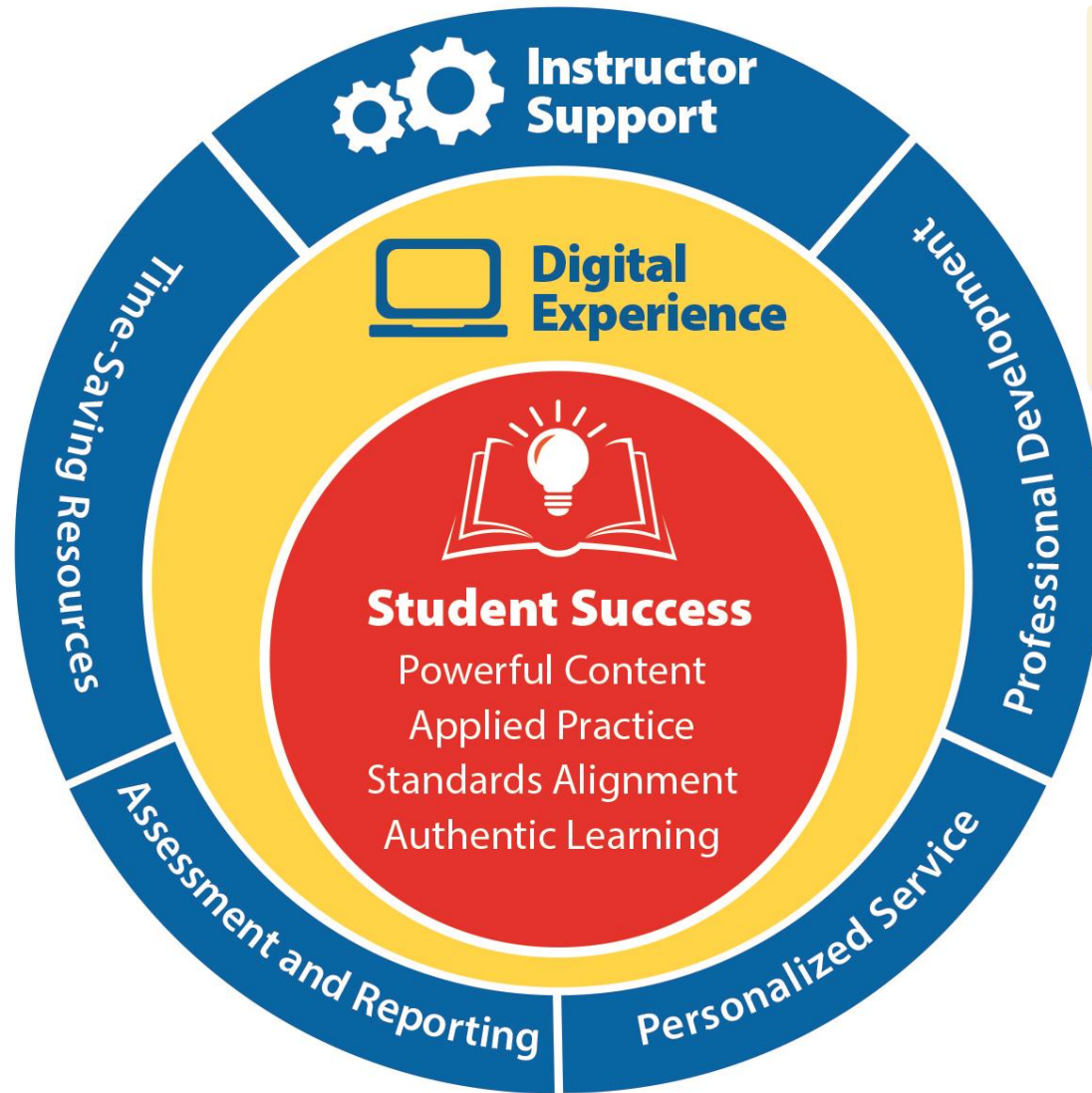


Print Reading for HVACR



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Student Success Is At the Heart of What We Do



Print Reading for HVACR: Lesson Plan

Instructor:

Date:

Course:

Unit:

Chapter 1: Introduction to Print Reading

Learning Outcomes

- 1.1 What is a Print?
 - 1.1-1 Define a print and its use in HVACR.
- 1.2 How Are Prints Created and Used?
 - 1.2-1 Discuss how prints are created.
- 1.3 Why Are Prints Needed?
 - 1.3-1 Explain the purpose of prints and why they are needed in the building trades.
- 1.4 Construction Drawings
 - 1.4-1 Explain the purpose of floor plans and site plans.
 - 1.4-2 Differentiate between a plan view and an elevation view.
 - 1.4-3 Discuss the types of prints used in the HVACR field and other trades.
- 1.5 Schedules
 - 1.5-1 Define a schedule and its purpose.

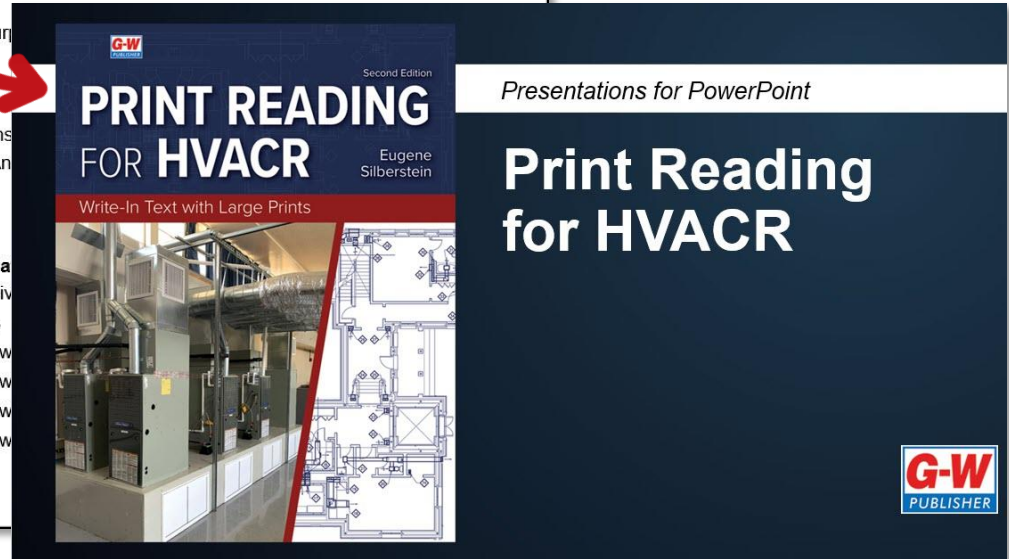
Instructional Resources

- Textbook/eBook: Chapter 1
- Instructor Resources: Chapter 1 Ins
- Instructor Resources: Chapter 1 An
- Large Prints Packet
- Other instructional resource:

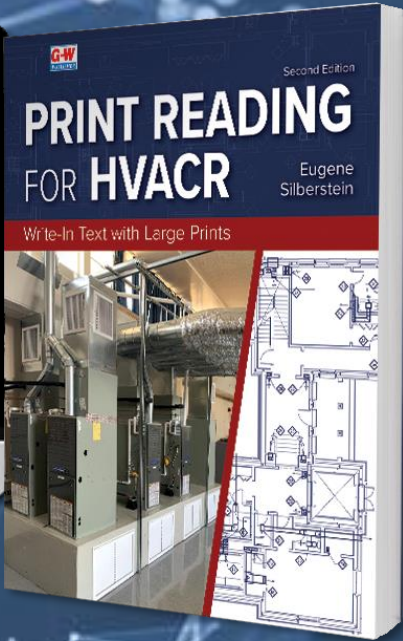
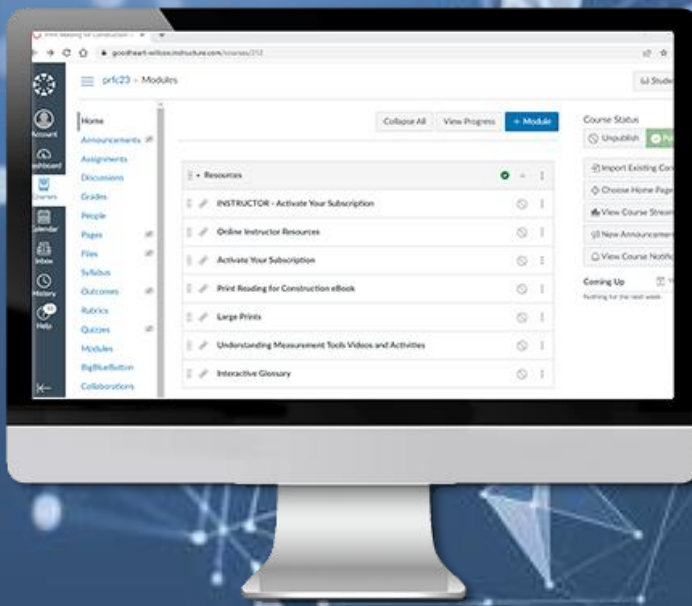
Resources for Practice and Application

- Digital Companion: Interactive Activi
- Digital Companion: E-Flash Cards
- Textbook/eBook: Chapter 1 Review
- Textbook/eBook: Chapter 1 Review
- Textbook/eBook: Chapter 1 Review
- Textbook/eBook: Chapter 1 Review
- Other resource:

Assessment



Lesson Plans, PowerPoint Presentations, and Answer Keys



Print • Digital • Bundle Options Available

Blackboard[®] D2L
BRIGHTSPACE  canvas

 moodle  schoolology[®]  Additional
LTI-Compliant
Platforms

Clever 
ClassLink


1EDTECH
CERTIFIED


Google Classroom

LMS and CMS Integration Easy Navigation

2: E-Flash Cards

Definition (1 of 31)

Item of value that is owned.

2: E-Flash Cards

Term (1 of 31)

asset

Select to flip

Previous Remove Next

E-Flash Cards & Vocabulary Practice

2: Vocabulary Game

Select a point value. Choose the term that matches the definition.

Score: 800

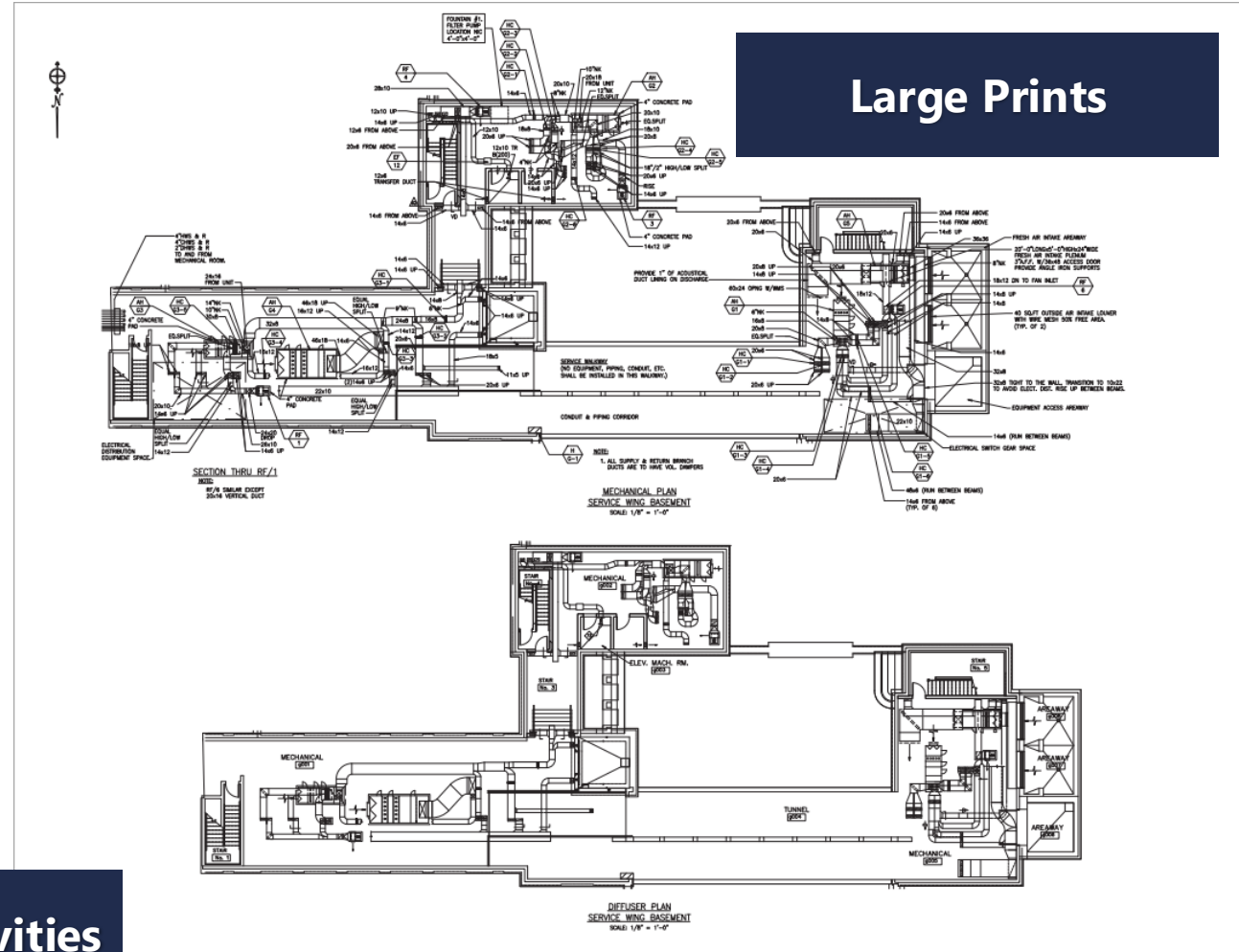
<input checked="" type="radio"/>	100	100	100	100
<input type="radio"/>	200	200	200	200
<input type="radio"/>	300	<input checked="" type="radio"/>	300	300
<input type="radio"/>	400	400	400	<input checked="" type="radio"/>

Definition: Act of giving money, goods, or services to meet the needs of others and support causes that are important to an individual.

- pay yourself first
- variable expense
- recordkeeping
- philanthropy

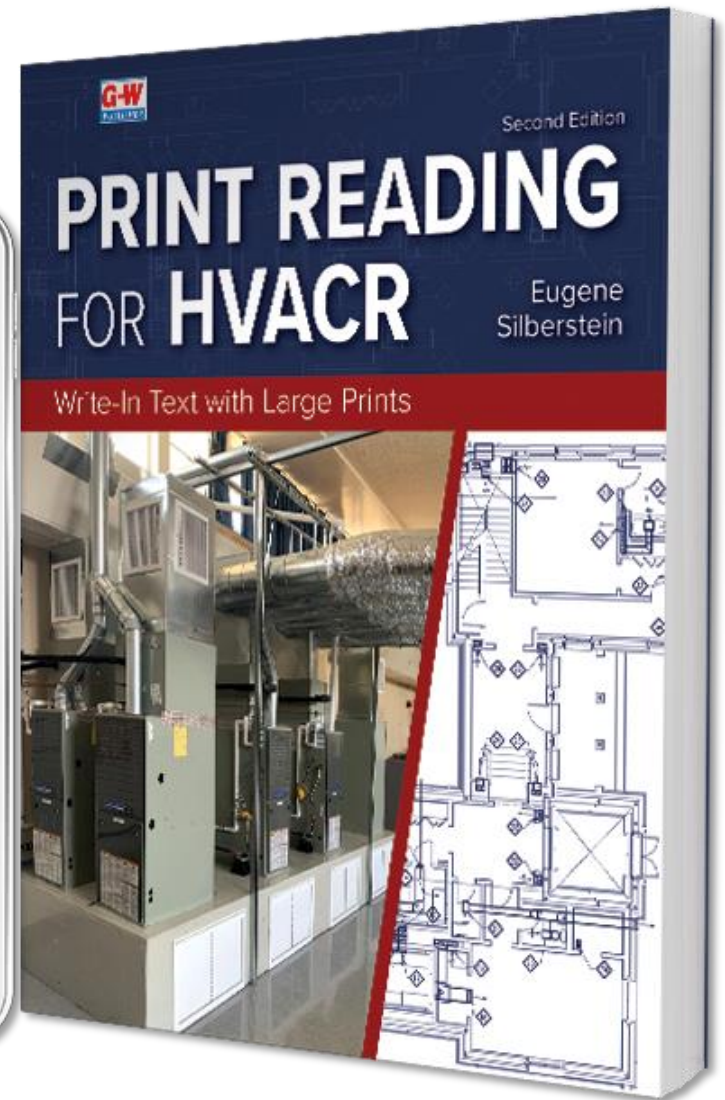
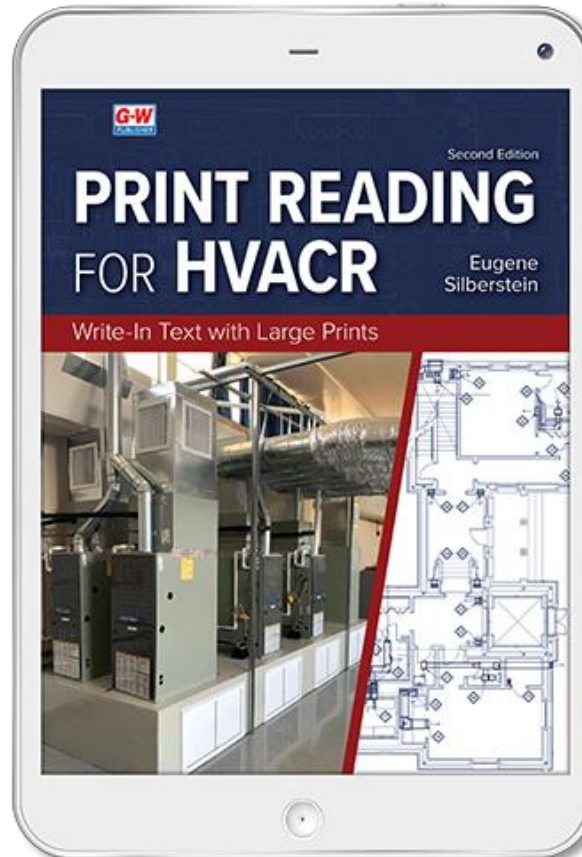
Check Answer

Interactive Activities

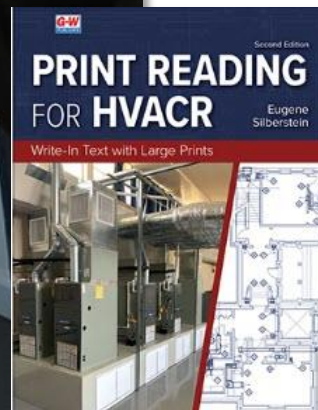


Large Prints

Integrate G-W Digital Resources



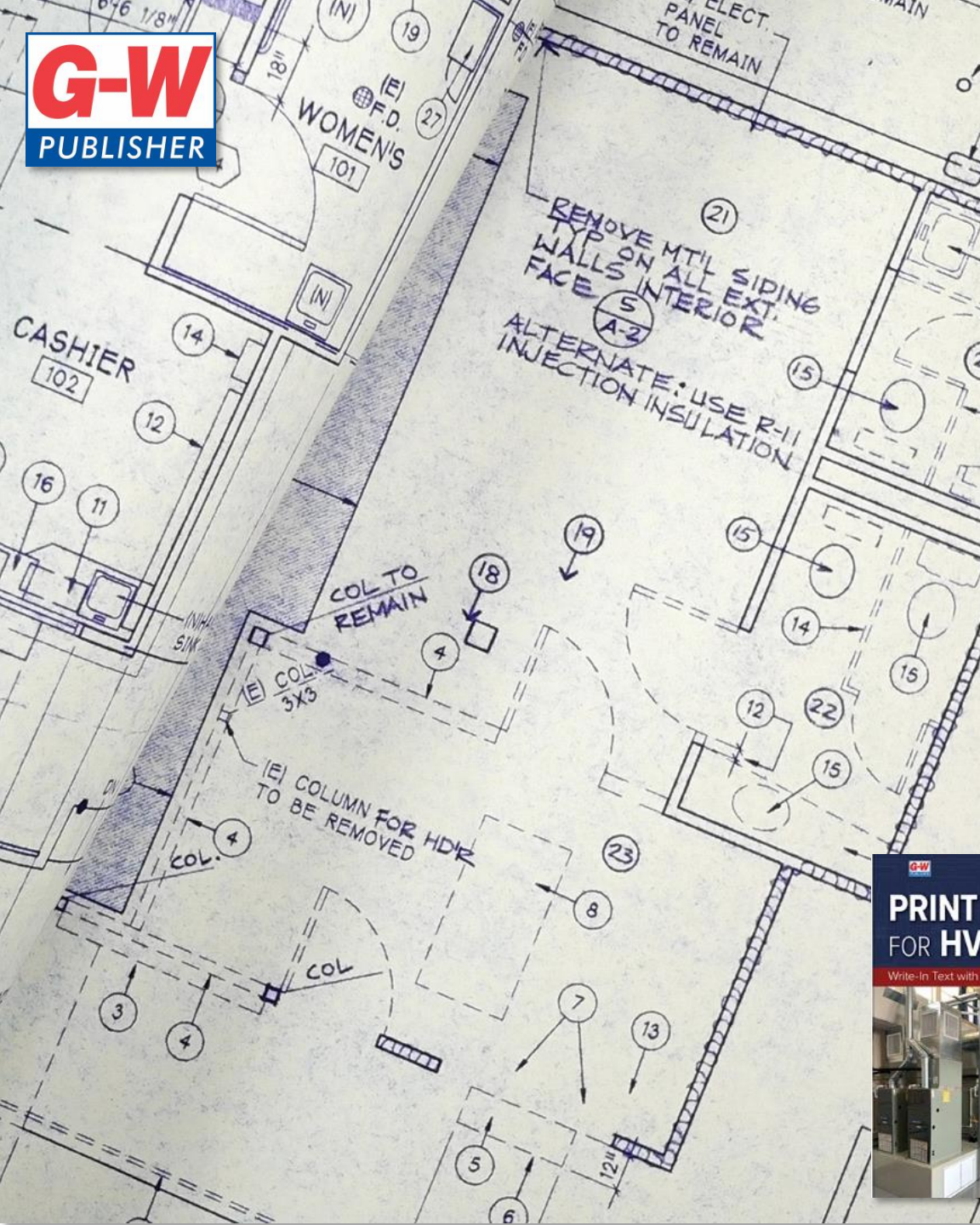
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by Eugene Silberstein



Brief Contents

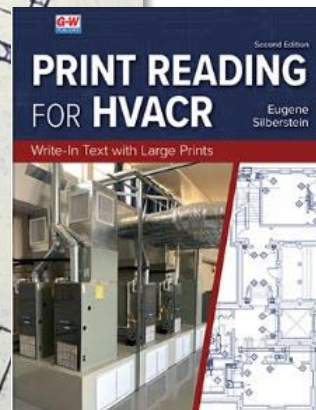
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12	Estimating HVACR Jobs	271

Student Textbook

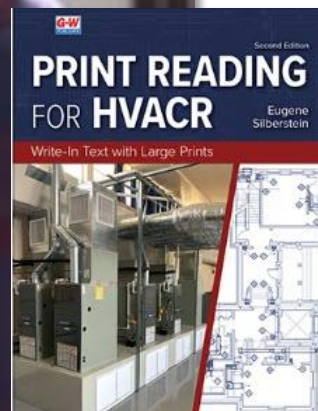


Summary

- Piping systems perform many tasks to ensure the proper function of an HVACR system and provide thermal comfort to occupants of a space. (7.1-1)
- An HVACR piping plan includes guidelines for proper installation. Piping systems must be installed with future service and repair in mind. (7.1-1)
- Drawings use piping abbreviations to identify the fluid being carried in the various pipes. (7.2-1)
- Always read any notes presented on the prints to ensure compliance with all codes and regulations. (7.2-1)
- HVACR piping circuits can carry refrigerant, water, or fuel, so the circuits must be properly designed and installed to safely contain these substances. (7.2-1)
- Many different types of valves are used in piping systems. Check valves, balancing valves, mixing valves, and pressure-reducing valves are commonly found in HVACR piping systems. (7.3-1)
- Valves in HVACR piping systems typically regulate the flow of air or limit the pressure through a system. (7.3-2)
- Always ensure valves are installed according to the installation guidelines to ensure proper operation of the device. (7.3-3)
- Pipe fittings change the direction and size of a pipe. (7.4-1)
- Common pipe fittings include elbows, tees, reducers, and unions. (7.4-2)
- Gauges and switches monitor and ensure proper system operation. Examples include thermometers, pressure gauges, flow switches, pressure switches, and aquastats. (7.5-1)
- Floor drains, strainers, and cleanouts are components used to improve system operation and prevent damage in the system. (7.5-1)
- Pipe guides allow a pipe to move in one direction and facilitate thermal expansion or contraction. (7.5-2)
- Other items are included in prints that do not represent a system component but help execute the project. These symbols can indicate new piping to install, existing piping to remove, specific connections, and up and downturning fittings. (7.6-1)



What's New to the Edition



Technical Terms

aquastat
balancing valve
check valve
concentric reducer
eccentric reducer
flanged union
flow switch
mixing valve
pipe guide
pressure switch
pressure-reducing valve
reducer
screwed union
union
valve

Introduction

A system designer or engineer must be able to convey ideas on piping system prints to ensure that the piping systems are installed correctly. On the job site, HVACR-related piping can involve the installation of refrigerant lines, condensate lines, chilled water lines, hot water heating lines, water-cooled condenser lines, fuel lines, drain lines, and make-up water lines. Not only must these lines be properly sized and pitched, they must also be properly supported. Properly designed and installed piping arrangements such as these help ensure the satisfactory operation of the air-conditioning system for years to come. This chapter introduces you to some concepts that are used to extract important information from piping drawings or prints. These skills will prove useful to those who ultimately estimate or install the piping circuits for HVACR equipment.

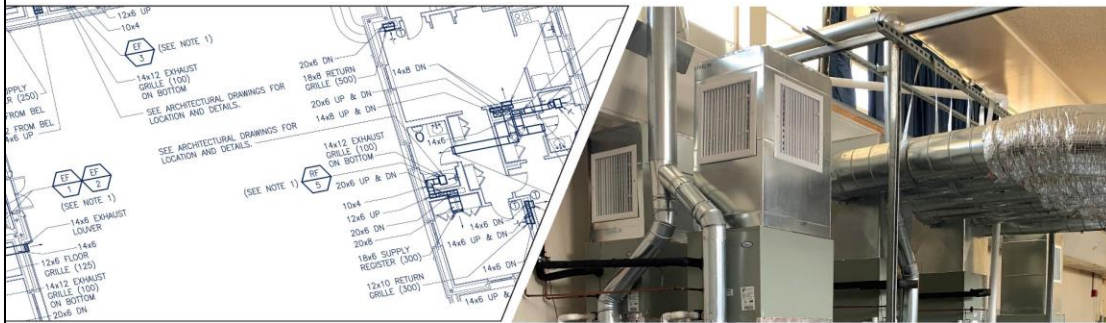
7.1 Piping Systems

The function of an HVACR system is to provide thermal comfort to the occupants of the space. This requires all of the system's components to function together. Various fluids must move through the system's piping arrangements. These piping arrangements are responsible for a number of tasks:

- Transferring condensate from the air handlers to remotely located drains.
- Carrying high-pressure and low-pressure vapor and liquid refrigerant between the indoor and outdoor units of a split air-conditioning system.
- Supplying heated water to duct-mounted hot water coils from the boiler.
- Carrying water from hot water coils back to the boiler.
- Supplying chilled water to duct-mounted cooling coils.
- Carrying water from cooling coils back to the chiller.
- Supplying water to water-cooled condenser coils from a cooling tower.
- Carrying water from condenser coils back to the cooling tower.
- Supplying fossil fuels, such as natural gas and oil, to furnaces and boilers.
- Providing make-up water to boilers and cooling towers.
- Transferring water between ground loops/coils and equipment loops/coils in geothermal heat pump applications.

Chapter Opening Material

7 Piping Drawings



Chapter Outline

- 7.1 Piping Systems
 - Piping System Installation
- 7.2 Piping Abbreviations
- 7.3 Valves
- 7.4 Pipe Fittings
 - Elbows
 - Tees
 - Unions
- 7.5 Gauges and Switches
 - Drains, Strainers, and Cleanouts
 - Pipe Guides
- 7.6 Piping Symbols and Drawing Concepts

Learning Outcomes

After studying this chapter, you will be able to:

- 7.1-1 Discuss the various functions of piping arrangements.
- 7.2-1 Identify the types of abbreviations used on plans.
- 7.3-1 Describe valves commonly used on HVACR systems.
- 7.3-2 Differentiate among directional valves, flow valves, and pressure control valves.
- 7.3-3 Identify the symbols used to represent various types of valves commonly found in HVACR piping drawings.
- 7.4-1 Describe the types of fittings used in piping drawings.
- 7.4-2 Identify fittings commonly used on HVACR piping drawings.
- 7.5-1 Explain the gauges and sensors used in piping drawings.
- 7.5-2 Explain the function of pipe guides and hangers.
- 7.6-1 Identify symbols that express specific piping functions.

BETWEEN THE LINES

Determining the Start Action

The action that starts a system can be easily found by the process of elimination. For example, the circulator pump, CP, circuit at the top of the diagram cannot initiate system operation because that circuit is waiting for the closing of contacts 1-3 for the circulator pump to turn on. Similarly, the VDM and GV circuits do not become energized until other system events occur.

Procedure Sequence of Operations

Consider the ladder diagram shown in **Figure 9-9**. This ladder diagram is a representation of the schematic diagram shown in **Figure 9-4**. This system has a relay with its coil marked COIL and two sets of normally open contacts, 1-3 and 4-6. These two sets of contacts close when the relay coil is energized. This system also has a set of normally open vent damper contacts, VD, that closes once the vent damper, controlled by the vent damper motor, VDM, has fully opened.

Determining the sequence of operations for this system can be broken down into a series of individual, logically organized steps:

1. Identify the components with no switches in series with them that are energized all the time. For instance, the primary size of the transformer is powered all the time, so 24 V is always supplied to the control circuit. Also, line voltage power is always supplied to the top portion of the circuit from L1 and L2, **Figure 9-10A**.

Identify the action that starts system operation. The action that typically starts the system is often an external event, such as the flipping of a switch or the closing of the thermostat. In this circuit, the action that starts the system is the thermostat,

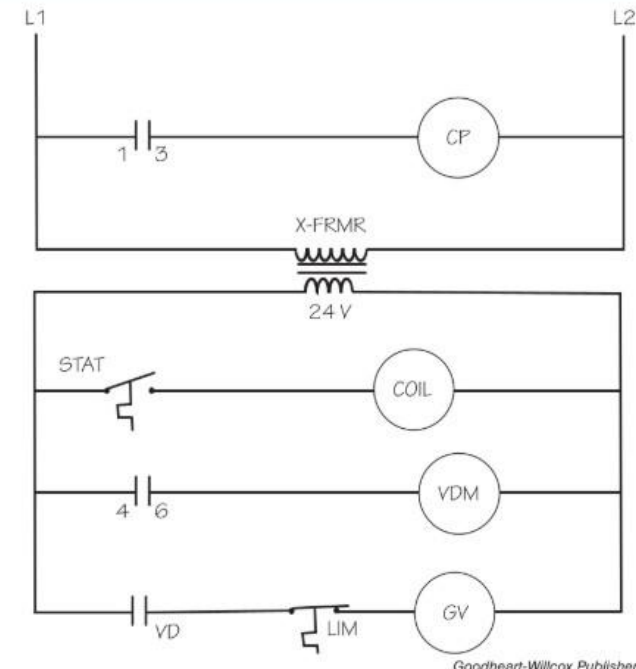
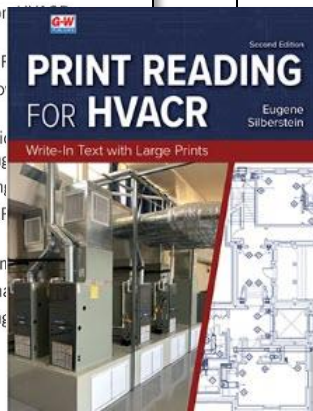


Figure 9-9. A ladder diagram that indicates 24 V is always being supplied to the control circuit.

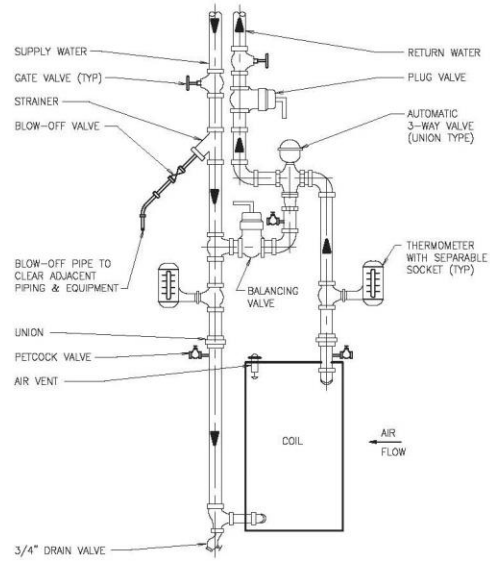
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Textbook Features

Apply and Analyze

Refer to the figure below to answer questions 1–2.



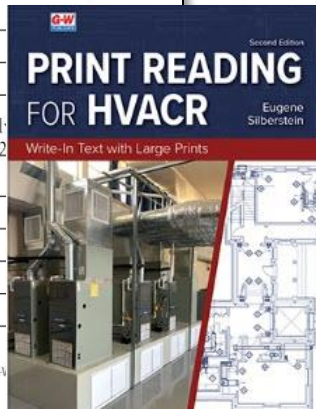
WATER COIL CONNECTIONS THREE-WAY VALVE
NOT TO SCALE

NOTE: LOCATE ALL VALVES INSIDE PACKAGED AIR CONDITIONING UNIT MOUNTED ON ROOF.

Lizardos Engineering Assoc., P.C.

1. Explain why it would *not* be desirable for all of the hot water to flow through the heating coil, as shown above. (7.3-2)

2. Explain how the balancing valve could be replaced with a three-port mixing valve so that the water entering the heating coil was to be maintained at a set temperature. (7.3-2)



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Chapter Assessment

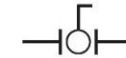


Name _____ Date _____ Class _____

Know and Understand

- _____ The abbreviations HHWS and HHWR would most likely be used in conjunction with which type of system? (7.2-1)
A. Hydronic heating system
B. Chilled water cooling system
C. Domestic hot water system
D. Hydronic cooling system
- _____ valves set the desired flow through a particular branch in a multi-circuit piping arrangement. (7.3-1)
A. Balancing
B. Mixing
C. Pressure-reducing
D. Butterfly
- _____ The valve that can be moved from a fully open to a fully closed position by moving the valve's handle only 90° is the _____ valve. (7.3-2)
A. plug
B. ball
C. gate
D. check
- _____ The valve that must be fully installed with its directional arrow pointing in the direction of intended fluid flow is the _____ valve. (7.3-2)
A. check
B. ball
C. plug
D. globe

5. _____ The following symbol represents a _____ valve. (7.3-3)



- A. ball
B. gate
C. butterfly
D. plug

6. _____ The following symbol represents a _____ valve. (7.3-3)



- A. ball
B. check
C. globe
D. plug

7. _____ The following symbol represents a _____ valve. (7.3-3)



- A. butterfly
B. gate
C. globe
D. check

8. _____ The following symbol represents a _____ valve. (7.3-3)



- A. check
B. gate

End-of-Chapter Content

Print Reading for HVACR 2e, Large Prints

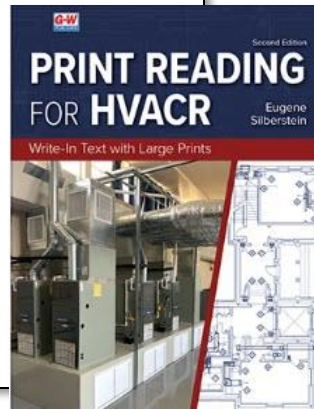


These large-size professional prints are used to complete textbook end-of-chapter Large Prints Activities and provide further practice with HVACR prints. Files are provided in PDF format. This type of file will require compatible programs.

[Collapse All](#)

Activities ▼

- [PDF](#) Print-01, ME B105 All Buildings: Automatic Temp Control Heating Hot Water Flow Diagram
- [PDF](#) Print-02, M D101 Living Wing: Cellar Ductwork & Diffuser Plan
- [PDF](#) Print-03, M D102 Living Wing: First Floor Ductwork & Diffuser Plan
- [PDF](#) Print-04, M D104 Living Wing: Cellar Mechanical Piping Plan
- [PDF](#) Print-05, M D106 Living Wing: Dining & Living Room Sections
- [PDF](#) Print-06, M D107 Living Wing: Air Device Schedule
- [PDF](#) Print-07, M E102 Bedroom Wing: First Floor Mechanical Plan
- [PDF](#) Print-08, M E103 Bedroom Wing: Second Floor Mechanical Plan
- [PDF](#) Print-09, M E105 Bedroom Wing: Cellar Air Device Plan & Schedule
- [PDF](#) Print-10, M E106 Bedroom Wing: First & Second Floor Air Device Plan
- [PDF](#) Print-11, E E118A Bedroom Wing: First & Second Floors Closet Lights & Misc
- [PDF](#) Print-12, M F104 Gallery Wing: Cellar Mechanical Piping Plan
- [PDF](#) Print-13, M F105 Gallery Wing: Cellar Air Device Plan & Schedule
- [PDF](#) Print-14, M G101 Service Wing: Cellar Mechanical Plan Ductwork & Diffuser Plan
- [PDF](#) Print-15, M G102 Service Wing: First Floor Mechanical Plan Ductwork & Diffuser Plan
- [PDF](#) Print-16, M G103 Service Wing: Second Floor Mechanical Plan Ductwork & Diffuser Plan
- [PDF](#) Print-17, M G105 Service Wing: Cellar Mechanical Piping Plan
- [PDF](#) Print-18, M G106 Service Wing: Air Device & Equipment Schedules



Large Prints Activity



Name _____ Date _____ Class _____

Practice Using Large Prints

Refer to Print-25 in the Large Prints supplement to answer the following question.
Note: The large prints are created at 50% of their original size. When extracting information from the print using an architect's scale, use a scale that is one-half of the one indicated on the drawing.

1. If the Security Office was drawn at a scale of $1/8" = 1'$, but was measured using a $1/4" = 1'$ scale, how will the measured area of the room compare to the actual measurements of the room?

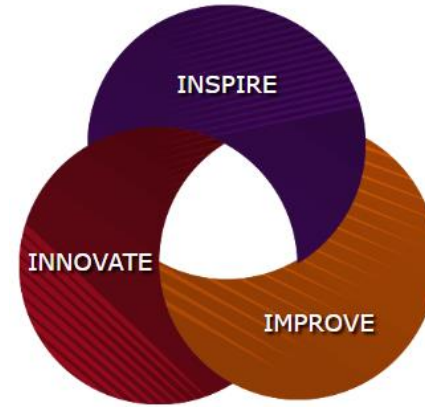
Refer to Print-26 in the Large Prints supplement to answer the following question.
Note: The large prints are created at 50% of their original size. When extracting information from the print using an architect's scale, use a scale that is one-half of the one indicated on the drawing.

2. The water lines in the garage ceiling are to be wrapped with heat trace to prevent freezing. If it will take 20" of heat trace to wrap each foot of pipe in the garage, how many feet of heat trace will be required to wrap the lines?

Large Prints



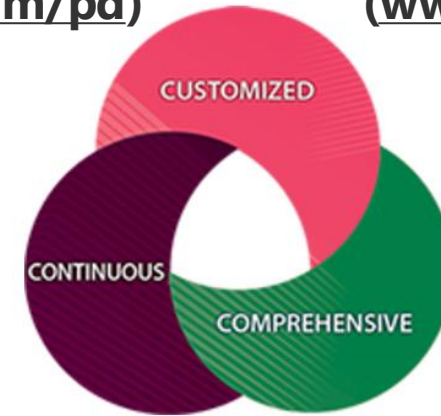
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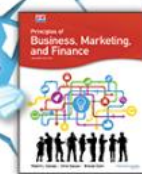
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Snap, Clap, Pop: Construction

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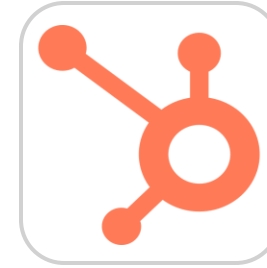


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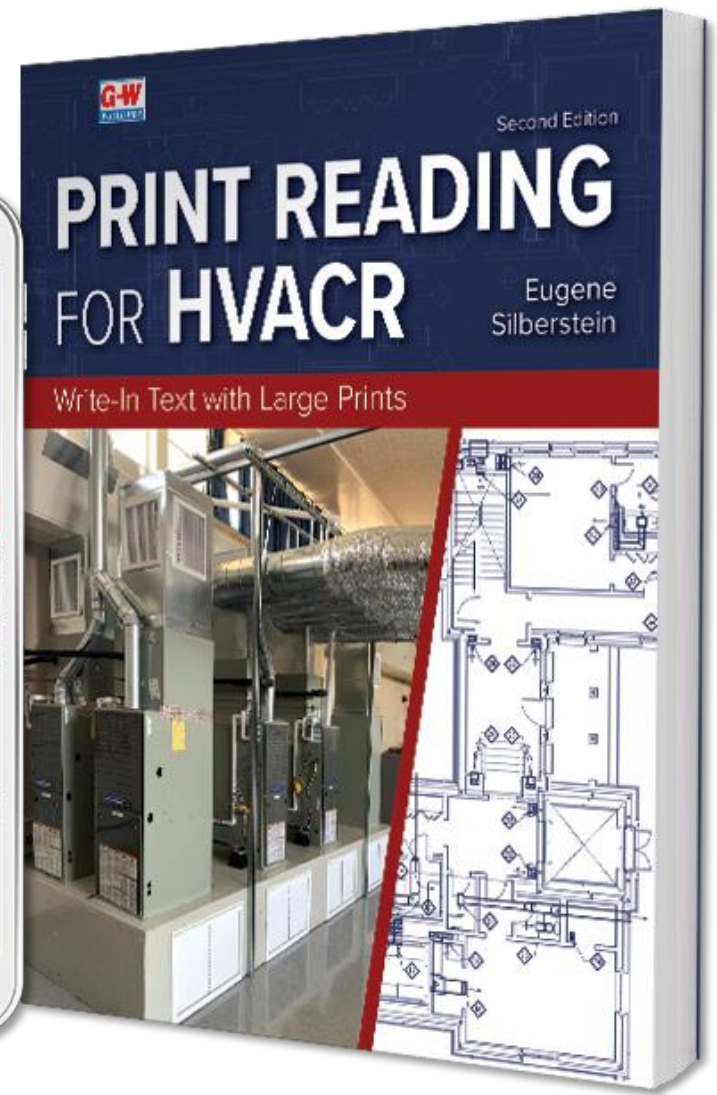
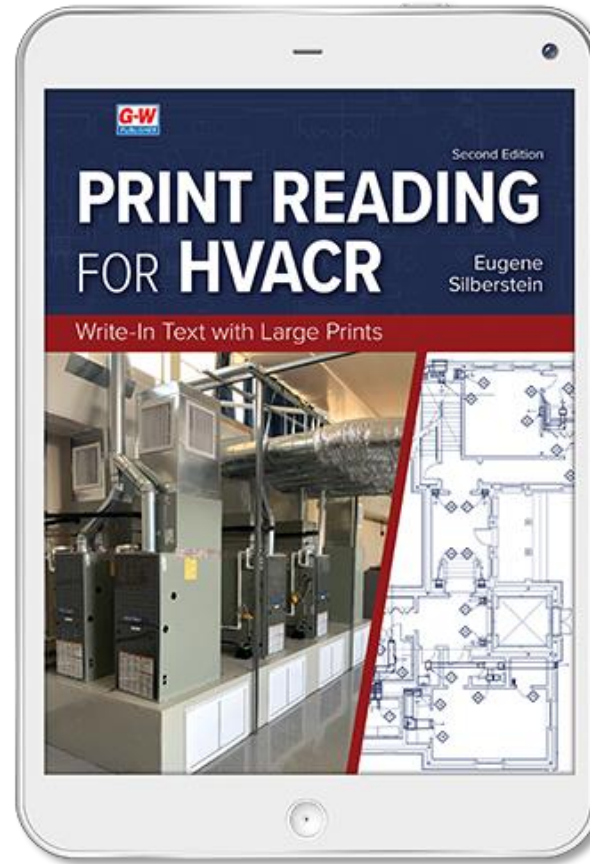


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