Module 02401-14 introduces trainees to concepts and practices that are essential for competitive, successful plumbing businesses. The module also covers basic business accounting and project estimating, as well as techniques for cost control and task organization.

### Objectives

#### Learning Objective 1

1. Identify cost control measures.
   a. Interpret a balance sheet and a profit and loss statement.
   b. Interpret how cost control measures affect the profit and loss statement.
   c. Interpret how on-the-job task organization affects profit and loss.

#### Learning Objective 2

2. Identify the information required to prepare a material takeoff.
   a. Identify the information required for insurance and liability.
   b. Identify the information required for the estimating process.
   c. Identify the information required for updates and revisions.

### Performance Tasks

#### Performance Task 1

(Learning Objective 2)

- Prepare a material takeoff as part of an estimate.

### Teaching Time: 15 hours

(Six 2.5-hour Classroom sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

### Prerequisites

*Core Curriculum, Plumbing Level One, Plumbing Level Two, and Plumbing Level Three*

### Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from [www.nccerirc.com](http://www.nccerirc.com). The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
**Safety Considerations**

Safety is paramount in the plumbing trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

---

**Classroom Equipment and Materials**

- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- *Plumbing Level Four PowerPoint®* Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing business applications related to plumbing (optional)
- TV/DVD player

**Equipment and Materials for Laboratories and Performance Testing**

- Assortment of tools, equipment, cell phones, and other devices
- Blank copies of the following forms:
  - Balance sheets
  - Change orders (optional)
  - Daily work reports
  - Purchase orders
  - Takeoff worksheets
- Completed copies of change orders
- Copies of moderately difficult plumbing drawings
- Copies of simple plumbing drawing
- Project schedule
- Sample insurance policy for a construction project
- Sample organizational chart

---

**Additional Resources and References**

This module presents thorough resources for task training. The following resource material is suggested for further study:


There are a number of online resources available for trainees who would like more information on business principles for plumbers. A search for additional information may be assigned as homework to interested trainees.
Session Outline for Module 02401-14

Business Principles for Plumbers

The lesson plan for this module is divided into six 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

Session One
Session One introduces the balance sheet and profit and loss (P & L) statement.
1. Show Session One PowerPoint® presentation slides.
2. Discuss how balance sheets are used by a plumbing company.
3. Discuss how profit and loss statements are used by a plumbing company.

Sessions Two and Three
Sessions Two and Three introduce the impact of cost control on the P & L statement.
1. Show Sessions Two and Three PowerPoint® presentation slides.
2. Discuss how cost control measures such as ordering of materials, material storage, and proper use of tools and equipment impact the P & L statement.
3. Discuss the use of purchase orders and invoices for ordering materials.
4. Discuss how cost control measures such as use of a company vehicle, change orders, and preplanning impact the P & L statement.
5. Discuss the use of change orders on a project.
6. Discuss how schedules are used to control costs.

Session Four and Five
Sessions Four and Five introduce the preparation of a material takeoff.
1. Show Sessions Four and Five PowerPoint® presentation slides.
2. Introduce trainees to the use of material takeoffs used in plumbing.
3. Provide an overview of the estimating process.
4. Demonstrate the proper method for performing a material takeoff.

Session Six
Session Six is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Five.) Answer any questions that trainees may have.
1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
## Materials Checklist for Module 02401-14, Business Principles for Plumbers

<table>
<thead>
<tr>
<th>Personal protective equipment:</th>
<th>Blank copies of balance sheets</th>
<th>Completed copies of change orders</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Blank copies of change orders (optional)</td>
<td>Copies of simple plumbing drawings</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Blank copies of daily work reports</td>
<td>Copies of moderately difficult plumbing drawings</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Blank copies of purchase orders</td>
<td>Sample insurance policy for a construction project</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Blank copies of takeoff worksheets</td>
<td>Sample organizational chart</td>
</tr>
<tr>
<td><strong>Plumbing Level Four</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PowerPoint® Presentation</strong></td>
<td>Assortment of tools, equipment, cell phones, and other devices</td>
<td>Project schedule</td>
</tr>
<tr>
<td><strong>Slides</strong></td>
<td></td>
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<tr>
<td>TV/DVD player</td>
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<tr>
<td>Computer</td>
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<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td></td>
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</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing business applications related to plumbing (optional)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
**Module 2- (46101-11) teaches the skills needed to become an effective crew leader. It will help a crew leader who wants to become more effective, as well as a crew member who aspires to become a crew leader. The module covers basic leadership skills, safety, and project control.**

<table>
<thead>
<tr>
<th><strong>Objectives</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Section One</strong></td>
<td></td>
</tr>
<tr>
<td>1. Describe the opportunities in the construction and power industries.</td>
<td></td>
</tr>
<tr>
<td>2. Describe how workers’ values change over time.</td>
<td></td>
</tr>
<tr>
<td>3. Explain the importance of training and safety for the leaders in the construction and power industries.</td>
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<tr>
<td>4. Describe how new technologies are beneficial to the construction and power industries.</td>
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<tr>
<td>5. Identify the gender and minority issues associated with a changing workforce.</td>
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<tr>
<td>6. Describe what employers can do to prevent workplace discrimination.</td>
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<tr>
<td>7. Differentiate between formal and informal organizations.</td>
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<tr>
<td>8. Describe the difference between authority, responsibility, and accountability.</td>
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<tr>
<td>9. Explain the purpose of job descriptions and what they should include.</td>
<td></td>
</tr>
<tr>
<td>10. Distinguish between company policies and procedures.</td>
<td></td>
</tr>
<tr>
<td><strong>Section Two</strong></td>
<td></td>
</tr>
<tr>
<td>1. Describe the role of a crew leader.</td>
<td></td>
</tr>
<tr>
<td>2. List the characteristics of effective leaders.</td>
<td></td>
</tr>
<tr>
<td>3. Be able to discuss the importance of ethics in a supervisor’s role.</td>
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<tr>
<td>4. Identify the three styles of leadership.</td>
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<tr>
<td>5. Describe the forms of communication.</td>
<td></td>
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<tr>
<td>6. Describe the four parts of verbal communication.</td>
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<tr>
<td>7. Describe the importance of active listening.</td>
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<tr>
<td>8. Explain how to overcome the barriers to communication.</td>
<td></td>
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<tr>
<td>9. List ways that leaders can motivate their employees.</td>
<td></td>
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<tr>
<td>10. Explain the importance of delegating and implementing policies and procedures.</td>
<td></td>
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<tr>
<td>11. Distinguish between problem solving and decision making.</td>
<td></td>
</tr>
<tr>
<td><strong>Section Three</strong></td>
<td></td>
</tr>
<tr>
<td>1. Explain the importance of safety.</td>
<td></td>
</tr>
<tr>
<td>2. Give examples of direct and indirect costs of workplace accidents.</td>
<td></td>
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<tr>
<td>3. Identify safety hazards of the construction industry.</td>
<td></td>
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<tr>
<td>4. Explain the purpose of OSHA.</td>
<td></td>
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<tr>
<td>5. Discuss OSHA inspection procedures.</td>
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<tr>
<td>6. Identify the key points of a safety program.</td>
<td></td>
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<tr>
<td>7. List steps to train employees on how to perform new tasks safely.</td>
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<tr>
<td>8. Identify a crew leader’s safety responsibilities.</td>
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<tr>
<td>9. Explain the importance of having employees trained in first aid and cardiopulmonary resuscitation (CPR).</td>
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<tr>
<td>10. Describe the indications of substance abuse.</td>
<td></td>
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<tr>
<td>11. List the essential parts of an accident investigation.</td>
<td></td>
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<tr>
<td>12. Describe ways to maintain employee interest in safety. Distinguish between company policies and procedures.</td>
<td></td>
</tr>
<tr>
<td><strong>Section Four</strong></td>
<td></td>
</tr>
<tr>
<td>1. Describe the three phases of a construction project.</td>
<td></td>
</tr>
<tr>
<td>2. Define the three types of project delivery systems.</td>
<td></td>
</tr>
<tr>
<td>3. Define planning and describe what it involves.</td>
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<tr>
<td>4. Explain why it is important to plan.</td>
<td></td>
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<tr>
<td>5. Describe the two major stages of planning.</td>
<td></td>
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<tr>
<td>6. Explain the importance of documenting job site work.</td>
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<tr>
<td>7. Describe the estimating process.</td>
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<tr>
<td>8. Explain how schedules are developed and used.</td>
<td></td>
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<tr>
<td>9. Identify the two most common schedules.</td>
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<tr>
<td>10. Explain how the critical path method (CPM) of scheduling is used.</td>
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<tr>
<td>11. Describe the different costs associated with building a job.</td>
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<tr>
<td>12. Explain the crew leader’s role in controlling costs.</td>
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<tr>
<td>13. Illustrate how to control the main resources of a job: materials, tools, equipment, and labor.</td>
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<tr>
<td>14. Explain the differences between production and productivity and the importance of each.</td>
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</tbody>
</table>

**Performance Tasks**

**Performance Task 1 (Section Four)**
- Develop and present a look-ahead schedule.

**Performance Task 2 (Section Four)**
- Develop an estimate for a given work activity.
Teaching Time: 20 hours
(Eight 2.5-Hour Classroom Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites
The prerequisites for this module are dependent upon the structure of the specific craft training program in which trainees are specifically enrolled.

Before You Begin
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the written examinations and performance profile sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70% or above for the written examination; performance testing is graded pass or fail.

Safety Considerations
This module should be conducted in a classroom or conference room environment. Therefore, no special safety precautions are required.

Classroom Equipment and Materials

<table>
<thead>
<tr>
<th>Whiteboard/chalkboard</th>
<th>Internet access during class (optional)</th>
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</thead>
<tbody>
<tr>
<td>Markers/chalk</td>
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<td>Pencils and paper</td>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
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<td><em>Plumbing Level Four</em></td>
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<td>LCD projector and screen</td>
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<td>Computer</td>
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</tbody>
</table>
Additional Resources
This module presents thorough resources for task training. The following resources are suggested for further study.

  National Institute of Occupational Safety and Health (NIOSH), www.cdc.gov/niosh.

NCCER Publications:
  Your Role in the Green Environment
  Sustainable Construction Supervisor
  Occupational Safety and Health Administration (OSHA), www.osha.gov.

There are a number of online resources, including video, available for trainees who would like more information on crew leadership. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are also encouraged to locate additional audiovisual aids available on the internet, make personal videos, and take photos related to the relevant trade and add them to the PowerPoint® presentations throughout the program.
Session Outline for 46101-11

FUNDAMENTALS OF CREW LEADERSHIP

The Lesson Plan for this module is divided into eight 2.5-hour sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.

**SESSION ONE**

Session One introduces the trainees to the basic elements of leadership. It covers an overview of industry and the need for a trained workforce; gender and cultural issues; and the structure and dynamics of business organizations.

1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to get trainees engaged and give them an idea of what they will learn in this module.
3. Describe how to understand and motivate crew members.
4. Discuss the importance of gender and cultural issues in the workplace.
5. Describe the various types of organizational structures found in businesses.
6. Discuss the relationships of authority, responsibility, and accountability.

**SESSION TWO**

Session Two covers leadership skills. It focuses on the role of the crew leader and the transition from crew member. It discusses the characteristics of good leaders, leadership styles, and ethics. Key elements of this session are effective communication; motivating others; team building; delegating; and problem solving. A number of exercises will allow the trainees to test their leadership skills.

1. Show the Session Two PowerPoint® presentation.
2. Describe the qualities of an effective leader.
3. Discuss methods of communication and the importance of listening.
4. Describe how to motivate others.
5. Discuss the elements of team building and delegating.
6. Describe how to deal with problems on the job.
7. Discuss how to resolve special problems that often confront a crew leader.

**SESSION THREE**

Session Three focuses on safety. It presents the role of the crew leader in maintaining crew safety. Trainees will learn the relationship between safety and cost and will learn to view safety from a leadership perspective. Included in this lesson are discussions of company and crew leader responsibility for safety and accident investigation, as well as methods of promoting safety among the workforce.

1. Show the Session Three PowerPoint® presentation.
2. Describe how safety issues can directly and indirectly affect a company’s cost of doing business.
3. Discuss OSHA inspections and penalties for safety violations.
4. Describe how an employer safety program is structured and the role of the crew leader in the program.
5. Explain how a crew leader is involved in day-to-day safety issues such as conducting safety training sessions and assisting in accident investigations.
6. Describe how crew leaders can promote safe work practices within their crews.
Session Outline for 46101-11

FUNDAMENTALS OF CREW LEADERSHIP

SESSION FOUR

Session Four introduces the subject of project control. It deals with the fundamentals, including project phases, project scheduling, cost estimating, and planning. It introduces the trainee to the contractual aspects of a project and the steps in completing a project, from its initial concept through the final delivery. Trainees will learn how to estimate labor and materials.

1. Show the Session Four PowerPoint® presentation.
2. Describe the different types of contracts and the three phases of a project.
3. Explain how to estimate the manpower and materials required for a project.
4. Discuss the function of planning and the planning process.
5. Describe how to plan the various resources such as manpower, tools, equipment and materials required for a project.

SESSION FIVE

Session Five continues to focus on project control. It introduces trainees to various types of schedules and how they are used. Included in this session are discussions of project control methods related to cost and the crew leader’s role in controlling project cost. Also covered in this session are methods used in controlling labor, material, tools, and equipment on the job site.

1. Show the Session Five PowerPoint® presentation.
2. Discuss the different project scheduling methods.
3. Explain how to prepare project schedules.
4. Describe the tools and methods used to control project cost.
5. Describe the tools and methods used to control resources during a job.
6. Explain the difference between production and productivity and explain why these concepts are an important part of project planning and control.

SESSIONS SIX AND SEVEN

Sessions Six and Seven are laboratory sessions in which the trainees will practice the development of a project schedule and a cost estimate.

1. Note that there is no PowerPoint® presentation associated with this session.
2. Using an instructor-prepared scenario appropriate for the trade, trainees complete the tasks associated with Performance Tasks 1 and 2.

SESSION EIGHT

Session Eight is a review and testing session.

1. Review any material that has not been fully presented and answer any questions that the trainees may have.
2. Have the trainees complete the written examination. Any outstanding performance testing must be completed during this session as well.
3. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
<table>
<thead>
<tr>
<th>Equipment and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
</tr>
<tr>
<td>[None]</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
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<td>Markers/chalk</td>
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<tr>
<td>Pencils and paper</td>
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<td><strong>Plumbing Level Four</strong></td>
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<td><strong>PowerPoint® Presentation</strong></td>
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<tr>
<td>Internet access during class (optional)</td>
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<tr>
<td>A drawing marked to show as-built changes.</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Module 02403-14 builds on trainees’ previous experience with pumps, storage tanks, controls, and pipes and fittings by teaching them to assemble these components into systems that boost water pressure and provide hot water.

### Objectives

#### Learning Objective 1
1. Describe the characteristics of a water pressure booster system and identify its components.
   a. Describe the types of water pressure booster systems.
   b. Describe the components of water pressure booster systems.
   c. Describe the design of water pressure booster systems.
   d. Describe how to install and maintain water pressure booster systems.

#### Learning Objective 2
2. Describe the characteristics of a recirculation system and identify its components.
   a. Describe the types of recirculation systems.
   b. Describe the components of recirculation systems.
   c. Describe how to install and maintain recirculation systems.

### Performance Tasks

#### Performance Task 1
**Performance Task 1**
*(Learning Objective 1)*
- Install the basic components of a water pressure booster system.

#### Performance Task 2
**Performance Task 2**
*(Learning Objective 2)*
- Install the basic components of a recirculation system.

### Teaching Time: 12.5 hours
*(Five 2.5-hour Classroom sessions)*

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

### Prerequisites

*Core Curriculum, Plumbing Level One, Plumbing Level Two, and Plumbing Level Three*

### Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from [www.nccerirc.com](http://www.nccerirc.com). The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
### Safety Considerations

This module requires that trainees safely install and maintain water pressure booster systems and recirculation systems. Safety is paramount in the plumbing trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

### Classroom Equipment and Materials

- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- *Plumbing Level Four* PowerPoint® Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing water pressure booster systems and recirculation systems (optional)
- TV/DVD player

### Equipment and Materials for Laboratories and Performance Testing

- Personal protective equipment
  - Gloves
  - Hard hat
  - Lockout/tagout equipment
  - Safety glasses
  - Safety shoes
- Aquastat
- Assortment of pipe materials including:
  - Acrylonitrile butadiene styrene (ABS), Polybutylene (PB), Cross-linked polyethylene (PEX), Polyvinyl chloride (PVC), and Chlorinated polyvinyl chloride (CPVC) plastic
  - Asbestos-cement
  - Brass
  - Gray and ductile iron
  - Copper
  - Steel
- Blank copy of Table 2
- Centrifugal water booster pump
- Check valves
- Copper tubing cutter
- Design data for a typical water pressure booster system
- Disassembled pump or pump cut-away
- Expansion pipe
- Expansion tank
- Flux
- Hacksaw
- Ladder
- Level
- Local building code
- Manufacturer product information for recirculation system components
- Measuring tape
- Pipe wrenches (assorted sizes)
- Pliers
- Plumbing drawings for a commercial building with a water pressure booster system (optional)
- Reamer
- Screwdrivers
- Set of box-end wrenches
- Set of socket wrenches
- Small water storage tank
- Solder
- Soldering kit
- Temperature and flow sensors
- Tempering mixing valve
- Vibration isolators
- Water hammer arrester

### Additional Resources and References

This module presents thorough resources for task training. The following resource material is suggested for further study:


There are a number of online resources available for trainees who would like more information on water pressure booster and recirculation systems. A search for additional information may be assigned as homework to interested trainees.
Session Outline for Module 02403-14

WATER PRESSURE BOOSTER AND RECIRCULATION SYSTEMS

The lesson plan for this module is divided into five 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSIONS ONE AND TWO**

Sessions One and Two introduce the types of water pressure booster systems, system components and design, and the installation of water pressure booster systems.

1. Show Sessions One and Two PowerPoint® presentation slides.
2. Identify and discuss the types of water pressure booster systems.
3. Differentiate between elevated-tank and hydropneumatic tank systems.
4. Identify and discuss the components of a water pressure booster system.
5. Discuss items that should be considered when designing water pressure booster systems.
6. Discuss the proper installation and maintenance of water pressure booster systems.

**SESSIONS THREE AND FOUR**

Sessions Three and Four introduce recirculation systems and components and the installation of recirculation systems.

1. Show Sessions Three and Four PowerPoint® presentation slides.
2. Identify and discuss the types of recirculation systems.
3. Identify and discuss the components of recirculation systems.
4. Discuss how to install a recirculation system.
5. Discuss how to maintain a recirculation system.

**SESSION FIVE**

Session Five is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Four.) Answer any questions that trainees may have.

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
### Materials Checklist for Module 02403-14, Water Pressure Booster and Recirculation Systems

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Aquastat</th>
<th>Local building code</th>
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</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gloves</td>
<td>Blank copy of Table 2</td>
<td>Manufacturer product information for recirculation system components</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Centrifugal water booster pump</td>
<td>Measuring tape</td>
</tr>
<tr>
<td>Lockout/tagout equipment</td>
<td>Check valves</td>
<td>Pipe wrenches (assorted sizes)</td>
</tr>
<tr>
<td>Safety glasses</td>
<td>Copper tubing cutter</td>
<td></td>
</tr>
<tr>
<td>Safety shoes</td>
<td>Design data for a typical water pressure booster system</td>
<td>Plumbing drawings for a commercial building with a water pressure booster system (optional)</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Disassembled pump or pump cut-away</td>
<td>Reamer</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Expansion pipe</td>
<td>Screwdrivers</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Expansion tank</td>
<td>Set of box-end wrenches</td>
</tr>
<tr>
<td><strong>Plumbing Level Four PowerPoint® Presentation Slides</strong></td>
<td>Flux</td>
<td>Set of socket wrenches</td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Hacksaw</td>
<td>Small water storage tank</td>
</tr>
<tr>
<td>Computer</td>
<td>Ladder</td>
<td>Solder</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td>Level</td>
<td>Soldering kit</td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing water pressure booster systems and recirculation systems (optional)</td>
<td>Assortment of pipe materials including: Acrylonitrile butadiene styrene (ABS), Polybutylene (PB), Cross-linked polyethylene (PEX), Polyvinyl chloride (PVC), and Chlorinated polyvinyl chloride (CPVC) plastic, Asbestos-cement, Brass, Gray and ductile iron, Copper, Steel</td>
<td>Temperature and flow sensors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tempering mixing valve</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vibration isolators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water hammer arrester</td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Lesson Plans for 02404-14

INDIRECT AND SPECIAL WASTE

Module 02404-14 describes the code requirements and installation procedures for systems that protect against contamination from indirect and special wastes.

Objectives

Learning Objective 1
1. Identify indirect waste systems.
   a. Identify the installation requirements for indirect waste piping.

Learning Objective 2
2. Identify special waste systems.
   a. Identify the various types of special waste.
   b. Explain how to install interceptors.

Performance Tasks

Performance Task 1
(Learning Objective 1)
- Install an indirect waste system.

Performance Task 2
(Learning Objective 2)
- Size and install an interceptor using information provided by the instructor.

Teaching Time: 17.5 hours
(Seven 2.5-hour classroom sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites
Core Curriculum, Plumbing Level One, Plumbing Level Two, and Plumbing Level Three

Before You Begin
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
**Safety Considerations**
This module requires that trainees work with indirect and special wastes, which may include waste products from health care facilities. Trainees may be exposed to interceptors that contain corrosive, flammable, or hazardous substances. In addition, confined-space training may be required for some installations. Safety is paramount in the plumbing trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

**Classroom Equipment and Materials**
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- *Plumbing Level Four*
- PowerPoint® Presentation Slides
- Computer
- Copies of the Module
- Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing types of indirect or special waste systems (*optional*)
- TV/DVD player

**Equipment and Materials for Laboratories and Performance Testing**
- Personal protective equipment:
  - Gloves
  - Hard hat
  - Safety glasses
  - Safety shoes
  - Tinted safety glasses
- 1/2” and 3/4” copper tube
- Automatic trap primer
- Copper tubing cutter
- Copy of ANSI Standard 112.14, *Grease Interceptors*
- Cut-away or cut-away diagram of an interceptor
- Draw-off hose
- Flux
- Ladder
- Local plumbing code
- Pipe wrenches (assorted sizes)
- Plumbing drawings (*optional*)
- Plumbing drawings for commercial building with a mechanical grease interceptor
- Plumbing drawings for a commercial building with a water pressure booster system (*optional*)
- Reamer
- Samples of receptors
- Screwdrivers
- Sediment interceptor
- Set of box-end wrenches
- Set of socket wrenches
- Small grease interceptor
- Solder
- Soldering kit

**Additional Resources and References**
This module presents thorough resources for task training. The following resource material is suggested for further study:


There are a number of online resources available for trainees who would like more information on indirect and special waste systems. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into seven 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSIONS ONE THROUGH THREE**

Sessions One thru Three introduce indirect waste systems and clear-water wastes.

1. Show Sessions One through Three PowerPoint® presentation slides.
2. Discuss the sources of indirect wastes.
3. Review local code requirements for air gaps.
4. Discuss how indirect waste systems are used in food preparation, handling, and storage areas, and demonstrate the proper procedure for installing an indirect waste system in such areas.
5. Discuss and demonstrate the proper procedure for installing an indirect waste system in a health care facility.
6. Discuss types of clear-water wastes.

**SESSIONS FOUR THROUGH SIX**

Sessions Four through Six introduce special waste systems, oil and sediment interceptors, and catch basins.

1. Show Sessions Four through Six PowerPoint® presentation slides.
2. Identify types of special wastes.
3. Discuss and demonstrate the proper procedure for installing grease interceptors.
4. Discuss applications for oil interceptors and sediment interceptors.
5. Discuss the use of catch basins.
6. Discuss and demonstrate the proper installation of interceptors.

**SESSION SEVEN**

Session Seven is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Six.) Answer any questions that trainees may have.

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
# Materials Checklist for Module 02404-14, Indirect and Special Waste

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
<td>$\frac{1}{2}''$ and $\frac{3}{4}''$ copper tube</td>
</tr>
<tr>
<td>Gloves</td>
<td>Automatic trap primer</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Copper tubing cutter</td>
</tr>
<tr>
<td>Safety glasses</td>
<td>Cut-away or cut-away diagram of an interceptor</td>
</tr>
<tr>
<td>Safety shoes</td>
<td>Samples of receptors</td>
</tr>
<tr>
<td>Tinted safety glasses</td>
<td>Draw-off hose</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Flux</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Ladder</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Local plumbing code</td>
</tr>
<tr>
<td><strong>Plumbing Level Four PowerPoint® Presentation Slides</strong></td>
<td>Pipe wrenches (assorted sizes)</td>
</tr>
<tr>
<td>DVD player</td>
<td>Plumbing drawings (optional)</td>
</tr>
<tr>
<td>Computer</td>
<td>Plumbing drawings for commercial building with a mechanical grease interceptor</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td>Plumbing drawings for a commercial building with a water pressure booster system (optional)</td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing types of indirect or special waste systems (optional)</td>
<td></td>
</tr>
<tr>
<td>TV/DVD player</td>
<td></td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Objectives

Learning Objective 1

1. Describe the principles of hydronic and solar heating systems.
   a. Describe water heaters, boilers, and collectors.
   b. Describe hot water circulation.
   c. Describe radiators and radiant loops.

Learning Objective 2

2. Describe the basic types of hydronic and solar heating systems and their components.
   a. Describe the basic types of hydronic systems.
   b. Describe the basic types of solar heating systems.

Learning Objective 3

3. Describe the procedures for roughing-in, installing, and testing hydronic and solar heating system piping.
   a. Describe how to rough-in the piping.
   b. Describe how to install boilers and heating units.
   c. Describe how to install controls.
   d. Describe how to test and balance the system.
   e. Describe corrosion prevention techniques.

Performance Tasks

Performance Task 1 (Learning Objective 3)

• Lay out a hydronic or solar heating system.

Teaching Time: 17.5 hours
(Seven 2.5-hour Classroom sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites

Core Curriculum, Plumbing Level One, Plumbing Level Two, and Plumbing Level Three

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
**Safety Considerations**
This module requires that trainees work around extremely hot water and corrosive materials. Safety is paramount in the plumbing trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

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**Classroom Equipment and Materials**
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- PowerPoint® Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing hydronic and solar heating systems (optional)
- TV/DVD player

**Equipment and Materials for Laboratories and Performance Testing**
- Personal protective equipment:
  - Gloves
  - Hard hat
  - Safety glasses
  - Safety shoes
- Assortment of pipe materials including:
  - Acrylonitrile butadiene styrene (ABS), polybutylene (PB), cross-linked polyethylene (PEX), polyvinyl chloride (PVC), and chlorinated polyvinyl chloride (CPVC) plastic
  - Asbestos-cement
  - Brass
  - Gray and ductile iron
  - Copper
  - Steel
- Baseboard radiator
- Boiler or heating unit
- Check valves
- Controls and valves used in hydronic systems
- Copper tubing cutter
- Expansion tank
- Flux
- Hacksaw
- Installation manual for hydronic or solar heating system
- Ladder
- Level
- Local plumbing code
- Measuring tape
- Pipe wrenches (assorted sizes)
- Pliers
- Pressure gauge
- Pressure-reducing valves
- Reamer
- Samples of diverter tees
- Screwdrivers
- Set of box-end wrenches
- Set of socket wrenches
- Solder
- Soldering kit
- Zone control valves

**Additional Resources and References**
This module presents thorough resources for task training. The following resource material is suggested for further study:


There are a number of online resources available for trainees who would like more information on hydronic and solar heating systems. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into seven 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSIONS ONE THROUGH THREE**

Sessions One through Three introduce hydronic and solar heating systems.

1. Show Sessions One through Three PowerPoint® presentation slides.
2. Describe water heaters, boilers, and collectors.
3. Describe the basic types of hydronic systems.
4. Describe the basic types of solar heating systems.

**SESSIONS FOUR THROUGH SIX**

Sessions Four through Six introduce laying out, roughing-in, installing, and testing hydronic and solar heating systems.

1. Show Sessions Four through Six PowerPoint® presentation slides.
2. Describe how to lay out and rough-in the piping.
3. Describe how to install boilers, heating units, and controls.
4. Describe how to test and balance the system.
5. Describe corrosion prevention techniques.

**SESSION SEVEN**

Session Seven is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Six.) Answer any questions that trainees may have.

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
# Materials Checklist for Module 02405-14, Hydronic and Solar Heating Systems

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
</tr>
<tr>
<td>Baseboard radiator</td>
</tr>
<tr>
<td>Measuring tape</td>
</tr>
<tr>
<td>Glove</td>
</tr>
<tr>
<td>Boiler or heating unit</td>
</tr>
<tr>
<td>Pipe wrenches (assorted sizes)</td>
</tr>
<tr>
<td>Hard hat</td>
</tr>
<tr>
<td>Check valves</td>
</tr>
<tr>
<td>Pliers</td>
</tr>
<tr>
<td>Safety glasses</td>
</tr>
<tr>
<td>Controls and valves used in hydronic systems</td>
</tr>
<tr>
<td>Pressure gauge</td>
</tr>
<tr>
<td>Safety shoes</td>
</tr>
<tr>
<td>Copper tubing cutter</td>
</tr>
<tr>
<td>Pressure-reducing valves</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
</tr>
<tr>
<td>Expansion tank</td>
</tr>
<tr>
<td>Reamer</td>
</tr>
<tr>
<td>Markers/chalk</td>
</tr>
<tr>
<td>Flux</td>
</tr>
<tr>
<td>Samples of diverter tees</td>
</tr>
<tr>
<td>Pencils and paper</td>
</tr>
<tr>
<td>Hacksaw</td>
</tr>
<tr>
<td>Screwdrivers</td>
</tr>
<tr>
<td><strong>Plumbing Level Four PowerPoint® Presentation Slides</strong></td>
</tr>
<tr>
<td>Installation manual for hydronic or solar heating system</td>
</tr>
<tr>
<td>Set of box-end wrenches</td>
</tr>
<tr>
<td>TV/DVD player</td>
</tr>
<tr>
<td>Ladder</td>
</tr>
<tr>
<td>Set of socket wrenches</td>
</tr>
<tr>
<td>Computer</td>
</tr>
<tr>
<td>Level</td>
</tr>
<tr>
<td>Solder</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
</tr>
<tr>
<td>Local plumbing code</td>
</tr>
<tr>
<td>Soldering kit</td>
</tr>
<tr>
<td><strong>Vendor-supplied videos/DVDs showing hydronic and solar heating systems (optional)</strong></td>
</tr>
<tr>
<td>Assortment of pipe materials including:</td>
</tr>
<tr>
<td>Acrylonitrile butadiene styrene (ABS), polybutylene (PB), cross-linked polyethylene (PEX), polyvinyl chloride (PVC), and chlorinated polyvinyl chloride (CPVC) plastic</td>
</tr>
<tr>
<td>Asbestos-cement</td>
</tr>
<tr>
<td>Brass</td>
</tr>
<tr>
<td>Gray and ductile iron</td>
</tr>
<tr>
<td>Copper</td>
</tr>
<tr>
<td>Steel</td>
</tr>
<tr>
<td>Zone control valves</td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Lesson Plans for 02406-14

CODES

Module 02406-14 discusses the different codes used by plumbers across the country and explains how those codes are written, adopted, modified, and implemented.

### Objectives

**Learning Objective 1**
1. Describe the model and local plumbing codes and their purposes.
   a. Describe the ICC model plumbing code.
   b. Describe the IAPMO model plumbing code.

**Learning Objective 2**
2. Explain how plumbing codes are developed and revised.
   a. Explain model code standards.
   b. Explain how model codes are revised and adopted.
   c. Explain typical code changes.

### Performance Task

**Performance Task 1**

(Learning Objective 1)

- Use the local applicable plumbing code to find and cite references for the questions in Appendix A.

---

Teaching Time: 12.5 hours

(Five 2.5-hour Classroom sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

**Prerequisites**

Core Curriculum, Plumbing Level One, Plumbing Level Two, and Plumbing Level Three

**Before You Begin**

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
Additional Resources and References

This module presents thorough resources for task training. The following resource material is suggested for further study:


There are a number of online resources available for trainees who would like more information on plumbing codes. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into five 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSIONS ONE AND TWO**

Sessions One and Two introduce model plumbing codes, particularly the *International Plumbing Code®* (IPC).

1. Show Sessions One and Two PowerPoint® presentation slides.
2. Discuss the purpose of model plumbing codes.
3. Discuss the *International Plumbing Code®* and explore its contents.
4. Discuss and demonstrate how to easily locate information in the IPC.

**SESSIONS THREE AND FOUR**

Sessions Three and Four introduce the IAPMO model plumbing code and plumbing code development and revision.

1. Show Sessions Three and Four PowerPoint® presentation slides.
2. Discuss the organization of the *Uniform Plumbing Code®*.
3. Discuss and demonstrate how to easily locate information in the UPC.
4. Discuss the code development and revision process.
5. Discuss the use of public comment forms to submit comments to the ICC or IAPMO for consideration.

**SESSION FIVE**

Session Five is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Four.) Answer any questions that trainees may have.

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
<table>
<thead>
<tr>
<th>Personal protective equipment:</th>
<th>Blank copies of the IAPMO public comment form</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Blank copies of the ICC public comment form</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td><em>International Plumbing Code</em>®</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Local plumbing code</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td><em>Uniform Plumbing Code</em>®</td>
</tr>
<tr>
<td><em>Plumbing Level Four</em></td>
<td></td>
</tr>
<tr>
<td><em>PowerPoint® Presentation</em></td>
<td></td>
</tr>
<tr>
<td><em>Slides</em></td>
<td></td>
</tr>
<tr>
<td>TV/DVD player</td>
<td></td>
</tr>
<tr>
<td>Computer</td>
<td></td>
</tr>
<tr>
<td>Copies of the Module</td>
<td></td>
</tr>
<tr>
<td><em>Examination and Performance</em></td>
<td></td>
</tr>
<tr>
<td><em>Profile Sheets</em></td>
<td></td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs</td>
<td></td>
</tr>
<tr>
<td>showing the use of plumbing</td>
<td></td>
</tr>
<tr>
<td>codes <em>(optional)</em></td>
<td></td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Module 02408-14 describes the operation of pumps and well components. In addition, the module reviews the qualities of good wells and how to assemble and disassemble pumps and components.

**Objectives**

**Learning Objective 1**
1. Explain how to drill wells.
   a. Explain how to locate wells.
   b. Explain how to size wells.
   c. Explain how to construct wells.
   d. Explain how to clean wells.

**Learning Objective 2**
2. Explain the operation of various types of pumps and pump components.
   a. Explain the operation of a shallow-well jet pump.
   b. Explain the operation of a deep-well jet pump.
   c. Explain the operation of a submersible pump.

**Learning Objective 3**
3. Explain how to select and install water supply and storage components.
   a. Explain how to select and install water supply lines.
   b. Explain how to select and install water storage tanks.

**Performance Tasks**

**Performance Task 1**
(Learning Objective 3)
• Assemble and disassemble given components of private water supply well systems.

**Teaching Time: 10 hours**
(Four 2.5-hour Classroom sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

**Prerequisites**
Core Curriculum, Plumbing Level One, Plumbing Level Two, and Plumbing Level Three.

**Before You Begin**
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
Safety Considerations
This module requires that trainees work with electric well pumps. Safety is paramount in the plumbing trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

Classroom Equipment and Materials
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- Plumbing Level Four PowerPoint® Presentation Slides
- Computer
- Copies of the Module
- Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing private well systems and well system components (optional)
- TV/DVD player

Equipment and Materials for Laboratories and Performance Testing
- Personal protective equipment:
  - Gloves
  - Hard hat
  - Safety glasses
  - Safety shoes
  - Assorted tools to install water supply lines, pressure tanks, and well/pump controls
  - Deep-well jet pump
  - International Plumbing Code® Level
  - Local plumbing code
  - Measuring tape
  - Pressure tank
  - Sample drilling logs
  - Screwdrivers
  - Set of box-end wrenches
  - Shallow-well jet pump
  - Submersible pump
  - Table 1 of Trainee Guide (optional)
  - Uniform Plumbing Code® Water supply pipe and fittings
  - Water test kit (optional)
  - Well/pump controls

Additional Resources and References
This module presents thorough resources for task training. The following resource material is suggested for further study:


There are a number of online resources available for trainees who would like more information on private well systems. A search for additional information may be assigned as homework to interested trainees.
Session Outline for 02408-14

PRIVATE WATER SUPPLY WELL SYSTEMS

The lesson plan for this module is divided into four 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSION ONE**

Session One introduces drilling wells.
1. Show Session One PowerPoint® presentation slides.
2. Review the hydrologic cycle.
3. Discuss the types of wells.
4. Identify three types of pumps and explain the operation of each pump.
5. Discuss and demonstrate the installation of well pumps.

**SESSIONS TWO AND THREE**

Sessions Two and Three introduce water supply lines and water storage tanks for well systems.
1. Show Sessions Two and Three PowerPoint® presentation slides.
2. Identify the types of materials used for water supply lines.
3. Discuss and demonstrate the installation of water supply lines.
4. Discuss the operation of water storage tanks.
5. Demonstrate the installation of a pressure tank and controls for a well system.

**SESSION FOUR**

Session Four is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Three.) Answer any questions that trainees may have.
1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
# Materials Checklist for Module 02408-14, Private Water Supply Well Systems

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Assorted tools to install water supply lines, pressure tanks, and well/pump controls</th>
<th>Pliers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves</td>
<td>Deep-well jet pump</td>
<td>Pressure tank</td>
</tr>
<tr>
<td>Hard hat</td>
<td><em>International Plumbing Code®</em></td>
<td>Sample drilling logs</td>
</tr>
<tr>
<td>Safety glasses</td>
<td>Level</td>
<td>Screwdrivers</td>
</tr>
<tr>
<td>Safety shoes</td>
<td>Local plumbing code</td>
<td>Set of box-end wrenches</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Measuring tape</td>
<td>Set of socket wrenches</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Photograph of a deep-well jet pump cut-away <em>(optional)</em></td>
<td>Shallow-well jet pump</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Photograph of a shallow-well jet pump cut-away <em>(optional)</em></td>
<td>Submersible pump</td>
</tr>
<tr>
<td><em>Plumbing Level Four PowerPoint® Presentation Slides</em></td>
<td>Photograph of a submersible pump cut-away <em>(optional)</em></td>
<td><em>Table 1 of Trainee Guide (optional)</em></td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Pipe wrenches (assorted sizes)</td>
<td><em>Uniform Plumbing Code®</em></td>
</tr>
<tr>
<td>Computer</td>
<td>Well/pump controls</td>
<td>Water supply pipe and fittings</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td></td>
<td>Water test kit <em>(optional)</em></td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing private well systems and well system components <em>(optional)</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Module 02409-14 describes the types of private waste disposal systems, discusses the maintenance and installation of these systems, and explains how to determine the local code requirements for these systems. In addition, the module covers percolation tests and sewage system planning and layout.

Objectives

Learning Objective 1
1. Describe the types of private waste disposal systems.
   a. Describe soil absorption systems.
   b. Describe organic systems.
   c. Describe closed systems.

Learning Objective 2
2. Explain how to locate and size private waste disposal systems.
   a. Explain how to locate and size septic tanks.
   b. Explain how to locate and size leach fields.

Learning Objective 3
3. Explain how to install private waste disposal systems.
   a. Explain how to install septic tanks.
   b. Explain how to install leach-field distribution piping.

Learning Objective 4
4. Explain how to clean and service private waste disposal systems.

Performance Tasks
This is a knowledge-based module; there are no performance tasks.

Teaching Time: 10 hours
(Four 2.5-hour Classroom sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites
Core Curriculum, Plumbing Level One, Plumbing Level Two, and Plumbing Level Three

Before You Begin
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
**Safety Considerations**

This module requires that trainees work with septic systems, which may contain hazardous gases and bacteria. Safety is paramount in the plumbing trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

**Classroom Equipment and Materials**
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- *Plumbing Level Four* PowerPoint® Presentation Slides
- Computer
- Copies of the Module
- Examination
- Vendor-supplied videos/DVDs showing private waste disposal systems (optional)
- TV/DVD player

**Equipment and Materials for Laboratories and Performance Testing**
- Personal protective equipment:
  - Gloves
  - Hard hat
  - Safety glasses
  - Safety shoes
- Calculator
- Distribution box
- Gravel
- *International Private Sewage Disposal Code® Level*
- Local plumbing code
- Perforated and nonperforated distribution piping
- Pipe fittings
- Pipe wrenches (assorted sizes)
- Results of percolation test
- Sand
- Septic tank
- Shovel
- Tape measure
- Water hose

**Additional Resources and References**

This module presents thorough resources for task training. The following resource material is suggested for further study:


There are a number of online resources available for trainees who would like more information on private waste disposal systems. A search for additional information may be assigned as homework to interested trainees.
Session Outline for 02409-14
PRIVATE WASTE DISPOSAL SYSTEMS

The lesson plan for this module is divided into four 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSION ONE**

Session One introduces types of private waste disposal systems.
1. Show Session One PowerPoint® presentation slides.
2. Identify the three types of private waste disposal systems and differentiate between each.
3. Identify the components of private waste disposal systems and explain the purpose of each.

**SESSION TWO**

Session Two introduces locating and sizing private waste disposal systems.
1. Show Session Two PowerPoint® presentation slides.
2. Discuss the process and need for properly locating a private waste disposal system on a piece of property.
3. Demonstrate how a percolation test is conducted.
4. Explain the proper procedure for sizing a septic tank and leach field.

**SESSION THREE**

Session Three introduces installing and servicing private waste disposal systems.
1. Show Session Three PowerPoint® presentation slides.
2. Review the guidelines for properly locating a septic tank.
3. Discuss the purpose of a leach field and identify the local code requirements.
4. Demonstrate the proper procedure for installing and cleaning a septic system.

**SESSION FOUR**

Session Four is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Three.) Answer any questions that trainees may have.
1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
## Materials Checklist for Module 02409-14, Private Waste Disposal Systems

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
<td><strong>Calculator</strong></td>
</tr>
<tr>
<td>Gloves</td>
<td>Distribution box</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Gravel</td>
</tr>
<tr>
<td>Safety glasses</td>
<td>Level</td>
</tr>
<tr>
<td>Safety shoes</td>
<td>Local plumbing code</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Pipe fittings</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Sand</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td></td>
</tr>
<tr>
<td><em>Plumbing Level Four PowerPoint® Presentation Slides</em></td>
<td></td>
</tr>
<tr>
<td>Computer</td>
<td></td>
</tr>
<tr>
<td>Copies of the Module Examination</td>
<td></td>
</tr>
<tr>
<td>Vendor-supplied videos/ DVDs showing private waste disposal systems (optional)</td>
<td></td>
</tr>
<tr>
<td>TV/DVD player</td>
<td></td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Module 02410-14 introduces trainees to plumbing systems in swimming pools, hot tubs, and spas.

Objectives

Learning Objective 1
1. Explain how to size and install swimming pool systems and components.
   a. Explain how to size a swimming pool.
   b. Explain how to install water supply and recirculation systems.
   c. Explain how to install gutters and drains.
   d. Explain how to maintain water quality.

Learning Objective 2
2. Identify hot tub and spa systems and their components.
   a. Identify hot tub and spa components.
   b. Explain how to install hot tubs and spas.

Performance Tasks

Performance Task 1
(Learning Objective 1)
Calculate the volume of a pool.

Performance Task 2
(Learning Objective 2)
Identify the components of piping for a spa.

Teaching Time: 7.5 hours
(Three 2.5-hour Classroom sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites
Core Curriculum, Plumbing Level One, Plumbing Level Two, and Plumbing Level Three

Before You Begin
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from www.nccerinc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
**Safety Considerations**

This module requires that trainees work with in and around water and electrical components. Safety is paramount in the plumbing trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

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**Classroom Equipment and Materials**

- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- *Plumbing Level Four* PowerPoint® Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing installation and maintenance of swimming pools and hot tubs (*optional*)
- TV/DVD player

**Equipment and Materials for Laboratories and Performance Testing**

- Air blower
- Calculator
- Drain
- Filter
- Heater
- Hot tub and spa manufacturers’ catalogs
- Hot tub and spa manufacturers’ installation guide
- Hydrojet
- *International Swimming Pool and Spa Code™*
- Local plumbing code
- Pool manufacturer literature (*optional*)
- Pump
- Samples of sidewall drains
- Samples of skimmers
- Samples of vacuum fittings
- Samples of water supply fittings

---

**Additional Resources and References**

This module presents thorough resources for task training. The following resource material is suggested for further study:


There are a number of online resources available for trainees who would like more information on swimming pools and hot tubs. A search for additional information may be assigned as homework to interested trainees.
### Session Outline for 02410-14

**Swimming Pools and Hot Tubs**

The lesson plan for this module is divided into three 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

<table>
<thead>
<tr>
<th>Session One</th>
<th>Session Two</th>
<th>Session Three</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session One introduces swimming pool systems and components.</td>
<td>Session Two introduces hot tub and spa systems and components.</td>
<td>Session Three is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Two.) Answer any questions that trainees may have.</td>
</tr>
<tr>
<td>1. Show Session One PowerPoint® presentation slides.</td>
<td>1. Show Session Two PowerPoint® presentation slides.</td>
<td>1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.</td>
</tr>
<tr>
<td>2. Explain how to calculate the capacity, turnover rate, and bathing load of a pool.</td>
<td>2. Differentiate between hot tubs and spas.</td>
<td>2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.</td>
</tr>
<tr>
<td>3. Identify the components of a swimming pool.</td>
<td>3. Identify the components of hot tubs and spas.</td>
<td></td>
</tr>
<tr>
<td>4. Explain the importance of maintaining water quality and balancing acidity and alkalinity levels.</td>
<td>4. Discuss the procedures for installing hot tubs and spas.</td>
<td></td>
</tr>
<tr>
<td>Equipment and Materials</td>
<td>Materials Needed</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Personal protective equipment:</strong></td>
<td>Air blower</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>Samples of sidewall drains</td>
<td></td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Calculator</td>
<td></td>
</tr>
<tr>
<td>Drain</td>
<td>Samples of skimmers</td>
<td></td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Filter</td>
<td></td>
</tr>
<tr>
<td>Hydrojet</td>
<td>Pump</td>
<td></td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Heater</td>
<td></td>
</tr>
<tr>
<td><strong>Plumbing Level Four PowerPoint Presentation</strong></td>
<td>Hot tub and spa manufacturers’ installation</td>
<td></td>
</tr>
<tr>
<td>Slides</td>
<td>guide</td>
<td></td>
</tr>
<tr>
<td><strong>Computer</strong></td>
<td>Local plumbing code</td>
<td></td>
</tr>
<tr>
<td><strong>International Swimming Pool and Spa Code™</strong></td>
<td>Pool manufacturer literature (optional)</td>
<td></td>
</tr>
<tr>
<td><strong>Copies of the Module Examination and Performance Profile Sheets</strong></td>
<td>Hot tub and spa manufacturers’ catalogs</td>
<td></td>
</tr>
<tr>
<td><strong>Vendor-supplied videos/DVDs showing installation and maintenance of swimming pools and hot tubs (optional)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TV/DVD player</strong></td>
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</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Module 02411-14 describes the location and layout of plumbing systems for mobile home and travel trailer parks. The module reviews how to design and lay out a system, how to connect water and sewer lines to a mobile home, and how to estimate materials for the park.

**Objectives**

**Learning Objective 1**
1. Describe water supply and DWV systems for mobile home parks.
   a. Describe water supply systems for mobile home parks.
   b. Describe DWV systems for mobile home parks.

**Learning Objective 2**
2. Describe water supply and DWV systems for travel trailer parks.
   a. Describe water supply systems for travel trailer parks.
   b. Describe DWV systems for travel trailer parks.

**Performance Tasks**

**Performance Task 1**

(Learning Objective 1)
- Size the water supply and DWV systems for a mobile home park using information provided by your instructor.

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**Teaching Time: 7.5 hours**

(Three 2.5-hour Classroom sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

**Prerequisites**

Core Curriculum, Plumbing Level One, Plumbing Level Two, and Plumbing Level Three

**Before You Begin**

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
**Safety Considerations**

Safety is paramount in the plumbing trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

---

### Classroom Equipment and Materials
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- *Plumbing Level Four PowerPoint® Presentation Slides*
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing plumbing systems for mobile homes and travel trailers *(optional)*
- TV/DVD player

### Equipment and Materials for Laboratories and Performance Testing
- Calculator
- Local plumbing code
- Plot plan for mobile home park
- Plumbing drawings for mobile home park
- Plumbing drawings for travel trailer park
- Recreational vehicle

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### Additional Resources and References

This module presents thorough resources for task training. The following resource material is suggested for further study:


There are a number of online resources available for trainees who would like more information on plumbing for mobile homes and travel trailers. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into three 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

### Session One

Session One introduces water supply and DWV systems for mobile home parks.

1. Show Session One PowerPoint® presentation slides.
2. Explain the process for developing a plumbing plan for a mobile home park.
3. Discuss and demonstrate the proper method for sizing the water supply and DWV systems for a mobile home park.

### Session Two

Session Two introduces water supply and DWV piping for travel trailer parks.

1. Show Session Two PowerPoint® presentation slides.
2. Discuss local plumbing code requirements for travel trailer parks.
3. Discuss the types of pipe and fittings commonly used in travel trailers.
4. Discuss the types of connections required at travel trailer parks.

### Session Three

Session Three is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Two.) Answer any questions that trainees may have.

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
# Materials Checklist for Module 02411-14, Plumbing for Mobile Homes and Travel Trailer Parks

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong> Calculator</td>
</tr>
<tr>
<td>None Local plumbing code</td>
</tr>
<tr>
<td>Whiteboard/chalkboard Plot plan for mobile home park</td>
</tr>
<tr>
<td>Markers/chalk Recreational vehicle</td>
</tr>
<tr>
<td>Pencils and paper Plumbing drawings for travel trailer park</td>
</tr>
<tr>
<td><em>Plumbing Level Four</em> Plumbing drawings for mobile home park</td>
</tr>
<tr>
<td><em>PowerPoint® Presentation Slides</em></td>
</tr>
<tr>
<td>DVD player</td>
</tr>
<tr>
<td>Computer</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing plumbing systems for mobile homes and travel trailers (optional)</td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Module 02412-14 provides an introduction to the various types of medical gas and vacuum systems used in health care facilities today. The module covers the system requirements and professional qualifications required by code, describes common types of medical gas and vacuum systems, and introduces trainees to the safety requirements that must be observed when installing, testing, and servicing these systems.

Objectives

Learning Objective 1
   a. Explain NFPA 99 building system categories.
   b. Explain ASSE/IAPMO/ANSI Series 6000 professional qualifications.

Learning Objective 2
2. Describe the various medical gas and vacuum systems.
   a. Identify medical gas and vacuum systems.
   b. Identify control panels and alarm systems.
   c. Identify zone valves and station outlets/inlets.

Learning Objective 3
3. Identify the safety issues related to medical gas and vacuum system installation.
   a. Identify personal protective equipment.
   b. Identify fire extinguishers and establish a fire watch.
   c. Explain shutdown and hot-work permits.
   d. Recognize life safety for the end user.

Learning Objective 4
4. Identify the materials and tools for medical gas and vacuum systems and their storage and handling requirements.
   a. Explain how materials and tools are stored and used.
   b. Identify labels and lettering used on medical gas and vacuum systems.

Learning Objective 5
5. Identify the equipment required for brazing copper tube with and without purging.
   a. Explain how to braze a joint with a purge.
   b. Explain how to braze a joint without a purge.

Learning Objective 6
6. Describe the process for testing and verifying a medical gas and vacuum system.
   a. Explain how to conduct installation tests.
   b. Explain how to conduct system verification tests.

Performance Tasks

Performance Task 1 (Learning Objective 5)
• Braze copper tube with purging.

Performance Task 2 (Learning Objective 5)
• Braze copper tube without purging.

Teaching Time: 15 hours
(Six 2.5-hour classroom sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites
Core Curriculum, Plumbing Level One, Plumbing Level Two, and Plumbing Level Three

Before You Begin
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
**Safety Considerations**

This module requires that trainees braze copper tube. Safety is paramount in the plumbing trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

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**Equipment and Materials for Laboratories and Performance Testing**

Personal protective equipment:
- Gloves
- Hard hat
- Safety glasses
- Safety shoes

Abrasive pads

Adapters for fitting pressure gauges on each type of station outlet and inlet

Ammonia-free leak detectant

ASSE/IAPMO/ANSI Series 6000, *Professional Qualifications Standard for Medical Gas Systems Personnel*

Blank copies of hot-work permits

Blank copies of shutdown permits

Brazing filler metal

Brazing torch kit

Clean white cloth

Copper tubing

Deburring tool

Flowmeter

Flux

Gas outlets for testing

Gauges for supply and outlet pressures

Hacksaw

Labels for piping, valves, station outlets and inlets, and alarm panels

Leak detection solution

Lint-free white cloth wipes

Local plumbing code

Medical gas system

Midget cutter


NFPA 99, *Health Care Facilities Code* (optional)

Nitrogen purge alarm

Oil-free, dry nitrogen

Outlet pressure regulators

Oxygen analyzer

Pipe caps/plugs

Plumbing plan for a medical gas installation

Plumbing plan for health care facility

Pressure gauge

Pressure regulator

Pump

Purge regulator

Rubber gloves

Samples of medical gas system outlets

Samples of vacuum system inlets

Socket-type fittings

Soft, wet cloth

Supply valve open/close switches

Test gauges

Tubing cutter

Ultrasonic leak detector

*United States Pharmacopeia*

Vacuum system
Additional Resources and References

This module presents thorough resources for task training. The following resource material is suggested for further study:


There are a number of online resources available for trainees who would like more information on medical gas and vacuum systems. A search for additional information may be assigned as homework to interested trainees.
Session Outline for 02412-14

INTRODUCTION TO MEDICAL GAS AND VACUUM SYSTEMS

The lesson plan for this module is divided into six 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSION ONE**

Session One introduces building system requirements and professional qualifications.

1. Show Session One PowerPoint® presentation slides.
2. Discuss the four categories of medical gas and vacuum systems.
3. Discuss the professional qualifications for each of the specialties identified in ASSE/IAPMO/ANSI Series 6000, Professional Qualifications Standard for Medical Gas Systems Personnel.

**SESSION TWO**

Session Two introduces types of medical gas systems.

1. Show Session Two PowerPoint® presentation slides.
2. Discuss how various gases for medical gas systems are stored and distributed to outlets.
3. Discuss the use of vacuum systems in health care facilities.
4. Discuss the purpose of control panels and alarm systems on medical gas and vacuum systems.
5. Discuss the types of alarms used on medical gas and vacuum systems.

**SESSION THREE**

Session Three introduces materials, tools, storage, handling, and installation safety.

1. Show Session Three PowerPoint® presentation slides.
2. Discuss installation safety and its importance when installing medical gas and vacuum systems.
3. Discuss the use of shutdown and hot-work permits when installing medical gas and vacuum systems.
4. Discuss and demonstrate the use of installation tools and materials.

**SESSION FOUR**

Session Four introduces brazing and line purging.

1. Show Session Four PowerPoint® presentation slides.
2. Discuss and demonstrate the procedure for brazing medical gas or vacuum system piping with a nitrogen purge.
3. Discuss and demonstrate the procedure for brazing medical gas or vacuum system piping without a purge.

**SESSION FIVE**

Session Five introduces testing and verifying medical gas systems.

1. Show Session Five PowerPoint® presentation slides.
2. Identify and discuss installation tests for medical gas and vacuum systems.
3. Identify and discuss verification tests for medical gas and vacuum systems.

**SESSION SIX**

Session Six is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Five.) Answer any questions that trainees may have.

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
## Equipment and Materials

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Abrasive pads</th>
<th>Brazing filler metal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal protective equipment:</td>
<td>Ammonia-free leak detector</td>
<td>Brazing torch kit</td>
</tr>
<tr>
<td>Gloves</td>
<td>Clean white cloth</td>
<td>Copper tubing</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Deburring tool</td>
<td>Flowmeter</td>
</tr>
<tr>
<td>Safety glasses</td>
<td>Flux</td>
<td>Gas outlets for testing</td>
</tr>
<tr>
<td>Safety shoes</td>
<td>Hacksaw</td>
<td>Leak detection solution</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Lint-free white cloth wipes</td>
<td>Local plumbing code</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Medical gas system</td>
<td>Midget cutter</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Adapters for fitting pressure gauges on each type of station outlet and inlet</td>
<td>Labels for piping, valves, station outlets and inlets, and alarm panels</td>
</tr>
<tr>
<td>Plumbing Level Four PowerPoint® Presentation Slides</td>
<td>Blank copies of shutdown permits</td>
<td>Blank copies of hot-work permits</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td>ASSE/IAPMO/ANSI Series 6000, <em>Professional Qualifications Standard for Medical Gas Systems Personnel</em></td>
<td>Supply valve open/close switches</td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing medical gas and vacuum systems (optional)</td>
<td>Nitrogen purge alarm</td>
<td>Oil-free, dry nitrogen</td>
</tr>
<tr>
<td>DVD player</td>
<td>Outlet pressure regulators</td>
<td>Oxygen analyzer</td>
</tr>
<tr>
<td></td>
<td>Pipe caps/plugs</td>
<td>Pressure gauge</td>
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<tr>
<td></td>
<td>Pressure regulator</td>
<td>Purge regulator</td>
</tr>
<tr>
<td></td>
<td>Rubber gloves</td>
<td>Test gauges</td>
</tr>
<tr>
<td></td>
<td>Socket-type fittings</td>
<td>Soft, wet cloth</td>
</tr>
<tr>
<td></td>
<td>Tubing cutter</td>
<td>Ultrasonic leak detector</td>
</tr>
<tr>
<td></td>
<td>United States Pharmacopeia</td>
<td>Vacuum system</td>
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<td></td>
<td>Gauges for supply and outlet pressures</td>
<td>Plumbing plan for a medical gas installation</td>
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<td>Plumbing plan for health care facility</td>
<td>Samples of medical gas system outlets</td>
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<tr>
<td></td>
<td>Samples of vacuum system inlets</td>
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</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.