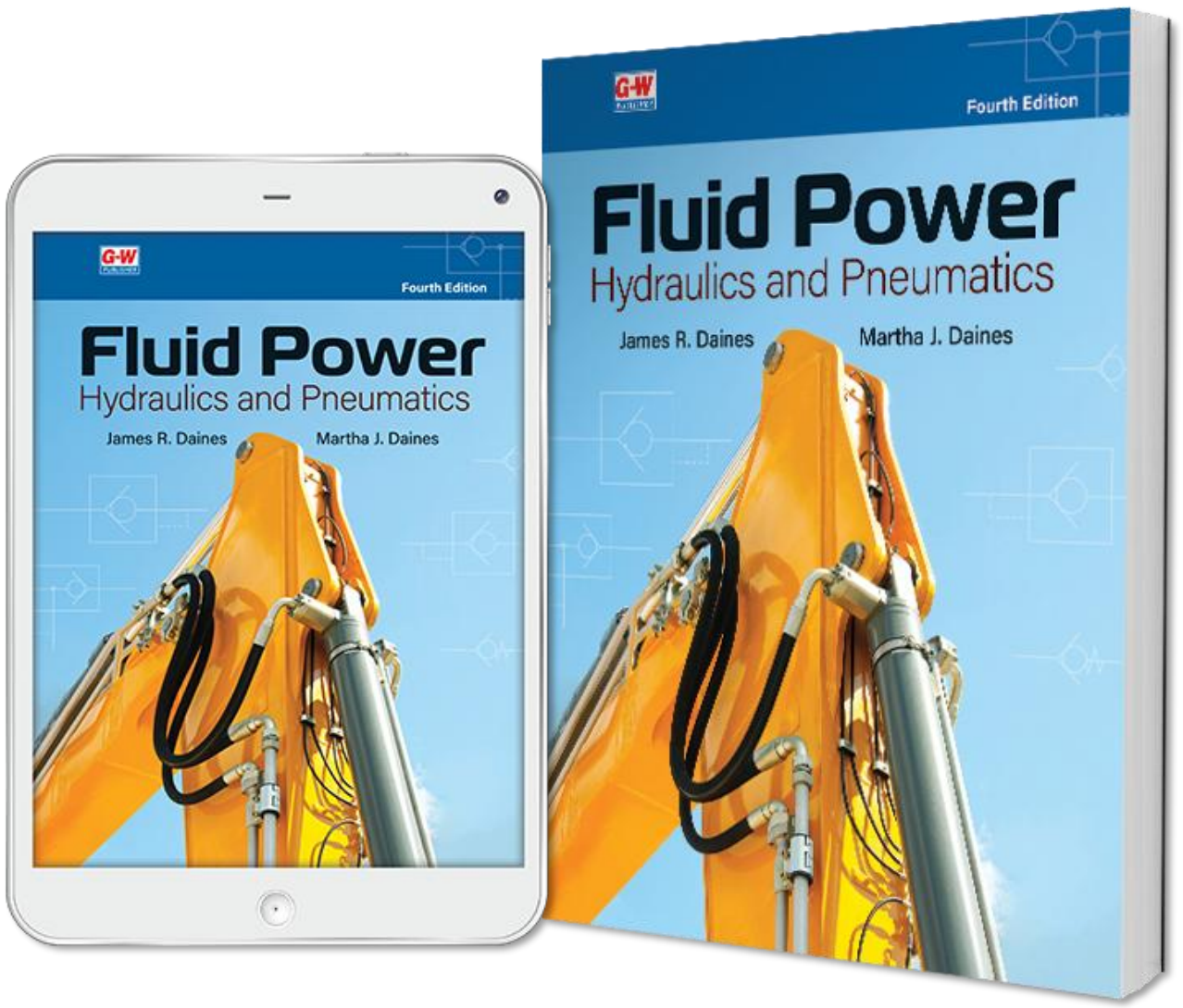

***Fluid Power*, 6e, ©2025**

by James Daines and Martha Daines

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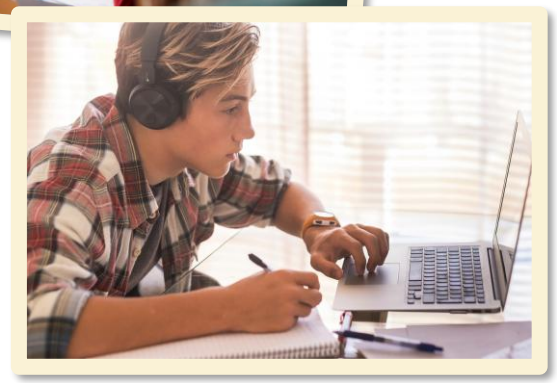

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- ✓ Prepare for class
- ✓ Reinforce new concepts
- ✓ Assess learning

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Lesson Plan: Chapter 2

Instructor: Date:
Course: Period/Section:

Chapter 2: Personal Financial Planning

Section 2.1: Personal Financial Landscape

Objectives

After completing this section, students will be able to:

- Identify steps to develop a budget based on personal goals.
- Explain how to create personal financial statements.
- Discuss the benefits of creating a good recordkeeping system for financial documents.
- Explain how money management software can assist in financial planning.

Terms

- life span
- nature of financial planning
- budget
- spreadsheet
- income
- expense
- fixed expense
- variable expense
- discretionary expense
- pay yourself first
- wealth
- emergency fund
- charity
- social responsibility
- data analysis
- discretionary income
- cash flow statement
- net worth
- asset
- liability
- net worth statement
- liquidity
- recordkeeping
- legal document
- money management softw

Materials

- *Foundations of Financial L*
- *Foundations of Financial L*

1

Assessment Software & Question Pools

ExamView® Assessment Suite v11 Software and Question Bank Files

The ExamView® Assessment Suite allows you to quickly and easily create, administer, and score paper and online tests. The ExamView® Assessment Suite includes the ExamView® Test Generator, ExamView® Test Manager, and ExamView® Test Player. G-W test banks are installed simultaneously with the software. If you cannot locate the test banks after installation, please refer to the "How do I locate the ExamView® v8.1 or later test banks on my computer after installation?" FAQ.

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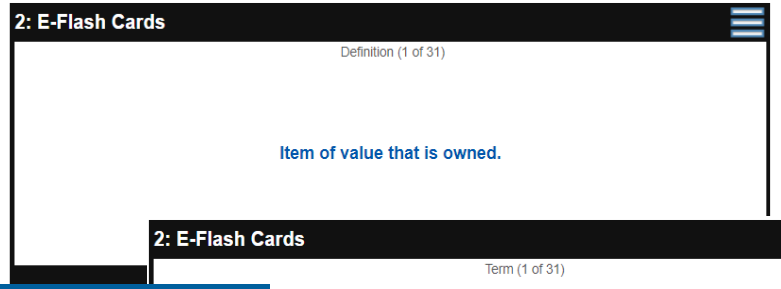
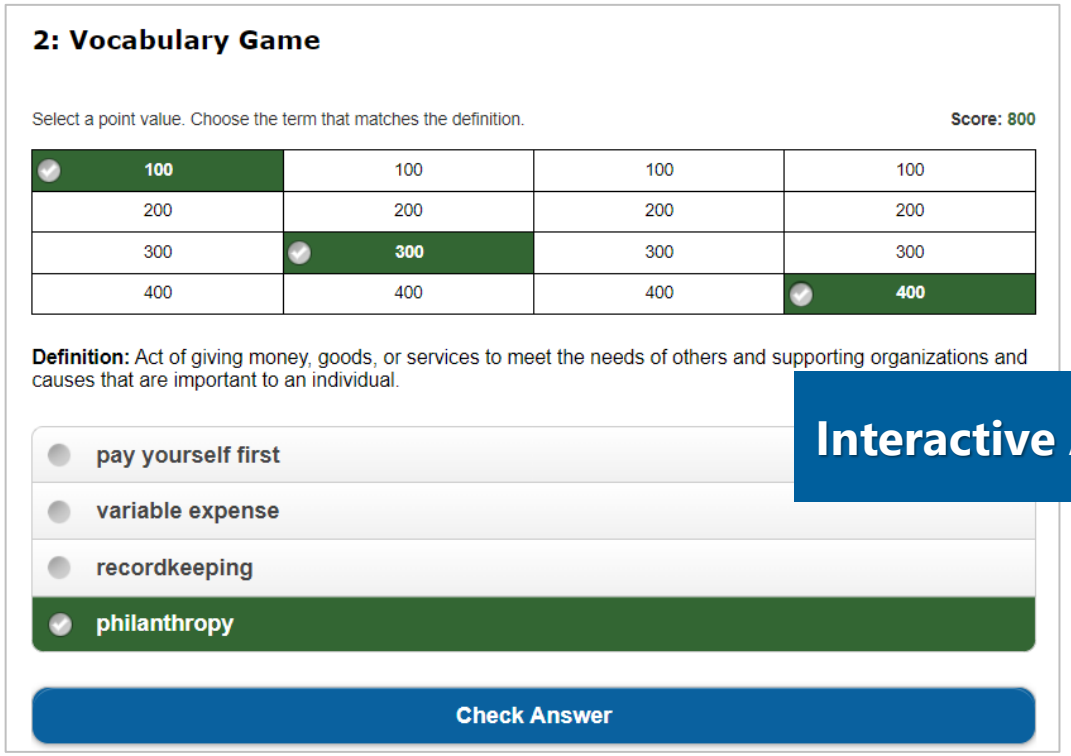
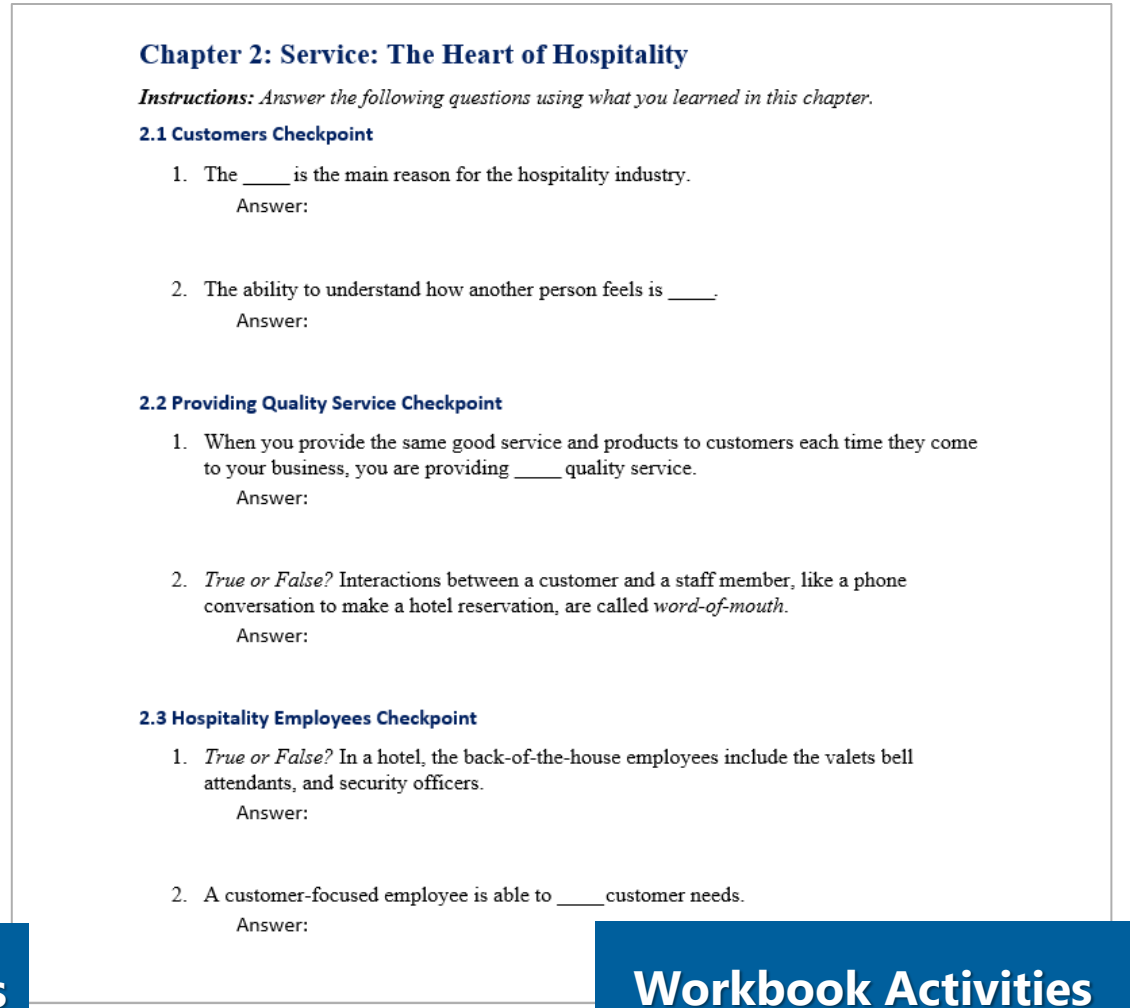


E-Flash Cards & Vocabulary Practice



Interactive Activities



Chapter 2: Service: The Heart of Hospitality

Instructions: *Answer the following questions using what you learned in this chapter.*

2.1 Customers Checkpoint

1. The _____ is the main reason for the hospitality industry.
   Answer:

2. The ability to understand how another person feels is _____.
   Answer:

2.2 Providing Quality Service Checkpoint

1. When you provide the same good service and products to customers each time they come to your business, you are providing _____ quality service.
   Answer:

2. *True or False?* Interactions between a customer and a staff member, like a phone conversation to make a hotel reservation, are called *word-of-mouth*.
   Answer:

2.3 Hospitality Employees Checkpoint

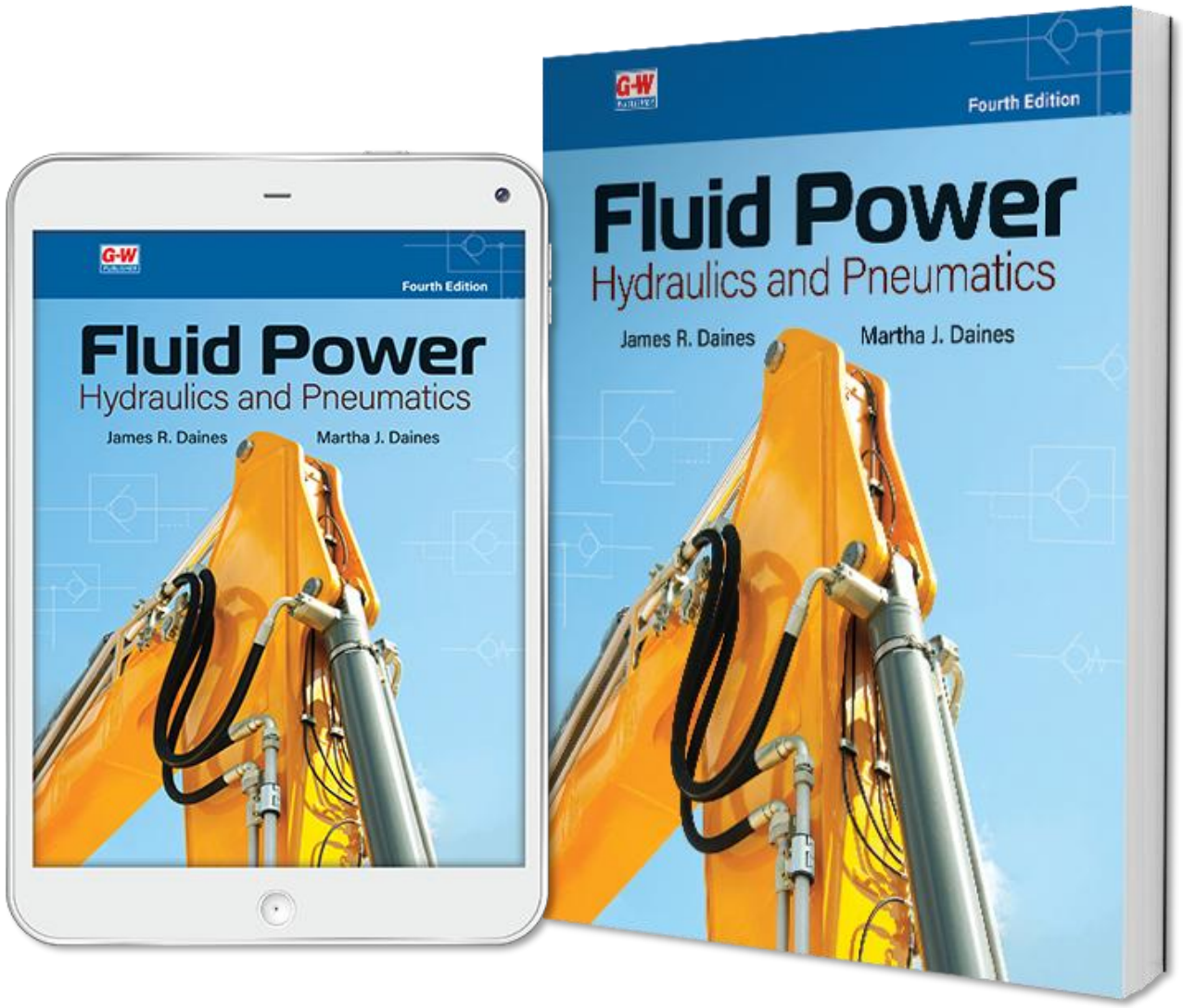
1. *True or False?* In a hotel, the back-of-the-house employees include the valets bell attendants, and security officers.
   Answer:

2. A customer-focused employee is able to _____customer needs.
   Answer:

Workbook Activities

Integrate G-W Digital Resources

*Shown are examples across various titles



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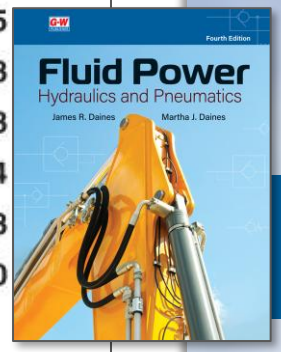
Brief Contents



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Student Textbook

7 Source of Hydraulic Power

Power Units and Pumps

Chapter Outline

7.1 Power Unit
7.2 Ba
7.3 Ba
7.4 Pu an
7.5 Ac of
7.6 Pu an

136

Chapter 8 Fluid Storage and Distribution 191

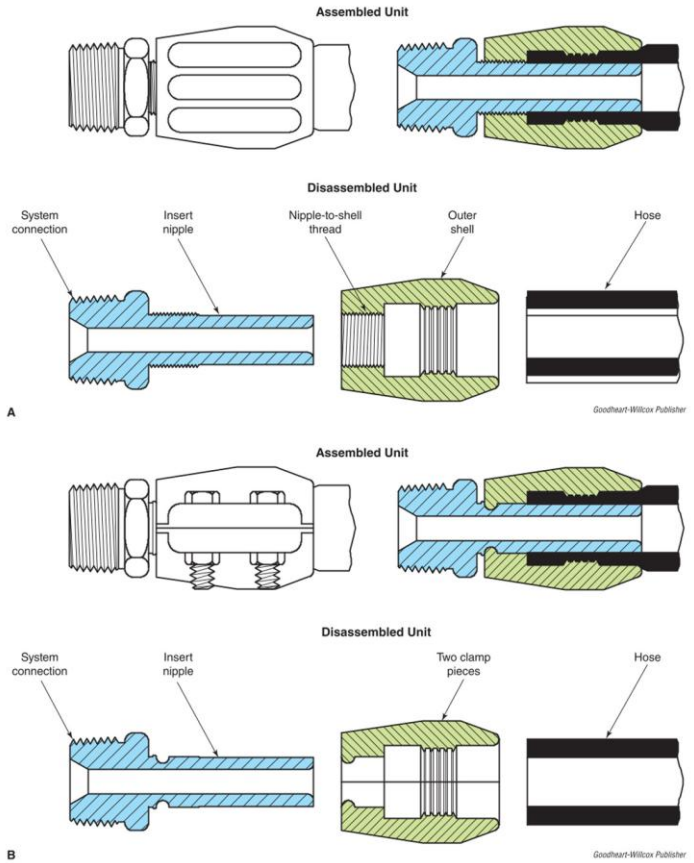


Figure 8-24. Reusable hose-end fittings are either screw-together or clamp type. A—Screw together. B—Clamp.

Photo courtesy of 3M ©2007

Figure 3-12. Respirator face masks are designed for use in a variety of atmospheres. Here, one is being used during asbestos abatement.

Photo courtesy of 3M ©2007

Figure 3-13. Air-line respirators supply usable air to the worker through a hose attached to the facepiece of the device.

Head and foot protection

Safety helmets (hard hats) are used to protect the head from injuries caused by the impact of falling or moving objects. See **Figure 3-14**. They also provide limited protection from heat and electrical shock. Some incorporate sound and eye/face protection elements into their design. Helmets are commonly used throughout industry, with their use required in many factory areas. A fluid power specialist needs to be aware of safety policies requiring helmet use and observe those rules as they work throughout a complex.

Helmets are generally made from plastic or metal and use a strap suspension system to hold the helmet shell away from the head. Metal helmets are lighter in weight than plastic, but do not provide protection from electrical shock or corrosive liquids.

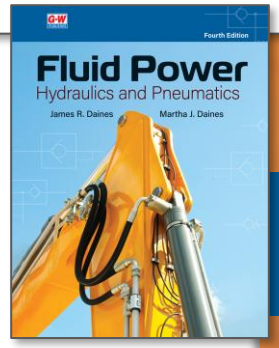
Safety shoes are another comon piece of protective equipment for the fluid power specialist. Specially designed shoes or shoes with built-in foot protection are needed in many industrial operations. See **Figure 3-15**. Wearing proper shoes can significantly reduce the number or severity of foot injuries. Manufacturing firms often provide proper safety footwear for their employees or assist in the purchase of such gear.

Steel-toed shoes provide protection from heavy weights. However, safety shoes are available in many styles and forms far beyond the traditional steel-toed work shoe. For example, metal-free footwear is available for use where there are severe electrical, fire, or explosion hazards. Wood-soled shoes are designed for working on wet floors or for jobs that require walking or standing on hot floors.

Metal safety guards worn over shoes to protect the toe and arch area of the foot are also available. These are worn in areas where heavy objects, such as metal castings and timbers, are routinely handled.

Atlas Copco

Figure 3-14. Safety helmets are primarily used to protect the head from impacts. A variety of designs are available to meet the special needs of particular industries.



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What's New to the Edition

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Introduction

Since the beginning of time, long before written history, people have searched for ways to conveniently transmit energy from its source to where it is needed and then convert the energy into a useful form to do work. This chapter introduces the fluid power field as an approach that provides an effective means of transferring, controlling, and converting energy.

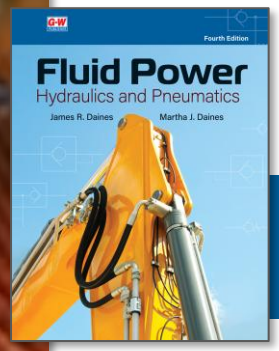
Learning Objectives

After completing this chapter, you will be able to:

- Define the terms fluid power, hydraulic system, and pneumatic system.
- Explain the extent of fluid power use in current society and provide several specific examples.
- List the advantages and disadvantages of fluid power systems.
- Discuss scientific discoveries and applications important to the historical development of the fluid power industry.

Key Terms

actuator
compact hydraulic units
cup seal
fluid
fluid compressibility
fluid power
hydraulic
hydraulic accumulator
hydraulic intensifier
Industrial Revolution
pneumatic
prime mover
scientific method
waterwheel



Chapter-Opening Material

CAUTION

Gas-charged accumulators are the most popular designs used today in both industrial and mobile hydraulic applications. The following is a list of safety factors that must be followed to provide a safe working environment when using gas-charged units.

- Only individuals with specific training should install accumulators or perform repair work.
- Never fill an accumulator with oxygen. An explosion may result if a mixture of oxygen and oil is pressurized.
- Never fill an accumulator with air. Three the use of air in an accumulator undesi there is a risk of explosion as the oxyge is compressed in the system. Second, t contained in the air can condense, rust parts and reducing hydraulic fluid life. T the air causes oxidation of the hydraulic
- Always fill an accumulator with an iner as dry nitrogen. Using dry nitrogen eli above
- Never ed by t
- Use so ply soa pressu there is
- Interna the app
- To rem hydrau an actu to relie a bleed the hyd
- Be cert cumula

NOTE

The horsepower formulas presented here provide the theoretical horsepower required to move the fluid in the system. They do not take into consideration losses that occur in the system.

EXAMPLE 7-4

Selecting a Pump

A warehouse is seeking to install a hydraulic lift system to raise large pieces of equipment to an overhead storage rack. Each lifting platform will be raised by a cylinder with a 4-inch diameter and a 72-inch length or stroke. The maximum load on the cylinder as it extends is 5,000 lb. If the shop would like the equipment to be raised in 30 seconds or less, what is required from the pump used in the system?

Calculate the system pressure (pump capacity) needed to raise the maximum load:

$$\text{Pressure (psi)} = \frac{\text{Force (lb)}}{\text{Cylinder Area (in}^2\text{)}}$$

$$= \frac{5{,}000 \text{ lb}}{\pi \times 4 \text{ in}^2}$$

$$= 1{,}250 \text{ psi}$$

Calculate the pump delivery rate (gpm) required to extend the cylinder in 30 seconds:

$$\text{Fluid Volume for Extension (gal)} = \frac{\pi \times 4 \text{ in}^2 \times 72 \text{ in} \times 1 \text{ gal}}{231 \text{ in}^3}$$

$$= 3.9 \text{ gal}$$

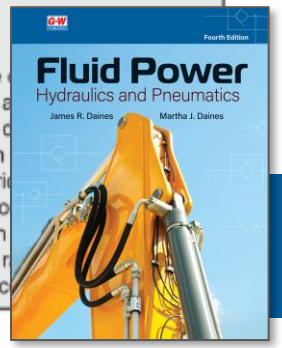
$$\text{Pump Delivery Rate (gpm)} = \frac{\text{Fluid Volume}}{\text{Time}}$$

$$= \frac{3.9 \text{ gal}}{30 \text{ s}} \times \frac{60 \text{ sec}}{1 \text{ min}}$$

$$= 7.8 \text{ gpm}$$

Based on these calculations, the
should be rated for at least 1,250 psi a
deliver 7.8 gpm at that pressure. This c
be the actual delivery rate rather than
calculated using the pump's volumetri

What type of pump (gear, vane, c
selected? Using **Figure 7-54**, you can
gear pump able to deliver fluid at the r
the loads would be the first option to c



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Special Features

Chapter Review

Summary

- Fluid power systems use pressurized fluids to transfer energy from a prime mover to an actuator that performs work.
- Fluid power systems are generally grouped under two broad classifications: hydraulic and pneumatic.
- Hydraulic systems generally use oil as the system fluid, while pneumatic systems use air.
- The fluid power industry is a broad field that includes education, design and manufacturing of components, design and assembly of systems using those parts, and troubleshooting and maintenance needed to keep the systems performing efficiently.
- Fluid power is used extensively in manufacturing, construction, transportation, agriculture, mining, military operations, health, and even recreation.
- Advantages of both hydraulic and pneumatic systems include easy control of force, torque, speed, and direction of actuators.
- The natural movement of air and water was used in the earliest applications of fluid power; wind and water mills were early prime movers that harnessed this natural movement to provide power until well into the Industrial Revolution.
- Many early fluid power devices were developed through observation or experimentation rather than scientific theory.
- Compact, self-contained power units which contained the prime mover, pump, and reservoir were invented in the early 1900s and had considerable influence on the development of fluid power as we know it today.

Know and Understand

Answer the following questions using information in this chapter.

1. *True or False?* Fluid power systems use pressurized fluids to transmit power.
2. *True or False?* The physical components in a fluid power system are used to generate, transmit, and control power to produce the desired results in an application.
3. *True or False?* Fluid, mechanical, and electrical power are transfer systems commonly used in industry today.
4. *True or False?* Fluid power is used exclusively in the agriculture industry.
5. *True or False?* Hydraulic power systems can provide lightweight, easily handled tool applications.
6. The cost of operating a pneumatic fluid power system is affected by _____.
   A. conditioning the air
   B. compressing the air
   C. distributing the air
   D. All of the above.
7. *True or False?* Clean operation with minimum fire hazards is a characteristic of hydraulic systems.
8. Which of the following is a disadvantage of using a fluid power system?
   A. No speed control for linear and rotary motion.
   B. Higher safety factors associated with high-pressure oil and compressed air.
   C. Cannot easily be adapted to accommodate a range of machine sizes and designs.
   D. All of the above.
9. *True or False?* Many early fluid power developments were the products of observation and experimentation rather than understanding of scientific principles.
10. Artwork from Egyptian tombs indicates that sails were used to assist in the propulsion of boats as early as _____ BCE.
    A. 200
    B. 1000
    C. 2500
    D. 3000
11. *True or False?* The use of water for doing work did not appear until after the decline of the Roman Empire.
12. *True or False?* The period of history during the eighteenth and nineteenth centuries, known as the Industrial Revolution, produced tremendous changes in industry, including the development of many fluid power concepts and components.
13. *True or False?* Technological changes during the Industrial Revolution occurred much more quickly than those during the Middle Ages.

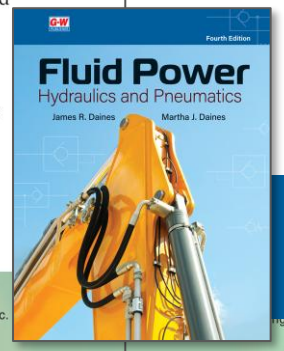
14. *True or False?* The invention of the cup seal led to the development of the first functional pneumatic system.
15. *True or False?* The development of new materials and manufacturing techniques has promoted the design of new fluid power concepts and allowed practical application of old ideas.

Apply and Analyze

1. How do mechanical systems transfer power from the prime mover to the point of use?
2. In what ways is fluid power used in modern transportation systems?
3. Which type of system is capable of operating at higher pressures: hydraulic or pneumatic?
4. Which of the two fluid power systems would you use in the following equipment? Why?
   A. City trash collecting vehicle.
   B. Dental drill.
   C. Log loader at a sawmill.
   D. Gripper to move a small plastic part in an automated assembly line.
   E. Retraction and extension of an airplane's landing gear.
   F. Power steering in automobile.

Critical Thinking

1. Examine your home or other building. List and describe at least three systems or appliances that use component parts or basic concepts associated with fluid power.
2. Skid-steer loaders typically employ hydraulic systems for operations.
   A. What impact would switching to a mechanical power transmission system have on loader operation? Why?
   B. What impact would switching to a pneumatic system for lifting have on how this loader could be used? Why?
   C. You are designing an automated system to hold a part in place during drilling. What information would you need to allow you to choose between a hydraulic and a pneumatic system? Why?
3. The first cup seal, developed by Joseph Bramah and Henry Maudslay, was made of leather. What properties do you think are important to consider when choosing a material for a hydraulic seal?
4. In the fluid power industry, trends are leaning toward miniaturization, increased energy efficiency, reduced environmental impact, and use of electronic controls. Predict how one of these trends might affect our use of hydraulic or pneumatic systems in the future.



End-of-Chapter Content

Activity 2-1: Hydraulic Fluid Power System Observation and Analysis

This activity is designed to show the structure and operation of a hydraulic circuit on an operating machine. Ideally, the machine should include hydraulic power as a significant part of its operation. Your instructor should suggest suitable equipment and locations where it may be found.

Note:

Check with your instructor to be certain that all the policies of the school are followed, especially if your activities involve a group outside of the school.

Activity Specifications

Study the list of questions below to become familiar with the factors that will be observed and analyzed in the hydraulic system. Based on the factors that should be observed, select an appropriate piece of equipment to be studied. Identify a machine that appears to contain as many of these factors as possible. Obtain permission to observe the machine for an extended operating period. Complete the activity questions based on your observations.

1. In general terms, describe the machine and what it does.
   Answer:

2. Where is the machine located and who is the owner?
   Answer:

3. Estimate the percentage of machine functions operated by the hydraulic system. How important are these functions to the overall operation of the system?
   Answer:

4. What type of prime mover is used to operate the hydraulic system of the n
   Identify the horsepower rating of the prime mover.
   Answer:

5. Describe the construction of the reservoir of the system power unit. Give the length, height, and width of the tank.
   Answer

6. Locate the pump and identify its flow rate per minute. Describe how the pump is connected to the prime mover.
   Answer:

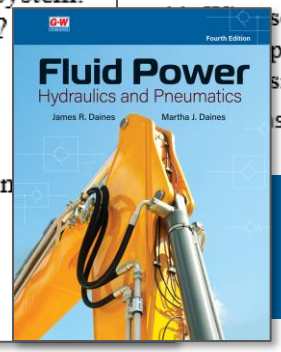
7. What fluid is used in the system?
   Answer:

8. Identify the filters used in the system. Describe the location of each filter.
   Answer:

9. Identify the maximum operating pressure of the system. What method appears to be used to adjust this pressure?
   Answer:

10. What types of actuators are used in the system? How many of each type are used and what is the general function of each?
    Answer:

serves as the control valve to start, stop, or reverse the actuators? Describe
pearance of the valve and how the machine operator manipulates it to obtain
sired machine operation.
swer:



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Lab Workbook

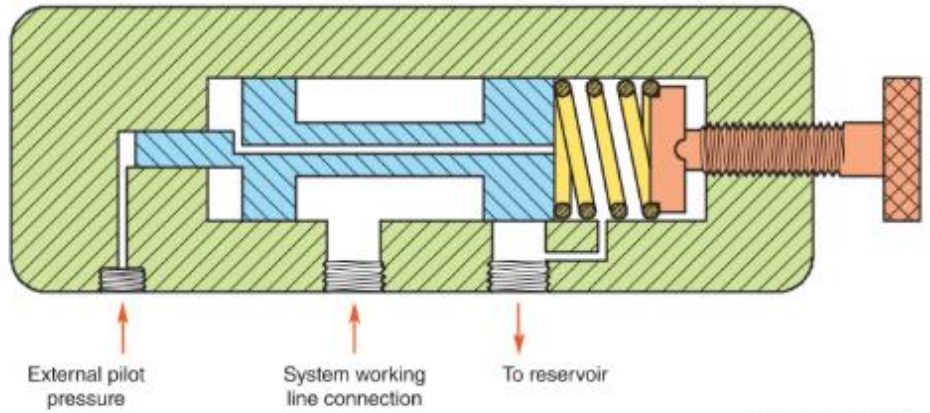


Figure 10-29. Unloading valves are often used in dual-pump applications that provide maximum system operating efficiency. These valves use external pilots as they sense pressure at remote locations.

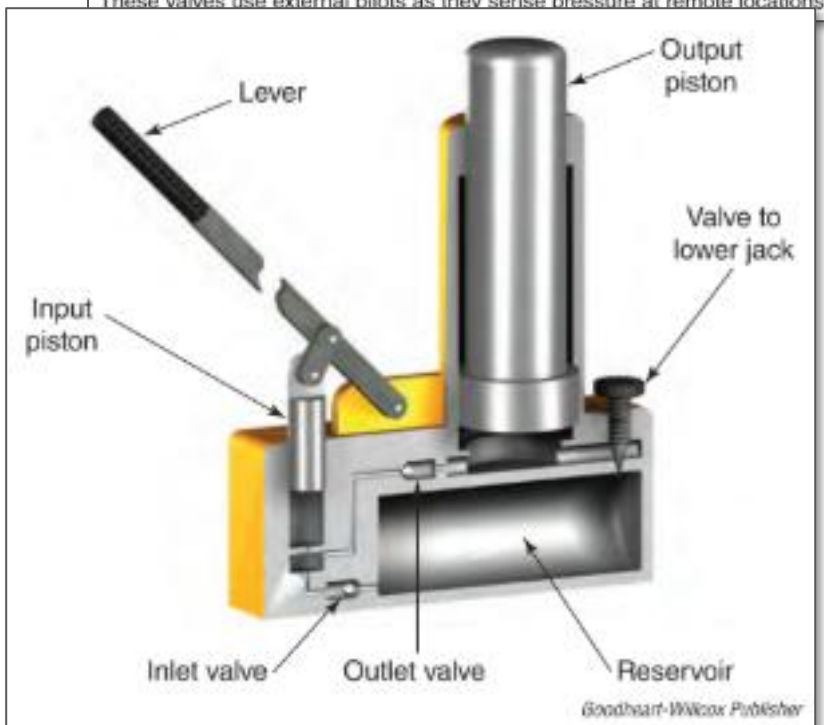


Figure 4-12. A hydraulic jack develops a high mechanical advantage through the use of both the area differences of the input and output pistons and the advantage gained in the first-class lever (the handle) operating the input piston.

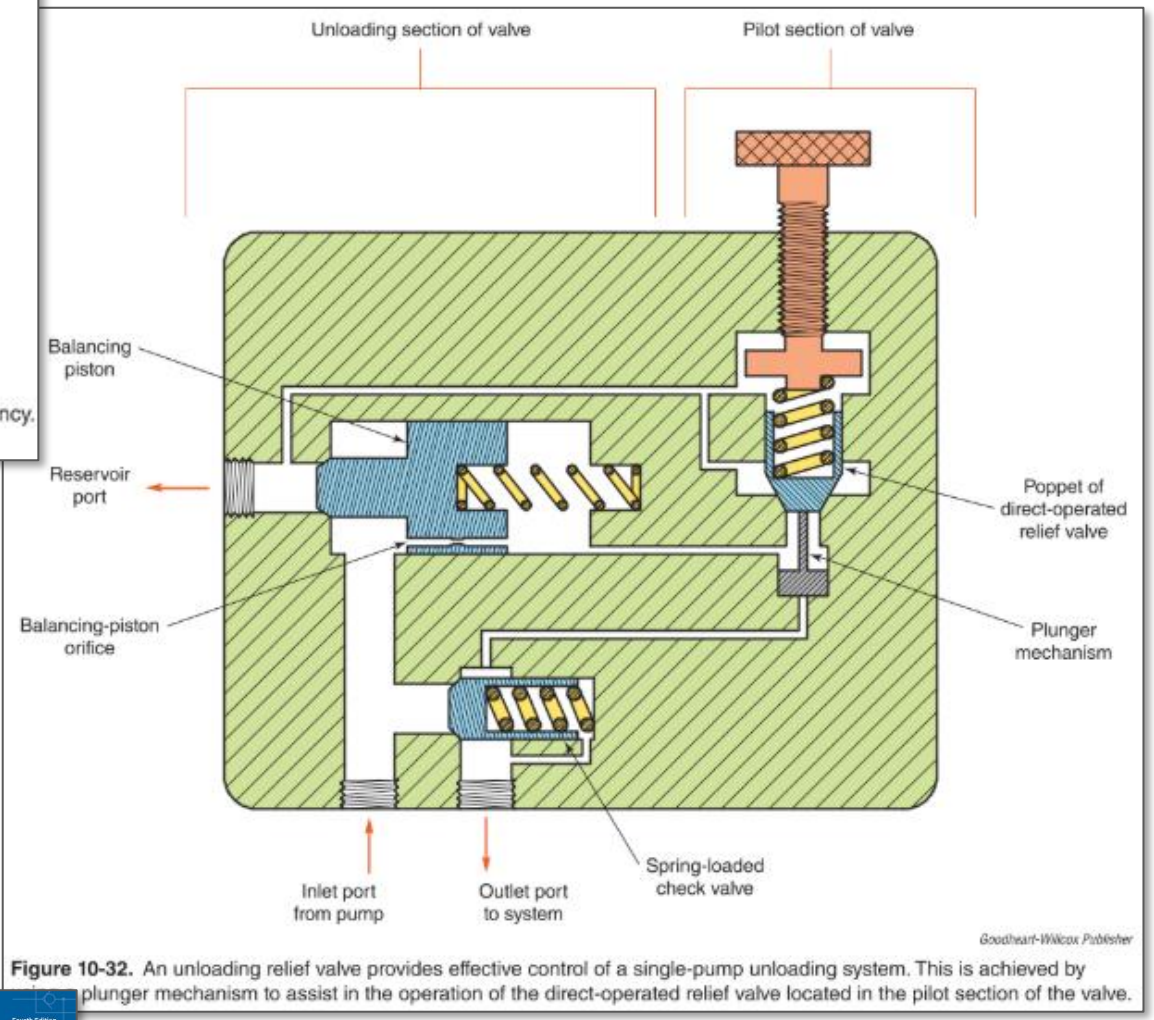
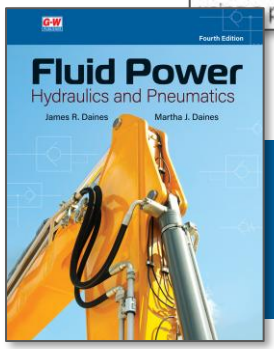


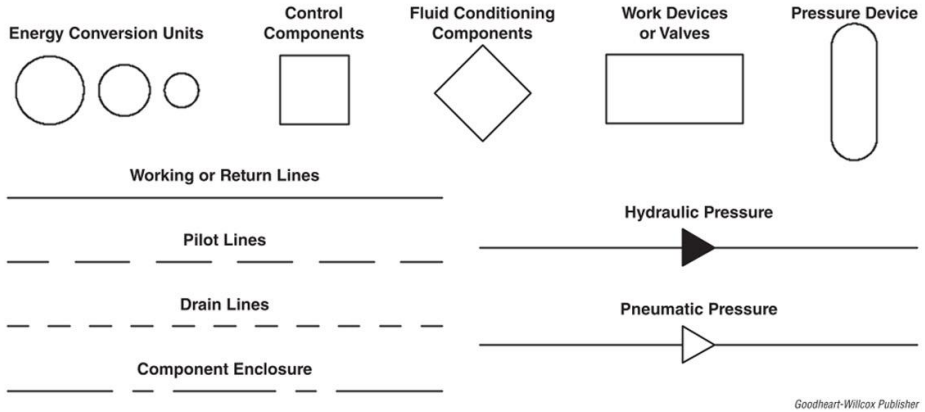
Figure 10-32. An unloading relief valve provides effective control of a single-pump unloading system. This is achieved by [illegible] plunger mechanism to assist in the operation of the direct-operated relief valve located in the pilot section of the valve.



Illustrations and Images

Appendix A Fluid Power Symbols Review

Basic Symbols



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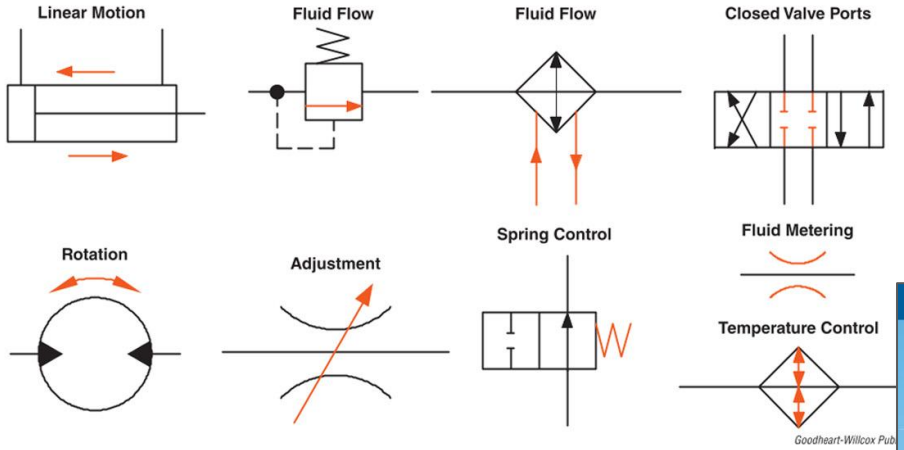
Function Indicators



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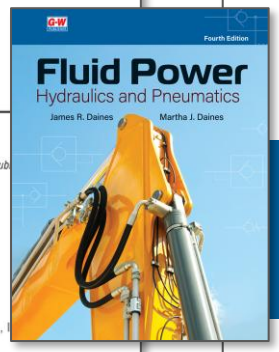

Appendix B Math Review

Why Math?

All technical trades involve using math for numerous tasks. Industrial maintenance technicians use math to make precise measurements and convert units. They must be able to read and interpret prints. Perhaps most importantly, technicians must be able to determine if equipment is maintained and operated within specific tolerances. Some maintenance tasks require other specialized or more advanced math, but all technicians require an understanding of what is presented here.

Whole Numbers

Whole numbers are simply numbers without fractions or decimal points, such as 1, 2, 3, 4, etc. Adding, subtracting, multiplying, and dividing whole numbers primarily requires memorizing a few math facts.

Adding and Subtracting Whole Numbers

For example, adding this column of whole numbers requires memorizing the *sum* of 3 + 5 and the sum of 8 + 2.

$$\begin{array}{r} 3 \\ 5 \\ +\ 2 \\ \hline 10 \end{array}$$

The same type of memorization of math facts is required to subtract whole numbers. We know the result of subtracting 12 from 37 is 25, because we know 2 from 7 is 5 and 1 from 3 is 2.

$$\begin{array}{r} 37 \\ -\ 12 \\ \hline 25 \end{array}$$

The key to both addition and subtraction is to line up the columns of digits correctly. Whole numbers should be aligned on the right.

In subtraction, if the number being subtracted (the number on the bottom) is larger than the number it is being subtracted from (the number on the top), borrow 10 from the next digit to the left and add it to the one

Multiplying Whole Numbers

Multiplication of whole numbers requires memorization of a multiplication table. The only way to get 6 × 5 = 30 is to know that multiplication fact or to add 6 + 6 + 6 + 6 + 6. Longhand addition quickly becomes tedious for bigger multiplication problems. To multiply numbers whose values are 10 or more, align the digits representing 0 through 9 (the 1s digit) in the right-hand column. Then multiply the top row by the 1s digit in the second row:

10s ↘ ↙ 1s

$$\begin{array}{r} 31 \\ \times\ 15 \\ \hline 155 \end{array}$$

Next, multiply the top row by the 10s digit in the second row. Because you multiplied by the 10s digit, the *product* (the result of multiplication) is written with its right-most digit in the 10s column:

$$\begin{array}{r} 31 \\ \times\ 15 \\ \hline 155 \\ 31 \end{array}$$

If the problem has more digits in the second row, repeat the above steps for each digit and write the products in rows beneath one another. Be sure to record the right-most digit in each row in the column for the place it represents: 100s, 1000s, etc.

When all multiplication is complete, add the products just as you would for a simple addition problem. The result is the product (answer) of the multiplication problem.

$$\begin{array}{r} 31 \\ \times\ 15 \\ \hline 155 \\ 31 \\ \hline 465 \end{array}$$

Dividing Whole Numbers

Division of whole numbers is simply the reverse of multiplication, but the problem must be set up differently. The *dividend* (the number being divided) is written inside the division symbol. The *divisor* (the number

Appendix

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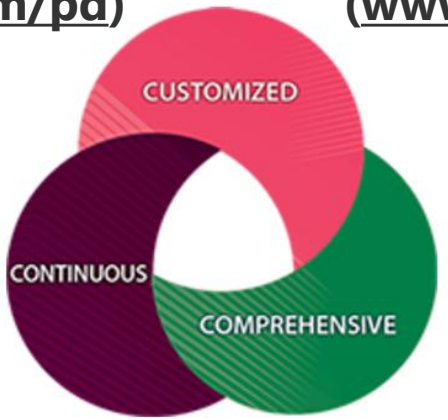

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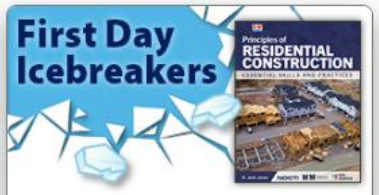

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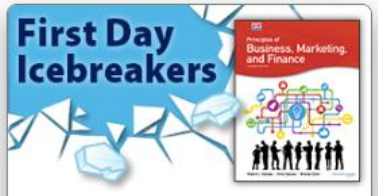

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Subject: Business, Marketing, and Finance

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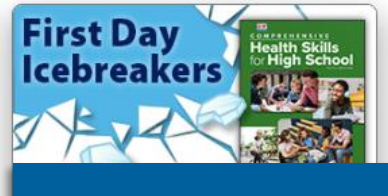

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