

Unit C: Agricultural Power Systems

Lesson 8: Using Pneumatic Systems

Student Learning Objectives:

Instruction in this lesson should result in students achieving the following objectives:

1. Define pneumatics and explain the major parts of a supply system.
2. Describe the purpose of a flow meter.
3. Explain the safety practices for pneumatics.

Recommended Teaching Time: 2 hours

Recommended Resources: The following resources may be useful in teaching this lesson:

Explorations in Fluid Power, Pittsburg, Kansas: Depco, Inc., 1995.

List of Equipment, Tools, Supplies, and Facilities:

- Writing surface
- PowerPoint Projector
- PowerPoint Slides
- Transparency Masters

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide 3):

- Air filter
- Air storage tank
- Compressor
- Flow meter
- Manifold
- Motor
- Needle valves
- Pneumatics
- Pressure limit switch
- Pressure regulator
- Pressure system gauge
- Safety filter
- Safety valve

Interest Approach:

Display a pneumatic hand tool (PowerPoint Slide #2). Ask students if they can explain how air makes it work.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Define pneumatics and explain the major parts of supply system.

Anticipated Problem: What is pneumatics and what are the major parts of the supply system?

(PowerPoint Slides 4 and 5)

- I. **Pneumatics** is any system that uses a gas to create motion. Generally, pneumatics uses air as the power source. The parts of a pneumatic system include:

(PowerPoint Slides 6, 7, and 8)

- A. The **motor** converts electricity from the wall outlet into rotary motion. The rotary motion turns the shaft of the compressor.
- B. A **compressor** takes in air from the atmosphere. It pushes the air into a storage tank. The compressor is connected to the storage tank and pressure regulator. There is a "T" in the hoses so that compressed air can go to the tank or to the regulator. The air goes where it is needed for circuit operations.
- C. An **air filter** removes the dirt from the air before it enters the compressor.
- D. A **safety filter** is a secondary device for the removal of dirt from air before the air enters the compressor.

(PowerPoint Slides 9 and 10)

- E. The **safety valve** allows extra air to escape into the atmosphere if there is too much air pressure in the air supply system.
- F. The **air storage tank** holds a supply of pressurized air until the air is needed in a pneumatic circuit.
- G. The **pressure limit switch** detects the presence of the air in the storage tank. It turns on the compressor when the air pressure in the storage tank drops below 240 kPa (2.42 bar). It turns off the compressor when the air pressure in the storage tank reaches 420 kPa (4.14 bar). PSI means pound per square inch. This is how air pressure is measured. "Bar" is the metric measurement.

(PowerPoint Slide 11)

- H. A **pressure regulator** controls the pressure of air entering the pneumatic circuit.
- I. The **pressure system gauge** shows the pressure of the air going into the pneumatic circuit.

(PowerPoint Slides 12 and 13)

- J. A **manifold** has two connections between the air supply system and the pneumatic circuit.
- K. **Needles valves** stop the supply of pressurized air to the circuit. They shut off the air supply system.

Use TM: 8-1 to reinforce the major parts of a supply system. Through classroom discussion, identify a list of pneumatic tools students have seen in use.

Objective 2: Describe the purpose of a flow meter.

Anticipated Problem: What functions does the flow meter perform?

(PowerPoint Slides 14 and 15)

- II. It is necessary to measure the flow rate as air moves through a pneumatic circuit.
 - A. A **flow meter** measures the amount of air flowing through a pneumatic circuit. The flow rate of air is usually measured in standard cubic feet per hour (SCFH).
 - B. Flow meters have many different uses. They are used whenever a system operator must know how much air is flowing through a pneumatic system.
 - C. In factories, flow meters are used to measure how much air or other gas is flowing into a container. The flow meter helps make sure that the products are correctly mixed with the gases.
 - D. Flow meters are very important in making soda. The bubbles in soda are made by a gas called carbon dioxide. Flow meters show how much carbon dioxide is being added to the soda mixture. If too little carbon dioxide is used, the soda is "flat." If too much carbon dioxide is used, the soda bottle would blow its top.
 - E. Flow meters are used in packaging potato chips. A certain amount of chips is placed in each bag, with lots of extra room. If the bag was closed with just the chips in it, the chips would break. So, very clean air is pumped into the bag as it is being closed. The air in the bag helps protect the chips.

Use classroom discussion to summarize the functions of a flow meter. Assign students the task of researching practical applications of flow meters in agriculture.

Objective 3: Explain the safety practices for pneumatics.

Anticipated Problem: What safety practices are used in pneumatics?

(PowerPoint Slides 16 and 17)

- III. Always follow safety rules when working with pneumatics.
 - A. Always wear safety glasses or goggles when working with pressurized air.
 - B. Keep all body parts and loose objects away from operating cylinders.
 - C. Always close the needle valve on the manifold before changing a pneumatic circuit.
 - D. Always read the directions completely before working on any pneumatic system.
 - E. Handle all electrical components and fittings carefully.

Use TM: 8-2 to reinforce the major safety rules when dealing with pneumatics. Have students gather information on safety guidelines that accompany pneumatic tools.

Review/Summary: The review and summary of the lesson may be accomplished by viewing the transparency masters with the students. (**PowerPoint Slide 18**) A discussion should be performed with students before proceeding with the laboratory activities and testing.

Evaluation: Objectives should be reviewed by the students. The following sample test will be helpful in evaluating student performance.

Answers to Sample Test:

Matching

1. E
2. A
3. F
4. B
5. H
6. C
7. G
8. D

Fill-in-the-blank

1. Pressure system gauge
2. Standard
3. Motor
4. Storage tank
5. kilopascal

Short Answer

Use Objective 3.

Using Pneumatic Systems

Name: _____

Matching: Match each word with the correct definition.

- | | |
|---------------|--------------------------|
| a. air filter | e. needle valves |
| b. compressor | f. pressure limit switch |
| c. flow meter | g. pressure regulator |
| d. manifold | h. safety valve |

- _____ 1. Stops the supply of pressurized air to the circuit.
- _____ 2. Removes the dirt from the air before it enters the compressor.
- _____ 3. Detects the presence of the air in the storage tank.
- _____ 4. Takes in air from the atmosphere.
- _____ 5. Allows extra air to escape into the atmosphere if there is too much air pressure in the air supply system.
- _____ 6. Measures the amount of air flowing through a pneumatic circuit.
- _____ 7. Controls the pressure of air entering the pneumatic circuit.
- _____ 8. Having two connections between the air supply system and the pneumatic circuit.

Fill-in-the-blank: Complete the following statements.

1. The _____ shows the pressure of the air going into the pneumatic circuit.
2. The flow rate of air is usually measured in _____ cubic feet per hour (SCFH).
3. The _____ converts electricity from the wall outlet into rotary motion.
4. The compressor is connected to the _____ and pressure regulator.
5. kPa means _____.

Short Answer: Answer the following question.

Name three safety practices dealing with pneumatics.

MAJOR PARTS OF A PNEUMATIC SUPPLY SYSTEM

1. Motor
2. Compressor
3. Air filter
4. Safety filter
5. Safety valve
6. Air storage tank
7. Pressure limit switch
8. Pressure regulator
9. Pressure system gauge
10. Manifold
11. Needle valves

PNEUMATIC SAFETY PRACTICES

1. Always wear proper eye protection.
2. Keep body parts away from operating cylinders.
3. Close needle valve before changing circuits.
4. Fully read and understand all directions.
5. Use caution around all electrical components and fittings.