DIESEL ENGINE SPECIALIZATION
Course Syllabus

Course Number: TRUK-0166
OCAS Code: None
Course Length: 165 Hours
Career Cluster: Transportation, Distribution, and Logistics
Career Pathway: Medium/Heavy Diesel Truck Repair
Career Major(s): Diesel Service Technician

Pre-requisite(s): Students will disassemble, repair and reassemble a diesel engine. Necessary engine measurements will be taken as students diagnose and repair the cylinder heads, valve train, cylinder block, crankshaft and related components. This course covers the fundamentals and construction of diesel engines and related components; how to service and repair diesel engines; diagnose causes of engine fuel, oil, coolant, air leaks, engine noises vibrations; and determine needed repairs.

Course Description: Students will disassemble, repair and reassemble a diesel engine. Necessary engine measurements will be taken as students diagnose and repair the cylinder heads, valve train, cylinder block, crankshaft and related components. This course covers the fundamentals and construction of diesel engines and related components; how to service and repair diesel engines; diagnose causes of engine fuel, oil, coolant, air leaks, engine noises vibrations; and determine needed repairs.

Textbooks/Materials:
- PTTTS Truck Web-Bases Training Online Courses

Course Objectives: A. Diagnose and Repair Problems in the Lubrication System.
1. Discuss lubricants used in the equipment.
2. Discuss crude oil by-products.
3. List common additives used in oils.
4. Identify SAE and API ratings.
5. Describe the parts of an engine's lubrication system.
6. Discuss how oil analysis programs assist in diagnosis and preventative maintenance.
7. Determine proper lubricant and perform oil and filter change. (P1-I.D.7)
8. Lubricate equipment parts with grease gun.
9. Discuss preventative maintenance for lubrication and cooling system.
10. Test engine oil pressure and check operation of pressure sensor, gauge, and/or sending unit; determine needed action. (P1-I.D.1)
11. Check engine oil level, condition, and consumption; determine needed action. (P1-I.D.2)
12. Inspect and measure oil pump, drives, inlet pipes, and pick-up screens; determine needed action. (P3-I.D.3)
13. Inspect oil pressure regulator valve(s), by-pass and pressure relief valve(s), oil thermostat, and filters; determine needed action. (P3-I.D.4)
14. Inspect, clean, and test oil cooler and components; determine needed action. (P3-I.D.5)
15. Inspect turbocharger lubrication system; determine needed action. (P2-I.D.6)
B. Diagnose and Repair Problems in the Cooling System.
   1. Identify parts of cooling system and discuss the purpose of each.
   2. Identify possible causes of engine overheating.
   3. Discuss preventive maintenance for lubrication and cooling system.
   4. Check engine coolant type, level, condition, and consumption; determine needed action. (P1-I.E.1)
   5. Inspect and repair coolant system leaks, both cold and hot.
   6. Perform oil pressure test.
   7. Perform coolant system leak test.
   8. Test coolant temperature and check operation of temperature sensor, gauge, and/or sending unit; determine needed action. (P2-I.E.2)
   9. Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment. (P1-I.E.3)
   10. Inspect thermostat(s), by-passes, housing(s), and seals; replace as needed. (P2-I.E.4)
   11. Test coolant for freeze protection and additive package concentration; adjust as needed. (P1-I.E.5)
   12. Recover, flush, and refill with recommended coolant/additive package; bleed cooling system. (P1-I.E.6)
   13. Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed. (P1-I.E.7)
   14. Inspect water pump and hoses; replace as needed. (P1-I.E.8)
   15. Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud; replace as needed. (P2-I.E.10)
   16. Inspect, clean, and pressure test radiator, pressure cap, tank(s); and recovery systems; determine needed action. (P1-I.E.9)

C. Inspect and Repair Air Flow System.
   1. Define terms associated with air flow system.
   2. Explain operation of turbo-charger, super-charger, air cleaners, and cooling system air flow.
   3. Check air induction system: piping, hoses, clamps, and mounting; check for air restrictions and leaks; service or replace air filter as needed. (P1-I.F.2)
   4. Inspect turbocharger(s), wastegate, and piping systems; determine needed action. (P2-I.F.1)
   5. Remove and reinstall turbocharger/wastegate assembly. (P2-I.F.3)
   6. Inspect intake manifold, gaskets, and connections; replace as needed. (P3-I.F.4)
   7. Measure air intake restriction.
   8. Inspect, clean, and test charge air cooler assemblies; replace as needed. (P2-I.F.5)
   9. Inspect exhaust manifold, piping, mufflers, exhaust after-treatment devices(s), and mounting hardware; repair or replace as needed. (P2-I.F.6)
   10. Inspect and measure exhaust manifold restriction.
   11. Inspect and test preheater/inlet air heater, or glow plug system and controls; perform needed action. (P2-I.F.7)
   12. Inspect and test exhaust gas recirculation (EGR) system; determine needed action. (P3-I.F.8)
   13. Inspect ether/starting fluid system and controls; repair or replace as needed.

D. Inspect, Diagnose and Repair Fuel System.
   1. Define terms associated with fuel systems.
   2. Explain operation of fuel systems.
3. List the checks and services usually performed with fuel system service.
4. Check fuel level, quality, and consumption; determine needed action. (P1-I.G.1.1)
5. Discuss how the need to control engine emissions has changed the emphasis of tune-up procedures (electronic ignition).
6. Describe checks involved in a visual inspection of the ignition system.
7. List and discuss the instruments most commonly used in troubleshooting fuel systems.
8. Demonstrate the ability to perform various tests with engine analyzer.
9. Use and compare the different types of timing lights.
10. List factors that affect setting engine timing (static/dynamic).
11. Discuss procedures for removing and replacing the fuel pump.
12. Diagnose no starting, hard starting, and engine misfire on engines and determine repair.
13. Compare and contrast the different electronic fuel injection systems (i.e., Caterpillar, Cummins, Detroit, Volvo).
14. Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, supply and return lines and fittings; determine needed action. (P1-I.G.1.2)
15. Inspect, clean, and test fuel transfer (lift) pump, pump drives, screens, fuel/water separators/indicators, filters, heaters, coolers, ECM cooling plates, and mounting hardware; determine needed action. (P1-I.G.1.3)
16. Check fuel system for air; determine needed action; prime and bleed fuel system; check primer pump. (P1-I.G.1.5)
17. Inspect and test low pressure regulator systems (check valves, pressure regulator valves, and restrictive fittings); determine needed action. (P1-I.G.1.4)
18. Inspect and adjust throttle control linkage; determine needed action. (P3-I.G.2.3)
19. Perform on-engine inspections. Remove, test, adjust injectors (and nozzles); determine needed repairs.
20. Perform on-engine inspections, tests, and adjustments; check and adjust timing or replace and time a distributor (rotary) type injection pump; determine needed action. (P3-I.G.2.1)
21. Perform on-engine inspections, tests, and adjustments; check and adjust timing or replace and time an in-line type injection pump; determine needed action. (P3-I.G.2.2)
22. Perform on-engine inspections, tests, and adjustments; replace a PT-type injection pump and injectors as needed.
23. Perform on-engine inspections, tests, and adjustments, or replace unit injectors and/or electronic controls.
24. Inspect, test, and adjust injection nozzles; determine needed repairs.
25. Inspect air/fuel ratio control systems; determine needed action. (P3-I.G.2.4)
26. Inspect high pressure injection lines, hold downs, fittings and seals; replace as needed. (P3-I.G.2.6)
27. Inspect low pressure fuel lines, fittings, and seals; replace as needed.
28. Inspect, test, and adjust engine fuel shut-down devices and controls; determine needed action. (P3-I.G.2.5)

E. Diagnose and Repair Cylinder Head and Valve Train.
1. Match terms relating to cylinder heads and valve trains to their correct definitions.
2. Discuss safety precautions to be followed when repairing cylinder heads.
3. List cylinder head service procedures that can be performed with the head still attached to the cylinder block.
4. Explain the importance of cleaning the engine before starting repairs and tell
what should be used.

5. Describe methods used during disassembly to help identify where parts go during reassembly.

6. Drain the cooling system and engine oil, disconnect all necessary electrical devices, make drawings, and tag parts.

7. Remove, clean, inspect for visible damage, and replace cylinder head(s) assembly. (P1-I.B.1)

8. Clean and inspect threaded holes, studs, and bolts for serviceability; determine needed action. (P1-I.B.2)

9. Inspect cylinder head for cracks/damage; check mating surfaces for warpage; check condition of passages; inspect core/expansion and gallery plugs; determine needed action. (P1-I.B.3)

10. Disassemble head and inspect valves, guides, seats, springs, retainers, rotators, licks, and seals; determine needed action. (P3-I.B.4)

11. List problems that should be checked for when performing a visual inspection of the valve train.

12. Demonstrate how to check for bent valve springs.

13. Measure valve head height relative to deck and valve face-to-seat contact; determine needed action. (P3-I.B.5)

14. Inspect injector sleeves and seals; measure injector tip or nozzle protrusion; perform needed action. (P3-I.B.6)

15. Inspect and adjust valve bridges (crossheads) and guides; perform needed action. (P2-I.B.7)

16. Reassemble cylinder head. (P3-I.B.8)

17. Inspect, measure, and replace/reinstall overhead camshaft; measure/adjust end play and backlash. (P2-I.B.9)

18. Inspect pushrods, rocker arms, rocker arm shafts, electronic wiring harness, and brackets for wear, bending, cracks, looseness, and blocked oil passages; perform needed action. (P2-I.B.10)

19. Inspect and measure camshaft lobes and journals using a dial indicator and/or a micrometer.

20. List camshaft defects that can indicate the need for replacement.

21. Inspect cam followers; perform needed action. (P2-I.B.11)

22. Inspect, test, and repair/replace all worn or defective components pertaining to the cylinder head and valve train.

23. Discuss how to check and adjust valve clearance on engines with rocker arms and overhead camshaft engines.


25. Inspect and replace camshaft drives (includes checking gear wear and backlash, sprocket and chain wear, overhead cam drive sprockets, drive belts, belt tension, and tensioners).

26. Measure camshaft timing according to manufacturers' specifications.

27. Install heads and gaskets; tighten according to manufacturers specifications.

F. Inspect, Repair and/or Replace Engine Pistons, Rings, and Rods.

1. List in order the steps for removing an engine.

2. Demonstrate how to safely remove an engine from a vehicle.

3. Discuss preliminary procedures performed before piston removal.

4. Mark position and location of connecting rods and bearing caps.

5. Demonstrate the correct use of Plastigage in measuring rod bearing clearance.

6. Demonstrate how to safely remove cylinder ridges.

7. Correctly remove and mark position and location of pistons and connecting rods from cylinders.

8. Remove compression rings and oil-control rings from piston without breakage.
9. Demonstrate the ability to remove piston pins with a hydraulic press.
10. Discuss factors that determine if piston service/replacement is necessary.
11. Determine piston-to-cylinder wall clearance; check ring-to-groove clearance and end gap; install rings on pistons. (P2-I.C.12)
12. Inspect connecting rod and bearings for wear patterns; measure pistons, pins, retainers, and bushings; perform needed action. (P2-I.C.11)
13. Assemble piston and connecting rods; install in block; install rod bearings and check clearances. (P2-I.C.13)
14. Check condition of piston cooling jets (nozzles); determine needed action. (P2-I.C.14)

G. Diagnose and Repair Cylinder Block, Crankshaft, and Related Components.
1. Define terms associated with cylinder block and crankshaft service.
2. Measure crankshaft end play and main bearing clearance.
3. Discuss when it’s appropriate to reuse a crankshaft; and list repair procedures generally included in cylinder block service.
4. Discuss procedures for engine block parts removal, cleaning, and inspection.
5. Disassemble, clean, and inspect engine block for cracks/damage; measure mating surfaces for warpage; check condition of passages, core/expansion and gallery plugs; inspect threaded holes, studs, dowel pins, and bolts for serviceability; determine needed action. (P3-I.C.2)
6. Inspect cylinder sleeve counterbore and lower bore; check bore distortion; determine needed action. (P3-I.C.3)
7. Clean, inspect and measure cylinder walls or liners for wear and damage; determine needed action. (P2-I.C.4)
8. Replace/reinstall cylinder liners and seals; check and adjust liner height. (P2-I.C.5)
9. Inspect in-block camshaft bearings for wear and damage; determine needed action. (P3-I.C.6)
10. Inspect, measure, and replace/reinstall in-block camshaft; measure/adjust end play. (P3-I.C.7)
11. Discuss when it’s appropriate to reuse camshafts.
12. List procedures included in cylinder block reassembly.
13. Clean and inspect crankshaft for surface cracks and journal damage; check condition of oil passages; check passage plugs; measure journal diameter; determine needed action. (P2-I.C.8)
14. Discuss the replacement of expansion plugs and crankshaft seals.
15. Explain the procedure for replacing main bearings.
16. Inspect main bearings for wear patterns and damage; replace as needed; check bearing clearances; check and adjust crankshaft end play. (P2-I.C.9)
17. Inspect flywheel/flexplate (including ring gear) and mounting surfaces for cracks and wear; measure runout; determine needed action. (P3-I.C.17)
18. Inspect, remove, and replace crankshaft pilot bearing/bushing.
19. Remove auxiliary shaft; inspect shaft and support bearings for damage and wear
20. Inspect, install and time gear train; measure gear backlash; determine needed action. (P3-I.C.10)
21. Remove, inspect, service, and install pans, covers, vents, gaskets, seals, and wear rings. (P1-I.C.1)
22. List procedures to safely install an engine.
23. Reassemble and install engine.
24. Inspect and measure crankshaft vibration damper; determine needed action. (P2-I.C.15)
25. Install and align flywheel housing; inspect flywheel housing(s) to transmission housing/engine mating surface(s) and measure flywheel housing face and bore
runout; determine needed action. (P3-I.C.16)

26. List procedures to follow during start-up and engine break-in.

\* ODCTE Objective
Coding indicates NATEF alignment.
All unmarked objectives are TTC instructor developed.

Teaching Methods: The class will primarily be taught by the lecture and demonstration method and supported by various media materials to address various learning styles. There will be question and answer sessions over material covered in lecture and media presentations. Supervised lab time is provided for students to complete required projects.

Grading Procedures: 1. Students are graded on theory and shop practice and performance.
2. Each course must be passed with seventy (70%) percent or better.
3. Grading scale: A=90-100%, B=80-89%, C=70-79%, D=60-69%, F=50-59%.

Description of Classroom, Laboratories, and Equipment: Tulsa Technology Center campuses are owned and operated by Tulsa Technology Center School District No. 18. All programs provide students the opportunity to work with professionally certified instructors in modern, well-equipped facilities.

Available Certifications/College Credit: The student may be eligible to take state, national or industry exam after completion of the program. College credit may be issued from Oklahoma State University-Okmulgee or Tulsa Community College. See program counselor for additional information.

College Credit Eligibility: The student must maintain a grade point average of 2.0 or better.