

Unit C: Agricultural Power Systems

Lesson 7: Using Hydraulic Systems

Terms

- ✦ Connectors
- ✦ Cycle time
- ✦ Directional control valve
- ✦ Energy
- ✦ Filter
- ✦ Flow rate
- ✦ Hydraulic actuator
- ✦ Hydraulics
- ✦ Hydrodynamics
- ✦ Hydrostatics
- ✦ Law of Conservation of Energy
- ✦ Linear actuator

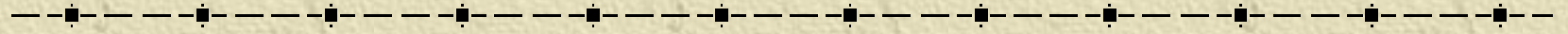
Terms (continued)

- ✦ Micron
- ✦ Multiplication of force
- ✦ Pascal's Law
- ✦ Piping
- ✦ Positive displacement pump
- ✦ Pressure gauge
- ✦ Pressure relief valve
- ✦ Prime mover
- ✦ Pump
- ✦ Reservoir
- ✦ Rotary actuator
- ✦ Strainer

Hydraulics

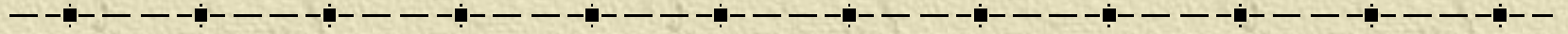
- ✦ A branch of physics dealing with the mechanical properties and practical applications of fluids in motion
- ✦ Hydraulic systems do not create power. They transfer power from an outside source
 - ✦ Prime mover – the outside source of power

Hydrodynamics



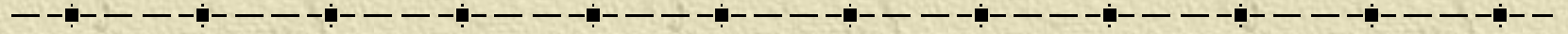
- ✦ The use of liquids at high flow and low pressure to perform work

Hydrostatics



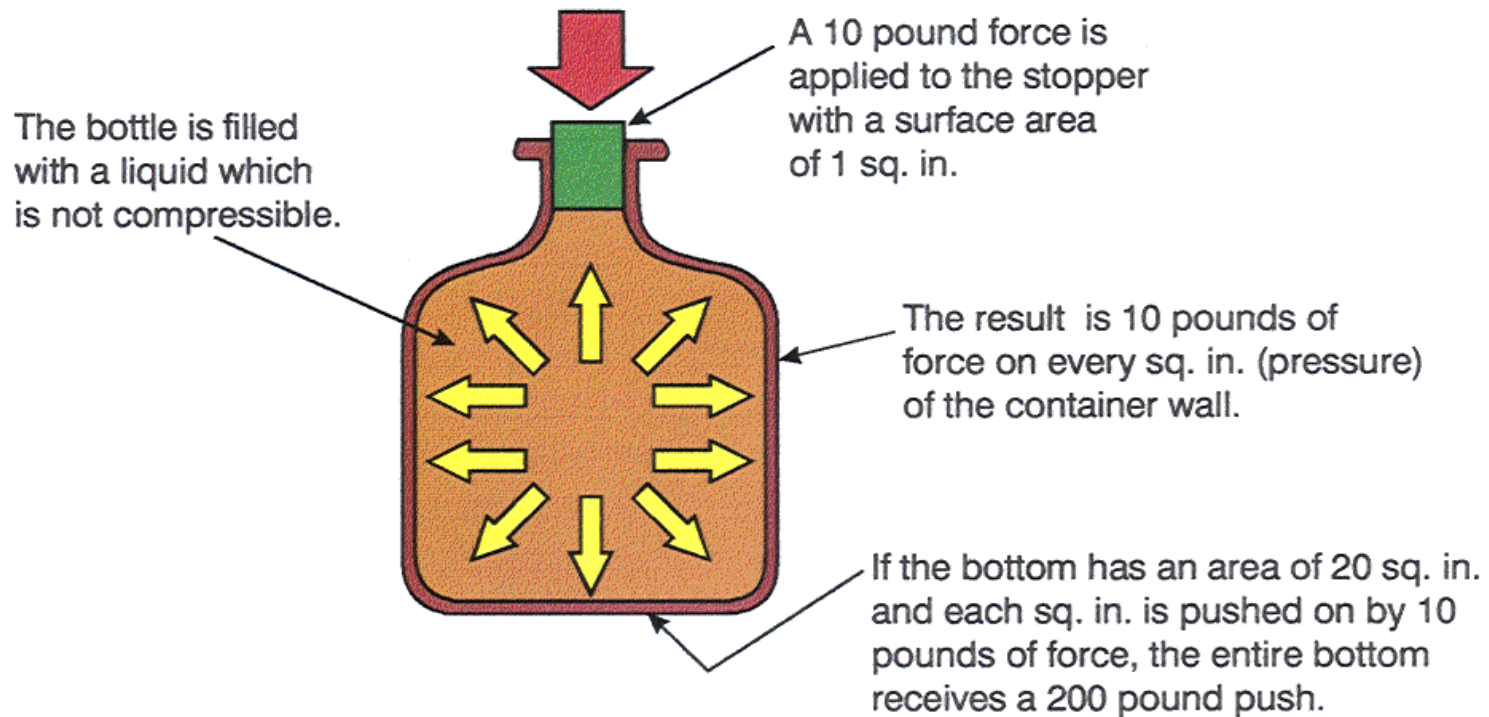
- ✦ Use of liquids at high pressure and low flow to perform work

Pascal's Law



✦ Pressure applied to a confined fluid is transmitted undiminished in all directions

Application of Pascal's Law



(Courtesy, Interstate Publishers, Inc.)

Multiplication of force

-
- ✦ The hydraulic system takes a small input force and transforms it into a larger output force

Cycle time

- ✦ The amount of time required for one complete set of operations to occur
 - ✦ Flow rate – the measure of how many gallons per minute of hydraulic fluid would run into a container

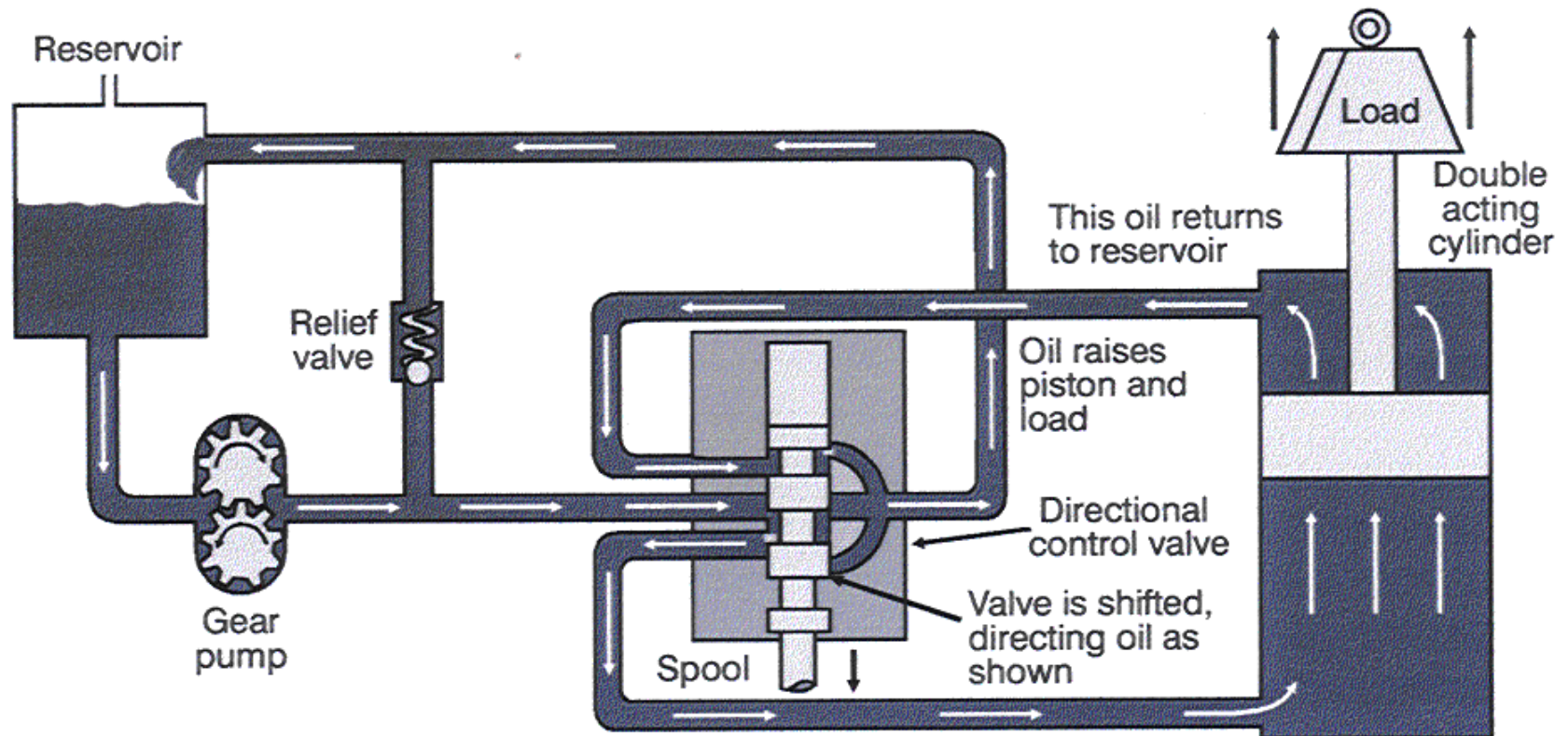
Law of Conservation of Energy

- ✦ Energy may be changed from one form to another, but it cannot either be created or destroyed
 - ◆ Energy – the capacity to do work

Components of a hydraulic system

- ✦ Reservoir – supplies oil to the hydraulic pump and stores oil that returns after passing through the hydraulic circuit
 - ✦ Strainer – directs the hydraulic oil in a straight line through an element made of metal screens attached to a metal core
 - ✦ Filter – directs hydraulic oil through one of more layers of a porous elements that may trap particles
 - ✦ Micron – equal to 1millionths of a meter

Primary components of a hydraulic system



(Courtesy, Interstate Publishers, Inc.)

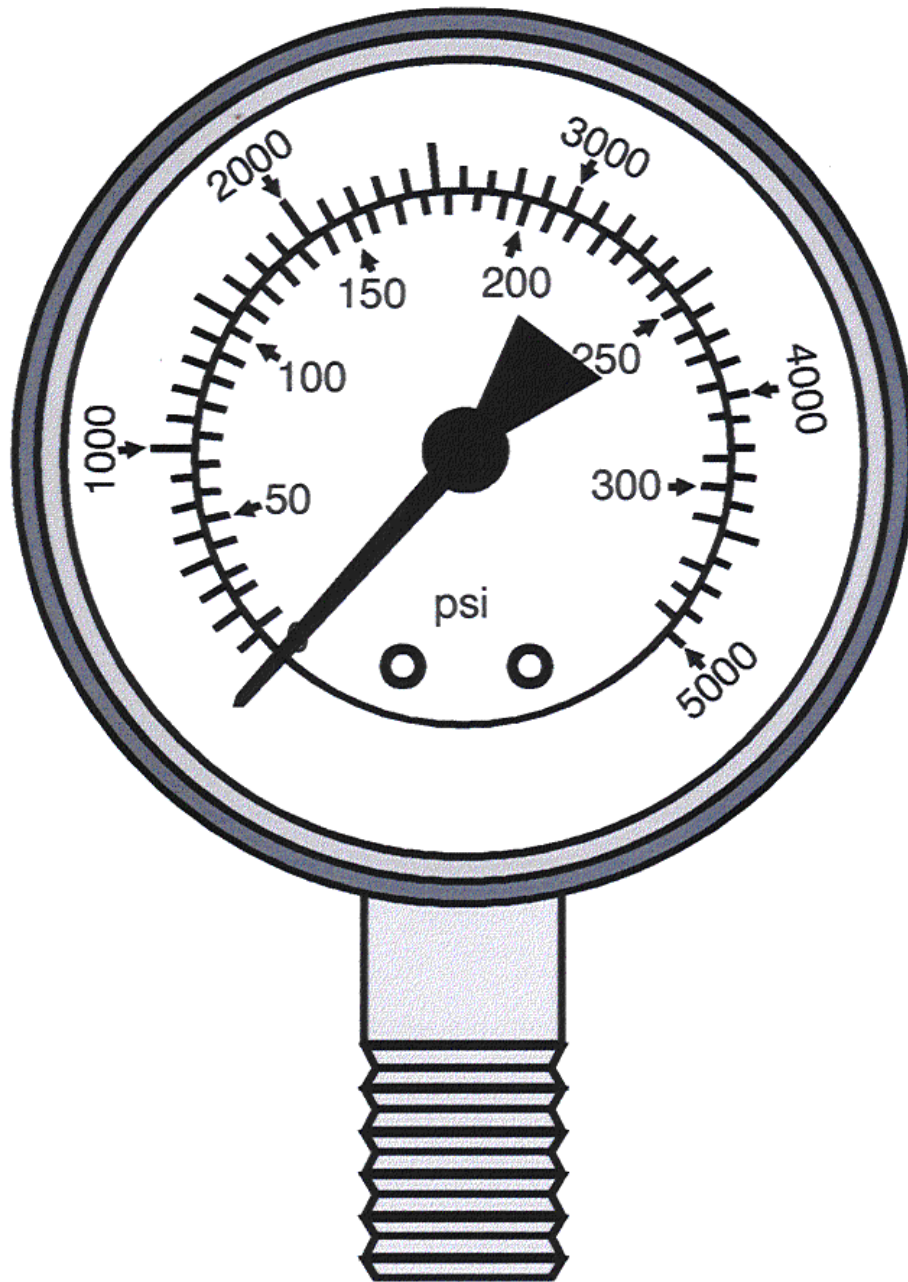
Components (continued)

✦ Pump – causes hydraulic oil to flow through the circuit

- ✦ Positive displacement pump – delivers the same volume of oil per cycle regardless of the pressure at the pump outlet

✦ Pressure gauge – measure and shows the pressure being produced in a hydraulic system

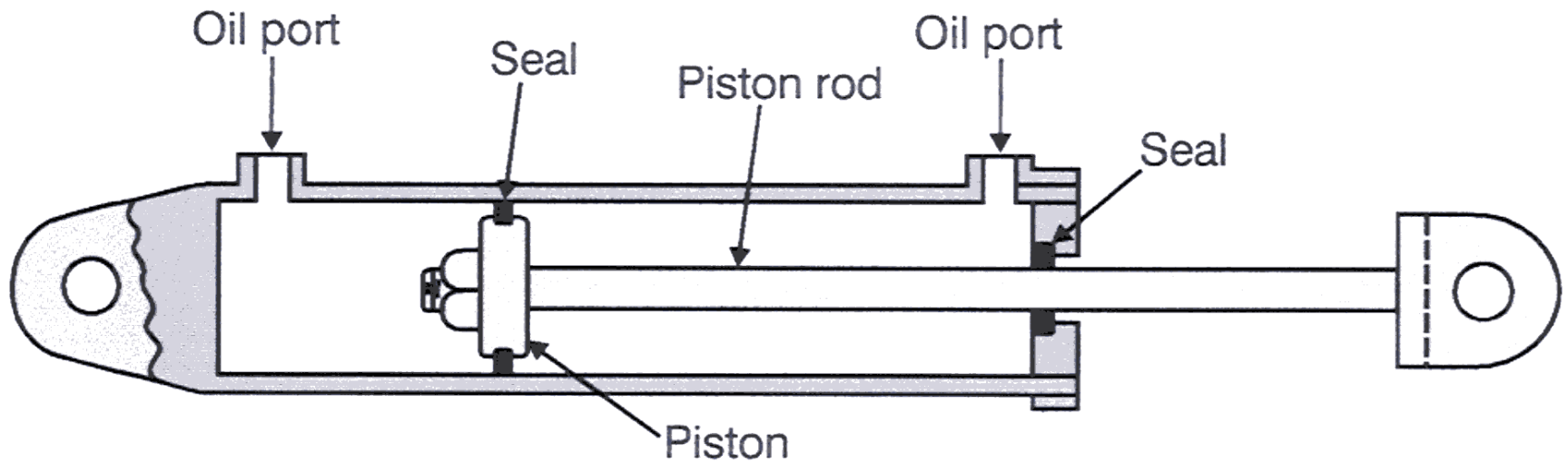
A
bourdoin
tube
pressure
gauge



Components (continued)

- ✦ Directional control valve – controls the operation of the system's cylinder and motors by directing the flow of the fluid in the system

Primary parts of a typical cylinder



(Courtesy, Interstate Publishers, Inc.)

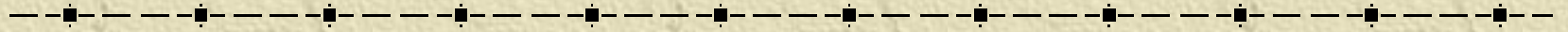
Components (continued)

- ✦ Hydraulic actuator – converts fluid energy into mechanical energy
 - ✦ Linear actuator – the output of the cylinder occurs in a straight-line manner
 - ✦ Rotary actuator – produces a rotating output force

Components (continued)

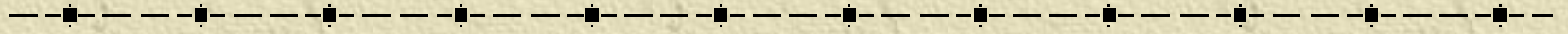
- ✦ Piping – fluid conducting lines that connect various components of a hydraulic system
 - ◆ Connectors – used to join one piece of piping to another, or to hydraulic system components

Advantages of hydraulic systems



- ✦ Increased flexibility
- ✦ Variable speed
- ✦ Multiplication of force
- ✦ Reduced wear
- ✦ Reversibility

Disadvantages of hydraulic systems



- ✦ High pressure
- ✦ Need for cleanliness
- ✦ Safety hazards

Review/Summary

- ✦ What is hydraulics and what are its major operating systems?
- ✦ What principles govern the use of hydraulics?
- ✦ What are the primary components of a hydraulic system?
- ✦ What are the advantages and disadvantages associated with hydraulic systems?