



BAKER COLLEGE
STUDENT LEARNING OUTCOMES

DSL 2610 Heavy Duty Drive Trains
4 Semester Hours

Student Learning Outcomes & Enabling Objectives

1. Diagnose Clutch 1
 - a. Identify causes of clutch noise, binding, slippage, pulsation, vibration, grabbing, dragging, and chatter problems.
 - i. Determine needed action.
 - b. Inspect clutch linkages, cables, levers, brackets, bushings, pivots, springs, and clutch safety switch (includes push and pull-type assemblies).
 - i. Check pedal height and travel.
 - ii. Perform needed action.
 - c. Assess hydraulic clutch slave and master cylinders, lines, and hoses.
 - i. Bleed system.
 - d. Inspect release (throw out) bearing, sleeve, bushings, springs, housing, levers, release fork, fork pads, rollers, shafts, and seals.
 - i. Determine needed action, i.e. adjust, lubricate or replace.

2. Diagnose Clutch 2
 - a. Inspect single-disc clutch pressure plate and clutch disc.
 - i. Determine needed action, i.e. adjust or replace as needed.
 - b. Inspect two-plate clutch pressure plate, clutch discs, intermediate plate, and drive pins/lugs.
 - i. Determine needed action, i.e. adjust or replace as needed.
 - c. Inspect clutch brake assembly.
 - i. Inspect input shaft and bearing retainer.
 - ii. Perform needed action.
 - iii. Replace as needed.
 - d. Inspect self-adjusting/continuous-adjusting clutch mechanisms.
 - i. Determine needed action, i.e. adjust or replace as needed.
 - e. Inspect pilot bearing.

- i. Replace as needed.
 - f. Examine flywheel.
 - i. Remove flywheel.
 - ii. Reinstall flywheel.
 - iii. Inspect mounting area on crankshaft, rear main oil seal, and measure crankshaft end play.
 - iv. Determine needed action.
 - g. Inspect flywheel and starter ring gear
 - i. Measure flywheel face and pilot bore runout.
 - ii. Determine needed action.
 - h. Inspect flywheel housing(s) to transmission housing/engine mating surface(s).
 - i. Measure flywheel housing face and bore runout.
 - ii. Determine needed action.
- 3. Examine Transmission – Introduction
 - a. Identify causes of transmission noise, shifting concerns, lockup, jumping-out-of-gear, overheating, and vibration problems.
 - i. Determine needed action.
 - b. Inspect air shift controls, lines, hoses, valves, regulators, filters, and cylinder assemblies.
 - i. Test air shift controls, lines, hoses, valves, regulators, filters, and cylinder assemblies.
 - ii. Determine needed action.
 - c. Inspect transmission mounts, insulators, and mounting bolts.
 - i. Replace as needed.
 - d. Inspect for leakage in transmission cover plates, gaskets, seals, cap bolts, seal surfaces and vents.
 - i. Repair as needed.
 - e. Check transmission fluid level and condition.
 - i. Determine needed service.
 - ii. Add proper type of lubricant.
- 4. Examine Transmission – Mechanical Component Inspection
 - a. Inspect transmission shift lever, cover, rails, forks, levers, bushings, sleeves, detents, interlocks, springs, and lock bolts/safety wires.
 - i. Adjust as needed.
 - ii. Replace as needed.
 - b. Inspect transmission.
 - i. Remove transmission.
 - ii. Reinstall transmission.
 - c. Inspect input shaft, gear, spacers, bearings, retainers, and slingers.

- i. Determine needed action.
 - d. Inspect transmission oil filters, coolers and related components.
 - i. Replace as needed.
 - e. Inspect speedometer components.
 - i. Determine needed action.
- 5. Examine Transmission – Power Take-Offs and Shift Controls
 - a. Inspect power take-off (P.T.O.) assemblies, controls, and shafts.
 - i. Determine needed action.
 - b. Test function of reverse light, neutral start, and warning device circuits.
 - i. Determine needed action.
 - c. Test transmission temperature gauge, wiring harnesses, and sensor/sending unit.
 - i. Determine needed action.
 - d. Test operation of automated mechanical transmission and manual electronic shift controls, shift, range, and splitter solenoids, shift motors, indicators, speed and range sensors, electronic/transmission control units (ETU,TCU), neutral/in gear and reverse switches, and wiring harnesses.
 - i. Determine needed action.
- 6. Examine Transmission – Electronic Control Diagnosis
 - a. Test operation of automated mechanical transmission electronic shift selectors, air and electrical switches, displays and indicators, wiring harnesses, and air lines.
 - i. Identify needed action.
 - b. Use appropriate electronic service tool(s) and procedures to diagnose automated mechanical transmission problems.
 - i. Record diagnostic codes, clear codes, and interpret digital multimeter (DMM) readings.
 - ii. Identify needed action.
 - c. Test operation of automatic transmission electronic shift controls, shift solenoids, shift motors, indicators, speed and range sensors, electronic/transmission control units (ECU/TCU), neutral/in gear and reverse switches, and wiring harnesses.
 - d. Test operation of automatic transmission electronic shift selectors, switches, displays, indicators, and wiring harnesses.
 - e. Use appropriate electronic service tool(s) and procedures to diagnose automatic transmission problems
 - i. Record diagnostic codes, clear codes, and interpret digital multimeter (DMM) readings.
 - ii. Determine needed action.
- 7. Examine Driveshaft and Universal Joint
 - a. Identify causes of driveshaft and universal joint noise and vibration problems.

- i. Determine needed action.
 - b. Inspect driveshaft, slip joints, yokes, drive flanges, and universal joints, driveshaft boots and seals, retaining hardware, and driveshaft phasing.
 - i. Identify needed action.
 - 1. Service as needed.
 - c. Inspect driveshaft center support bearings and mounts.
 - i. Determine needed action.
 - d. Measure driveline angles.
 - i. Determine needed action.
- 8. Examine Drive Axle 1
 - a. Identify causes of drive axle(s) drive unit noise and overheating problems.
 - i. Determine needed action.
 - b. Check for fluid leaks.
 - i. Repair as needed.
 - ii. Inspect drive axle housing cover plates, gaskets, sealants, vents, magnetic plugs, and seals. 1
 - 1. Service as needed.
 - c. Check drive axle fluid level and condition.
 - i. Determine needed service.
 - ii. Add proper type of lubricant.
 - d. Service differential carrier assembly.
 - i. Remove differential carrier assembly.
 - ii. Replace differential carrier assembly.
 - e. Inspect differential case assembly including spider gears, cross shaft, side gears, thrust washers, case halves, and bearings.
 - i. Replace as needed.
 - f. Inspect components of locking differential case assembly.
 - i. Service as needed.
 - g. Inspect differential carrier housing and caps, side bearing bores, and pilot (spigot, pocket) bearing bore.
 - i. Determine needed action.
- 9. Examine Drive Axle 2
 - a. Measure ring gear runout.
 - i. Determine needed action.
 - b. Inspect ring and drive pinion gears, spacers, sleeves, bearing cages, and bearings.
 - i. Service as needed.
 - c. Measure drive pinion bearing preload.
 - i. Adjust as needed.
 - d. Measure drive pinion depth.

- i. Adjust as needed.
- e. Measure side bearing preload and ring gear backlash.
 - i. Adjust as needed.
- f. Analyze ring gear and pinon tooth contact pattern.
 - i. Determine needed action.
- g. Inspect ring gear thrust block/screw.
 - i. Service as needed.
- h. Inspect power divider (inter-axle differential) assembly.
 - i. Determine needed action.

10. Examine Drive Axle 3

- a. Inspect air operated power divider (inter-axle differential) lockout assembly including diaphragms, seals, springs, yokes, pins, lines, hoses, fittings, and controls.
 - i. Service as needed.
- b. Inspect drive axle lubrication system: pump, troughs, collectors, slingers, tubes, and filters.
 - i. Service as needed.
- c. Inspect drive axle shafts.
 - i. Replace as needed.
- d. Service wheel assembly.
 - i. Remove wheel assembly.
 - ii. Replace wheel assembly.
 - iii. Check rear wheel seal and axle flange gasket for leaks.
 - iv. Perform needed action.

11. Examine Drive Axle 4

- a. Determine the causes of drive axle wheel bearing noise and check for damage.
 - i. Perform needed action.
- b. Test drive axle temperature gauge, wiring harnesses, and sending unit/sensor.
 - i. Determine needed action.
- c. Service wheel bearings.
 - i. Clean wheel bearings.
 - ii. Inspect wheel bearings.
 - iii. Lubricate wheel bearings.
 - iv. Replace wheel bearings.
 - v. Replace seals and wear rings.
 - vi. Inspect and replace retaining hardware.
 - vii. Adjust drive axle wheel bearings.
 - viii. Identify end play with dial indicator method

Big Ideas

Drive Shafts and Universal Joints Clutches

Transmissions

Drive Axles

Essential Questions:

1. What problems do you find and need to correct on Drive shafts and universal joints on medium/heavy duty trucks?
2. How do you diagnose Transmission shifting and noise problems on medium/heavy duty trucks?
3. What can you find when analyzing clutch systems on medium/heavy duty trucks?
4. How do you diagnose Rear axle issues?
5. What problems can you find when evaluating Drive Assistance systems?

These SLOs are approved for experiential credit.

Effective: Fall 2021