust color and odor; determine necessary action. P-2 872-874, 892
18. Perform engine vacuum tests; determine necessary action. P-1 872-874, 892
19. Perform cylinder power balance tests; determine necessary action. P-2 895
10. Perform cylinder cranking and running compression tests; determine necessary action. P-1 916-920
11. Perform cylinder leakage tests; determine necessary action. P-1 920
12. Remove and reinstall engine in an OBDII or newer vehicle; reconnect all attaching components and restore the vehicle to running condition. P-2 931-937, 1011, 1012
13. Install engine covers using gaskets, seals, and sealers as required. P-1 119-124, 996-997, 1006-1007
14. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert. P-1 117-120
15. Inspect, remove, and replace engine mounts. P-2 925-926, 932-935

B. Cylinder Head and Valve Train Diagnosis and Repair

11. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specifications and procedures. P-1 115-117, 942, 943, 990, 991
12. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition. P-1 938, 939, 971-974
13. Inspect valve springs for squareness and free height comparison; determine necessary action. P-3 983, 984
14. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action. P-3 984-986
15. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action. P-3 974-976
16. Inspect valves and valve seats; determine necessary action. P-3 974-983, 986
17. Check valve spring assembled height and valve stem height; determine necessary action. P-3 984
18. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action. P-2 989
19. Inspect valve lifters; determine necessary action. P-2 988, 989
10. Adjust valves (mechanical or hydraulic lifters). P-1 993-996

11. Inspect and replace camshaft and drive belt/chain (includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and variable valve timing components). P-1 983-986, 989-993
12. Inspect and/or measure camshaft for runout, journal wear, and lobe wear. P-2 987, 988
13. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action. P-2 988

C. Engine Block Assembly Diagnosis and Repair

11. Disassemble engine block; clean and prepare components for inspection and reassembly. P-1 940-945
12. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action. P-2 948-955, 973
13. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action. P-2 950, 951, 953, 954
14. Deglaze and clean cylinder walls. P-2 951-953
15. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action. P-3 988
16. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action. P-1 960-961, 963-964
17. Inspect main and connecting rod bearings for damage and wear; determine necessary action. P-2 958, 961-963, 965
18. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action. P-3 949, 954, 955
19. Inspect and measure piston skirts and ring lands; determine necessary action. P-2 941, 954-958, 964, 965
10. Remove and replace piston pin. P-3 956, 957, 958
11. Determine piston-to-bore clearance. P-2 955-956
12. Inspect, measure, and install piston rings. P-2 941, 955-956, 958-960
13. Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time. P-2 936, 954, 955, 987, 988
14. Remove, inspect, or replace crankshaft vibration damper (harmonic balancer). P-2 217
15. Assemble engine block. P-1 120-124, 791-793, 962, 990-993, 996, 997, 1004-1007

D. Lubrication and Cooling Systems Diagnosis and Repair

11. Perform oil pressure tests; determine necessary action. P-1 789
12. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action. P-2 793-797
13. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; determine necessary action. P-1 747-749
14. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. P-1 548-550, 756-757
15. Inspect and replace engine cooling and heater system hoses. P-1 754, 755
16. Inspect, test, and replace thermostat and gasket/seal. P-1 751-754
17. Test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required. P-1 132, 751, 754, 759-765
18. Inspect, remove and replace water pump. P-2 750, 751
19. Remove and replace radiator. P-2 756
10. Inspect, and test fans(s) (electrical or mechanical), fan clutch, fan shroud, and air dams. P-1 757, 758
11. Inspect auxiliary coolers; determine necessary action. P-3 779
12. Inspect, test, and replace oil temperature and pressure switches and sensors. P-2 798, 799
13. Perform oil and filter change. P-1 128-130
14. Identify causes of engine overheating.

VIII. ENGINE PERFORMANCE

A. General Engine Diagnosis

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1 94–95
2. Identify and interpret engine performance concern; determine necessary action. P-1 137–139, 859–866, 871–896, 913–926
3. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins. P-1 85–95, 862
4. Locate and interpret vehicle and major component identification numbers. P-1 86, 87, 269, 1072, 1110
5. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. P-2 914–916
6. Diagnose abnormal engine noise or vibration concerns; determine necessary action. P-3 138, 139, 859, 916
7. Diagnose abnormal exhaust color, odor, and sound; determine necessary action. P-2 431, 915, 916

NATEF Task List Correlation Chart 53

Task Number and Description Priority Page #s

8. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action. P-1 872–874
9. Perform cylinder power balance test; determine necessary action. P-2 895
10. Perform cylinder cranking and running compression tests; determine necessary action. P-1 906, 916–920
11. Perform cylinder leakage test; determine necessary action. P-1 920
12. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action. P-1 107, 108, 282–294, 599, 880–896
13. Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action. P-3 833–836, 837–840
14. Verify engine operating temperature; determine necessary action. P-1 752
15. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action. P-1 746–749, 755, 756, 759–761
16. Verify correct camshaft timing. P-1 1001–1004, 1009

B. Computerized Engine Controls Diagnosis and Repair

1. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable. P-1 268–277
2. Diagnose the causes of emissions or driveability concerns with stored or active diagnostic trouble codes; obtain, graph, and interpret scan tool data. P-1 268–277, 373, 374, 384–391, 622, 846–849
3. Diagnose emissions or driveability concerns without stored diagnostic trouble codes; determine necessary action. P-1 283–294, 373, 374, 384–391, 622, 846–849
4. Check for module communication (including CAN/BUS systems) errors using a scan tool. P-2 284
5. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action. P-1 282–294, 384–388, 622
6. Access and use service information to perform step-by-step diagnosis. P-1 85–95, 269, 277
7. Diagnose 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); determine necessary action. P-3 683–687, 1110–1113, 1493, 1544, 1545
8. Perform active tests of actuators using a scan tool; determine necessary action. P-1 273, 875

C. Ignition System Diagnosis and Repair

1. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns;

- determine necessary action. P-1 595, 596, 621, 831, 863–866, 905
 - 2. Inspect and test ignition primary and secondary circuit wiring and solid-state components; test ignition coil(s); perform necessary action. P-1 600–602, 618–619
 - 3. Inspect and test crankshaft and camshaft position sensor(s); perform necessary action. P-1 618
 - 4. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram as necessary. P-2 291–294
- D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair
- 1. Diagnose 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; determine necessary action. P-1 371–392, 403–408, 430–433, 863–867
 - 2. Check fuel for contaminants and quality; determine necessary action. P-2 308–309
 - 3. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action. P-1 329–334
 - 4. Replace fuel filters. P-2 135, 329, 330
 - 5. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air. P-2 135, 334, 377, 378, 391, 991–993
 - 6. Inspect and test fuel injectors. P-1 376–381
 - 7. Verify idle control operation. P-1 381–383, 407–408, 432–437
 - 8. Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action. P-1 450–455
 - 9. Perform exhaust system backpressure test; determine necessary action. P-1 449, 847
 - 10. Test the operation of turbocharger/supercharger systems; determine necessary action. P-3 450–458
- E. Emissions Control Systems Diagnosis and Repair
- 1. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action. P-2 798, 799, 804–809, 831–853
 - 2. Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action. P-2 806–810, 842, 843
 - 3. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action. P-1 811–815, 845, 846
 - 4. Inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action. P-1 811–815, 845, 846
 - 5. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action. P-2 811–815, 845, 846
 - 6. Diagnose emissions and driveability concerns caused by the secondary air injection and catalytic converter systems; determine necessary action. P-2 815–821, 846–849
 - 7. Inspect and test mechanical components of secondary air injection systems; perform necessary action. P-3 846, 847
 - 8. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action. P-3 846, 847
 - 9. Inspect and test catalytic converter efficiency. P-1 847, 848
 - 10. Diagnose emissions and driveability concerns caused by the evaporative emissions control system; determine necessary action. P-1 808–811, 826, 843, 844
 - 11. Inspect and test components and hoses of the evaporative emissions control system; perform necessary action. P-1 843, 844
 - 12. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action. P-1 831, 832

F. Engine Related Service

1. Adjust valves on engines with mechanical or hydraulic lifters. P-1 993–996
2. Remove and replace timing belt; verify correct camshaft timing. P-1 1009–1011
3. Remove and replace thermostat and gasket/seal. P-1 751–753
4. Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action. P-1 757–758
5. Perform common fastener and thread repairs, to include: remove broken bolt, restore internal and external threads, and repair internal threads with a threaded insert. P-1 117–120
6. Perform engine oil and filter change. P-1 129–130
7. Identify hybrid vehicle internal combustion engine service precautions.

Remediation:

Re-teach major concepts
Review with teacher assistance
Study group
Worksheets
Individual tutoring
Group tutoring
Study groups
Review games

Reading comprehension packets
Placing events in a time line
Create a chart
Retest or alternative assessment
Technology integration
Study guides
Computer assisted instruction
Checklists

Enrichment:

Student will work on NATEF required tasks from student workbook to earn one year of industry credit toward ASE Certification.
Working on skills for SkillsUSA, Local and state competition.

Safety:

Student Must:
Handle material in a safe manner.
Use protective clothing and equipment.
Use hand tools in a safe manner.
Use adequate ventilation when working in enclosed area.
Follow manufacturer's directions when using any product, tool, equipment, etc.
Use proper safety precautions when using /operating hand tools.
Use tools and equipment in a professional work like manner according to OSHA standards.
Know and follow the established safety rules at all times.

Assessment:

Written test
Activity worksheets
Workbooks
Quizzes
Pre/Post Tests
Summaries
Writing Activities
Video/DVD Worksheets

Rubrics
Check Lists
Oral Presentation
Diagrams
Individual Projects
Group Projects
Research Papers
Current Events

RECOURCES

Stockel W.9(2003). Textbook,Workbook and Student Job Manual - Modern Automotive Technology (7th ed).
Tinley Park: IL: The Goodheart-Willcox Company, Inc.

All-Data and on line service information.

Automotive Technology Workbooks
MSDS handbook

NATEF Task Assessment Worksheet

Computers

Textbook:

Web base training - Service Information

Common hand tools:

Wrenches--open end, box end, and combination

Sockets--shallow, deep, 6-point, 12-point, standard, and impact

Drive size--1/4 inch, 3/8 inch, 1/2 inch, and 3/4 inch

Socket accessories--speed handle, extensions 3 to 36 inches long, universals, flex handle, and T bar

Screwdrivers--flat blade (standard), Phillips, clutch, and Torx

Pliers--slip joint, water pump, diagonal cutting, vise grip, snap ring, needle nose, battery, and duck bill

Punches--taper, pin, and center

Hammers--ball peen, soft face, and brass

Coolant Pressure Test Kit

Electronic Stethoscope

Fuel Pressure Line Disconnect Kit

Micrometer Measuring Tool

Caliber Measuring Tool

Dial Indicator Measuring Tool

Above the ground vehicle lifts

Drive-On lifts with hydraulic jacks

Tripod Jack Stands

Screw Jack Stand

Standard Jack Stand

Four 2 1/2 ton Floor Jacks

Torque Wrenches: 3/8 - 1/2 inch Drive

Inch Pound Torque wrench

Two Electric Reversible Drills

1/2 Inch Drive Impact Wrench - battery operated

1/2 Inch Drive Impact Air Wrench

3/8 Drive Air Impact Ratchet

1/4 Air Impact Ratchet

Oil Caddy

Drain pans and funnels

School -Owned Shop Vehicles

STEEL CENTER CAREER AND TECHNICAL CENTER

Course Name: Automotive Technology

Unit Name: PA900 - ENGINE REPAIR

Unit Number: PA900



Dates: Fall 2019 **Hours:** 20.00

Last Edited By: Automotive Technology (05-12-2016)

Unit Description/Objectives:

Students will be able to identify, troubleshoot and demonstrate knowledge related to service information regarding engine maintenance.

Tasks:

PA901 - Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.

PA902 - Verify operation of the instrument panel engine warning indicators.

PA903 - Install engine covers using gaskets, seals, and sealers as required.

PA904 - RESERVED

PA905 - Adjust valves (mechanical or hydraulic lifters).

PA906 - Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.

PA907 - Inspect and test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required.

Standards / Assessment Anchors

Focus Anchor/Standard #1:

- Pennsylvania Core Standards for Reading for Technical Subjects Standard 3.5

Supporting Anchor/Standards

Standard CC.3.5.9-10 B / Standard CC.3.5.11-12 B Determine the central ideas or conclusions of a text; etc.

Standard CC.3.5.9-10.C / Standard CC.3.5.11-12.C Follow precisely a complex multistep procedure, etc.

Standard CC.3.5.11-12. I Synthesize information from a range of sources into a coherent understanding.

Focus Anchor/Standard #2:

- Pennsylvania Core Standards for Writing for Technical Subjects Standard 3.6

Supporting Anchor/Standards:

Standard CC.3.6.9-10.B Standard CC.3.6.11-12.B Write informative or explanatory texts, including the narration of technical processes, etc.

Standard CC.3.6.9-10.E Standard CC.3.6.11-12.E. Use technology, including the internet, to produce, publish, and update individual or shared writing products.

Connecting Anchor/Standard:

Use units as a way to understand problems and to guide the solution of multistep problems.

Supporting Anchor/Standards:

NUMBERS AND OPERATIONS

Standard 2.1.HS.F.2 Apply properties of rational and irrational numbers to solve real world or mathematical problems.

Standard 2.1.HS.F.5 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Instructional Activities:

Knowledge:

Participate in lecture and discussion and respond to questions.

Complete reading assignments.

Complete written assignments.

Participate with the group activities.

Complete Task Sheet Assignment.

List all the parts of the cylinder head, engine oiling system, and cooling system.

Analyze the purposes of valve guides, seals, seats, springs, keepers, retainers, rotators.

Identify the parts in the valve operating mechanism including lifters, pushrods, rocker-arms, camshaft, oil gauges.

Explain the importance of vehicle maintenance.

Correctly answer ASE certification test questions on fluid service and vehicle maintenance.

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.

Discuss safety procedures to follow when working with cooling systems.

Correctly answer ASE certification test questions on cooling system construction and operation.

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.
Correctly answer ASE certification test questions on cooling system troubleshooting and repair.

Explain why proper diagnosis methods are important to engine repair.
List common symptoms of engine mechanical problems.
Discuss how to find abnormal engine noises.
Summarize procedures for gasoline and diesel engine compression testing.
Explain when and how to do a wet compression test.
Summarize common causes of engine mechanical problems.
Discuss safety practices to follow while performing engine inspections.
Correctly answer ASE certification test questions on engine mechanical problems.

Determine if engine removal is needed to make specific engine repairs.
List the preparations for engine removal.
Describe the general safety rules pertaining to engine removal, disassembly, and parts cleaning.
Explain the use of an engine lifting fixture or chain, and an engine crane.
Summarize how to properly disassemble an engine.
Describe typical inspections that should be made during engine disassembly and cleaning.
List various methods for cleaning engine parts.
Describe safety practices to follow when cleaning parts.
Correctly answer ASE certification test questions on engine removal, disassembly, and cleaning procedure

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.
Summarize where computers, control modules, sensors, and actuators are typically located.
Explain how a computer uses sensor inputs to determine correct outputs.
Correctly answer ASE certification test questions that require a knowledge of automotive computer system fundamentals.

Discuss the purpose and operation of on-board diagnostic Explain
the use of scan tools to simplify reading of trouble codes.
Compare OBD I and OBD II system capabilities and procedures.
Correctly answer ASE certification test questions concerning late-model on-board diagnostics and scan tool use.
Correctly answer ASE certification test questions on servicing computer system components.

Define the major parts of a fuel supply system.
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.
Correctly answer ASE certification test questions on fuel tanks, fuel pumps, fuel lines, fuel filters, and air filters.

List some of the possible advantages of gasoline injection.
Describe the classifications of gasoline injection.
Explain the operation of electronic throttle body gasoline injection.
Explain the operation of electronic multiport gasoline injection.
Summarize the operation of airflow-sensing, hydraulic-mechanical (continuous), and pressure-sensing gasoline injection systems.
Compare the various types of gasoline injection systems.
Correctly answer ASE certification test questions on gasoline injection system.

Explain OBD II testing features used on late-model fuel injection systems.
Cite safety rules for injection system service.
Correctly answer ASE certification test questions about fuel injection system diagnosis, service, and repair.

Explain the operating principles of an automotive ignition system.
Compare contact point, electronic, and computer-controlled ignition systems.
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.
Compare ignition coil, spark plug, and distributor design variations.
Describe the safety practices that must be followed when working with ignition systems.
Correctly answer ASE certification test questions that require a knowledge of ignition system fundamentals.
List the symptoms produced by faulty ignition system components.
Describe common tests used to find ignition system troubles.
Explain how to replace or repair ignition system parts.
Summarize contact point and pickup coil adjustments.

Define the fundamental terms relating to automotive emission control systems.
Explain the sources of air pollution.
Describe the operating principles of emission control systems.
Compare design differences in 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.
Correctly answer ASE certification test questions that require a knowledge of emission control system operation and construction.

Describe the basic parts of an exhaust system.
Compare exhaust system design differences.
Describe the construction and operation of a turbocharger and waste gate.
Summarize the construction and operation of a supercharging system.
Demonstrate an understanding of safety procedures for working on exhaust systems, turbochargers, and superchargers.
Correctly answer ASE certification test questions on exhaust system, turbocharger, and supercharger operation and service.

List the most common engine performance problems.
Describe the symptoms for common engine performance problems.
Explain typical causes of engine performance problems.
Use a systematic approach when diagnosing engine performance problems.
Correctly answer ASE certification test questions on problems affecting engine performance.
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.
Describe the typical difference between a minor 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.
Correctly answer ASE certification test questions on engine tune-up and engine problem diagnosis.

Skills:

Check a car's fluid levels.
Locate fluid leaks.
Replace engine oil and filter.
Change automatic transmission fluid and filter.
Perform a grease job.
Inspect for general problems with hoses, belts, and other components.
Demonstrate safe practices while working with vehicle fluids.
Perform a combustion leak test and a system pressure test.
Check the major parts of a cooling system for proper operation.
Replace faulty cooling system components.
Drain, flush, and refill a cooling system.

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.
Use a trouble code chart in a service manual or code conversion by a scan tool.
Erase diagnostic trouble codes.
Perform a visual inspection of the engine, its sensors, actuators, and the systems they monitor and control.
Test sensors and their circuits.
Remove and replace sensors.
Test and replace actuators.
Remove and replace a computer.
Remove and replace a computer PROM.
Program an EEPROM.
Demonstrate safe working practices when servicing automotive computers.

Repair a fuel line or replace a fuel hose.
Locate and replace fuel filters in both gasoline and diesel fuel systems.
Diagnose typical gasoline injection system problems.
Test a fuel pressure regulator.
Test both electronic and continuous fuel injectors.
Use a service manual when making basic adjustments on gasoline injection systems.

Diagnose typical ignition system problems.
Adjust ignition timing.

Inspect and troubleshoot emission control systems.
Perform periodic service operations on emission control systems.
Test individual emission control components.
Replace or repair major emission control components.
Demonstrate and practice safe work procedures.

Perform exhaust system repairs.
Remove and replace a turbocharger and waste gate.

Use advanced diagnostic techniques to troubleshoot difficult problems.
Use scan tool snapshot and data stream values to find problems not tripping trouble codes. Use a breakout box to measure circuit values.

I. ENGINE REPAIR

- A. General Engine Diagnosis; Removal and Reinstallation (R & R)
Task Number and Description Priority Page #s
11. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1 94-95
 12. Identify and interpret engine concern; determine necessary action. P-1 137, 138-139, 871-896, 913-926
 13. Research applicable vehicle and service information, such as internal engine operation, vehicle service history, service precautions, and technical service bulletins. P-1 85-95

14. Locate and interpret vehicle and major component identification numbers. P-1 86, 87, 269, 1072, 1110
15. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. P-1 746, 786–788, 915
16. Diagnose engine noises and vibrations; determine necessary action. P-2 138, 139, 916
17. Diagnose the cause of excessive oil consumption, coolant consumption, unusual engine exhaust color and odor; determine necessary action. P-2 872–874, 892
18. Perform engine vacuum tests; determine necessary action. P-1 872–874, 892
19. Perform cylinder power balance tests; determine necessary action. P-2 895
20. Perform cylinder cranking and running compression tests; determine necessary action. P-1 916–920
21. Perform cylinder leakage tests; determine necessary action. P-1 920
22. Remove and reinstall engine in an OBDII or newer vehicle; reconnect all attaching components and restore the vehicle to running condition. P-2 931–937, 1011, 1012
23. Install engine covers using gaskets, seals, and sealers as required. P-1 119–124, 996–997, 1006–1007
24. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert. P-1 117–120
25. Inspect, remove, and replace engine mounts. P-2 925–926, 932–935

B. Cylinder Head and Valve Train Diagnosis and Repair

11. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specifications and procedures. P-1 115–117, 942, 943, 990, 991
12. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition. P-1 938, 939, 971–974
13. Inspect valve springs for squareness and free height comparison; determine necessary action. P-3 983, 984
14. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action. P-3 984–986
15. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action. P-3 974–976
16. Inspect valves and valve seats; determine necessary action. P-3 974–983, 986
17. Check valve spring assembled height and valve stem height; determine necessary action. P-3 984
18. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action. P-2 989
19. Inspect valve lifters; determine necessary action. P-2 988, 989
20. Adjust valves (mechanical or hydraulic lifters). P-1 993–996
21. Inspect and replace camshaft and drive belt/chain (includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and variable valve timing components). P-1 983–986, 989–993
22. Inspect and/or measure camshaft for runout, journal wear, and lobe wear. P-2 987, 988
23. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action. P-2 988

C. Engine Block Assembly Diagnosis and Repair

11. Disassemble engine block; clean and prepare components for inspection and reassembly. P-1 940–945
12. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action. P-2 948–955, 973
13. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action. P-2 950, 951, 953, 954
14. Deglaze and clean cylinder walls. P-2 951–953
15. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action. P-3 988
16. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and

journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action. P-1 960–961, 963–964

17. Inspect main and connecting rod bearings for damage and wear; determine necessary action. P-2 958, 961–963, 965
18. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action. P-3 949, 954, 955
19. Inspect and measure piston skirts and ring lands; determine necessary action. P-2 941, 954–958, 964, 965
20. Remove and replace piston pin. P-3 956, 957, 958
21. Determine piston-to-bore clearance. P-2 955–956
22. Inspect, measure, and install piston rings. P-2 941, 955–956, 958–960
23. Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time. P-2 936, 954, 955, 987, 988
24. Remove, inspect, or replace crankshaft vibration damper (harmonic balancer). P-2 217 15.
25. Assemble engine block. P-1 120–124, 791–793, 962, 990–993, 996, 997, 1004–1007

D. Lubrication and Cooling Systems Diagnosis and Repair

1. Perform oil pressure tests; determine necessary action. P-1 789
2. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action. P-2 793–797
3. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; determine necessary action. P-1 747–749
4. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. P-1 548–550, 756–757
5. Inspect and replace engine cooling and heater system hoses. P-1 754, 755
6. Inspect, test, and replace thermostat and gasket/seal. P-1 751–754
7. Test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required. P-1 132, 751, 754, 759–765
8. Inspect, remove and replace water pump. P-2 750, 751
9. Remove and replace radiator. P-2 756
10. Inspect, and test fans(s) (electrical or mechanical), fan clutch, fan shroud, and air dams. P-1 757, 758
11. Inspect auxiliary coolers; determine necessary action. P-3 779
12. Inspect, test, and replace oil temperature and pressure switches and sensors. P-2 798, 799
13. Perform oil and filter change. P-1 128–130
14. Identify causes of engine overheating.

VIII. ENGINE PERFORMANCE

A. General Engine Diagnosis

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1 94–95
2. Identify and interpret engine performance concern; determine necessary action. P-1 137–139, 859–866, 871–896, 913–926
3. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins. P-1 85–95, 862
4. Locate and interpret vehicle and major component identification numbers. P-1 86, 87, 269, 1072, 1110
5. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. P-2 914–916
6. Diagnose abnormal engine noise or vibration concerns; determine necessary action. P-3 138, 139, 859, 916
7. Diagnose abnormal exhaust color, odor, and sound; determine necessary action. P-2 431, 915, 916
NATEF Task List Correlation Chart 53
Task Number and Description Priority Page #s
8. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action. P-1 872–874

9. Perform cylinder power balance test; determine necessary action. P-2 895
10. Perform cylinder cranking and running compression tests; determine necessary action. P-1 906, 916–920
11. Perform cylinder leakage test; determine necessary action. P-1 920
12. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action. P-1 107, 108, 282–294, 599, 880–896
13. Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action. P-3 833–836, 837–840
14. Verify engine operating temperature; determine necessary action. P-1 752
15. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action. P-1 746–749, 755, 756, 759–761
16. Verify correct camshaft timing. P-1 1001–1004, 1009

B. Computerized Engine Controls Diagnosis and Repair

1. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable. P-1 268–277
2. Diagnose the causes of emissions or driveability concerns with stored or active diagnostic trouble codes; obtain, graph, and interpret scan tool data. P-1 268–277, 373, 374, 384–391, 622, 846–849
3. Diagnose emissions or driveability concerns without stored diagnostic trouble codes; determine necessary action. P-1 283–294, 373, 374, 384–391, 622, 846–849
4. Check for module communication (including CAN/BUS systems) errors using a scan tool. P-2 284
5. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action. P-1 282–294, 384–388, 622
6. Access and use service information to perform step-by-step diagnosis. P-1 85–95, 269, 277
7. Diagnose 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); determine necessary action. P-3 683–687, 1110–1113, 1493, 1544, 1545
8. Perform active tests of actuators using a scan tool; determine necessary action. P-1 273, 875

C. Ignition System Diagnosis and Repair

1. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action. P-1 595, 596, 621, 831, 863–866, 905
2. Inspect and test ignition primary and secondary circuit wiring and solid-state components; test ignition coil(s); perform necessary action. P-1 600–602, 618–619
3. Inspect and test crankshaft and camshaft position sensor(s); perform necessary action. P-1 618
4. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram as necessary. P-2 291–294

D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

1. Diagnose 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; determine necessary action. P-1 371–392, 403–408, 430–433, 863–867
2. Check fuel for contaminants and quality; determine necessary action. P-2 308–309
3. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action. P-1 329–334
4. Replace fuel filters. P-2 135, 329, 330
5. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air. P-2 135, 334, 377, 378, 391, 991–993
6. Inspect and test fuel injectors. P-1 376–381
7. Verify idle control operation. P-1 381–383, 407–408, 432–437

8. Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action.
9. P-1 450–455
10. Perform exhaust system backpressure test; determine necessary action. P-1 449, 847
11. Test the operation of turbocharger/supercharger systems; determine necessary action. P-3 450–458

E. Emissions Control Systems Diagnosis and Repair

1. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action. P-2 798, 799, 804–809, 831–853
2. Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action. P-2 806–810, 842, 843
3. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action. P-1 811–815, 845, 846
4. Inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action. P-1 811–815, 845, 846
5. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action. P-2 811–815, 845, 846
6. Diagnose emissions and driveability concerns caused by the secondary air injection and catalytic converter systems; determine necessary action. P-2 815–821, 846–849
7. Inspect and test mechanical components of secondary air injection systems; perform necessary action.
8. P-3 846, 847
9. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action. P-3 846, 847
10. Inspect and test catalytic converter efficiency. P-1 847, 848
11. Diagnose emissions and driveability concerns caused by the evaporative emissions control system; determine necessary action. P-1 808–811, 826, 843, 844
12. Inspect and test components and hoses of the evaporative emissions control system; perform necessary action. P-1 843, 844
13. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action. P-1 831, 832

F. Engine Related Service

1. Adjust valves on engines with mechanical or hydraulic lifters. P-1 993–996
2. Remove and replace timing belt; verify correct camshaft timing. P-1 1009–1011
3. Remove and replace thermostat and gasket/seal. P-1 751–753
4. Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action. P-1 757–758
5. Perform common fastener and thread repairs, to include: remove broken bolt, restore internal and external threads, and repair internal threads with a threaded insert. P-1 117–120
6. Perform engine oil and filter change. P-1 129–130
7. Identify hybrid vehicle internal combustion engine service precautions.

Remediation:

Re-teach major concepts
 Review with teacher assistance
 Worksheets
 Individual tutoring
 Group tutoring
 Peer tutoring
 Study groups
 Review games

Reading comprehension packets
 Placing events in a time line
 Retest or alternative assessment
 Technology integration
 Study guides
 Computer assisted instruction

Enrichment:

Working on skills for SkillsUSA, Lehigh Valley Dealers Association, and/or Northampton Community College competitions

Special Adaptations:

Extended Time (assignments and/or testing)
Directions/Comprehension Check (frequent checks for understanding)
Study Guide
Directions and/or Tests Read Aloud
Adapted Tests and/or Assignments
Use of Calculator
Taking Tests in Alternate Setting (or if requested)
Verbal/Gestural Redirection (prompts to remain on task)
Drill and Practice (Repetition of Material)
Provide Visual Model to Accompany Verbal Directions (Written/Oral Directions)
Use of Computer (Access to)
Positive Reinforcement
Have Student Repeat Directions
Access to School Counselor
Use of Highlighter/Highlighted Text
Provide Frequent Feedback
Provide Frequent Breaks
Regular Notebook Check
Variety of Assessment Methods
Highly Structured Classroom
Syllabus for Major Projects
Limited, Short Directions
Grading Rubric
Communication Regarding Behavior & Consequences (PBS)
Clear Language for Directions
Provide Opportunities to Retest
Frequent Review Sessions
Use a variety of Modalities when Introducing Skills/Concepts
Allow Oral Answers for Testing
Cue for Oral Response
De-Escalation Opportunities
Daily Classwork Check
Encourage Student to Check Work Before Turning In
Opportunities for Repeated Practice of MATH Skills
Provide repetition During Initial Instruction
Allow Pre-read of Questions Before Reading Written Passage
Provide Verbal and Written Directions
All Vocabulary to be Defined Before Testing
Time out
Encouragement to Participate in Positive Leadership Roles
Student Self-Evaluation for Behavior
Exempt from reading Aloud in Front of Peers

Safety:

Student Must:
Handle material in a safe manner.
Use protective clothing and equipment.
Use hand tools in a safe manner.
Use adequate ventilation when working in enclosed area.

Follow manufacturer's directions when using any product, tool, equipment, etc.
Use proper safety precautions when using /operating hand tools.
Use tools and equipment in a professional work like manner according to OSHA standards.
Know and follow the established safety rules at all times.

Assessment:

Written test	Debates
Activity worksheets	Oral Presentation
Workbooks	Diagrams
Quizzes	Individual Projects
Pre/Post Tests	Group Projects
Summaries	Current Events
Writing Activities	
Video/DVD Worksheets	

Resources/Equipment:

Stockel Martin {2003}.Modern Automotive Technology (7th ed). Tinley Park: IL: The Goodhearth-Willcox Company, Inc.

Module 2 Lessons 1-15 Automotive Engines and Module 4 Lessons 1-14 Engine Performance and Computer Fundamentals Modern Technology Service Technician (MAST) On-Line Training. (2014)).Tinley Park: IL: The Goodhearth-Willcox Company, Inc.

Stockel Martin. {20014} Textbook, Workbook and Student Job Manual - Modern Automotive Technology (7th ed). Tinley Park: IL: The Goodheart-Willcox Company, Inc.

Automotive Technology Workbooks

MSDS hand book

NATEF Task Assessment Worksheet

Computers

Textbook:

Common hand tools:

Wrenches--open end, box end, and combination

Sockets--shallow, deep, 6-point, 12-point, standard, and impact

Drive size--1/4 inch, 3/8 inch, 1/2 inch, and 3/4 inch

Socket accessories--speed handle, extensions 3 to 36 inches long, universals, flex handle, and T bar

Screwdrivers--flat blade (standard), Phillips, clutch, and Torx

Pliers--slip joint, water pump, diagonal cutting, vise grip, snap ring, needle nose, battery, and duck bill

Punches--taper, pin, and center

Hammers--ball peen, soft face, and brass

Coolant Pressure Test Kit

Electronic Stethoscope

Fuel Pressure Line Disconnect Kit

Micrometer Measuring Tool

Caliber Measuring Tool

Dial Indicator Measuring Tool

Above the ground vehicle lifts

Drive-On lifts with hydraulic jacks

Tripod Jack Stands

Screw Jack Stand

Standard Jack Stand

Four 2 ½ ton Floor Jacks

Torque Wrenches: 3/8 – 1/2 inch Drive
Inch Pound Torque wrench
Two Electric Reversible Drills
1/2 Inch Drive Impact Wrench – battery operated
1/2 Inch Drive Impact Air Wrench
3/8 Drive Air Impact Ratchet
1/4 Air Impact Ratchet
Oil Caddy
Drain pans and funnels
School –Owned Shop Vehicles 2002 Ford Taurus,2010 Kia customer vehicles.

www.g-wonlinetextbooks.com

www.sp2.org

www.library.alldatapro.com



Unit Name: PA1000 – AUTOMATIC

**TRANSMISSION AND
TRANSAXLE**

Unit Number: PA1000

Dates: Fall 2019 **Hours:**

Unit Description/Objectives:

Students will be able to identify, troubleshoot and demonstrate knowledge related to service information regarding transmission and transaxle maintenance.

Tasks:

PA1001 - Research applicable vehicle and service information, fluid type, vehicle service history, service precautions, and technical service bulletins.

PA1002 - Check fluid level in a transmission or a transaxle equipped with a dip-stick.

PA1003 - Check fluid level in a transmission or a transaxle not equipped with a dip-stick.

PA1004 - Drain and replace fluid and filter(s).

Standards / Assessment Anchors

Focus Anchor/Standard #1:

- Pennsylvania Core Standards for Reading for Technical Subjects Standard 3.5

Supporting Anchor/Standards

Standard CC.3.5.9-10.C / Standard CC.3.5.11-12.C Follow precisely a complex multistep procedure, etc.

Standard CC.3.5.11-12. G Integrate and evaluate multiple sources of information presented in diverse formats...to solve a problem.

Focus Anchor/Standard #2:

- Pennsylvania Core Standards for Writing for Technical Subjects Standard 3.6

Supporting Anchor/Standards:

PRODUCTION & DISTRIBUTION OF WRITING GRADES 10-11-12

Standard CC.3.6.9-10.C Standard CC.3.6.11-12 C Produce clear and coherent writing...appropriate to task, purpose, and audience.

RESEARCH GRADES 9-10-11-12

Standard CC.3.6.9-10.F Standard CC.3.6.11-12.F Conduct short and more sustained research to answer a question or solve a problem

Connecting Anchor/Standard:

- Pennsylvania Core Standards for Mathematics Standard 2.0

Supporting Anchor/Standards:

NUMBERS AND OPERATIONS

Standard 2.1.HS.F.2 Apply properties of rational and irrational numbers to solve real world or mathematical problems.

Standard 2.1.HS.F.4 Use units as a way to understand problems and to guide the solution of multistep problems.

Instructional Activities:

Knowledge:

Participate in lecture and discussion and respond to questions.

Complete reading assignments.

Complete written assignments.

Participate with the group activities.

Complete Task Sheet Assignment.

List all the parts of the cylinder head, engine oiling system, and cooling system.

Analyze the purposes of valve guides, seals, seats, springs, keepers, retainers, rotators.

Identify the parts in the valve operating mechanism including lifters, pushrods, rocker-arms, camshaft, oil gauges.

Explain the importance of vehicle maintenance.

Correctly answer ASE certification test questions on fluid service and vehicle maintenance.

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.

Discuss safety procedures to follow when working with cooling systems.

Correctly answer ASE certification test questions on cooling system construction and operation.

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.

Correctly answer ASE certification test questions on cooling system troubleshooting and repair.

Explain why proper diagnosis methods are important to engine repair.
List common symptoms of engine mechanical problems.
Discuss how to find abnormal engine noises.
Summarize procedures for gasoline and diesel engine compression testing.
Explain when and how to do a wet compression test.
Summarize common causes of engine mechanical problems.
Discuss safety practices to follow while performing engine inspections.
Correctly answer ASE certification test questions on engine mechanical problems.

Determine if engine removal is needed to make specific engine repairs.
List the preparations for engine removal.
Describe the general safety rules pertaining to engine removal, disassembly, and parts cleaning.
Explain the use of an engine lifting fixture or chain, and an engine crane.
Summarize how to properly disassemble an engine.
Describe typical inspections that should be made during engine disassembly and cleaning.
List various methods for cleaning engine parts.
Describe safety practices to follow when cleaning parts.
Correctly answer ASE certification test questions on engine removal, disassembly, and cleaning procedures.

Compare computer systems to the human body's nervous system.
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.
Correctly answer ASE certification test questions that require a knowledge of automotive computer system fundamentals.

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.
Correctly answer ASE certification test questions concerning late-model on-board diagnostics and scan tool use.
Correctly answer ASE certification test questions on servicing computer system components.

Define the major parts of a fuel supply system.
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.
Correctly answer ASE certification test questions on fuel tanks, fuel pumps, fuel lines, fuel filters, and air filters.

List some of the possible advantages of gasoline injection.
Describe the classifications of gasoline injection.
Explain the operation of electronic throttle body gasoline injection.
Explain the operation of electronic multiport gasoline injection.
Summarize the operation of airflow-sensing, hydraulic-mechanical (continuous), and pressure-sensing gasoline injection systems.
Compare the various types of gasoline injection systems.
Correctly answer ASE certification test questions on gasoline injection systems..
Explain OBD II testing features used on late-model fuel injection systems.
Cite safety rules for injection system service.
Correctly answer ASE certification test questions about fuel injection system diagnosis, service, and repair.

Explain the operating principles of an automotive ignition system.
Compare contact point, electronic, and computer-controlled ignition systems.
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.
Compare ignition coil, spark plug, and distributor design variations.
Describe the safety practices that must be followed when working with ignition systems.
Correctly answer ASE certification test questions that require a knowledge of ignition system fundamentals.
List the symptoms produced by faulty ignition system components.
Describe common tests used to find ignition system troubles.
Explain how to replace or repair ignition system parts.
Summarize contact point and pickup coil adjustments.

Define the fundamental terms relating to automotive emission control systems.
Explain the sources of air pollution.
Describe the operating principles of emission control systems.
Compare design differences in 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.
Correctly answer ASE certification test questions that require a knowledge of emission control system operation and construction.

Describe the basic parts of an exhaust system.
Compare exhaust system design differences.
Explain the fundamental parts of a turbocharging system.
Describe the construction and operation of a turbocharger and waste gate.
Summarize the construction and operation of a supercharging system.
Demonstrate an understanding of safety procedures for working on exhaust systems, turbochargers, and superchargers.
Correctly answer ASE certification test questions on exhaust system, turbocharger, and supercharger operation and service.

List the most common engine performance problems.
Describe the symptoms for common engine performance problems.
Explain typical causes of engine performance problems.
Use a systematic approach when diagnosing engine performance problems.
Correctly answer ASE certification test questions on problems affecting engine performance.
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.

Describe the typical difference between a minor 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.
Correctly answer ASE certification test questions on engine tune-up and engine problem diagnosis.

Skills:

Check a car's fluid levels.
Locate fluid leaks.
Replace engine oil and filter.
Change automatic transmission fluid and filter.
Perform a grease job.
Inspect for general problems with hoses, belts, and other components.

Demonstrate safe practices while working with vehicle fluids.
Perform a combustion leak test and a system pressure test.
Check the major parts of a cooling system for proper operation.
Replace faulty cooling system components.
Drain, flush, and refill a cooling system.

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.
Use a trouble code chart in a service manual or code conversion by a scan tool.
Erase diagnostic trouble codes.
Perform a visual inspection of the engine, its sensors, actuators, and the systems they monitor and control.
Test sensors and their circuits.
Remove and replace sensors.
Test and replace actuators.
Remove and replace a computer.
Demonstrate safe working practices when servicing automotive computers.

Repair a fuel line or replace a fuel hose.
Locate and replace fuel filters in both gasoline and diesel fuel systems.
Diagnose typical gasoline injection system problems.
Test a fuel pressure regulator.
Test both electronic and continuous fuel injectors.
Use a service manual when making basic adjustments on gasoline injection systems.

Diagnose typical ignition system problems.
Adjust ignition timing.

Inspect and troubleshoot emission control systems.
Perform periodic service operations on emission control systems.
Test individual emission control components.
Replace or repair major emission control components.
Demonstrate and practice safe work procedures.

Perform exhaust system repairs.
Remove and replace a turbocharger and waste gate.

Use advanced diagnostic techniques to troubleshoot difficult problems.
Use scan tool snapshot and datastream values to find problems not tripping trouble codes.

I. ENGINE REPAIR

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

Task Number and Description Priority Page #s

11. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1 94-95
12. Identify and interpret engine concern; determine necessary action. P-1 137, 138-139, 871-896, 913-926
13. Research applicable vehicle and service information, such as internal engine operation, vehicle service history, service precautions, and technical service bulletins. P-1 85-95
14. Locate and interpret vehicle and major component identification numbers. P-1 86, 87, 269, 1072, 1110
15. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. P-1 746, 786-788, 915
16. Diagnose engine noises and vibrations; determine necessary action. P-2 138, 139, 916
17. Diagnose the cause of excessive oil consumption, coolant consumption, unusual engine exhaust color and odor; determine necessary action. P-2 872-874, 892

18. Perform engine vacuum tests; determine necessary action. P-1 872–874, 892
19. Perform cylinder power balance tests; determine necessary action. P-2 895
10. Perform cylinder cranking and running compression tests; determine necessary action. P-1 916–920
11. Perform cylinder leakage tests; determine necessary action. P-1 920
12. Remove and reinstall engine in an OBDII or newer vehicle; reconnect all attaching components and restore the vehicle to running condition. P-2 931–937, 1011, 1012
13. Install engine covers using gaskets, seals, and sealers as required. P-1 119–124, 996–997, 1006–1007
14. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert. P-1 117–120
15. Inspect, remove, and replace engine mounts. P-2 925–926, 932–935

B. Cylinder Head and Valve Train Diagnosis and Repair

1. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specifications and procedures. P-1 115–117, 942, 943, 990, 991
2. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition. P-1 938, 939, 971–974
3. Inspect valve springs for squareness and free height comparison; determine necessary action. P-3 983, 984
4. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action. P-3 984–986
5. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action. P-3 974–976
6. Inspect valves and valve seats; determine necessary action. P-3 974–983, 986
7. Check valve spring assembled height and valve stem height; determine necessary action. P-3 984
8. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action. P-2 989
9. Inspect valve lifters; determine necessary action. P-2 988, 989
10. Adjust valves (mechanical or hydraulic lifters). P-1 993–996
11. Inspect and replace camshaft and drive belt/chain (includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and variable valve timing components). P-1 983–986, 989–993
12. Inspect and/or measure camshaft for runout, journal wear, and lobe wear. P-2 987, 988
13. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action. P-2 988

C. Engine Block Assembly Diagnosis and Repair

1. Disassemble engine block; clean and prepare components for inspection and reassembly. P-1 940–945
2. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action. P-2 948–955, 973
3. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action. P-2 950, 951, 953, 954
4. Deglaze and clean cylinder walls. P-2 951–953
5. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action. P-3 988
6. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action. P-1 960–961, 963–964
7. Inspect main and connecting rod bearings for damage and wear; determine necessary action. P-2 958, 961–963, 965
8. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action. P-3 949, 954, 955
9. Inspect and measure piston skirts and ring lands; determine necessary action. P-2 941, 954–958, 964, 965

10. Remove and replace piston pin. P-3 956, 957, 958
11. Determine piston-to-bore clearance. P-2 955–956
12. Inspect, measure, and install piston rings. P-2 941, 955–956, 958–960
13. Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time. P-2 936, 954, 955, 987, 988
14. Remove, inspect, or replace crankshaft vibration damper (harmonic balancer). P-2 217
15. Assemble engine block. P-1 120–124, 791–793, 962, 990–993, 996, 997, 1004–1007

D. Lubrication and Cooling Systems Diagnosis and Repair

1. Perform oil pressure tests; determine necessary action. P-1 789
2. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action. P-2 793–797
3. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; determine necessary action. P-1 747–749
4. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. P-1 548–550, 756–757
5. Inspect and replace engine cooling and heater system hoses. P-1 754, 755
6. Inspect, test, and replace thermostat and gasket/seal. P-1 751–754
7. Test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required. P-1 132, 751, 754, 759–765
8. Inspect, remove and replace water pump. P-2 750, 751
9. Remove and replace radiator. P-2 756
10. Inspect, and test fans(s) (electrical or mechanical), fan clutch, fan shroud, and air dams. P-1 757, 758
11. Inspect auxiliary coolers; determine necessary action. P-3 779
12. Inspect, test, and replace oil temperature and pressure switches and sensors. P-2 798, 799
13. Perform oil and filter change. P-1 128–130
14. Identify causes of engine overheating.

VIII. ENGINE PERFORMANCE

A. General Engine Diagnosis

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1 94–95
 2. Identify and interpret engine performance concern; determine necessary action. P-1 137–139, 859–866, 871–896, 913–926
 3. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins. P-1 85–95, 862
 4. Locate and interpret vehicle and major component identification numbers. P-1 86, 87, 269, 1072, 1110
 5. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. P-2 914–916
 6. Diagnose abnormal engine noise or vibration concerns; determine necessary action. P-3 138, 139, 859, 916
 7. Diagnose abnormal exhaust color, odor, and sound; determine necessary action. P-2 431, 915, 916
- NATEF Task List Correlation Chart 53
Task Number and Description Priority Page #s
8. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action. P-1 872–874
 9. Perform cylinder power balance test; determine necessary action. P-2 895
 10. Perform cylinder cranking and running compression tests; determine necessary action. P-1 906, 916–920
 11. Perform cylinder leakage test; determine necessary action. P-1 920
 12. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action. P-1 107, 108, 282–294, 599, 880–896

13. Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action. P-3 833–836, 837–840
14. Verify engine operating temperature; determine necessary action. P-1 752
15. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action. P-1 746–749, 755, 756, 759–761
16. Verify correct camshaft timing. P-1 1001–1004, 1009

B. Computerized Engine Controls Diagnosis and Repair

1. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable. P-1 268–277
2. Diagnose the causes of emissions or driveability concerns with stored or active diagnostic trouble codes; obtain, graph, and interpret scan tool data. P-1 268–277, 373, 374, 384–391, 622, 846–849
3. Diagnose emissions or driveability concerns without stored diagnostic trouble codes; determine necessary action. P-1 283–294, 373, 374, 384–391, 622, 846–849
4. Check for module communication (including CAN/BUS systems) errors using a scan tool. P-2 284
5. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action. P-1 282–294, 384–388, 622
6. Access and use service information to perform step-by-step diagnosis. P-1 85–95, 269, 277
7. Diagnose 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); determine necessary action. P-3 683–687, 1110–1113, 1493, 1544, 1545
8. Perform active tests of actuators using a scan tool; determine necessary action. P-1 273, 875

C. Ignition System Diagnosis and Repair

1. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action. P-1 595, 596, 621, 831, 863–866, 905
2. Inspect and test ignition primary and secondary circuit wiring and solid-state components; test ignition coil(s); perform necessary action. P-1 600–602, 618–619
3. Inspect and test crankshaft and camshaft position sensor(s); perform necessary action. P-1 618
4. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram as necessary. P-2 291–294

D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

1. Diagnose 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; determine necessary action. P-1 371–392, 403–408, 430–433, 863–867
2. Check fuel for contaminants and quality; determine necessary action. P-2 308–3093. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action. P-1 329–334
3. Replace fuel filters. P-2 135, 329, 330
4. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air. P-2 135, 334, 377, 378, 391, 991–993
5. Inspect and test fuel injectors. P-1 376–381
6. Verify idle control operation. P-1 381–383, 407–408, 432–437
7. Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action. P-1 450–455
8. Perform exhaust system backpressure test; determine necessary action. P-1 449, 847
9. Test the operation of turbocharger/supercharger systems; determine necessary action. P-3 450–458

E. Emissions Control Systems Diagnosis and Repair

1. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action. P-2 798, 799, 804–809, 831–853
2. Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action. P-2 806–810, 842, 843
3. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action. P-1 811–815, 845, 846
4. Inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action. P-1 811–815, 845, 846
5. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action. P-2 811–815, 845, 846
6. Diagnose emissions and driveability concerns caused by the secondary air injection and catalytic converter systems; determine necessary action. P-2 815–821, 846–849
7. Inspect and test mechanical components of secondary air injection systems; perform necessary action. P-3 846, 847
8. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action. P-3 846, 847
9. Inspect and test catalytic converter efficiency. P-1 847, 848
10. Diagnose emissions and driveability concerns caused by the evaporative emissions control system; determine necessary action. P-1 808–811, 826, 843, 844
11. Inspect and test components and hoses of the evaporative emissions control system; perform necessary action. P-1 843, 844
12. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action. P-1 831, 832

F. Engine Related Service

1. Adjust valves on engines with mechanical or hydraulic lifters. P-1 993–996
2. Remove and replace timing belt; verify correct camshaft timing. P-1 1009–1011
3. Remove and replace thermostat and gasket/seal. P-1 751–753
4. Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action. P-1 757–758
5. Perform common fastener and thread repairs, to include: remove broken bolt, restore internal and external threads, and repair internal threads with a threaded insert. P-1 117–120
6. Perform engine oil and filter change. P-1 129–130
7. Identify hybrid vehicle internal combustion engine service precautions.

Remediation:

Re-teach major concepts

Review with teacher assistance
Study group
Worksheets
Individual tutoring
Group tutoring
Peer tutoring
Study groups
Review games

Reading comprehension packets
Placing events in a time line
Create a chart
Retest or alternative assessment
Technology integration
Study guides
Computer assisted instruction
Checklists

Enrichment:

Student will work on NATEF required tasks from student workbook to earn one year of industry credit toward ASE Certification.
Working on skills for SkillsUSA, Local and State competition.

Special Adaptations:

- Extended Time (assignments and/or testing)
- Preferential Seating
- Directions/Comprehension Check (frequent checks for understanding)
- Study Guide
- Directions and/or Tests Read Aloud
- Adapted Tests and/or Assignments
- Use of Calculator
- Taking Tests in Alternate Setting (or if requested)
- Verbal/Gestural Redirection (prompts to remain on task)
- Drill and Practice (Repetition of Material)
- Small Group Instruction
- Provide Visual Model to Accompany Verbal Directions (Written/Oral Directions)
- Use of Computer (Access to)
- Positive Reinforcement
- Have Student Repeat Directions
- Wait Time
- Access to School Counselor
- Use of Highlighter/Highlighted Text
- Provide Frequent Feedback
- Provide Frequent Breaks
- Regular Notebook Check
- Variety of Assessment Methods
- Highly Structured Classroom
- Syllabus for Major Projects
- Limited, Short Directions
- Grading Rubric
- Communication Regarding Behavior & Consequences (PBS)
- Clear Language for Directions
- Provide Opportunities to Retest
- Frequent Review Sessions
- Use a variety of Modalities when Introducing Skills/Concepts
- Allow Oral Answers for Testing
- Cue for Oral Response
- De-Escalation Opportunities
- Daily Classwork Check
- Encourage Student to Check Work Before Turning In
- Opportunities for Repeated Practice of MATH Skills
- Provide repetition During Initial Instruction
- Allow Pre-read of Questions Before Reading Written Passage
- Provide Verbal and Written Directions
- All Vocabulary to be Defined Before Testing
- Time out
- Encouragement to Participate in Positive Leadership Roles
- Student Self-Evaluation for Behavior
- Exempt from reading Aloud in Front of Peers

Safety:

- Student Must:
- Handle material in a safe manner.
- Use protective clothing and equipment.
- Use hand tools in a safe manner.
- Use adequate ventilation when working in enclosed area.
- Follow manufacturer's directions when using any product, tool, equipment, etc.
- Use proper safety precautions when using /operating hand tools.
- Use tools and equipment in a professional work like manner according to OSHA standards.
- Know and follow the established safety rules at all times.

Assessment:

Written test
 Activity worksheets
 Workbooks
 Quizzes
 Pre/Post Tests
 Essays
 Summaries

Writing Activities Video/DVD Worksheets
 Check Lists Debates
 Oral Presentations
 Individual Projects
 Group Projects
 Research Papers
 Current Events

Resources/Equipment:

Stockel Martin {2003}. Modern Automotive Technology (7th ed). Tinley Park: IL: The Goodheart-Willcox Company, Inc.

Module 2 Lessons 1-15 Automotive Engines and Module 4 Lessons 1-14 Engine Performance and Computer Fundamentals Modern Technology Service Technician (MAST) On-Line Training. (2008). Tinley Park: IL: The Goodheart-Willcox Company, Inc.

Stockel Martin {2003} Textbook, Workbook and Student Job Manual - Modern Automotive Technology (7th ed). Tinley Park: IL: The Goodheart-Willcox Company, Inc.

All-Data on line service manual

Service Information Automotive Technology Workbooks

MSDS hand book

Textbook:

Web base training - Service Information (ShopKey 5)

Common hand tools:

Wrenches--open end, box end, and combination

Sockets--shallow, deep, 6-point, 12-point, standard, and impact

Drive size--1/4 inch, 3/8 inch, 1/2 inch, and 3/4 inch

Socket accessories--speed handle, extensions 3 to 36 inches long, universals, flex handle, and T bar

Screwdrivers--flat blade (standard), Phillips, clutch, and Torx

Pliers--slip joint, water pump, diagonal cutting, vise grip, snap ring, needle nose, battery, and duck bill

Punches--taper, pin, and center

Hammers--ball peen, soft face, and brass

Coolant Pressure Test Kit

Electronic Stethoscope

Fuel Pressure Line Disconnect Kit

Micrometer Measuring Tool

Caliber Measuring Tool

Dial Indicator Measuring Tool

Above the ground vehicle lifts

Drive-On lifts with hydraulic jacks

Tripod Jack Stands

Screw Jack Stand

Standard Jack Stand

Four 2 1/2 ton Floor Jacks

Torque Wrenches: 3/8 - 1/2 inch Drive

Inch Pound Torque wrench

Two Electric Reversible Drills

1/2 Inch Drive Impact Wrench -

battery operated

1/2 Inch Drive Impact Air Wrench

3/8 Drive Air Impact Ratchet

1/4 Air Impact Ratchet

Oil Caddy

Drain pans and funnels

School -Owned Shop Vehicles - 2002 Chevy S-10 Pick-up Truck, 1999 Chevy Cavaliers (2), 1995 Pontiac Bonneville, 1991 Honda Civic, 1991 Chevy Lumina, 1997 Jeep Cherokee, 2001 Chevy Astro Van, 1991 Ford Ranger Pick-up Truck, 1991 Buick Regal, 1991 Chevy Corsica, 1998 Subaru Legacy, 1998 Mitsubishi Mirage

Hyperlinks:

www.g-wonlinetextbooks.com

www.sp2.org

www.library.alldatapro.com

Steel Center and Technical Center

Unit Name: 1100 MANUAL DRIVE TRAIN AND AXLES

Number: 1100

Hours: 12.00



Dates: Spring 2019

Last Edited By: Automotive Technology (05-12-2016)

Description/Objectives:

Students will be able to identify, troubleshoot and demonstrate knowledge related to service information regarding transmission and transaxle maintenance.

Tasks:

- 1101 Research applicable vehicle and service information, fluid type, vehicle service history, service precautions, and technical service bulletins.
- 1102 Drain and refill manual transmission/transaxle and final drive unit.
- 1103 Check and adjust clutch master cylinder fluid level.
- 1104 Check for system leaks.
- 1105 Check and adjust differential housing fluid level.
- 1106 Drain and refill differential housing.

Standards / Assessment Anchors

Focus Anchor/Standard #1:

- Pennsylvania Core Standards for Reading for Technical Subjects Standard 3.5

Supporting Anchor/Standards:

KEY IDEAS/DETAILS GRADES 9-10-11-12

Standard CC.3.5.9-10.C / Standard CC.3.5.11-12.C Follow precisely a complex multistep procedure, etc.

CRAFT & STRUCTURE GRADES 9-10-11-1

Standard CC.3.5.9-10.E / Standard CC.3.5.11-12.E Analyze the structure of the relationships among concepts in a text, etc

INTEGRATE KNOWLEDGE & IDEAS GRADES 9-10

Standard CC.3.5.9-10.G Translate quantitative or technical information expressed in a text into visual form (e.g. a table or chart).

Focus Anchor/Standard #2:

- Pennsylvania Core Standards for Writing for Technical Subjects Standard 3.6

Supporting Anchor/Standards:

Standard CC.3.6.9-10.C Standard CC.3.6.11-12 C Produce clear and coherent writing...appropriate to task, purpose, and audience.

Standard CC.3.6.9-10.E Standard CC.3.6.11-12.E. Use technology, including the internet, to produce, publish, and update individual or shared writing products.
RESEARCH GRADES 9-10-11-12

Standard CC.3.6.9-10.F Standard CC.3.6.11-12.F Conduct short and more sustained research to answer a question or solve a problem

Connecting Anchor/Standard:

- Pennsylvania Core Standards for Mathematics Standard 2.0

Supporting Anchor/Standards:

NUMBERS AND OPERATIONS

Standard 2.1.HS.F.4 Use units as a way to understand problems and to guide the solution of multistep problems.

Standard 2.1.HS.F.5 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

GEOMETRY

Standard 2.3.HS.A.13 Analyze relationships between two dimensional and three dimensional objects.

Instructional Activities:

Knowledge:

Participate in lecture and discussion and respond to questions.

Complete reading assignments.

Complete written assignments.

Participate with the group activities.

Complete Task Sheet Assignment.

List all the parts of the cylinder head, engine oiling system, and cooling system.

Analyze the purposes of valve guides, seals, seats, springs, keepers, retainers, rotators.

Identify the parts in the valve operating mechanism including lifters, pushrods, rocker-arms, camshaft, oil gauges.

Explain the importance of vehicle maintenance.

Correctly answer ASE certification test questions on fluid service and vehicle maintenance.

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.

Discuss safety procedures to follow when working with cooling systems.

Correctly answer ASE certification test questions on cooling system construction and operation.

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.

Correctly answer ASE certification test questions on cooling system troubleshooting and repair.

Explain why proper diagnosis methods are important to engine repair.

List common symptoms of engine mechanical problems.

Discuss how to find abnormal engine noises.

Summarize procedures for gasoline and diesel engine compression testing.

Explain when and how to do a wet compression test.

Summarize common causes of engine mechanical problems.

Discuss safety practices to follow while performing engine inspections.

Correctly answer ASE certification test questions on engine mechanical problems.

Determine if engine removal is needed to make specific engine repairs.

List the preparations for engine removal.

Describe the general safety rules pertaining to engine removal, disassembly, and parts cleaning.

Explain the use of an engine lifting fixture or chain, and an engine crane.

Summarize how to properly disassemble an engine.

Describe typical inspections that should be made during engine disassembly and cleaning.

List various methods for cleaning engine parts.

Describe safety practices to follow when cleaning parts.
Correctly answer ASE certification test questions on engine removal, disassembly, and cleaning procedures.

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.
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.
Correctly answer ASE certification test questions that require a knowledge of automotive computer system fundamentals.

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.
Correctly answer ASE certification test questions concerning late-model on-board diagnostics and scan tool use.
Correctly answer ASE certification test questions on servicing computer system components.

Define the major parts of a fuel supply system.
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.
Correctly answer ASE certification test questions on fuel tanks, fuel pumps, fuel lines, fuel filters, and air filters.

List some of the possible advantages of gasoline injection.
Describe the classifications of gasoline injection.
Explain the operation of electronic throttle body gasoline injection.
Explain the operation of electronic multiport gasoline injection.
Summarize the operation of airflow-sensing, hydraulic-mechanical (continuous), and pressure-sensing gasoline injection systems.
Compare the various types of gasoline injection systems.
Correctly answer ASE certification test questions on gasoline injection systems..
Explain OBD II testing features used on late-model fuel injection systems.
Cite safety rules for injection system service.
Correctly answer ASE certification test questions about fuel injection system diagnosis, service, and repair.

Explain the operating principles of an automotive ignition system.
Compare contact point, electronic, and computer-controlled ignition systems.
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.
Compare ignition coil, spark plug, and distributor design variations.
Describe the safety practices that must be followed when working with ignition systems.
Correctly answer ASE certification test questions that require a knowledge of ignition system fundamentals.
List the symptoms produced by faulty ignition system components.
Describe common tests used to find ignition system troubles.
Explain how to replace or repair ignition system parts.
Summarize contact point and pickup coil adjustments.

Define the fundamental terms relating to automotive emission control systems.

Explain the sources of air pollution.
Describe the operating principles of emission control systems.
Compare design differences in 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.
Correctly answer ASE certification test questions that require a knowledge of emission control system operation and construction.

Describe the basic parts of an exhaust system.
Compare exhaust system design difference.
Describe the construction and operation of a turbocharger and waste gate.
Demonstrate an understanding of safety procedures for working on exhaust systems.
Correctly answer ASE certification test questions on exhaust system, turbocharger, and supercharger operation and service.

List the most common engine performance problems.
Describe the symptoms for common engine performance problems.
Explain typical causes of engine performance problems.
Use a systematic approach when diagnosing engine performance problems.
Correctly answer ASE certification test questions on problems affecting engine performance.
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.

Describe the typical difference between a minor 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.
Correctly answer ASE certification test questions on engine tune-up and engine problem diagnosis.

Skills:

Check a car's fluid levels.
Locate fluid leaks.
Replace engine oil and filter.
Change automatic transmission fluid and filter.
Perform a grease job.
Inspect for general problems with hoses, belts, and other components.
Demonstrate safe practices while working with vehicle fluids.
Perform a combustion leak test and a system pressure test.
Check the major parts of a cooling system for proper operation.
Replace faulty cooling system components.
Drain, flush, and refill a cooling system.

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.
Use a trouble code chart in a service manual or code conversion by a scan tool.
Erase diagnostic trouble codes.
Perform a visual inspection of the engine, its sensors, actuators, and the systems they monitor and control.
Test sensors and their circuits.
Remove and replace sensors.

Test and replace actuators.
Remove and replace a computer.
Remove and replace a computer PROM.
Program an EEPROM.
Demonstrate safe working practices when servicing automotive computers.

Repair a fuel line or replace a fuel hose.
Locate and replace fuel filters in both gasoline and diesel fuel systems.
Diagnose typical gasoline injection system problems.
Test a fuel pressure regulator.
Test both electronic and continuous fuel injectors.
Use a service manual when making basic adjustments on gasoline injection systems.

Diagnose typical ignition system problems.
Adjust ignition timing.

Inspect and troubleshoot emission control systems.
Perform periodic service operations on emission control systems.
Test individual emission control components.
Replace or repair major emission control components.
Demonstrate and practice safe work procedures.

Perform exhaust system repairs.

Use advanced diagnostic techniques to troubleshoot difficult problems.
Use scan tool snapshot and datastream values to find problems not tripping trouble codes.

I. ENGINE REPAIR

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

Task Number and Description Priority Page #s

11. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.

P-1 94-95

12. Identify and interpret engine concern; determine necessary action.

P-1 137, 138-139, 871-896, 913-926

13. Research applicable vehicle and service information, such as internal engine operation, vehicle service history, service precautions, and technical service bulletins.

P-1 85-95

14. Locate and interpret vehicle and major component identification numbers.

P-1 86, 87, 269, 1072, 1110

15. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.

P-1 746, 786-788, 915

16. Diagnose engine noises and vibrations; determine necessary action.

P-2 138, 139, 916

17. Diagnose the cause of excessive oil consumption, coolant consumption, unusual engine exhaust color and odor; determine necessary action.

P-2 872-874, 892

18. Perform engine vacuum tests; determine necessary action.

P-1 872-874, 892

19. Perform cylinder power balance tests; determine necessary action.

P-2 895

10. Perform cylinder cranking and running compression tests; determine necessary action.

P-1 916-920

11. Perform cylinder leakage tests; determine necessary action.

P-1 920

12. Remove and reinstall engine in an OBDII or newer vehicle; reconnect all attaching components and restore the vehicle to running condition.

P-2 931-937, 1011, 1012

13. Install engine covers using gaskets, seals, and sealers as required.

P-1 119-124, 996-997, 1006-1007

14. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert.

P-1 117-120

15. Inspect, remove, and replace engine mounts.

P-2 925-926, 932-935

B. Cylinder Head and Valve Train Diagnosis and Repair

11. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specifications and procedures.

P-1 115-117, 942, 943, 990, 991

12. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.

P-1 938, 939, 971-974

13. Inspect valve springs for squareness and free height comparison; determine necessary action.

P-3 983, 984

14. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action.

P-3 984-986

15. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action.

P-3 974-976

16. Inspect valves and valve seats; determine necessary action.

P-3 974-983, 986

17. Check valve spring assembled height and valve stem height; determine necessary action.

P-3 984

18. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action.

P-2 989

19. Inspect valve lifters; determine necessary action.

P-2 988, 989

10. Adjust valves (mechanical or hydraulic lifters).

P-1 993-996

11. Inspect and replace camshaft and drive belt/chain (includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and variable valve timing components).

P-1 983-986, 989-993

12. Inspect and/or measure camshaft for runout, journal wear, and lobe wear.

P-2 987, 988

13. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action.

P-2 988

C. Engine Block Assembly Diagnosis and Repair

11. Disassemble engine block; clean and prepare components for inspection and reassembly.

P-1 940-945

12. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action.

P-2 948-955, 973

13. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action.

P-2 950, 951, 953, 954

14. Deglaze and clean cylinder walls.

P-2 951–953

15. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action.

P-3 988

16. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action.

P-1 960–961, 963–964

17. Inspect main and connecting rod bearings for damage and wear; determine necessary action.

P-2 958, 961–963, 965

18. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action.

P-3 949, 954, 955

19. Inspect and measure piston skirts and ring lands; determine necessary action.

P-2 941, 954–958, 964, 965

10. Remove and replace piston pin.

P-3 956, 957, 958

11. Determine piston-to-bore clearance.

P-2 955–956

12. Inspect, measure, and install piston rings.

P-2 941, 955–956, 958–960

13. Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time.

P-2 936, 954, 955, 987, 988

14. Remove, inspect, or replace crankshaft vibration damper (harmonic balancer).

P-2 217

15. Assemble engine block.

P-1 120–124, 791–793, 962, 990–993, 996, 997, 1004–1007

D. Lubrication and Cooling Systems Diagnosis and Repair

11. Perform oil pressure tests; determine necessary action.

P-1 789

12. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action.

P-2 793–797

13. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; determine necessary action.

P-1 747–749

14. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.

P-1 548–550, 756–757

15. Inspect and replace engine cooling and heater system hoses.

P-1 754, 755

16. Inspect, test, and replace thermostat and gasket/seal.

P-1 751–754

17. Test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required.

P-1 132, 751, 754, 759–765

18. Inspect, remove and replace water pump.

P-2 750, 751

19. Remove and replace radiator.

P-2 756

10. Inspect, and test fans(s) (electrical or mechanical), fan clutch, fan shroud, and air dams.

P-1 757, 758

11. Inspect auxiliary coolers; determine necessary action.
P-3 779
12. Inspect, test, and replace oil temperature and pressure switches and sensors.
P-2 798, 799
13. Perform oil and filter change.
P-1 128–130
14. Identify causes of engine overheating.

VIII. ENGINE PERFORMANCE

A. General Engine Diagnosis

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
P-1 94–95
 2. Identify and interpret engine performance concern; determine necessary action.
P-1 137–139, 859–866, 871–896, 913–926
 3. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins.
P-1 85–95, 862
 4. Locate and interpret vehicle and major component identification numbers.
P-1 86, 87, 269, 1072, 1110
 5. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
P-2 914–916
 6. Diagnose abnormal engine noise or vibration concerns; determine necessary action.
P-3 138, 139, 859, 916
 7. Diagnose abnormal exhaust color, odor, and sound; determine necessary action.
P-2 431, 915, 916
- NATEF Task List Correlation Chart 53
Task Number and Description Priority Page #s
8. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action.
P-1 872–874
 9. Perform cylinder power balance test; determine necessary action. P-2 895
 10. Perform cylinder cranking and running compression tests; determine necessary action.
P-1 906, 916–920
 11. Perform cylinder leakage test; determine necessary action.
P-1 920
 12. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action.
P-1 107, 108, 282–294, 599, 880–896
 13. Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action.
P-3 833–836, 837–840
 14. Verify engine operating temperature; determine necessary action.
P-1 752
 15. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.
P-1 746–749, 755, 756, 759–761
 16. Verify correct camshaft timing.
P-1 1001–1004, 1009
- ### B. Computerized Engine Controls Diagnosis and Repair
1. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable.
P-1 268–277
 2. Diagnose the causes of emissions or driveability concerns with stored or active diagnostic trouble codes; obtain, graph, and interpret scan tool data.
P-1 268–277, 373, 374, 384–391, 622, 846–849

3. Diagnose emissions or driveability concerns without stored diagnostic trouble codes; determine necessary action.
P-1 283-294, 373, 374, 384-391, 622, 846-849
4. Check for module communication (including CAN/BUS systems) errors using a scan tool.
P-2 284
5. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action.
P-1 282-294, 384-388, 622
6. Access and use service information to perform step-by-step diagnosis.
P-1 85-95, 269, 277
7. Diagnose 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); determine necessary action.
P-3 683-687, 1110-1113, 1493, 1544, 1545
8. Perform active tests of actuators using a scan tool; determine necessary action.
P-1 273, 875
- C. Ignition System Diagnosis and Repair
 1. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action.
P-1 595, 596, 621, 831, 863-866, 905
 2. Inspect and test ignition primary and secondary circuit wiring and solid-state components; test ignition coil(s); perform necessary action.
P-1 600-602, 618-619
 3. Inspect and test crankshaft and camshaft position sensor(s); perform necessary action.
P-1 618
 4. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram as necessary.
P-2 291-294
- D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair
 1. Diagnose 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; determine necessary action.
P-1 371-392, 403-408, 430-433, 863-867
 2. Check fuel for contaminants and quality; determine necessary action.
P-2 308-309
 3. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action.
P-1 329-334
 4. Replace fuel filters.
P-2 135, 329, 330
 5. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.
P-2 135, 334, 377, 378, 391, 991-993
 6. Inspect and test fuel injectors. P-1 376-381
 7. Verify idle control operation. P-1 381-383, 407-408, 432-437
 8. Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action.
P-1 450-455
 9. Perform exhaust system backpressure test; determine necessary action.
P-1 449, 847
 10. Test the operation of turbocharger/supercharger systems; determine necessary action.
P-3 450-458
- E. Emissions Control Systems Diagnosis and Repair
 1. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary

action.

P-2 798, 799, 804–809, 831–853

2. Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action.

P-2 806–810, 842, 843

3. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action.

P-1 811–815, 845, 846

4. Inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action.

P-1 811–815, 845, 846

5. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action.

P-2 811–815, 845, 846

6. Diagnose emissions and driveability concerns caused by the secondary air injection and catalytic converter systems; determine necessary action.

P-2 815–821, 846–849

7. Inspect and test mechanical components of secondary air injection systems; perform necessary action.

P-3 846, 847

8. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action.

P-3 846, 847

9. Inspect and test catalytic converter efficiency.

P-1 847, 848

10. Diagnose emissions and driveability concerns caused by the evaporative emissions control system; determine necessary action.

P-1 808–811, 826, 843, 844

11. Inspect and test components and hoses of the evaporative emissions control system; perform necessary action.

P-1 843, 844

12. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action.

P-1 831, 832

F. Engine Related Service

1. Adjust valves on engines with mechanical or hydraulic lifters.

P-1 993–996

2. Remove and replace timing belt; verify correct camshaft timing.

P-1 1009–1011

3. Remove and replace thermostat and gasket/seal.

P-1 751–753

4. Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action.

P-1 757–758

5. Perform common fastener and thread repairs, to include: remove broken bolt, restore internal and external threads, and repair internal threads with a threaded insert.

P-1 117–120

6. Perform engine oil and filter change.

P-1 129–130

7. Identify hybrid vehicle internal combustion engine service precautions.

Remediation:

Re-teach major concepts

Review with teacher assistance

Worksheets

Individual tutoring

Study groups
Review games
Reading comprehension packets
Retest or alternative assessment
Technology integration
Study guides
Computer assisted instruction
Checklists

Enrichment:

Working on skills for SkillsUSA , for local and state competition.

Special Adaptations:

Adaptations
Extended Time (assignments and/or testing)
Directions/Comprehension Check (frequent checks for understanding)
Study Guide
Directions and/or Tests Read Aloud
Adapted Tests and/or Assignments
Use of Calculator
Taking Tests in Alternate Setting (or if requested)
Verbal/Gestural Redirection (prompts to remain on task)
Drill and Practice (Repetition of Material)

Provide Visual Model to Accompany Verbal Directions (Written/Oral Directions)
Use of Computer (Access to)
Positive Reinforcement
Have Student Repeat Directions
Wait Time
Access to School Counselor
Use of Highlighter/Highlighted Text
Provide Frequent Feedback
Provide Frequent Breaks
Regular Notebook Check
Variety of Assessment Methods
Highly Structured Classroom
Syllabus for Major Projects
Limited, Short Directions
Grading Rubric
Communication Regarding Behavior & Consequences (PBS)
Clear Language for Directions
Provide Opportunities to Retest
Frequent Review Sessions
Use a variety of Modalities when Introducing Skills/Concepts
Allow Oral Answers for Testing
Cue for Oral Response
Daily Classwork Check
Encourage Student to Check Work Before Turning In
Opportunities for Repeated Practice of MATH Skills
Provide repetition During Initial Instruction
Allow Pre-read of Questions Before Reading Written Passage

Provide Verbal and Written Directions
All Vocabulary to be Defined Before Testing
Time out
Encouragement to Participate in Positive Leadership Roles
Student Self-Evaluation for Behavior
Exempt from reading Aloud in Front of Peers

Safety:

Student Must:
Handle material in a safe manner.
Use protective clothing and equipment.
Use hand tools in a safe manner.
Use adequate ventilation when working in enclosed area.
Follow manufacturer's directions when using any product, tool, equipment, etc.
Use proper safety precautions when using /operating hand tools.
Use tools and equipment in a professional work like manner according to OSHA standards.
Know and follow the established safety rules at all times.

Assessment:

Written test
Activity worksheets
Workbooks
Quizzes
Pre/Post Test
Writing Activities
Video/DVD Worksheets
Rubrics
Debates
Oral Presentation
Diagrams
Individual Projects
Group Projects
Current Events

Resources/Equipment:

Stockel Martin [2003] Modern Automotive Technology (7th ed). Tinley Park:
IL: The Goodhearth-Willcox Company, Inc.

Module 2 Lessons 1-15 Automotive Engines and Module 4 Lessons 1-14 Engine Performance
and Computer Fundamentals Modern Technology Service Technician (MAST) On-Line
Training. (2008)).Tinley Park: IL: The Goodhearth-Willcox Company, Inc.

Stockel Martin [2003] Textbook, Workbook and Student Job Manual - Modern
Automotive Technology (7th ed). Tinley Park: IL: The Goodhearth-Willcox Company,
Inc.

Snap-on Incorporated. (2014) All-Data Service Information.

MSDS hand book. Computers

Textbook:

Web base training - Service Information

hand tools:

Wrenches--open end, box end, and combination

Sockets--shallow, deep, 6-point, 12-point, standard, and impact

Drive size--1/4 inch, 3/8 inch, 1/2 inch, and 3/4 inch

Socket accessories--speed handle, extensions 3 to 36 inches long, universals, flex handle, and T bar

Screwdrivers--flat blade (standard), Phillips, clutch, and Torx

Pliers--slip joint, water pump, diagonal cutting, vise grip, snap ring, needle nose, battery, and duck bill

Punches--taper, pin, and center

Hammers--ball peen, soft face, and brass

Coolant Pressure Test Kit

Electronic Stethoscope

Fuel Pressure Line Disconnect Kit

Micrometer Measuring Tool

Caliber Measuring Tool

Dial Indicator Measuring Tool

Above the ground vehicle lifts

Drive-On lifts with hydraulic jacks

Tripod Jack Stands

Screw Jack Stand

Standard Jack Stand

Four 2 1/2 ton Floor Jacks

Torque Wrenches: 3/8 - 1/2 inch Drive

Inch Pound Torque wrench

Two Electric Reversible Drills

1/2 Inch Drive Impact Wrench - battery operated

1/2 Inch Drive Impact Air Wrench

3/8 Drive Air Impact Ratchet

1/4 Air Impact Ratchet

Oil Caddy

Drain pans and funnels

School -Owned Shop Vehicles - 2002 Ford Taurus. 2010 Kia Sorento. 2006 PT Cruiser.

Hyperlinks:

www.g-wonlinetextbooks.com

www.sp2.org

www.library.alldatapro.com

Steel Center and Technical Center

Unit Name: 1200 HEATING AND AIR
CONDITIONING



Number: 1200 **Hours:** 10.00

Dates: Fall 2019

Last Edited By: Automotive Technology (05-12-2016)

Description/Objectives:

Students will be able to identify, troubleshoot and demonstrate knowledge related to service information regarding heating and air conditioning maintenance.

Tasks:

- 1201 Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.
- 1202 Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action.
- 1203 Inspect A/C condenser for airflow restrictions; determine necessary action.
- 1204 Inspect engine cooling and heater systems hoses; perform necessary action.
- 1205 Inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets; perform necessary action.

Standards / Assessment Anchors

Focus Anchor/Standard #1:

- Pennsylvania Core Standards for Reading for Technical Subjects Standard 3.5

Supporting Anchor/Standards:

Standard CC.3.5.9-10.C / Standard CC.3.5.11-12.C Follow precisely a complex multistep procedure, etc.

Standard CC.3.5.9-10.G Translate quantitative or technical information expressed in a text into visual form (e.g. a table or chart).

Standard CC.3.5.11-12. G Integrate and evaluate multiple sources of information presented in diverse formats...to solve a problem.

Focus Anchor/Standard #2:

- Pennsylvania Core Standards for Writing for Technical Subjects Standard 3.6

Supporting Anchor/Standards:

Standard CC.3.6.9-10.C Standard CC.3.6.11-12 C Produce clear and coherent writing...appropriate to task, purpose, and audience.

Standard CC.3.6.9-10.E Standard CC.3.6.11-12.E. Use technology, including the internet, to produce, publish, and update individual or shared writing products.

RESEARCH GRADES 9-10-11-12

Standard CC.3.6.9-10.H. Standard CC.3.6.11-12.H. Draw evidence from informational texts to support analysis, reflection, and research.

Connecting Anchor/Standard:

- Pennsylvania Core Standards for Mathematics Standard 2.0

Supporting Anchor/Standards:

NUMBERS AND OPERATIONS

Standard 2.1.HS.F.2 Apply properties of rational and irrational numbers to solve real world or mathematical problems.

Standard 2.1.HS.F.4 Use units as a way to understand problems and to guide the solution of multistep problems.

Instructional Activities:

Knowledge:

Participate in lecture and discussion and respond to questions.
Complete reading assignments.
Complete written assignments.
Participate with the group activities.
Complete Task Sheet Assignment.
List all the parts of the cylinder head, engine oiling system, and cooling system.
Analyze the purposes of valve guides, seals, seats, springs, keepers, retainers, rotators.
Identify the parts in the valve operating mechanism including lifters, pushrods, rocker-arms, camshaft, oil gauges.
Explain the importance of vehicle maintenance.
Correctly answer ASE certification test questions on fluid service and vehicle maintenance.

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.
Discuss safety procedures to follow when working with cooling systems.
Correctly answer ASE certification test questions on cooling system construction and operation.

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.
Correctly answer ASE certification test questions on cooling system troubleshooting and repair.

Skills:

Check a car's fluid levels.
Locate fluid leaks.
Replace engine oil and filter.
Change automatic transmission fluid and filter.
Perform a grease job.
Inspect for general problems with hoses, belts, and other components.
Demonstrate safe practices while working with vehicle fluids.
Perform a combustion leak test and a system pressure test.
Check the major parts of a cooling system for proper operation.
Replace faulty cooling system components.
Drain, flush, and refill a cooling system.

Remediation:

Re-teach major concepts
Review with teacher assistance
Study group

Worksheets
Individual tutoring
Study groups
Review games
Reading comprehension packets
Placing events in a time line
Create a chart
Retest or alternative assessment
Technology integration
Study guides
Computer assisted instruction
Checklists

Enrichment:

Student will work on NATEF required tasks from student workbook to earn one year of industry credit toward ASE Certification.

Working on skills for SkillsUSA, For Local and State Competition.

Special Adaptations:

Extended Time (assignments and/or testing)
Preferential Seating
Directions/Comprehension Check (frequent checks for understanding)
Study Guide
Directions and/or Tests Read Aloud
Adapted Tests and/or Assignments
Use of Calculator
Taking Tests in Alternate Setting (or if requested)
Verbal/Gestural Redirection (prompts to remain on task)
Drill and Practice (Repetition of Material)
Small Group Instruction
Provide Visual Model to Accompany Verbal Directions (Written/Oral Directions)
Use of Computer (Access to)
Positive Reinforcement
Have Student Repeat Directions
Wait Time
Access to School Counselor
Use of Highlighter/Highlighted Text
Provide Frequent Feedback
Provide Frequent Breaks
Regular Notebook Check
Variety of Assessment Methods
Highly Structured Classroom
Syllabus for Major Projects
Limited, Short Directions
Grading Rubric
Communication Regarding Behavior & Consequences (PBS)
Clear Language for Directions
Provide Opportunities to Retest
Frequent Review Sessions
Use a variety of Modalities when Introducing Skills/Concepts
Allow Oral Answers for Testing
Cue for Oral Response
De-Escalation Opportunities
Daily Classwork Check

Encourage Student to Check Work Before Turning In
Opportunities for Repeated Practice of MATH Skills
Provide repetition During Initial Instruction
Allow Pre-read of Questions Before Reading Written Passage
Provide Verbal and Written Directions
All Vocabulary to be Defined Before Testing
Time out
Encouragement to Participate in Positive Leadership Roles
Student Self-Evaluation for Behavior
Exempt from reading Aloud in Front of Peers

Safety:

Student Must:
Handle material in a safe manner.
Use protective clothing and equipment.
Use hand tools in a safe manner.
Use adequate ventilation when working in enclosed area.
Follow manufacturer's directions when using any product, tool, equipment, etc.
Use proper safety precautions when using /operating hand tools.
Use tools and equipment in a professional work like manner according to OSHA standards.
Know and follow the established safety rules at all times.

Assessment:

Written test
Activity worksheets
Workbooks
Quizzes
Pre/Post Tests
Writing Activities
Video/DVD Worksheets
Rubrics
Debates
Oral Presentation
Diagrams
Individual Projects
Group Projects
Research Papers
Current Events

Resources/Equipment:

Stockel Martin [2003] .Modern Automotive Technology (7th ed). Tinley Park:
IL: The Goodheart-Willcox Company, Inc.

Stockel Martin [2003] Textbook, Workbook and Student Job Manual - Modern
Automotive Technology (7th ed). Tinley Park: IL: The Goodheart-Willcox Company,
Inc.

Snap-on Incorporated. (2014] All- Data on line Service Manuel.

Automotive Technology Workbooks

MSDS hand book

NATEF Task Assessment Worksheet

Computers

Textbook:

Wrenches--open end, box end, and combination

Sockets--shallow, deep, 6-point, 12-point, standard, and impact Drive
size--1/4 inch, 3/8 inch, 1/2 inch, and 3/4 inch

Socket accessories--speed handle, extensions 3 to 36 inches long, universals, flex handle, and T
bar

Screwdrivers--flat blade (standard), Phillips, clutch, and Torx
Pliers--slip joint, water pump, diagonal cutting, vise grip, snap ring, needle nose, battery, and duck bill
Punches--taper, pin, and center Hammers--ball
peen, soft face, and brass Coolant Pressure Test
Kit
Electronic Stethoscope
Fuel Pressure Line Disconnect Kit
Micrometer Measuring Tool Caliber
Measuring Tool
Dial Indicator Measuring Tool Above the
ground vehicle lifts Drive-On lifts with
hydraulic jacks Tripod Jack Stands
Screw Jack Stand Standard Jack
Stand Four 2 ½ ton Floor Jacks
Torque Wrenches: 3/8 – ½ inch Drive Inch
Pound Torque wrench
Two Electric Reversible Drills
½ Inch Drive Impact Wrench – battery operated
½ Inch Drive Impact Air Wrench 3/8
Drive Air Impact Ratchet
¼ Air Impact Ratchet Oil
Caddy
Drain pans and funnels
School –Owned Shop Vehicles – 2002 Chevy S-10 Pick-up Truck, 1999 Chevy Cavaliers (2), 1995
Pontiac Bonneville, 1991 Honda Civic, 1991 Chevy Lumina, 1997 Jeep Cherokee, 2001 Chevy Astro
Van, 1991 Ford Ranger Pick-up Truck, 1991 Buick Regal, 1991 Chevy Corsica, 1998 Subaru Legacy,
1998 Mitsubishi Mirage

Hyperlinks:

www.g-wonlinetextbooks.com www.sp2.org

www.library.alldatapro.com