Module 11: Engines Brakes and Retarders

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Terms and Definitions

READY FOR REVIEW

- Air suppressor is a device that stops air pulsations.
- Clutch switch is a switch that disengages the compression brake when the clutch is depressed.
- Eddy current is a circular current produced along coil windings that generates both heat and resistance to movement.
- Electronic control module is a computerized device that monitors other electronic parts by receiving and sending electronic signals.
- Engine brake is a device that causes the vehicle to slow down by releasing the compressed air normally needed for ignition.
- Master piston is the piston that supplies high pressure oil to the slave piston.
- Pump switch is a switch that disengages when the clutch is depressed upon acceleration.
- Retarder is any device that slows the vehicle.
- Rheostat is a manually operated switch that varies current flow.
- Slave piston is the piston that is directly responsive to the master piston and operates exhaust valves.

Types of Engine Brakes

READY FOR REVIEW

- An engine compression brake (Jake Brake®) alters exhaust valve operation to convert the engine into an energy-absorbing vacuum pump, and it places tremendous drag on the piston, slowing the vehicle.
- An exhaust brake stops exhaust outflow, turning the engine into an energy-absorbing air compressor and produces drag on the pistons, slowing the vehicle.
- A hydraulic engine retarder (BrakeSaver®) uses pressurized engine oil to produce drag inside a torque converter attached to the crankshaft.
- A driveline retarder uses electromagnetic or hydraulic devices to create drag on the driveline, slowing the driving wheels.

Advantages of Engine Brake Systems

READY FOR REVIEW

- Faster, steadier, and more efficient braking performance
- Reduced wear on engine, tires, and foundation brakes
- Reduced vehicle downtime
- Improved vehicle productivity
- Increased operator confidence

Engine Compression Brake Components

READY FOR REVIEW

- Control valve
- Solenoid valve
- Accumulator piston
- Power™ Lash assembly
- Slave piston
- Master piston
- Bridge

Functions of Engine Compression Brake Components

READY FOR REVIEW

- An electronic control valve completes an electrical circuit, sending power to the engine brake solenoids, and it can be triggered by foot- or hand-operated switches or by the electronic control module (ECM).
- A solenoid valve receives power from the completed electrical circuit it opens, allowing engine oil to flow to both the slave piston and the master piston, and engine oil pressure pushes the master piston down until it contacts the injector rocker arm adjusting screw.
- A master piston sends high pressure oil to the slave piston when the rocker arm adjusting screw moves upward.
- A slave piston forces the exhaust rocker arm down, opening the exhaust valve(s) and releasing compression.

Engine Operation with the Engine Compression Brake Energized

READY FOR REVIEW

- During the intake stroke, the intake valve(s) opens, and air enters the cylinder.
- During the compression stroke, air is compressed by the upward-moving piston, and near top dead center (TDC), the engine brake opens the exhaust valve(s), venting high pressure air from the cylinder through the exhaust system.
- During the power stroke, as the piston moves down, a strong vacuum is created, and this vacuum and the loss of combustion energy provide a strong drag to the engine, flywheel, and driving wheels.
- During the exhaust stroke, as the piston moves up, the exhaust valves open as normal.

Exhaust Brake Components

READY FOR REVIEW

- Air/vacuum supply lines
- Electronic control switch
- Solenoid valve
- Exhaust brake

Functions of Exhaust Brake Components

READY FOR REVIEW

- The electronic control switch completes an electrical circuit, sending power to the air/vacuum solenoid valve, and it is usually triggered by the ECM.
- The solenoid valve opens, allowing either air pressure or vacuum to the exhaust brake piston.
- The air/vacuum supply lines supply the force to operate the exhaust brake.
- The exhaust brake has an internal piston that closes a gate inside the exhaust brake housing, and the exhaust flow is stopped, causing exhaust gases to back up into the exhaust manifold and cylinders, creating drag each time the piston comes up.

Engine Operation with the Exhaust Brake Energized (Throttle-Off Operation)

READY FOR REVIEW

- During the intake stroke, the intake valve(s) opens, and air enters the cylinder; complete cylinder filling is not possible because of the remaining exhaust gases.
- During the compression stroke, the piston moves up, compressing the air, creating engine drag.
- During the power stroke, no fuel is injected during closed-throttle coasting, so no energy is produced, creating further drag.
- During the exhaust stroke, air is unable to exit the cylinder, and the rising piston meets increasing resistance.

Hydraulic Engine Retarder Components (BrakeSaver®)

READY FOR REVIEW

- BrakeSaver® housing
- Pocket
- Rotor
- Oil flow
- Stator

Functions of Hydraulic Engine Retarder Components

READY FOR REVIEW

- The control valve varies the amount of oil flow to the housing, and the greater the flow, the greater the braking force.
- The housing mounts to the back of the engine block and contains the oil passages, and along its inside edge are pockets to provide resistance to oil flow.
- The rotor is fastened to the crankshaft, and it turns in the hollow space between the housing and stator.
- The stator is bolted to the housing, and it forms the back half of a hollow "doughnut," and like the housing, it has pockets along its inside edge.

Engine Operation With the Hydraulic Engine Retarder Energized

READY FOR REVIEW

- Step 1: The control valve allows oil to flow into the housing.
- Step 2: Pressurized engine oil enters the housing at the bottom, begins surrounding the rotor, and fills the space between the stator and the housing.
- Step 3: The vanes on the rotor constantly churn the oil, forcing it against the pockets in the stator and the housing.
- Step 4: The resistance of the oil between the vanes and pockets provides drag to the driveline and drive wheels.

Electric Driveline Retarder Components

READY FOR REVIEW

- Rotors
- Coils
- Stator
- Driver-operated rheostat

Functions of Electric Driveline Retarder Components

READY FOR REVIEW

- The driver-operated rheostat controls the amount of current flow to the retarder, and it may be hand- or foot-operated.
- The coils create strong magnetic fields when an electrical current flows through them.
- The stator contains the coils and is mounted to the vehicle chassis, transmission, or axle.
- The rotors are vented, circular steel discs, similar to disc brake rotors, mounted to the vehicle's driveline.

Engine Operation With an Electric Driveline Retarder Energized

READY FOR REVIEW

- Step 1: The driver activates a multiposition switch either by hand control or through the brake pedal.
- Step 2: Current flows to the stator coils, setting up strong magnetic fields (eddy currents).
- Step 3: As the rotor passes through the magnetic fields, the eddy currents try to stop movement, and this loss of motion generates great heat.
- Step 4: The vanes in the rotor force cool air over the coils, dissipating the heat.