

Unit C: Agricultural Power Systems

Lesson 6: Using Multiple Cylinder Engines

Terms

- ❖ Bleed
- ❖ Coolant hydrometer
- ❖ Diesel engine
- ❖ Drawbar power
- ❖ Engine horsepower
- ❖ Fuel injectors
- ❖ Horsepower
- ❖ Multiple cylinder engines
- ❖ Power
- ❖ Power-take off shaft
- ❖ PTO power
- ❖ Preventative maintenance
- ❖ Turbocharger

Multiple cylinder engines

- ❖ Have 2, 3, 4, 5, 6, 8, or more cylinders.
- ❖ **Preventative maintenance –**
performing periodic practice to keep equipment in good working order
- ❖ Preventative maintenance helps multiple cylinder engines perform well

General preventative practices

- ★ Read the operator's manual
- ★ Know the history of the equipment
- ★ Follow all manufacturer recommendations
- ★ Use quality materials
- ★ Keep accurate records
- ★ Use common sense
- ★ Use safety practices

Power

- ★ The rate of performing work
- ★ Engine power is stated as horsepower

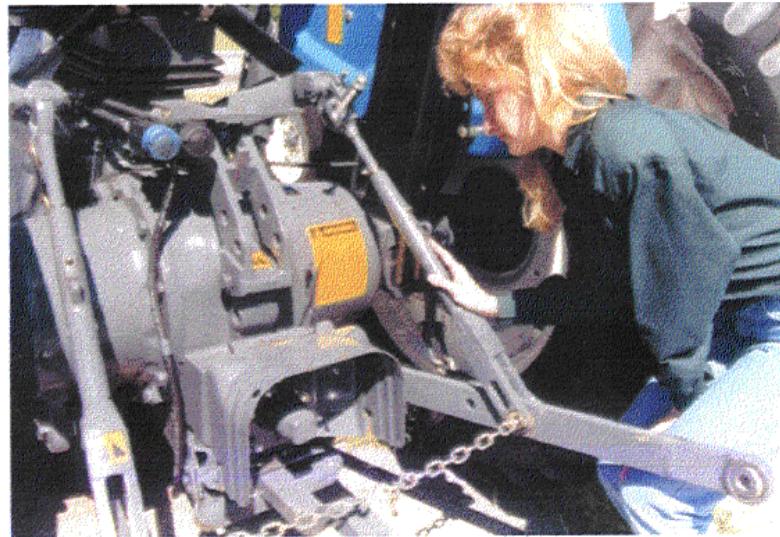
Types of power

- ★ **Engine horsepower** – rates engines based on their displacement and configuration
 - ◆ **Horsepower** – the force needed to lift 75 kilograms one meter in one second
- ★ **Drawbar power** – is derived as machines are pushed or pulled by the engine as power is delivered to the drive wheels

Types of power (continued)

- ❖ **PTO power** – rotary power converted to hydraulic or electrical energy
 - ◆ **Power-take-off (PTO) shaft** transfers power from the engine to the attached implement

PTO shaft & implement



(Courtesy, Interstate Publishers, Inc.)

Maintenance practices

- ★ Maintaining the intake system
- ★ Maintaining the fuel system
 - ◆ **Bleed** – to remove air from the system
- ★ Maintaining the exhaust system
- ★ Maintaining the cooling system
 - ◆ **Coolant hydrometer** – determines the proportion of antifreeze to water

Antifreeze chart

Cooling System Capacity Quarts (Liters)	Full Strength "Permanent" Antrifreeze Required										
	4 °F (°C)	5 °F (°C)	6 °F (°C)	7 °F (°C)	Quarts 8 °F (°C)	9 °F (°C)	10 °F (°C)	11 °F (°C)	12 °F (°C)	13 °F (°C)	
5 (4.7)											
6 (5.7)	-54° (-47.5°)										
7 (6.6)	-34° (-36.5°)	-69° (-56.0°)									
8											
9 (8.5)	-21° (-29.5°)	-50° (-45.5°)									
10 (9.5)	-12° (-24.5°)	-34° (-36.5°)	-62° (-52.0°)								
11 (10.4)	-6° (-21.0°)	-23° (-31.0°)	-47° (-44.0°)								
12 (11.4)	0° (-17.5°)	-15° (-26.0°)	-34° (-36.5°)	-57° (-49.5°)							
13 (12.3)	3° (-16.0°)	-9° (-23.0°)	-25° (-31.5°)	-45° (-43.0°)	-66° (-55.5°)						
14 (13.2)	6° (-14.5°)	-5° (-20.5°)	-18° (-28.0°)	-34° (-36.5°)	-54° (-47.5°)						
15 (14.2)	8° (-13.5°)	0° (-17.5°)	-12° (-24.5°)	-26° (-32.0°)	-43° (-41.5°)	-62° (-52.0°)					
16 (15.1)	10° (-12.0°)	2° (-16.5°)	-8° (-22.0°)	-19° (-28.5°)	-34° (-36.5°)	-52° (-46.5°)					
17 (16.1)	12° (-11.0°)	5° (-15.0°)	-4° (-20.0°)	-14° (-25.5°)	-27° (-33.0°)	-42° (-41.0°)	-58° (-50.0°)				
18 (17.0)	14° (-14.0°)	7° (-14.0°)	0° (-17.5°)	-10° (-23.5°)	-21° (-29.5°)	-34° (-36.5°)	-50° (-45.5°)	-65° (-54.0°)			
19 (18.0)	15° (- 9.5°)	9° (-13.0°)	2° (-16.5°)	-7° (-22.0°)	-16° (-26.5°)	-28° (-33.5°)	-42° (-41.0°)	-56° (-49.0°)			
20 (18.9)	16° (- 9.0°)	10° (-12.0°)	4° (-15.5°)	-3° (-19.5°)	-12° (-24.5°)	-22° (-30.0°)	-34° (-35.5°)	-48° (-44.5°)	-62° (-52.0°)		
21 (19.9)	17° (- 8.5°)	12° (-11.0°)	6° (-14.5°)	0° (-17.0°)	-9° (-23.0°)	-17° (-27.0°)	-28° (-33.5°)	-41° (-40.5°)	-54° (-47.5°)	-68° (-55.5°)	
22 (20.8)	18° (- 8.0°)	13° (-10.5°)	8° (-13.5°)	2° (-16.5°)	-6° (-21.0°)	-14° (-25.5°)	-23° (-31.0°)	-34° (-36.5°)	-47° (-44.0°)	-59° (-50.5°)	
23 (21.8)	19° (- 7.0°)	14° (-10.0°)	9° (-13.0°)	4° (-15.5°)	-3° (-19.5°)	-10° (-23.5°)	-19° (-28.5°)	-29° (-34.0°)	-40° (-40.0°)	-52° (-46.5°)	
24 (22.7)		15° (- 9.5°)	10° (-12.0°)	15° (-15.0°)	0° (-17.0°)	-8°	-15° (-26.0°)	-24° (-31.0°)	-34° (-36.5°)	-46° (-43.5°)	

Maintenance practices (continued)

- ★ Maintaining the ignition system
- ★ Maintaining the lubrication system
- ★ Maintaining the starting systems

Diesel engine

- ★ An engine with a very high compression ration in which the air-fuel mixture is ignited by the heat of compression
- ★ Available in two-stroke or four-stroke engines

Diesel engines have:

- ★ **Fuel injectors** – measure the correct amount of fuel for injection at the correct time
- ★ **Turbocharger** – a turbine-type air pump that is driven by the engine's exhaust gasses

Comparison between spark ignition & diesel cycle engines

Spark ignition (Otto Cycle Engine)	Compression Ignition (Diesel Cycle) Engines
<ul style="list-style-type: none">❖ Lighter weight components❖ Lower compression ratios❖ Easier starting❖ Lower fuel efficiency❖ Quicker speed acceleration❖ Higher engine speeds❖ Lower engine torque	<ul style="list-style-type: none">❖ Heavier weight components❖ Higher compression ratios❖ More difficult starting❖ Higher fuel efficiency❖ Slower speed acceleration❖ Slower engine speeds❖ Higher engine torque

Review/Summary

- ❖ What are some common preventative maintenance practices associated with multiple cylinder engines?
- ❖ What is power? How does it apply to multiple cylinder engines?

Review/Summary

- ❖ What are common maintenance practices associated with multiple cylinder engines?
- ❖ What are the characteristics of a diesel engine?