

HEAVY EQUIPMENT AND TRUCK TECHNOLOGY

INTRODUCTION OF DIESEL ELECTRICAL AND ELECTRONIC SYSTEMS

Calculate current using Ohm's law
Calculate voltage using Ohm's law
Calculate resistance using Ohm's law
Predict changes in voltage, current, and resistance in a circuit

UNDERSTANDING CIRCUITS AND CIRCUIT DEVICES

Explain what the color bands found on resistors represent, and use the color bands on a resistor to determine its resistance value
Determine correct replacement fuses
Use wire color and circuit identification codes to locate circuit information
Use wiring diagrams to locate information about circuits
Use your knowledge of electric/electronic theory and circuit devices to predict changes in current, voltage, and resistance in a series circuit
Inspect, test, and replace spike suppression diodes/resistors

DEVELOPING BASIC DIAGNOSIS AND REPAIR SKILLS

Identify types of circuits and circuit devices on a circuit
Perform calculations using units of electrical measurement
Prepare to measure current, voltage, resistance, and frequency with a multimeter
Calculate resistance in sample circuits
Calculate current in sample circuits
Calculate voltage drops in sample circuits
Calculate voltage in sample circuits
Calibrate and make functionality tests on electrical diagnostic instruments
Check electrical/electronic circuits with jumper wires
Check electrical circuits with a test light
Check voltage in electrical/electronic circuits with a multimeter
Check voltage drops in electrical/electronic with a multimeter
Check current flow in electrical/electronic circuits with a multimeter
Check continuity and resistance in electrical/electronic circuits and components with a multimeter
Find shorts, grounds, opens, and high resistance problems in electrical/electronic circuits
Tin a soldering iron or gun
Inspect, test, repair, and replace switches, connectors, terminals, and wires of electrical/electronic circuits
Inspect, test, and replace fusible links, circuit breakers, and fuses

UNDERSTANDING VEHICLE COMPUTER CONTROLS

Demonstrate how a potentiometer functions as a sensor
Use a DVOM to measure reference voltage output from the electronic control module

BATTERY DIAGNOSIS AND SERVICING

Evaluate factors in selecting the appropriate battery for a vehicle

Maintain and restore electronic memory functions

Inspect, clean, fill, and replace a battery, battery cables, connectors, clamps, battery box, and hold-downs

Make a battery state-of-charge test

Make a battery capacity (load) test

Determine battery state-of-charge- using an open circuit voltage test

Slow and fast charge a battery

Diagnose parasitic (key-off) battery drain problems

Connect batteries in series, parallel, and series-parallel

Jump-start a vehicle

STARTING SYSTEMS DIAGNOSIS AND REPAIR

Diagnose starting system problems

Make a no-load starter current draw test

Make starter circuit voltage drop tests

Inspect, test, and repair or replace switches, connectors, and wires of starter control circuits

Inspect, test, and replace starter relays and solenoids

Remove and replace starter

CHARGING SYSTEMS DIAGNOSIS AND REPAIR

Diagnose charging system problems that cause an undercharge, a no-charge, or an overcharge condition

Inspect, adjust, and replace alternator drive belts, pulleys, and tensioners.

Make a charging system output test; determine needed repairs

Make a charging circuit voltage drop test; determine needed repairs

Test an S.I. series alternator

Inspect, repair, or replace connectors and wires of charging circuits

Remove, inspect, and replace an alternator

LIGHTING SYSTEMS DIAGNOSIS AND REPAIR

Diagnose the cause of headlights and daytime running lights problems

Diagnose the cause of parking lights, clearance lights, and taillights problems

Diagnose the cause of stoplight (brake light) problems

Diagnose the cause of turn signals and hazard lights problems

Diagnose the cause of back-up lights problems

Diagnose the cause of instrument lighting problems

Diagnose the cause of courtesy lights problems

Inspect, replace, and aim headlights/bulbs

Inspect, test, and replace light bulbs and test sockets

Inspect, test, repair and replace the components of a headlights and daytime running lights circuit

Inspect, test, repair and replace the components of a parking light, clearance light and tailgate circuit

Inspect, test, repair and replace the components of a stoplight (brake light) circuit
Inspect, test, repair and replace the components of a turn signal and hazard lights circuit
Inspect, test, repair and replace the components of a back-up lights circuit
Inspect, test, repair and replace the components of an instrument lighting circuit
Inspect, test, repair and replace the components of a courtesy lights circuit
Inspect, test, repair and replace the components of tractor-to-trailer lights circuit

DRIVER INFORMATION SYSTEMS DIAGNOSIS AND REPAIR

Diagnose the cause(s) of faulty gauge readings
Diagnose the cause(s) of the faulty operation of an electronic instrument cluster, warning light, indicator light, and driver information circuit
Diagnose the cause(s) of the faulty operation of audible warning devices
Inspect, test, repair, and replace the components of a gauge circuit
Inspect, test, repair, and replace the components of an electronic instrument cluster, warning light, indicator light, and driver information circuit
Inspect, test, repair, and replace components of audible warning device circuits
Inspect, test, replace, and calibrate electronic speedometer, odometer, and tachometer circuits

RELATED ELECTRICAL COMPONENTS

Diagnose the cause of horn problems
Diagnose the cause of wiper problems
Diagnose the cause of windshield washer problems
Diagnose the cause of heater problems
Inspect, test, repair, and replace the components of a horn circuit
Inspect, test, repair, and replace the components of wiper circuits
Inspect, test, repair, and replace intermittent (pulsing) wiper controls
Inspect, test, repair, and replace the components of a windshield washer circuit
Inspect, test, repair, and replace the components of a heater circuit
Inspect, test, repair, and replace the components of an engine block heater

MISCELLANEOUS ELECTRICAL ACCESSORIES

Diagnose the cause of power window problems
Diagnose the cause of heated, lighted, and electrically operated mirror problems
Diagnose the cause of electric door lock problems
Inspect, test, repair, and replace the parts of a power window
Inspect, test, repair, and replace the parts of a heated, lighted, and electrically operated mirror
Inspect, test, repair, and replace the parts of an electric door lock
Inspect, test, repair, and replace the parts of a cigarette lighter/auxiliary power outlet

INTRODUCTION TO BRAKES

Diagnose and determine possible causes of general brake problems
Identify features for assigned vehicle
Move vehicle and prepare for service

Check brake fluid level and condition and inspect for leaks

ANTILOCK BRAKE SYSTEMS

Diagnose and determine possible causes of ABS problems

Inspect, test, and service an antilock brake system

Troubleshoot antilock brake system problems

HYDRAULIC FOUNDATION DRUM BRAKES

Remove, clean, inspect, and measure a brake drum

Remove, inspect, and replace brake shoes and related hardware

Replace brake drum and adjust brake clearance

HYDRAULIC FOUNDATION DISC BRAKES

Remove, clean, and inspect a caliper and pad assembly

Inspect, measure, remove, and reinstall a rotor assembly

Reinstall caliper and pad assembly and check brake operation

HYDRAULIC SYSTEM

Interpret hydraulic system diagrams

Interpret brake light system circuit diagrams

Test hydraulic system and inspect for leaks; determine needed repairs

Bleed and/or flush the hydraulic brake system

Remove, inspect, and repair or replace the master cylinder

Create flare and double flare fittings

Remove and repair or replace the wheel cylinder

Check operation of brake light switch; adjust or replace as needed

POWER ASSIST UNITS AND RELATED COMPONENTS

Check operation of brake failure lights and braking warning devices; repair or replace as needed

AIR FOUNDATION BRAKES

Inspect, service, and adjust slack adjuster on front axle

Inspect, test, service, and replace service brake chamber

Inspect, test, service, and replace brake shoes, drum, and hardware for s-cam drum foundation brakes

AIR SUPPLY SYSTEM

Identify and connect components in an air supply system

Service the reservoir and check valve function, build-up time, and cut-out pressure

Inspect and service belt-driven compressor and associated lines

Inspect, service, and time gear-driven compressor, valves, and associated lines

Inspect and service air dryer system; repair or replace as needed

AIR SERVICE CIRCUITS

Identify and connect components in the air service circuits

Inspect and test brake application (foot) valve, fittings, and mounts; adjust or replace as needed

Inspect and test stop light circuit switches, wiring and connectors; repair or replace as needed

Inspect and test relay valve; replace as needed

Inspect and test quick release valve; replace as needed

SPECIAL CIRCUITS

Identify and connect components in a truck brake system

Identify and connect components in a tractor brake system

Inspect and test parking brake hand (control) valve; replace as needed

Inspect and test inversion valve; replace as needed

Inspect and test anti-compounding circuit equipped with Quick Release (QR) 1-C; replace as needed

Inspect and test trailer air supply valve; replace as needed

Inspect and test tractor protection valve; replace as needed

Check operation of parking brake; remove, inspect, and replace parking brake (spring brake) chamber as needed

TRAILER AIR BRAKE SYSTEMS

Identify and connect components of a trailer full function air brake system

Inspect and test tractor trailer gladhands; repair or replace as needed

CAB COMPONENTS

Inspect, test, and adjust cab air suspension components and determine needed repairs

Inspect, test, and adjust driver's air seat components and determine needed repairs

TIRES, RIMS, AND WHEELS

Diagnose unusual tire wear patterns, check tire pressure, and measure and match tires

Diagnose tire/wheel vibration, inspect mounting hardware, and check tire/wheel runout and balance

CHASSIS COMPONENTS

Inspect and install or repair frame, hangers, brackets, and cross members

Check and inspect vehicle frame alignment

Inspect and service fifth wheel assemblies, pintle hitch, kingpin, and trailer plate

Couple and uncouple fifth wheel

POWER STEERING SYSTEMS

Diagnose, test, and troubleshoot problems on a power steering system

Remove and repair/replace power steering gear

Rebuild power steering

Remove and replace power steering pump; adjust belt if used

Inspect, clean, disassemble, and rebuild power steering pump; replace worn parts

Test and repair/replace flow control/pressure relief valve(s) on power steering pump

STEERING AXLE COMPONENTS

Select wheel bearings and seals

Remove, inspect, clean, replace and adjust wheel bearings and seals

Repair or replace a steering knuckle assembly

Inspect and replace tie rod ends

Diagnose and troubleshoot the steering axle assembly

CYLINDER BLOCKS AND LINERS

Disassemble and clean a cylinder block

Inspect a cylinder block

Install new camshaft bushings

Clean and inspect cylinder bores

Install cylinder liners and set liner protrusion

CRANKSHAFTS AND BEARINGS

Remove, clean, and inspect a crankshaft

Install main bearings and crankshaft

Perform an in-frame bearing roll-in

Inspect viscous vibration damper/harmonic balancer

Inspect bonded vibration damper/harmonic balancer

Inspect flywheel

PISTONS AND CONNECTING RODS

Remove, disassemble, and inspect a piston and connecting rod assembly

Measure piston-to-cylinder wall clearance and ring end gap

Assemble and install piston and connecting rod assembly

CAMSHAFTS, TRAINS, AND TIMING

Remove, clean, and inspect a camshaft

Remove, inspect, and install cam bushings

Install a camshaft and set cam timing

CYLINDER HEAD ASSEMBLIES

Locate and label intake and exhaust valves

Clean and inspect a cylinder head

Recondition a cylinder head

Install a cylinder head assembly and adjust valves

AIR INDUCTION AND EXHAUST SYSTEMS

Inspect and test air/induction system

Inspect and service turbo/supercharger and related components

Clean and test jacket water intercooler

Clean and test air-to-air intercooler

Inspect and test exhaust system

Inspect starting preheater controls

ENGINE BRAKES AND RETARDERS

Remove, inspect, install, and adjust a Jacobs Engine Brake

BASIC FUEL SYSTEMS AND COMPONENTS

Trace fuel flow through basic fuel systems

Check fuel level, quality, and consumption

Inspect and service basic fuel supply components

MECHANICAL FUEL INJECTION DIAGNOSIS AND REPAIR

Isolate, remove, test, rebuild or replace, and reinstall injection nozzles

Isolate, remove, test, and reinstall or replace mechanical unit injectors

Inspect, test, adjust, and time a distributor-type (rotary) injection pump; determine needed repairs

Inspect, test, adjust, and time in an-line injection pump; determine needed repairs

Inspect, test, and adjust a PT injection pump and time the injectors; determine needed repairs

ELECTRONIC FUEL INJECTION DIAGNOSIS AND REPAIR

Inspect and test power and ground circuits and connections; determine needed repairs

Check diagnostic trouble codes using electronic diagnostic equipment and technical information; determine needed repairs

Inspect and replace electrical connectors, terminals, seals, and locks

Access engine parameters; monitor or change as requested by customer

Remove, inspect, and rebuild or replace a fuel transfer pump

Remove, inspect, reinstall, and adjust electronic unit injectors; determine needed repairs

EMISSIONS

Check vehicle for presence and operation of emission control devices

Check vehicle for fuel type and appropriate application

Test vehicle for excessive exhaust smoke

Check vehicle for noise abatement devices

GENERAL ENGINE DIAGNOSIS

Conduct an operator survey for engine diagnosis

Interpret SAE code identifiers

Check air intake system for restrictions

Check exhaust back pressure

Check crankcase pressure

Check oil pressure

Load test an engine with a dynamometer

Locate a misfiring cylinder

Locate an active fault code

PREVENTIVE MAINTENANCE AND TUNE-UP

- Determine maintenance needed for given situations
- Interpret maintenance troubleshooting charts
- Inspect engine coolant level and condition
- Pressure test coolant system and radiator cap
- Take oil sample, and change oil and filter(s)
- Inspect and test indicator system components
- Perform a daily preventative maintenance check
- Perform a mileage preventive maintenance check
- Perform an engine tune-up

ENGINE OPERATING PRINCIPLES

- Identify companion cylinders
- Locate and record engine specifications
- Identify valve and piston position during each stroke
- Locate TDC for #1 piston
- Measure bore and stroke and compute engine displacement

DISSASSEMBLY PROCEDURES AND ANALYSIS

- Determine required tools for various tasks
- Evaluate worn engine components
- Determine possible causes of engine component failures
- Steam clean an engine
- Remove engine accessories and external lines
- Remove engine and mount on an engine stand
- Engine disassembly: Remove cylinder head
- Engine disassembly: Remove gear train and camshaft
- Engine disassembly: Remove pistons and connecting rods
- Engine disassembly: Remove cylinder liners
- Engine disassembly: Remove crankshaft

LUBRICATION SYSTEMS

- Service and install oil pump and oil pump drive components
- Service and inspect lubrication system screens and pipes
- Service and inspect oil pressure regulator valve and bypass valve
- Service and inspect oil cooler and lines
- Pressure test oil cooler

COOLING SYSTEMS

- Flush, refill, and bleed coolant system
- Inspect water pump, belts, and hoses
- Check operation of fan assembly and controls
- Test operation of thermostat installed in engine
- Test operation of thermostat on the bench
- Check operation and accuracy of temperature indicating system

Pressure test radiator

FRONT SUSPENSION

Inspect front suspension components

Remove and replace front spring suspension components

Pretest

REAR SPRING SUSPENSION

Inspect rear spring suspension components

Replace rear spring suspension components

Pretest

REAR AIR SUSPENSION

Inspect, test, and replace an air spring

Inspect and test an air suspension system, replace the leveling valve, and adjust frame (ride) height

Pretest

VEHICLE ALIGNMENT

Perform pre-alignment tests

Check camber and kingpin inclination; determine needed repairs

Check caster; adjust or repair as needed

Check toe; adjust as needed

Check rear axle alignment; adjust or repair as needed

Measure and adjust pinion angle

Pretest