

EASTERN ARIZONA COLLEGE

Manual Transmission and Drive Train

Course Design
2016-2017

Course Information

Division Industrial Technology Education
Course Number AUT 120
Title Manual Transmission and Drive Train
Credits 3
Developed by Brian Coppola
Lecture/Lab Ratio 2 Lecture/3 Lab

Transfer Status

ASU	NAU	UA
Non Transferable	CTE Departmental Elective	Non Transferable

Activity Course No
CIP Code 47.0604
Assessment Mode Pre/Post Test (25 Questions/100 Points)
Semester Taught Fall semester in even-numbered years
GE Category None
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 diagnosis items related to manual transmissions, transaxles, and the drive train.

Description

This course provides instruction related to power train theory, diagnosis, and service of clutches, driveline, synchromesh transmissions, and final drives. Course covers standard transmission, transaxles, and 4-wheel drive operation. Prepares the student for the ASE certification test on manual drive train.

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 chemical used in shop.

Performance Standards

You will demonstrate your competence:

- o through completing safety assignments and written exam at a satisfactory level

Your performance will be successful when:

- o learner observes and practices safety procedures

2. Diagnose mechanical and hydraulic clutch concerns using a strategy-based process. (NATEF III A).

Learning objectives

What you will learn as you master the competency:

- a. Perform trouble-shooting process to include verifying customer concern, preliminary inspection, and clutch systems performance tests.
- b. Perform linkage adjustments and any needed preventative service on clutch systems.

Performance Standards

You will demonstrate your competence:

- o in completing NATEF aligned assignments 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 through performing 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 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. Perform clutch replacement procedure according to the manufacturer's requirements. (NATEF III A)

Learning objectives

What you will learn as you master the competency:

- a. Remove, inspect, and replace clutch systems components as needed.

Performance Standards

You will demonstrate your competence:

- in completing NATEF aligned assignments and job sheets listed in the related learning plan (the assignment and job sheets must be completed at a satisfactory level to the instructor)
- through performing 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:

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

4. Diagnose mechanical and electrical manual transmission/transaxle concerns using a strategy-based process. (NATEF III A)**Learning objectives**

What you will learn as you master the competency:

- a. Perform trouble-shooting process to include verifying customer concern preliminary inspection, and transmission/transaxle performance tests.
- b. Determine root cause for various vehicle noise, vibration, fluid linkages, and operational concerns on transmission and transaxle.
- c. Perform linkage adjustments and any recommended preventative service on transmission/transaxle.

Performance Standards

You will demonstrate your competence:

- in completing NATEF aligned assignments and job sheets listed in the related learning plan (the assignment and job sheets must be completed at a satisfactory level to the instructor)
- through performing 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:

- 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 requirements 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

5. Perform overhaul inspection and repair on manual transmission and transaxle. (NATEF III B)

Learning objectives

What you will learn as you master the competency:

- a. Remove, inspect, and replace transmission and transaxle components as needed.

Performance Standards

You will demonstrate your competence:

- o in completing NATEF aligned assignments 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 through performing 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
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- o learner attends required class and lab sessions and shows up on time

6. Diagnose operational concerns related to RWD and FWD vehicle drive axle, shaft and differential assembly using a strategy-based process. (NATEF III C & D)

Learning objectives

What you will learn as you master the competency:

- a. Determine root cause for various noise, vibration, fluid linkages, and operational concerns on transmission and transaxle drive axle, shaft, and differential assembly.
- b. Perform any recommended preventative service on driveline assembly.

Performance Standards

You will demonstrate your competence:

- o in completing NATEF aligned assignments 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 through performing 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:

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

7. Perform service and major repair on RWD and FWD vehicle drive axles, shaft, and differential assembly according to the manufacturer's recommended procedures. (NATEF III C & D)

Learning objectives

What you will learn as you master the competency:

- a. Remove, inspect, and replace system components within or on drive axles, shaft, and differential assembly.

Performance Standards

You will demonstrate your competence:

- o in completing NATEF aligned assignments 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 through performing the priority NATEF tasks listed in the related learning plan (the tasks must be completed with limited supervision-entry level)

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

8. Diagnose four-wheel drive/all-wheel drive component concerns using a strategy-based process. (NATEF III E)

Learning objectives

What you will learn as you master the competency:

- a. Determine root cause for operational problems related to four-wheel drive transfer case and hub assemblies.
- b. Perform linkage adjustments and any recommended preventative service on transfer case and hub assemblies.

Performance Standards

You will demonstrate your competence:

- o in completing NATEF aligned assignments 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 through performing the priority NATEF tasks listed in the related learning plan (the tasks must be completed with limited supervision-entry level)

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- 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

9. Perform inspection and overhaul to four-wheel drive transfer case and hub assemblies. (NATEF III E)

Learning objectives

What you will learn as you master the competency:

- a. Remove, inspect, and replace four-wheel drive transfer case components as needed.

Performance Standards

You will demonstrate your competence:

- o in completing NATEF aligned assignments 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 through performing the priority NATEF tasks listed in the related learning plan (the tasks must be completed with limited supervision-entry level)

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

Types of Instruction

Classroom Presentation

Lab

Individualized/Independent Study

Simulated or Actual Work Experience

Grading Information

Grading Rationale

Each instructor has the flexibility to develop evaluative procedures within the following parameters:

1. The Post-test will represent 10% of the course grade.
2. Course learning activities shall represent 90% of the course grade.

Lab = 50%

Class (Includes Test and Assignments and Final) = 50%

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 %

C 70-79 %

D 60-69 %

F Below 60%

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. Participates in safety discussion.

- ____ 2. Complete activities in lesson.

- ____ 3. Complete written safety test.

Learning Plan

Mechanical and Hydraulic Clutch Concerns

Overview

To accurately diagnose clutch problems.

2. Diagnose mechanical and hydraulic clutch concerns using a strategy-based process. (NATEF III A)

Learning Activities

- ____1. Identify causes of clutch noise, binding, slippage, pulsation, and chatter. (P-1 NATEF III A1)

- ____2. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs. (P-1 NATEF III A2)

- ____3. Inspect hydraulic clutch slave and master cylinders, lines, and hoses. (P-1 NATEF III A3)

Assessment Activities

- ____1. Participate in discussion of subject material. Listen, take notes, complete CBI instructional activities, and discuss material presented in lesson.

- ____2. Complete assignment sheets related to clutch diagnosis. (AS1-L1-UIV)

Learning Plan

Clutch Replacement Procedures

Overview

To accurately repair clutch problems.

4. Diagnose mechanical and electrical manual transmission/transaxle concerns using a strategy-based process. (NATEF III A)

Learning Activities

- ____ 1. Inspect release (throw-out) bearing, lever, and pivot and perform necessary action. (P-1 NATEF III A 4)

- ____ 2. Inspect and replace clutch pressure plate assembly and clutch disc. (P-1 NATEF III A 5)

- ____ 3. Inspect, remove, or replace crankshaft pilot bearing or bushing (as applicable). (P-1 NATEF III A 6)

- ____ 4. Inspect flywheel and ring gear for wear and cracks and measure runout. (P-1 NATEF III A7)

- ____ 5. Inspect engine block, clutch (bell) housing, and transmission/transaxle case mating surfaces. (P-3 NATEF III A8)

- ____ 6. Measure flywheel-to-block runout and crankshaft endplay. (P-3 NATEF III A9)

Assessment Activities

- ____ 1. Participate in discussion of subject material. Listen, take notes, and participate in discussion related to clutch replacement.

- ____ 2. Complete job sheets related to clutch system repair. JS1-L1-UV, JS1-L2-UV

- ____ 3. Complete written test covering clutch system.

Learning Plan

Mechanical and Electrical Manual Transmission/Transaxle concerns

Overview

To accurately diagnose mechanical and electrical manual transmission/transaxle concerns.

4. Diagnose mechanical and electrical manual transmission/transaxle concerns using a strategy-based process. (NATEF III A)

Learning Activities

- ____ 1. Identify causes of noise, hard shifting, jumping out of gear, and fluid leakage concerns. (P-3 NATEF III B4)

- ____ 2. Inspect, adjust, and reinstall shift linkages, brackets, bushings, cables, pivots, and levers. (P-3 NATEF III B5)

- ____ 3. Inspect and reinstall powertrain mounts. (P-3 NATEF III B6)

- ____ 4. Identify causes of transaxle final drive assembly noise and vibration concerns. (P-3 NATEF III B13)

Assessment Activities

- ____ 1. Participate in discussion of subject material. Listen, take notes, complete CBI activity, and discuss lesson material.

- ____ 2. Complete assignment and job sheets in lesson. AS1-L1-UI, AS1-L1-UII, AS1-L2-UII, AS1-L1-UII & JS1-L1-UII

Learning Plan

Overhaul Inspection and Repair on Manual Transmission and Transaxle

Overview

To perform overhaul inspection and repair on manual transmission and transaxle.

5. Perform overhaul inspection and repair on manual transmission and transaxle. (NATEF III B)

Learning Activities

- ____ 1. Remove and reinstall transmission/transaxle. (P-2 NATEF III B1)

- ____ 2. Disassemble, clean, and reassemble transmission/transaxle components. (P-2 NATEF III B2)

- ____ 3. Inspect transmission/transaxle case, extension housing case mating surfaces, bores, bushings, and vents. (P-3 NATEF III B3)

- ____ 4. Inspect and replace gaskets, seals, and sealants and inspect sealing surfaces. (P-2 NATEF III B7)

- ____ 5. Remove and replace transaxle final drive. (P-3 NATEF III B8)

- ____ 6. Inspect, adjust, and reinstall shift cover, forks, levers, grommets, shafts, sleeves, detent mechanism, interlocks, and springs. (P-2 NATEF III B9)

- ____ 7. Measure endplay or preload (shim or spacer selection procedure) on transmission/transaxle shafts and perform necessary action. (P-1 NATEF III B10)

- ____ 8. Inspect and reinstall synchronizer hub, sleeve, keys (inserts), springs, and blocking rings. (P-2 NATEF III B11)

- ____ 9. Inspect and reinstall speedometer drive gear, driven gear, vehicle speed sensor (VSS), and

retainers. (P-2 NATEF III B12)

- _____10. Remove, inspect measure, adjust, and reinstall transaxle final drive pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case assembly. (P-2 NATEF III B14)

- _____11. Inspect lubrication devices (oil pump or slingers). (P-1 NATEF III B15)

- _____12. Inspect, test, and replace transmission/transaxle sensors and switches. (P-1 NATEF III B16)

Assessment Activities

- _____1. Participate in discussion of subject material. Listen, take notes, review process, and discuss material presented related to transmission overhaul.

- _____2. Complete assignment and job sheets related to overhauling transmission / transaxle. AS1-L2-UIII, AS2-L2-UIII, AS1-L3-UIII, JS1-L2-UIII, JS2-L2-UIII, JS1-L3-UIII, JS2-L3-UIII

- _____3. Complete written test related to transmission components and overhaul process.

Learning Plan

RWD and FWD Vehicle Drive Axle, Shaft and Differential Assemblies

Overview

To accurately diagnose operational concerns related to RWD and FWD vehicle drive axle, shaft, and differential assemblies.

6. Diagnose operational concerns related to RWD and FWD vehicle drive axle, shaft and differential assembly using a strategy-based process. (NATEF III C & D)

Learning Activities

- ____ 1. Identify cause of constant-velocity (CV) joint noise and vibration concerns and determine necessary action. (P-2 NATEF III C1)

- ____ 2. Identify cause of universal joint noise and vibration concerns. (P-2 NATEF III C2)

- ____ 3. Identify cause of noise and vibration concerns. (P-2 NATEF III D1-1)

- ____ 4. Identify cause of fluid leakage concerns. (P-2 NATEF III D1-2)

- ____ 5. Identify cause of noise, slippage, and chatter concerns. (P-3 NATEF III D2-1)

- ____ 6. Measure rotating torque. (limited slip) (P-3 NATEF III D2-4)

- ____ 7. Identify causes for axle shaft noise and vibration. (P-2 NATEF III D3-1)

- ____ 8. Identify cause for axle assembly fluid leakage. (P-2 NATEF III D3-2)

Assessment Activities

- ____ 1. Participate in discussion of subject material. Listen, take notes, and discuss operation and service related to differential & drive assemblies.

- ____ 2. Complete assignment and job sheets related to lesson. AS1-L1-UVII, AS1-L1-UVII & JS1-L1-UVIII

Learning Plan

Service and Major Repairs on RWD and FWD Vehicle Drive Axles, Shaft and Differential Assemblies

Overview

To service RWD and FWD vehicle drive axles, shaft and differential assemblies.

7. **Perform service and major repair on RWD and FWD vehicle drive axles, shaft, and differential assembly according to the manufacturer's recommended procedures. (NATEF III C & D)**

Learning Activities

- ____ 1. Replace front wheel drive (FWD) front wheel bearing. (P-2 NATEF III C3)
- ____ 2. Inspect, service, and replace shafts, yokes, boots, and CV joints. (P-1 NATEF III C4)
- ____ 3. Inspect, service, and replace shaft center support bearings. (P-3 NATEF III C5)
- ____ 4. Check shaft balance, measure shaft runout, and measure and adjust driveline angles. (P-3 NATEF III C6)
- ____ 5. Inspect and replace companion flange and pinion seal and measure companion flange runout. (P-2 NATEF III D1-3)
- ____ 6. Inspect ring gear and measure runout and determine necessary action. (P-2 NATEF III D1-4)
- ____ 7. Remove, inspect, and reinstall drive pinion and ring gear, spacers, sleeves, and bearings. (P-2 NATEF III D1-5)
- ____ 8. Measure and adjust drive pinion depth. (P-2 NATEF III D1-6)
- ____ 9. Measure and adjust drive pinion bearing preload. (P-1 NATEF III D1-7)

- ____ 10. Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types). (P-1 NATEF III D1-8)
- ____ 11. Check ring and pinion tooth contact patterns and perform necessary action. (P-1 NATEF III D1-9)
- ____ 12. Disassemble, inspect, measure, and adjust or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case. (P-2 NATEF III D1-10)
- ____ 13. Reassemble and reinstall differential case assembly and measure runout. (P-2 NATEF III D1-11)
- ____ 14. Inspect and flush differential housing and refill with correct lubricant. (limited slip) (P-2 NATEF III D2-2)
- ____ 15. Inspect and reinstall clutch (cone or plate) components. (P-3 NATEF III D2-3)
- ____ 16. Inspect and replace drive axle shaft wheel studs. (P-3 NATEF III D3-2)
- ____ 17. Remove and replace drive axle shafts. (P-1 NATEF III D3-3)
- ____ 18. Inspect and replace drive axle shaft seals, bearings, and retainers. (P-2 NATEF III D3-4)
- ____ 19. Measure drive axle flange runout and shaft endplay and determine necessary action. (P-2 NATEF III D3-5)

Assessment Activities

- ____ 1. Participate in discussion of subject material. Listen, take notes, and discuss material presented in lesson.
- ____ 2. Complete assignment and job sheets in lesson. AS1-L2-UXI, AS2-L2-UXI & JS1--L3-UVI
- ____ 3. Complete written test covering axles, drive lines, and differential assemblies.

Learning Plan

Four-Wheel Drive/All-Wheel Drive Component Concerns

Overview

To diagnose four-wheel drive/all-wheel drive components concerns.

8. Diagnose four-wheel drive/all-wheel drive component concerns using a strategy-based process. (NATEF III E)

Learning Activities

- ____1. Identify causes of noise, vibration, and unusual steering concerns. (P-3 NATEF III E1)

- ____2. Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets. (P-3 NATEF III E2)

- ____3. Check drive assembly seals and vents and check lube level. (P-3 NATEF III E6)

- ____4. Diagnose test, adjust, and replace electrical/electronic components of four-wheel drive systems. (P-3 NATEF III E7)

Assessment Activities

- ____1. Participate in discussion of subject material. Listen, take notes, watch demonstration, and discuss repairing transfer case assemblies.

- ____2. Complete assignment and job sheets in lesson. AS1-L2-UXII, AS2-L2-UXII & JS1-L2-UXII, JS1-L4-UXIII

Learning Plan

Inspection and Overhaul of Four-Wheel Drive Transfer Case and Hub Assemblies

Overview

To accurately inspect and overhaul four-wheel drive transfer case and hub assemblies.

9. Perform inspection and overhaul to four-wheel drive transfer case and hub assemblies. (NATEF III E)

Learning Activities

- ____1. Remove and reinstall transfer case. (P-3 NATEF III E3)

- ____2. Disassemble, service, and reassembly transfer case and components. (P-3 NATEF III E4)

- ____3. Inspect front-wheel bearings and locking hubs. (P-3 NATEF III E5)

Assessment Activities

- ____1. Participate in discussion of subject material. Listen, take notes, watch demonstration and participate in discussion related to transfer case assemblies.

- ____2. Complete assignment and job sheets in lesson. AS1-L4-UXIII & JS2-L2-UXII, JS2-L4-UXII

- ____3. Complete written test covering transfer case assembly.