TKP3501
Farm Mechanization

Topic 3a:
Engine Systems

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Outlines

- Fuel systems
- Intake and exhaust systems
- Lubricating systems
- Cooling systems
- Electrical systems
- Governing systems
Learning Outcome

- Understand the different transmission systems
- Know the basic power transmission of a tractor
- Comprehend the principle of speed to torque variations in gear settings
Engine Fuel Systems
Engine Fuel Systems

- A fuel system – to deliver the clean fuel at required quantity to the intake of an engine
- Safe fuel storage and transfer
- Three tractor fuel systems
  - Gasoline
  - Diesel
  - LP-gas (optional)
Gasoline fuel system

- Supply combustible mixture – fuel + air
- Basic components
  - Fuel tank – store fuel
  - Fuel pump – moves fuel to carburetor
  - Carburetor – atomizes and mix the fuel and air
Diesel fuel system

- Fuel is sprayed directly into engine combustion system where it mixes with hot compressed air and ignites. No spark plug
- Instead of carburetor- used a fuel injection pump and spray
- Basic components
  - Fuel tank – store fuel
  - Fuel filters – help clean the fuel
  - Fuel pump – moves fuel to injection pump
  - Injection pump – times, measured and pressurized fuel
  - Injection nozzles – atomizes and spray fuel into cylinders
LP-gas fuel system

- Supply combustible mixture – fuel + air (low temperature)
- Fuel tank - close unit to prevent vapor
- Carburetor
  - Design is much more simpler than gasoline since the fuel is already vaporized. Its meters the vapor and mixes with proper amount of air and fuel
Fuel System

Never refuel the tractor while the engine is running or extremely hot.
Intake and Exhaust System

- Carry the fuel-air mixture into engine and remove exhaust gases after combustion

Intake System

- Supply clean air at proper temperature and mix
  - Air cleaners – filter dust and dirt
  - Turbochargers – increase power, forced more air
  - Carburetor air inlet
  - Intake manifold
  - Intake valve – controlled by camshaft
- Intercooler (if used) - improve fuel efficient, help in increase power
Exhaust System

- Collect the hot exhaust gases after combustion and channel them out
- Main parts
  - Exhaust valves – to release burned gases
  - Exhaust manifold – collect the exhaust gases and conduct them away
  - Muffler – to reduce the emission sounds
Engine Lubricating System

- To reduce the friction, dissipates engine heat and helps the engine parts clean
- Main parts
  - Crankcase oil reservoir
  - Oil pump
  - Oil filter and passages
  - Pressure regulator valve
Cooling System

HOT water

COOLER water
Cooling system

- To prevent overheating and regulates its temperature at the best level
- Fluid – water as a coolant or anti-freeze
- Water circulates in a jacket around the cylinders and cylinder head
- As heats radiate, the water absorb the heat then cool down through the radiator
Engine Electrical Systems

- Charging unit - control the input charge
  - Battery, voltage regulator, alternator
- Ignition unit
- Starting unit – switch, motor switch to drive a flywheel
Basic Starting Circuit

Fig. 12—Basic Starting Circuit
Ignition Circuit

Combustion sequence in 4-stroke cylinder engine

Magic Number: 1 4 3 2 or 1 3 4 2
Engine Governing System

1. Engine speed varies with load
2. Governor reacts
3. Adjust the fuel-air mixture
4. Increase / decrease engine speed under variable load
Maintenance
Type of maintenance: Fluids and filters

- **Fluids**
  - Engine oil
    - Change for 40-50 hours of operation.
    - Type of engine oil e.g. 15W40, 10W30 and SAE30
  - Hydraulic oil
  - Gear oil
  - Grease
  - Brake fluid

- **Filters**
  - Engine oil
  - Hydraulic oil
  - Air filter
  - General inspection
    - Oil level
    - Tire pressure
• Internal filter element has steel caps bonded to the filter media with oil resistant adhesive to increase the structural strength of the element.

• Sealing gasket compound for severe service and high temperature operation, reduces oil leakage due to hardening.

• High efficiency filtration with synthetic fibers for hot oil resistance.

• Special oil inlet configuration to reduce pressure loss and assist HST function and performance.

• Deep drawn one piece steel shell for high burst strength and fatigue resistance.

• Sealing gasket compound for severe service and high temperature operation, reduces oil leakage due to hardening.

• High efficiency, low restriction filtration media for high flow operation.
QUESTIONS

- Name five of the six engine systems.
- The ________ atomizes and mixes the fuel with air to provide a combustible mixture for the engine.
- ______ system take control the entire engine processes especially during heavy load operation.
Thank you.