

EASTERN ARIZONA COLLEGE

Steering and Suspension Systems

Course Design
2016-2017

Course Information

Division Industrial Technology Education
Course Number AUT 131
Title Steering and Suspension Systems
Credits 3
Developed by Brian Coppola
Lecture/Lab Ratio 2 Lecture/3 Lab

Transfer Status

ASU	NAU	UA
OMT Department Elective	CTE Department Elective	Non Transferable

Activity Course No
CIP Code 47.0604
Assessment Mode Pre/Post Test (25 Questions/100 Points)
Semester Taught Spring
GE Category No
Separate Lab No
Awareness Course No
Intensive Writing Course No

Prerequisites

None

Educational Value

This course is designed to reinforce and apply information, processes, and ideas gained in other courses. The major intent of this course is to enhance the individual's abilities to work with and diagnose vehicle steering and suspension systems.

Description

Course provides theory, diagnosis and the repair of automotive steering and suspension systems. Course includes an in-depth study of tires and wheels, wheel balancing, two and four wheel alignment, and diagnostic and service techniques. Course prepares students for ASE certification test on steering and suspension systems.

Supplies

Safety Glasses

Competencies and Performance Standards

1. Apply proper safety procedures and processes.

Learning objectives

What you will learn as you master the competency:

- a. Acquaint self with shop environment and hazards.
- b. Acquaint self with emergency procedures and policy.
- c. Accept responsibility for personal well being and practice and follow safety guidelines.
- d. Acquaint self with material safety data sheets and chemicals used in shop.

Performance Standards

Competence will be demonstrated:

- o when learner completes safety assignments and written exam at a satisfactory level

Criteria - Performance will be satisfactory when:

- o learner observes and practices safety procedures

2. Diagnose and repair various steering system concerns using a strategy-based process.

Learning objectives

What you will learn as you master the competency:

- a. Determine root cause for steering systems' problems related to steering columns, linkages, gearbox, rack, power steering components, and electronically controlled systems.
- b. Perform needed repairs to solve steering systems' problems related to steering columns, linkages, gearbox, rack, power steering components, and electronically controlled systems.

Performance Standards

Competence will be demonstrated:

- o when learner completes NATEF aligned assignment and job sheets listed in the related learning plan (The assignment and job sheets must be completed at a satisfactory level to the instructor)
- o when learner performs the priority NATEF tasks listed in the related learning plan (The tasks must be completed with limited supervision - entry level)

Criteria - Performance will be satisfactory when:

- o learner is productive, works safely, and in a professional manner while working on NATEF task requirements listed in related learning plan
- o learner provides acceptable oral and/or written responses to questions and/or situations asked by the instructor, while working on the NATEF task requirements listed in related learning plan
- o learner actively participates in the NATEF task requirements listed in the related learning plan
- o learner attends required class and lab sessions and shows up on time

3. Diagnose and repair various front suspension system concerns using a strategy-based process.

Learning objectives

What you will learn as you master the competency:

- a. Determine root cause for front suspension problems related to ride height, body sway,

MacPherson strut, SLA components, linkages, knuckle assemblies, ball joints, and bearing plated assemblies.

- b. Perform needed repairs to solve front system problems related to ride height, body sway, MacPherson strut, SLA components, linkages, knuckle assemblies, ball joints, and bearing plated assemblies.

Performance Standards

Competence will be demonstrated:

- o when learner completes NATEF aligned assignment and job sheets listed in the related learning plan (The assignment and job sheets must be completed at a satisfactory level to the instructor)
- o when learner performs the priority NATEF tasks listed in the related learning plan (The tasks must be completed with limited supervision - entry level)

Criteria - Performance will be satisfactory when:

- o learner is productive, works safely, and in a professional manner while working on NATEF task requirements listed in related learning plan
- o learner provides acceptable oral and/or written responses to questions and/or situations asked by the instructor, while working on the NATEF task requirements listed in related learning plan
- o learner actively participates in the NATEF task requirements listed in the related learning plan
- o learner attends required class and lab sessions and shows up on time

4. Diagnose and repair various rear suspension system concerns using a strategy-based process. (NATEF IV B 2)

Learning objectives

What you will learn as you master the competency:

- a. Determine root cause for steering systems' problems related to steering columns, linkages, gearbox, rack, power steering components, and electronically controlled systems.
- b. Perform needed repairs to solve front system problems related to ride height, body sway, MacPherson strut, SLA components, linkages, knuckle assemblies, ball joints, and bearing plated assemblies.

Performance Standards

You will demonstrate your competence:

- o when learner completes NATEF aligned assignment and job sheets listed in the related learning plan (The assignment and job sheets must be completed at a satisfactory level to the instructor)
- o when learner performs the priority NATEF tasks listed in the related learning plan (The tasks must be completed with limited supervision - entry level)

Your performance will be successful when:

- o learner is productive, works safely, and in a professional manner while working on NATEF task requirements listed in related learning plan
- o learner provides acceptable oral and/or written responses to questions and/or situations asked by the instructor, while working on the NATEF task requirement listed in related learning plan
- o learner actively participates in the NATEF task requirements listed in the related learning plan

- o learner attends required class and lab sessions and shows up on time

5. Diagnose wheel alignment problems and performs needed adjustments or repair. (NATEF IV C)

Learning objectives

What you will learn as you master the competency:

- a. Determine root cause of alignment problems related to vehicle stability and handling, tire wear, and steering wheel location.
- b. Perform pre-alignment inspection procedures according to MFG recommendations.
- c. Perform two- and four-wheel alignment inspection and adjust front and rear wheel as needed.
- d. Perform front cradle alignment procedure.

Performance Standards

You will demonstrate your competence:

- o when learner completes NATEF aligned assignment and job sheets listed in the related learning plan (The assignment and job sheets must be completed at a satisfactory level to the instructor)
- o when learner performs the priority NATEF tasks listed in the related learning plan (The tasks must be completed with limited supervision - entry level)

Your performance will be successful when:

- o learner is productive, works safely, and in a professional manner while working on NATEF task requirements listed in related learning plan
- o learner provides acceptable oral and/or written responses to questions and/or situations asked by the instructor, while working on the NATEF task requirement listed in related learning plan
- o learner actively participates in the NATEF task requirements listed in the related learning plan
- o learner attends required class and lab sessions and shows up on time

6. Diagnose and repair various wheel and tire concerns. (NATEF IV D)

Learning objectives

What you will learn as you master the competency:

- a. Demonstrate root cause of unusual tire problems related to wear patterns, vibration, shimmy, noise, and vehicle pull.
- b. Perform needed repairs to solve tire related problems.
- c. Perform proper preventative service on tire and wheel components.

Performance Standards

You will demonstrate your competence:

- o when learner completes NATEF aligned assignment and job sheets listed in the related learning plan (The assignment and job sheets must be completed at a satisfactory level to the instructor)
- o when the learner performs the priority NATEF tasks listed in the related learning plan (The tasks must be completed with limited supervision - entry level)

Your performance will be successful when:

- o learner is productive, works safely, and in a professional manner while working on

- NATEF task requirements listed in related learning plan
- learner provides acceptable oral and/or written responses to questions and/or situations asked by the instructor, while working on the NATEF task requirement listed in related learning plan
- learner actively participates in the NATEF task requirements listed in the related learning plan
- learner attends required class and lab sessions and shows up on time

Types of Instruction

Classroom presentation

Lab

Computer-based instruction

Simulated or actual work experience

Individualized self-study

Grading Information

Grading Rationale

Grading Weights

Lab = 45%

Class (Includes Test and Assignments) = 45%

Final Exam (Post Test is the Final) = 10%

Grading Methods

Class score calculation-

Quizzes, assignments and job sheet points shall be added and carry a weight equal to one test score.

All exams except the final shall have equal weight (test scores averaged) and used in class score calculations.

The final (post test) will be worth at least 10% of the overall final grade calculation.

Lab score calculation-

Instructor should evaluate each student's work habits using lab time card.

Each student should be evaluated on productivity and progress on task requirements, working in a professional manner, clean-up and safe work habits. Instructor is also required to evaluate each student's skill level in achieving the NATEF task requirement outlined in the various learning plans.

Instructors are encouraged to reward students for showing up on time and attending each class and lab session. This can be done by requiring students to make arrangements with the instructor to make-up any lost time prior to missed day. All students need to notify the instructor of sick days through voice mail, etc. on the day of sickness. Instructors should not allow for any work to be turned in late or any test made up without some type of deduction for late assignments/test. Suggested deduction 50% of original score.

Grading Scale

- A 90-100%
- B 80-89.9%
- C 70-79.9%
- D 60-69.9%
- F 0-59.9%

Pass/Fail A non-major student may choose to have a grade of P or F rather than a letter grade. A grade of P will require that the student receive a percentage grade of at least 70%. A grade less than this will result in a grade of F.

Learning Plan

Safety

Overview

In this learning plan you will develop the knowledge needed to work safely in a shop environment. You will learn safety procedures, the location of safety equipment, and the safety features of various shop equipment. The instruction will cover general shop safety processes, fire safety, battery safety, lifting procedures, and health-related hazards.

1. Apply proper safety procedures and processes.

Learning Activities

- ____ 1. Complete a worksheet/assignment sheet.

- ____ 2. Collect a current article that relates to concepts and issues about which you are studying.

- ____ 3. Listen and observe a lecture covering safety procedures and practices - review a safety and hazards video.

- ____ 4. Operate hoist, floor jack (jack stands) and any equipment needed during assigned lab activities.

- ____ 5. Identify location of safety equipment, first aid kit, phone, fire blanket, fire extinguishers, exits, light switches, and vents.

Assessment Activities

- ____ 1. Participate in safety discussion.
- ____ 2. Complete activities in lesson.
- ____ 3. Complete written safety test.

Learning Plan

Steering Systems Diagnosis and Repair

Overview

To be able to properly diagnose and repair steering systems.

2. Diagnose and repair various steering system concerns using a strategy-based process. (NATEF IV A)

Learning Activities

- ____ 1. Disable and enable supplemental restraint system (SRS) in accordance with manufacturer's procedures. (P-1 NATEF IV A 1)
- ____ 2. Remove and replace steering wheel and center/time supplemental restraint system (SRS) coil in accordance with manufacturer's procedures. (P-1 NATEF IV A 2)
- ____ 3. Check steering column noises, looseness, and binding concerns (including tilt mechanisms). (P-3 NATEF IV A 3)
- ____ 4. Check power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and fluid leakage concerns. (P-3 NATEF IV A 4)
- ____ 5. Check power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and fluid leakage concerns. (P-3 NATEF IV A 5)
- ____ 6. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel. (P-2 NATEF IV A 6)
- ____ 7. Adjust manual or power non-rack and pinion worn bearing preload and sector lash. (P-3 NATEF IV A 7)
- ____ 8. Remove and replace manual or power rack and pinion steering gear and inspect mounting bushings and brackets. (P-2 NATEF IV A 8)
- ____ 9. Disassemble, inspect, perform necessary action, and reassemble rack and pinion steering gear. (P-3 NATEF IV A 9)
- ____ 10. Adjust manual or power rack and pinion steering gear. (P-3 NATEF IV A 10)
- ____ 11. Inspect and replace manual or power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots. (P-2 NATEF IV A 11)
- ____ 12. Inspect power steering fluid levels and condition. (P-1 NATEF IV A 12)

- _____ 13. Flush, fill, and bleed power steering system. (P-2 NATEF IV A 13)
- _____ 14. Diagnose power steering fluid leakage and determine necessary action. (P-2 NATEF IV A 14)
- _____ 15. Remove, inspect, replace, and adjust power steering pump belt. (P-1 NATEF IV A 15)
- _____ 16. Remove, inspect, and replace power steering pump pulley and check alignment. (P-3 NATEF IV A 16)
- _____ 17. Remove, inspect, and replace power steering pump pulley and check alignment. (P-3 NATEF IV A 17)
- _____ 18. Inspect and replace power steering hoses and fittings. (P-2 NATEF IV A 18)
- _____ 19. Inspect and replace pitman arm, relay (center link/intermediate) rod, idler arm and mountings, and steering linkage damper. (P-3 NATEF IV A 19)
- _____ 20. Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps. (P-2 NATEF IV A 20)
- _____ 21. Check and adjust components of electronically controlled steering systems. (P-3 NATEF IV A 21)

Assessment Activities

- _____ 1. Participate in classroom discussions. Listen, take notes, and discuss items presented in class related to vehicle steering systems.
- _____ 2. Access and use repair information systems and interactive computer-based learning systems and reference material.
- _____ 3. Complete assignments requirements related to steering systems. AS1-L1-UI, AS1-L2-UI, AS1-L3-UI, AS1-L1-UII, AS1-L2,UIII, AS2-L2-UIII, AS3-L2-UIII, AS1-L1-UIV, AS2-L1-UIV, AS3-L1-UVI, AS1-L1-UV, AS2-L1-UV, AS3-L1-UV, AS4-L1-UV, AS1-L2-UV, AS2-L2-UV, AS3-L2-UV, AS1-L2-UVI, AS2-L1-UVI, AS3-L1-UVI, AS1-L2-UVII, AS2-L2-UVII.
- _____ 4. Complete job sheets related to steering system. JS1-L1-UII, JS2-L1-UII, JS1-L2-UII, JS3-L2-UII, JS1-L2-UIII, JS2-L2-UII, JS3-L2-UII, JS3-L2-UII, JS4-L2-UII, JS5-L2-UII, JS1-L1-UIV, JS2-L1-UIV, JS3-L1-UIV, JS1-L2-UIV, JS2-L2-UIV, JS3-L2-UIV, JS1-L1-UV, JS2-L1-UV, JS3-L1-UV, JS4-L1-UV, JS1-L2-UV, JS1-L1-UVI, JS1-L2-UVI, JS2-L2-UVI, JS3-L2-UVI, JS1-L2-UVII, JS-L2-UVII
- _____ 5. Complete written test covering steering system theory, service, and repair.

Learning Plan

Suspension Systems Diagnosis and Repair

Overview

To be able to properly diagnose and repair suspension systems.

3. Diagnose and repair various front suspension system concerns using a strategy-based process. (NATEF IV B 1)

AND

4. Diagnose and repair various rear suspension system concerns using a strategy-based process. (NATEF IV B 2)

Learning Activities

- ____ 1. Inspect short and long arm suspension system noises, body sway, and uneven riding height concerns. (P-1 NATEF IV B 1-1)
- ____ 2. Inspect MacPherson strut suspension system noises, body sway, and uneven riding height concerns. (P-1 NATEF IV B 1-2)
- ____ 3. Remove, inspect, and install upper and lower control arms, bushings, shafts, and rebound bumpers. (P-2 NATEF IV B 1-3)
- ____ 4. Remove, inspect, install, and adjust strut (compression/tension) rods and bushings. (P-2 NATEF IV B 1-4)
- ____ 5. Remove, inspect, and install upper and lower ball joints on short and long arm suspension systems. (P-2 NATEF IV B 1-5)
- ____ 6. Remove, inspect, and install steering knuckle assemblies. (P-2 NATEF IV B 1-6)
- ____ 7. Remove, inspect, and install short and long arm suspension system coil springs and spring insulators. (P-2 NATEF IV B 1-7)
- ____ 8. Remove, inspect, install, and adjust suspension system torsion bars and inspect mounts. (P-3 NATEF IV B 1-8)
- ____ 9. Remove, inspect, and install stabilizer bar bushings, brackets, and links. (P-3 NATEF IV B 1-9)
- ____ 10. Remove, inspect, and install MacPherson strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount. (P-1 NATEF IV B 1-10)
- ____ 11. Lubricate suspension and steering systems. (P-2 NATEF IV B 1-11)

- _____ 12. Remove, inspect, and install coil springs and spring insulators. (P-2 NATEF IV B 2-1)
- _____ 13. Remove, inspect, and install transverse links, control arms, bushings, and mounts. (P-2 NATEF IV B 2-2)
- _____ 14. Remove, inspect, and install leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts. (P-3 NATEF IV B 2-3)
- _____ 15. Remove, inspect, and install MacPherson strut cartridge or assembly, strut coil spring, and insulators (silencers). (P-2 NATEF IV B 2-4)
- _____ 16. Inspect, remove, and replace shock absorbers. (P-1 NATEF IV B 3-1)
- _____ 17. Remove, inspect, and service or replace front and rear wheel bearings. (P-1 NATEF IV B 3-2)
- _____ 18. Diagnose, inspect, adjust, repair, or replace components of electronically controlled suspension systems. (P-2 NATEF IV B 3-3)

Assessment Activities

- _____ 1. Participate in classroom discussion / lectures. Listen, take notes, and discuss topic presented.
- _____ 2. Access and use electronic learning systems CBI and manuals
- _____ 3. Complete related assignment sheets. AS1-L1-UIX, AS2-L1-UIX, AS1-L1-UX, AS1-L2-UX, AS2-L2-UX, AS3-L2-UX, AS4-L2-UX, AS1-L2-UX, AS1-L1-UXI, AS2-L1-UXI, AS1-L2-UXII, AS2-L2-UXII, AS3-L2-UXIII, AS1-L2-UXIV, AS2-L1-UXIV.
- _____ 4. Complete related job sheets. JS1-L1-UIX, JS2-L1-UIX, JS3-L1-UIX, JS1-L1-UX, JS2-L1-UX, JS3-L1-UX, JS1-L2-UX, JS2-L2-UX, JS3-L2-UX, JS4-L4-UX, JS5-L2-UX, JS1-L1-UXI, JS2-L1-UXI, JS1-L1-UXII, JS2-L1-UXII, JS3-L1-UXII, JS1-L2-UXIII, JS2-L2-UXIII, JS3-L2-UXIII, JS4-L2-UXIII - AND complete Fords electronic self diagnosis testing sequence using scan tool on Lincoln.
- _____ 5. Complete written test covering suspension systems.

Learning Plan

Wheel Alignment Diagnosis, Adjustment, and Repair

Overview

To be able to properly diagnose, adjust and repair wheel alignment problems.

5. Diagnose wheel alignment problems and perform needed adjustments or repair. (NATEF IV C)

Learning Activities

- ____1. Verify customer concerns related to vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns. (P-1 NATEF IV C 1)
- ____2. Perform pre-alignment inspection. (P-1 NATEF IV C 2)
- ____3. Measure vehicle riding height. (P-1 NATEF IV C 3)
- ____4. Check and adjust front and rear wheel camber. (P-1 NATEF IV C 4)
- ____5. Check and adjust caster. (P-1 NATEF IV C 5)
- ____6. Check and adjust front wheel toe. (P-1 NATEF IV C 6)
- ____7. Center steering wheel. (P-1 NATEF IV C 7)
- ____8. Check toe-out-on-turns (turning radius). (P-2 NATEF IV C 8)
- ____9. Check SAI (steering axis inclination) and included angle. (P-2 NATEF IV C 9)
- ____10. Check and adjust rear wheel toe. (P-2 NATEF IV C 10)
- ____11. Check rear wheel thrust angle and determine necessary action. (P-2 NATEF IV C 11)
- ____12. Check for front wheel setback and determine necessary action. (P-2 NATEF IV C 12)
- ____13. Check front cradle (sub frame) alignment and determine necessary action. (P-3 NATEF IV C 13)

Assessment Activities

- ____1. Participate in classroom discussion / lecture. Listen, take notes, and discuss alignments process.
- ____2. Access and use repair information / manuals during learning process.

- _____3. Complete Bear Alignment computer-based instruction module.
- _____4. Complete required assignment sheets related to alignment. AS1-L1-UXVII, AS1-L2-UXVI, AS1-L3-UXVII, AS2-L3-UXVII.
- _____5. Complete required job sheets related to alignment. JS1-L1-UXVII, JS1-L3-UXVII, JS2-L3-UXVII.
- _____6. Complete written test covering alignment.

Learning Plan

Wheel and Tire Diagnosis and Repair

Overview

To be able to properly diagnose and repair wheel and tire components.

6. Diagnose and repair various wheel and tire concerns. (NATEF IV D)

Learning Activities

- ____1. Inspect for unusual tire wear patterns. (P-1 NATEF IV D 1)
- ____2. Inspect tires and check and adjust air pressure. (P-1 NATEF IV D 2)
- ____3. Diagnose wheel/tire vibration, shimmy, and noise. (P-2 NATEF IV D 3)
- ____4. Rotate tires according to manufacturer's recommendations. (P-1 NATEF IV D 4)
- ____5. Measure wheel, tire, axle, and hub run out. (P-2 NATEF IV D 5)
- ____6. Diagnose tire pull (lead) problem. (P-2 NATEF IV D 6)
- ____7. Balance wheel and tire assembly (static and dynamic). (P-1 NATEF IV D 7)
- ____8. Dismount, inspect, repair, and remount tire on wheel. (P-2 NATEF IV D 8)
- ____9. Reinstall wheel and torque lug nuts. (P-1 NATEF IV D 9)

Assessment Activities

- ____1. Participate in class lecture. Listen, take notes, and discuss topic.
- ____2. Complete required assignments sheets related to tires, wheels and bearing assembly. AS1-L2-UXV, AS1-L2-UXVI
- ____3. Complete job sheet related to tires, wheels and bearing assembly. JS1-L2-UXV, JS2-L2-UXV, JS1-L3-UXV, JS2-L3-UXV, JS1-L2-UXVI, JS2-UXVI
- ____4. Complete written test related to tires, wheels and bearing assembly.