Acknowledgments

The components of this instructional framework were developed by the following curriculum development panelists:

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Course Description

Suggested Grade Level: 11 or 12
Prerequisites: 8551

Students practice mathematics skills related to the plumbing profession. They read, interpret, and create drawings of piping systems. Students learn to safely assemble, install, and repair pipes, fittings, and fixtures of heating, water, and drainage systems, according to specification and plumbing codes.

As noted in Superintendent's Memo #058-17 (2-28-2017), this Career and Technical Education (CTE) course must maintain a maximum pupil-to-teacher ratio of 20 students to one teacher, due to safety regulations. The 2016-2018 biennial budget waiver of the teacher-to-pupil ratio staffing requirement does not apply.
## Task Essentials Table

- Tasks/competencies designated by plus icons (+) in the left-hand column(s) are essential.
- Tasks/competencies designated by empty-circle icons (○) are optional.
- Tasks/competencies designated by minus icons (−) are omitted.
- Tasks marked with an asterisk (*) are sensitive.

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<thead>
<tr>
<th>Task Number</th>
<th>8552</th>
<th>Tasks/Competencies</th>
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<td><strong>Applying Basic Construction Safety Standards (Core Safety)</strong></td>
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<tr>
<td>39</td>
<td>+</td>
<td>Comply with federal, state, and local safety legal requirements.</td>
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<td>40</td>
<td>+</td>
<td>Identify PPE (personal protective equipment) requirements.</td>
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<td>Maintain a safe working environment.</td>
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<td>42</td>
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<td>Explain safe working practices around electrical hazards.</td>
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<td>Identify emergency first-aid procedures.</td>
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<td>Identify the types of fires and the methods used to extinguish them.</td>
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<td>45</td>
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<td>Inspect course-specific hand and power tools to visually identify defects.</td>
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<td>46</td>
<td>+</td>
<td>Demonstrate lifting and carrying techniques.</td>
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<tr>
<td>47</td>
<td>+</td>
<td>Demonstrate safe laddering techniques.</td>
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<tr>
<td>48</td>
<td>○</td>
<td>Demonstrate safe scaffolding techniques.</td>
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<td>Report personal injuries and environmental and equipment safety violations to the appropriate authority.</td>
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<td>Pass a safety exam for lab/site safety and the use of tools and equipment specific to the construction industry.</td>
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<td>+</td>
<td>Calculate the area of a room and the volume of a tank.</td>
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<td>Calculate the slope of a pipe.</td>
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<td><strong>Reading Drawings for the Plumbing Profession</strong></td>
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<td>Develop fitting/material lists based on drawings.</td>
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<td>Lay out plumbing systems and fixture rough-ins.</td>
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<td>Complete a material takeoff for drain, waste, and vent (DWV) and water supply systems.</td>
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<td><strong>Performing Pipe Cutting and Joining</strong></td>
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<tr>
<td>56</td>
<td>+</td>
<td>Join copper pipe (tubing) to fittings using the flare method.</td>
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<tr>
<td>57</td>
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<td>Join dissimilar materials.</td>
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<tr>
<td><strong>Supporting and Hanging Pipe</strong></td>
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<tr>
<td>58</td>
<td>+</td>
<td>Identify types of anchors and straps.</td>
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<tr>
<td>59</td>
<td>+</td>
<td>Install backing and ledger supports for various plumbing fixtures.</td>
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<td>60</td>
<td>+</td>
<td>Describe the installation of pipe sleeves through a concrete or masonry wall.</td>
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<tr>
<td>61</td>
<td>+</td>
<td>Identify common types of fire-stopping materials and assemblies.</td>
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<tr>
<td><strong>Installing Waste and Soil Pipes</strong></td>
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<tr>
<td>62</td>
<td>+</td>
<td>Construct a no-hub cast-iron pipe assembly.</td>
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<tr>
<td>63</td>
<td>+</td>
<td>Rough-in a DWV assembly of PVC/ABS, for the following: water closet, lavatory, bathtub, shower, kitchen or bar sink, washing machine, indirect waste.</td>
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<tr>
<td>64</td>
<td>+</td>
<td>Calculate and set waste and soil pipes to level and gradient.</td>
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<td>65</td>
<td>+</td>
<td>Install a water closet flange.</td>
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<td>66</td>
<td>○</td>
<td>Describe the use of a backwater valve.</td>
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<tr>
<td>67</td>
<td>+</td>
<td>Demonstrate the boring and notching of structural members of the building.</td>
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<td>Test a drainage system by performing a standing water test.</td>
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<td>Install various types of bathtubs, shower stalls, and shower pans.</td>
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<td><strong>Roughing-in Water Distribution Components</strong></td>
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<td>Rough-in a water distribution system of hard-drawn copper, CPVC (chlorinated polyvinyl chloride), and PEX (cross-linked polyethylene) for the following fixtures: washing machine, lavatory, kitchen sink, tank-type water closet, bathtub and/or shower, ice maker, hose bib.</td>
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<td>Identify procedures and materials for installing a building's water service.</td>
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<td>Identify types of main shutoff valves.</td>
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<td>Install a main shutoff valve.</td>
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<td>74</td>
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<td>Perform an air- or water-pressure test.</td>
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<td>Insulate water lines.</td>
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<td>Identify the need for backflow prevention devices.</td>
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<td>Install nail guards for the protection of piping.</td>
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<tr>
<td><strong>Installing Fixtures and Trim</strong></td>
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<td>Install lavatory (wall hung and cabinet installation).</td>
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<td>Install tank-type water closet.</td>
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<td>Install a kitchen sink.</td>
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<td>Install a garbage disposal.</td>
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<td>Install a dishwasher.</td>
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<td>Install a gas water heater.</td>
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<td>Install an electric water heater.</td>
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<td>Trim a tub and shower valve.</td>
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<td>Install various fixture shutoff valves.</td>
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<td>Connect icemaker lines.</td>
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<td>Install kitchen sink continuous waste.</td>
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<td>Describe the installation and operation of a tankless water heater.</td>
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<td><strong>Exploring Basic Electricity Concepts Related to Plumbing</strong></td>
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<td>Identify how voltage, current, resistance, and power are related.</td>
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<td>Describe the use of an electricity testing meter.</td>
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<td>Identify the purpose and operation of the various electrical components used in plumbing equipment.</td>
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<td><strong>Servicing and Repairing Plumbing and Fixtures</strong></td>
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<td>93</td>
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<td>Replace and adjust the water closet fill valve.</td>
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<td>Troubleshoot a flushometer.</td>
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<td>Repair or replace a twohandled faucet, both compression and washerless types.</td>
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<td>Repair or replace various single-lever faucets.</td>
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<td>97</td>
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<td>Repair or replace a tub diverter.</td>
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<td>98</td>
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<td>Troubleshoot a gas or electric water heater.</td>
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<td><strong>Installing Natural Gas Piping Systems</strong></td>
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<td>99</td>
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<td>Identify the local gas code for installation requirements.</td>
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<td>Identify the different types of natural gas distribution materials.</td>
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<td>Describe testing and purging procedures.</td>
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<td>102</td>
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<td>Describe the installation of a gas appliance.</td>
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</table>

Legend: ✦Essential ☓Non-essential ☨Omitted
Curriculum Framework

Applying Basic Construction Safety Standards (Core Safety)

Task Number 39

Comply with federal, state, and local safety legal requirements.

Definition

Compliance should include

- understanding the roles of the Occupational Safety and Health Administration (OSHA), Virginia Occupational Safety and Health (VOSH), and the Environmental Protection Agency (EPA)
- identifying the OSHA Hazard Communication Standard (HazCom)
- interpreting the information included on safety data sheets (SDS)
- describing the responsibilities of employers and employees under HazCom.

Process/Skill Questions

- Where should hazardous materials be stored?
- What information can be found on an SDS?

NCCER Core Curriculum: Introductory Craft Skills, 2015

00101-15 Basic Safety
Module One (00101-15) explains the importance of safety in the construction and industrial crafts. Trainees will learn how to identify and follow safe work practices and procedures and how to properly inspect and use safety equipment. Trainees will be able to describe the safety practices associated with elevated work; energy release; and various hazards encountered on job sites. NOTE: The successful completion of this module will award a Construction Site Safety Orientation credential.

NCCER Plumbing Standards

Level 1, Module 02102-12: Plumbing Safety
This module reviews the common causes of plumbing-related accidents and injuries. Trainees will learn how to identify hazardous situations and unsafe conditions as well as how to handle and respond to these situations and conditions.
Task Number 40

Identify PPE (personal protective equipment) requirements.

Definition

Identification could include procedures for inspecting, wearing, and removing

- eye protection
- respirator
- hard hat
- gloves
- safety harness
- hearing protection
- safety shoes.

Identification should also include explaining when particular PPE is required.

Process/Skill Questions

- What are some dangerous effects of sun exposure, and how can these risks be mitigated?
- Why is wearing jewelry prohibited while in the lab or on the job site?

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Task Number 41

Maintain a safe working environment.

Definition
Maintaining safety should be an ongoing process and should result in identifying potential hazards on a job site or in the lab, such as unstable or improperly erected scaffolding, electrical hazards, job-site debris, improperly stored materials, and air quality hazards. When present, hazards must be remedied by appropriate measures, in compliance with school and instructor guidelines.

Process/Skill Questions

- What are examples of job-site hazards?
- Why is it important to use good housekeeping standards on a job site?
- Why is it important to store materials and tools in their proper places?

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Task Number 42

Explain safe working practices around electrical hazards.

Definition

Explanation should include

- identifying equipment used to test electrical circuits
- describing safe working conditions (e.g., grounding, using ground-fault circuit interrupters [GFCIs] and cords)
- demonstrating safe work habits

according to industry standards and instructor's guidelines.

Process/Skill Questions

- What is the definition of proximity work?
- What are safe working clearances according to the National Electrical Code (NEC) code?
- What are considered safe working conditions and safe work habits?
What is the unseen hazard with electrical work?
What are some common electrical workplace issues?

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NCCER Plumbing Standards

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Task Number 43

Identify emergency first-aid procedures.

Definition
Identification should include standard first-aid procedures and school policies regarding incidents involving

- bodily fluids
- electrical injuries
- eye injuries
- falls
- burns.

Process/Skill Questions

- What are the steps that should be followed after an accident?
- Why is knowing cardiopulmonary resuscitation (CPR) an important skill in the construction trades?
- Why is it important to be certified to administer first aid?
- What are the different degrees of electrical burns?

NCCER Core Curriculum: Introductory Craft Skills, 2015

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Task Number 44

Identify the types of fires and the methods used to extinguish them.

Definition

Identification should include classifications of fires (e.g., Classes A, B, C, and D), causes and prevention of fires, types of extinguishers, and, when possible, the demonstrated use of a fire extinguisher, in accordance with government regulations and instructor guidelines.

Process/Skill Questions

- Why do fires have different classifications, and what are they?
- What is the fire triangle and the fire tetrahedron?
- What are the three things necessary to start a fire?
- Why is it important to know the classification of fire when trying to extinguish it?
- Why should extinguishers be inspected, and how often should they be inspected?
- What are the classifications of extinguishers?

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Task Number 45

Inspect course-specific hand and power tools to visually identify defects.

Definition

Inspection of tools should include

- identifying the components of the machinery (e.g., guards, blades, moving parts, start/stop switches)
- identifying standard safety procedures (i.e., shop practices and manufacturer recommendations)
- observing a demonstration of the safe operation and use of each piece of machinery in the lab
- identifying tool defects.
Process/Skill Questions

- What are some of the basic power tools used in construction?
- What are the proper actions to take before using a circular saw?
- Why should a power tool always be grounded?

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NCCER Plumbing Standards

Level 1, Module 02102-12: Plumbing Safety
This module reviews the common causes of plumbing-related accidents and injuries. Trainees will learn how to identify hazardous situations and unsafe conditions as well as how to handle and respond to these situations and conditions.

Task Number 46

Demonstrate lifting and carrying techniques.

Definition

Demonstration involves lifting and carrying materials and equipment based on the principles of

- lifting with the legs
- keeping the back straight
- holding the load close to the body
- getting help, if necessary.

Process/Skill Questions

- What are common injuries associated with improper lifting techniques?
- What can one do to prevent injury?
- How does positioning affect technique?

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Task Number 47

Demonstrate safe laddering techniques.

Definition

Demonstration should include using appropriate conduct and safety procedures while

- using aluminum ladders (e.g., three-point contact)
- carrying ladders (e.g., two people at all times)
- erecting and setting ladders (e.g., use the 4:1 rule)
- identifying types of ladders and the components and safety features of each (e.g., wall or straight, extension, roof, stepladder, attic, special-purpose, solid-beam, aluminum, wood/aluminum truss ladder, fiberglass).

Process/Skill Questions

- Why are ladders rated for certain weights?
- Why is the apex (highest point) of a stepladder not considered a step?
- What other methods are used to adjust ladders?

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NCCER Plumbing Standards

Level 1, Module 02102-12: Plumbing Safety

This module reviews the common causes of plumbing-related accidents and injuries. Trainees will learn how to identify hazardous situations and unsafe conditions as well as how to handle and respond to these situations and conditions.

Task Number 48

Demonstrate safe scaffolding techniques.

Definition
Demonstration should include inspecting settings, duty ratings, and safety tags.

**Process/Skill Questions**

- How can one determine the safe weight limit of any particular scaffolding?
- When is scaffolding preferred or required?

**NCCER Core Curriculum: Introductory Craft Skills, 2015**

**00101-15 Basic Safety**

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**Task Number 49**

**Report personal injuries and environmental and equipment safety violations to the appropriate authority.**

**Definition**

Report should include

- providing a verbal or written statement
- identifying the violation
- documenting the date when the incident or behavior was observed
- following the protocol for submitting the report to the instructor, the supervisor, or the local OSHA inspectors.

**Process/Skill Questions**

- What ethical considerations might be involved when reporting coworkers?
- Why is it important to follow reporting procedures?
- What is liability?

**NCCER Core Curriculum: Introductory Craft Skills, 2015**

**00101-15 Basic Safety**

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Task Number 50

Pass a safety exam for lab/site safety and the use of tools and equipment specific to the construction industry.

Definition

Assessment must measure participation in safety training programs, including attending safety meetings and periodically demonstrating knowledge and skills gained from program topics (e.g., interpretation of SDS).

Process/Skill Questions

- How often should one participate in safety training programs? Why?
- Why are retraining programs relevant to a company's insurance policy?
- What is workers' compensation?

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Applying Basic Mathematics to the Plumbing Profession

Task Number 51

Calculate the area of a room and the volume of a tank.

Definition

Calculations must be accurate to within +/- 5 percent.

Process/Skill Questions

- When might a plumber need to calculate the areas of rooms or volumes of tanks?
- What unit of measurement is used to indicate the volume of a tank?
- What is the formula for finding the volume of a tank?
• Why would a plumber need to know the square area of a room?

NCCER Plumbing Standards

Level 2, Module 02201-13: Plumbing Math Two
Module one (02201-13) explains the Pythagorean theorem, reviews methods for laying out square corners, and discusses the techniques used to calculate simple and rolling offsets, as well as offsets on parallel runs of pipe.

Task Number 52

Calculate the slope of a pipe.

Definition
Calculation should be performed in accordance with the International Plumbing Code (IPC).

Process/Skill Questions
• When should pipe slope be calculated?
• What are some consequences of failing to measure pipe slope correctly?

NCCER Plumbing Standards

Level 2, Module 02201-13: Plumbing Math Two
Module one (02201-13) explains the Pythagorean theorem, reviews methods for laying out square corners, and discusses the techniques used to calculate simple and rolling offsets, as well as offsets on parallel runs of pipe.

Reading Drawings for the Plumbing Profession

Task Number 53

Develop fitting/material lists based on drawings.

Definition
Development of fitting/material lists should include the use of addition and subtraction of decimals, fractions, and an ability to convert decimals to fractions.

Process/Skill Questions
• Why is a fitting/material list important to a plumber?
• How are fitting/material lists used to determine the costs, and therefore, the cost effectiveness of jobs?
Task Number 54

Lay out plumbing systems and fixture rough-ins.

Definition

Laying out should include

- establishing a piping route
- establishing fixture locations using commercial drawings and approved submittals
- recognizing the need for coordination drawings and lab drawings
- using building information modeling (BIM) for coordination.

Process/Skill Questions

- What considerations should be taken when establishing a piping route?
- What is BIM, and how does a plumber access it?

Task Number 55

Complete a material takeoff for drain, waste, and vent (DWV) and water supply systems.

Definition

Completion should include

- gathering information shown on drawings
- creating an isometric drawing.
Process/Skill Questions

- Where on isometric drawings can a plumber find information needed for a material takeoff?
- How are three-view drawings used for drawing isometric sketches?

NCCER Plumbing Standards

Level 2, Module 02202-13: Reading Commercial Drawings
Module two (02202-13) provides instruction in the identification and interpretation of civil, architectural, structural, HVAC/mechanical, plumbing, and electrical drawings, as well as how to use them to ensure accurate dimensions, generate RFIs, locate plumbing entry points, and establish piping routes and fixture locations.

Performing Pipe Cutting and Joining

Task Number 56

Join copper pipe (tubing) to fittings using the flare method.

Definition

Joining should include use of a flaring tool and block, according to the instructor's guidelines.

Process/Skill Questions

- What type of copper system requires flare fittings?
- What tools are used to join flare fittings?
- What must be put on a pipe before flaring has begun?

Task Number 57

Join dissimilar materials.

Definition

Joining should be done according to instructor's guidelines and so the finished assembly does not leak.

Process/Skill Questions

- What are two fittings used in conjunction that can join dissimilar materials?
- Are there any singular fittings that can join dissimilar materials?

Supporting and Hanging Pipe
Task Number 58

Identify types of anchors and straps.

Definition

Identification should include

- expansion anchors
- inserts
- Red Head anchors
- clevis hangers
- split-ring hangers
- beam clamps
- riser clamps
- wire hooks
- perforated straps
- tube straps
- talon hooks.

Process/Skill Questions

- How are anchors normally installed in concrete?
- What type of hanger is used to support pipe from a ceiling?
- How far apart do hangers have to be spaced on various piping materials?

Task Number 59

Install backing and ledger supports for various plumbing fixtures.

Definition

Installation should include

- the backing properly positioned and cut to fit snugly in the space
- the assembly level and secured.

Process/Skill Questions

- What materials are used to support various plumbing fixtures?
- At what point in construction are backing and ledger supports installed?
Task Number 60

Describe the installation of pipe sleeves through a concrete or masonry wall.

Definition

Description should note that the sleeve is installed according to industry and manufacturer's guidelines and caulked.

Process/Skill Questions

- What is the purpose of a pipe sleeve?
- How is a pipe sleeve installed?
- Pipe sleeves are typically composed of what type of material?

NCCER Plumbing Standards

Level 2, Module 02203-13: Structural Penetrations, Insulation, and Fire-Stopping
Module three (02203-13) covers how to cut, bore, and sleeve structural members using the appropriate tools including proper locations, restrictions, and reinforcement techniques; how to install fiberglass and flexible foam insulation on pipe; and how to install fire-stopping on walls, floors, and ceiling according to code.

Task Number 61

Identify common types of fire-stopping materials and assemblies.

Definition

Identification should include

- an explanation of fire-rating requirements
- listing materials that meet fire-rating requirements.

Process/Skill Questions

- Where is fire-stopping material required? Why?
- What are the most commonly used fire-stopping materials?

NCCER Plumbing Standards

Level 2, Module 02203-13: Structural Penetrations, Insulation, and Fire-Stopping
Module three (02203-13) covers how to cut, bore, and sleeve structural members using the appropriate tools including proper locations, restrictions, and reinforcement techniques; how to install fiberglass and flexible foam insulation on pipe; and how to install fire-stopping on walls, floors, and ceiling according to code.
Installing Waste and Soil Pipes

Task Number 62

Construct a no-hub cast-iron pipe assembly.

Definition

Construction should include

- pipes being aligned and graded
- appropriate fittings being used
- finished assembly with no visible leaks.

Process/Skill Questions

- What are some advantages of using cast iron over plastic pipe?
- What is a disadvantage of using a cast-iron system?

NCCER Plumbing Standards

Level 2, Module 02204-13: Installing and Testing DWV Piping

Module four (02204-13) provides instruction in locating, installing, connecting, and testing a complete drain, waste, and vent (DWV) system including how to develop material takeoffs, set up and use levels, locate building sewers and building drains, locate fixtures, and test a DWV system.

Task Number 63

Rough-in a DWV assembly of PVC/ABS, for the following: water closet, lavatory, bathtub, shower, kitchen or bar sink, washing machine, indirect waste.

Definition

Rough-in should be according to the Plumbing Code, manufacturer's specifications, and industry standards.

Process/Skill Questions

- What is meant by rough-in?
- What is another name for a water closet?
• In which direction does all drainage water flow?
• What is indirect waste?

NCCER Plumbing Standards

Level 2, Module 02204-13: Installing and Testing DWV Piping
Module four (02204-13) provides instruction in locating, installing, connecting, and testing a complete drain, waste, and vent (DWV) system including how to develop material takeoffs, set up and use levels, locate building sewers and building drains, locate fixtures, and test a DWV system.

Task Number 64

Calculate and set waste and soil pipes to level and gradient.

Definition
Calculation and installation should be completed according to measurement and leveling instruments and acceptable according to instructor's guidelines.

Process/Skill Questions

• How much head pressure is required for an accurate water test?
• How are open lines sealed?
• Who oversees and checks the water test?

NCCER Plumbing Standards

Level 2, Module 02204-13: Installing and Testing DWV Piping
Module four (02204-13) provides instruction in locating, installing, connecting, and testing a complete drain, waste, and vent (DWV) system including how to develop material takeoffs, set up and use levels, locate building sewers and building drains, locate fixtures, and test a DWV system.

Task Number 65

Install a water closet flange.

Definition
Installation should follow the Plumbing Code, manufacturer's specifications, blueprints, and the Americans with Disabilities Act (ADA).

Process/Skill Questions

• Of what materials are closet flanges made?
• What holds the water closet to the flange?
• Of what materials are closet bolts made?

NCCER Plumbing Standards

Level 2, Module 02204-13: Installing and Testing DWV Piping
Module four (02204-13) provides instruction in locating, installing, connecting, and testing a complete drain, waste, and vent (DWV) system including how to develop material takeoffs, set up and use levels, locate building sewers and building drains, locate fixtures, and test a DWV system.

Task Number 66

Describe the use of a backwater valve.

Definition

Description should note that the backwater valve prevents the dangerous reversal of flow in a piping system that can contaminate the system.

Process/Skill Questions

• How does a backwater valve work?
• Where are backwater valves required?
• What tools are needed to install a backwater valve?

NCCER Plumbing Standards

Level 2, Module 02204-13: Installing and Testing DWV Piping
Module four (02204-13) provides instruction in locating, installing, connecting, and testing a complete drain, waste, and vent (DWV) system including how to develop material takeoffs, set up and use levels, locate building sewers and building drains, locate fixtures, and test a DWV system.

Task Number 67

Demonstrate the boring and notching of structural members of the building.

Definition

Demonstration should include cutting and notching of studs and joists according to the Plumbing Code.

NCCER Plumbing Standards

Level 2, Module 02204-13: Installing and Testing DWV Piping
Module four (02204-13) provides instruction in locating, installing, connecting, and testing a complete drain, waste, and vent (DWV) system including how to develop material takeoffs, set up and use levels, locate building sewers and building drains, locate fixtures, and test a DWV system.

Task Number 68

Test a drainage system by performing a standing water test.

Definition

Testing is performed according to instructor's guidelines, following procedures according to the Plumbing Code.

Process/Skill Questions

- How much head pressure is required for an accurate water test?
- How are open lines sealed?
- Who oversees and checks the water test?

NCCER Plumbing Standards

Level 2, Module 02204-13: Installing and Testing DWV Piping

Task Number 69

Install various types of bathtubs, shower stalls, and shower pans.

Definition

Installation is performed according to manufacturer's specifications and industry standards.

Process/Skill Questions

- Bathtubs and shower stalls are typically constructed from what materials?
- Shower pans are typically constructed from what materials?
- At what height are fixtures typically installed?

NCCER Plumbing Standards

Level 2, Module 02204-13: Installing and Testing DWV Piping
Module four (02204-13) provides instruction in locating, installing, connecting, and testing a complete drain, waste, and vent (DWV) system including how to develop material takeoffs, set up and use levels, locate building sewers and building drains, locate fixtures, and test a DWV system.

Roughing-in Water Distribution Components

Task Number 70

Rough-in a water distribution system of hard-drawn copper, CPVC (chlorinated polyvinyl chloride), and PEX (cross-linked polyethylene) for the following fixtures: washing machine, lavatory, kitchen sink, tank-type water closet, bathtub and/or shower, ice maker, hose bib.

Definition

Rough-in should follow blueprints, manufacturer's specifications, and the Plumbing Code.

Process/Skill Questions

- How are water systems sized?
- How are the three types of pipes joined?
- Which type of system costs the least to install?

Task Number 71

Identify procedures and materials for installing a building's water service.

Definition

Identification should follow instructor's guidelines.

Process/Skill Questions

- At what depth are water services put into the ground?
- What are three types of pipe used for water service?
- Where are values placed on water services?

Task Number 72
Definition

Identification may include

- gate
- ball
- butterfly.

Process/Skill Questions

- Where are main shutoff valves typically located in a house?
- What size is the main shutoff valve in a house?
- The main shutoff valve is constructed of what types of materials?

Task Number 73

Install a main shutoff valve.

Definition

Installation should be made so the valve operates properly without leaks.

Process/Skill Questions

- What materials are used to install shutoff valves?
- Where is the main shutoff valve typically located?

Task Number 74

Perform an air- or water-pressure test.

Definition

Performance should include using a pressure gauge to determine pressure.

Process/Skill Questions

- At what pressure should an air test be conducted?
- What materials are needed to perform the test?
- Who checks the tests on the piping?

Task Number 75
**Insulate water lines.**

**Definition**

Insulation should follow manufacturer's guidelines and the *Plumbing Code*, taking into account construction materials.

**Process/Skill Questions**

- What materials are used to insulate water lines?
- Where are water lines required to be insulated?
- What does insulation do for water lines?

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**Task Number 76**

**Identify the need for backflow prevention devices.**

**Definition**

Identification should follow instructor's guidelines.

**Process/Skill Questions**

- Where are backflow devices used?
- What is required to install backflow devices?
- Who can install backflow devices?

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**Task Number 77**

**Install nail guards for the protection of piping.**

**Definition**

Installation should include determining when nail guards are necessary and the associated hazards associated with installation. Special attention should be given to using the correct nail guard size and to determining the location and placement.

**Process/Skill Questions**

- Of what materials are nail guards typically constructed?
- Where are nail guards typically installed?
- How are nail guards attached?
Installing Fixtures and Trim

Task Number 78

Install lavatory (wall hung and cabinet installation).

Definition
Installation should follow blueprints and manufacturer's specifications, be leveled, trimmed out, and caulked.

Process/Skill Questions
- At what height are bathroom lavatories typically installed?
- How are wall-hung lavatory brackets installed?
- What types of connections are used on lavatory supplies?

NCCER Plumbing Standards
Level 2, Module 02208-13: Installing Fixtures and Valves
Module Eight (02208-13) provides instruction on how to install basic plumbing fixtures, including bathtubs, shower stalls, lavatories, sinks, water closets, and urinals; reviews the installation of associated valves, faucets, and components; and discusses how to connect appliances such as dishwashers, food-waste disposers, refrigerators and ice makers, and washing machines.

Task Number 79

Install tank-type water closet.

Definition
Installation should follow manufacturer's specifications and be trimmed out, secure, level, and plumb, with seal correctly installed.

Process/Skill Questions
- What is the standard inch requirement for the rough-in of standard tank-type water closets?
- Where is the water closet shutoff valve installed?
- Why is the water closet sealed to the closet flange?

NCCER Plumbing Standards
Level 2, Module 02208-13: Installing Fixtures and Valves
Module Eight (02208-13) provides instruction on how to install basic plumbing fixtures, including bathtubs, shower stalls, lavatories, sinks, water closets, and urinals; reviews the installation of associated valves, faucets, and components; and discusses how to connect appliances such as dishwashers, food-waste disposers, refrigerators and ice makers, and washing machines.

Task Number 80
Install a kitchen sink.

Definition
Installation should follow manufacturer's specifications and be trimmed out, plumb, and level.

Process/Skill Questions
- What trap size is installed on a kitchen sink?
- What appliance can be attached to a kitchen sink?
- How many handles does a kitchen sink have?

NCCER Plumbing Standards
Level 2, Module 02208-13: Installing Fixtures and Valves
Module Eight (02208-13) provides instruction on how to install basic plumbing fixtures, including bathtubs, shower stalls, lavatories, sinks, water closets, and urinals; reviews the installation of associated valves, faucets, and components; and discusses how to connect appliances such as dishwashers, food-waste disposers, refrigerators and ice makers, and washing machines.

Task Number 81
Install a garbage disposal.

Definition
Installation should follow manufacturer's specifications, with no leaks.

Process/Skill Questions
- How are garbage disposals rated?
- What other appliance drains can be hooked to the garbage disposal?
- What minimum trap size must serve a garbage disposal?

NCCER Plumbing Standards
Level 2, Module 02208-13: Installing Fixtures and Valves
Task Number 82

Install a dishwasher.

Definition

Installation should follow this procedure:

- Set the dishwasher in the cabinet space plumb and trim.
- Secure the dishwasher to the cabinet.
- Install the drain loop.
- Connect the water supply.
- Remove the knock-out from the garbage disposal connection, if necessary.
- Connect the drain connection (to the tail piece or to the garbage disposal).

Process/Skill Questions

- In what situation would an air gap be required?
- What other tradespeople might be involved with the proper hook up?
- What size are the supply and drain lines used with dishwashers?

NCCER Plumbing Standards

Level 2, Module 02208-13: Installing Fixtures and Valves

Module Eight (02208-13) provides instruction on how to install basic plumbing fixtures, including bathtubs, shower stalls, lavatories, sinks, water closets, and urinals; reviews the installation of associated valves, faucets, and components; and discusses how to connect appliances such as dishwashers, food-waste disposers, refrigerators and ice makers, and washing machines.

Task Number 83

Install a gas water heater.

Definition

Installation should follow the manufacturer's instructions and the Plumbing Code, be tested, and should not leak.

Process/Skill Questions
• What are the technical differences and considerations between electric and gas water heater installation?
• What is one key advantage of the gas water heater over the electric?
• What is a BTU (British Thermal Unit), and what does it measure?

NCCER Plumbing Standards

Level 2, Module 02209-13: Installing Water Heaters
Module Nine (02209-13) provides an introduction to gas-fired, electric, tankless, heat pump, and indirect water heaters, components, and applications; reviews proper installation and testing techniques; and covers the latest code requirements for water heaters.

Task Number 84

Install an electric water heater.

Definition
Installation should follow manufacturer's instructions.

Process/Skill Questions

• What is the key advantage of an electric water heater over a gas water heater?
• What is the watt-to-kilowatt ratio?
• What is the kilowatt-to-BTU ratio?
• What is a point-of-use electric water heater?
• How do you determine water heater size and capacity?
• When is a drain pan necessary?
• How do you read the energy efficiency rating?
• Who sets the thermostat on the water heater?
• What temperature is required for a dishwasher?

NCCER Plumbing Standards

Level 2, Module 02209-13: Installing Water Heaters
Module Nine (02209-13) provides an introduction to gas-fired, electric, tankless, heat pump, and indirect water heaters, components, and applications; reviews proper installation and testing techniques; and covers the latest code requirements for water heaters.

Task Number 85

Trim a tub and shower valve.

Definition
Trimming should follow the manufacturer's specifications, and installation should be straight and neat.
Process/Skill Questions

- What is the difference between single-handle, dual-handle, and triple-handle valves?
- What is the function of the scald-proof valve?
- Can shower heads be changed?
- What is the function of a flow-limiter shower head?

NCCER Plumbing Standards

Level 2, Module 02207-13: Types of Valves
Module Seven (02207-13) provides trainees with an overview of the many types of valves, their components, and valve applications, and explains how to service common valves.

Level 2, Module 02208-13: Installing Fixtures and Valves
Module Eight (02208-13) provides instruction on how to install basic plumbing fixtures, including bathtubs, shower stalls, lavatories, sinks, water closets, and urinals; reviews the installation of associated valves, faucets, and components; and discusses how to connect appliances such as dishwashers, food-waste disposers, refrigerators and ice makers, and washing machines.

Task Number 86

Install various fixture shutoff valves.

Definition

Installation should follow the manufacturer's specifications and not leak.

Process/Skill Questions

- What is the function of the shutoff valve?
- When is it necessary to use a shutoff valve?
- How do you determine whether to use a straight or 90-degree configuration?

NCCER Plumbing Standards

Level 2, Module 02207-13: Types of Valves
Module Seven (02207-13) provides trainees with an overview of the many types of valves, their components, and valve applications, and explains how to service common valves.

Task Number 87

Connect icemaker lines.

Definition

Connection should be made using coils that allow for the removal of the refrigerator.
Process/Skill Questions

- What is the typical size of the OD compression connection?
- What is the typical installation location of an icemaker box?

Task Number 88

Install kitchen sink continuous waste.

Definition

Installation should be performed according to the Plumbing Code.

Process/Skill Questions

- What are the components of a continuous waste kit?
- How is the kitchen sink typically sealed to the countertop?
- What is the minimum sized p-trap used for a kitchen sink?

Task Number 89

Describe the installation and operation of a tankless water heater.

Definition

Description should include

- considerations when installing
- differences in operation of a tankless water heater and a traditional water heater
- referring to the manufacturer's specifications.

Process/Skill Questions

- What are the benefits and drawbacks of tankless water heaters?
- What are the most common models of tankless water heaters?

NCCER Plumbing Standards

Level 2, Module 02209-13: Installing Water Heaters
Module Nine (02209-13) provides an introduction to gas-fired, electric, tankless, heat pump, and indirect water heaters, components, and applications; reviews proper installation and testing techniques; and covers the latest code requirements for water heaters.
Exploring Basic Electricity Concepts Related to Plumbing

Task Number 90

Identify how voltage, current, resistance, and power are related.

Definition

Identification should include

- electrical safety hazards
- gas safety hazards
- steam safety hazards.

Process/Skill Questions

- What electrical hazards are associated with gas-powered appliances?
- How can plumbers protect themselves from steam safety hazards?

NCCER Plumbing Standards

Level 2, Module 02210-13: Basic Electricity
Module Ten (02210-13) provides an introduction to electrical safety and the principles of electricity, including voltage, current, resistance, and power. Trainees will learn about important electrical formulas, circuitry, and common plumbing-related electrical applications.

Task Number 91

Describe the use of an electricity testing meter.

Definition

Description should include

- following manufacturer’s specifications
- selecting the proper meter for the job.

Process/Skill Questions

- What are the most common types of meters?
Task Number 92

Identify the purpose and operation of the various electrical components used in plumbing equipment.

Definition

Identification may include components used in

- gas water heaters
- electric water heaters
- tankless water heaters
- heat pump water heaters
- indirect water heaters.

Process/Skill Questions

- What electrical components are common to all plumbing equipment?
- Why must a plumber understand the operation of electrical components?

Servicing and Repairing Plumbing and Fixtures

Task Number 93

Replace and adjust the water closet fill valve.

Definition
Replacement should follow the manufacturer's specifications and may include adjustment of the valve.

**Process/Skill Questions**

- What is the function of a fill valve?
- What precautions should you take before replacing the fill valve?
- Will changing or adjusting the fill valve affect a noisy toilet?

**NCCER Plumbing Standards**

**Level 2, Module 02208-13: Installing Fixtures and Valves**
Module Eight (02208-13) provides instruction on how to install basic plumbing fixtures, including bathtubs, shower stalls, lavatories, sinks, water closets, and urinals; reviews the installation of associated valves, faucets, and components; and discusses how to connect appliances such as dishwashers, food-waste disposers, refrigerators and ice makers, and washing machines.

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**Task Number 94**

**Troubleshoot a flushometer.**

**Definition**

Troubleshooting should follow the manufacturer's maintenance manual.

**Process/Skill Questions**

- What is the function of a flushometer?
- Where might you locate a flushometer's shutoff valve?
- What are common problems in a malfunctioning flushometer?

**NCCER Plumbing Standards**

**Level 2, Module 02208-13: Installing Fixtures and Valves**
Module Eight (02208-13) provides instruction on how to install basic plumbing fixtures, including bathtubs, shower stalls, lavatories, sinks, water closets, and urinals; reviews the installation of associated valves, faucets, and components; and discusses how to connect appliances such as dishwashers, food-waste disposers, refrigerators and ice makers, and washing machines.

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**Task Number 95**

**Repair or replace a two-handled faucet, both compression and washerless types.**

**Definition**
Repairing and replacing should be done in accordance with manufacturer's manuals.

**Process/Skill Questions**

- What precautions should be taken when removing a faucet?
- Why are fixture types an important consideration when purchasing faucets and drain assemblies?

**NCCER Plumbing Standards**

**Level 2, Module 02208-13: Installing Fixtures and Valves**

Module Eight (02208-13) provides instruction on how to install basic plumbing fixtures, including bathtubs, shower stalls, lavatories, sinks, water closets, and urinals; reviews the installation of associated valves, faucets, and components; and discusses how to connect appliances such as dishwashers, food-waste disposers, refrigerators and ice makers, and washing machines.

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**Task Number 96**

**Repair or replace various single-lever faucets.**

**Definition**

Repair and replacement of faucets (e.g., ball type, cartridge type, or ceramic disk type) should be done in accordance with manufacturer's manuals.

**Process/Skill Questions**

- What precautions should be taken when removing a faucet?
- Why are fixture types an important consideration when purchasing faucets and drain assemblies?

**NCCER Plumbing Standards**

**Level 2, Module 02208-13: Installing Fixtures and Valves**

Module Eight (02208-13) provides instruction on how to install basic plumbing fixtures, including bathtubs, shower stalls, lavatories, sinks, water closets, and urinals; reviews the installation of associated valves, faucets, and components; and discusses how to connect appliances such as dishwashers, food-waste disposers, refrigerators and ice makers, and washing machines.

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**Task Number 97**

**Repair or replace a tub diverter.**

**Definition**

Repairing and replacing should include removing and replacing the trim (for single handle, two-handle, or triple-handle configurations) and reinstalling, ensuring there are no leaks.
Process/Skill Questions

- In a three-handle tub and shower faucet, which one is the diverter?
- What are the common types of diverters?

NCCER Plumbing Standards

Level 2, Module 02208-13: Installing Fixtures and Valves
Module Eight (02208-13) provides instruction on how to install basic plumbing fixtures, including bathtubs, shower stalls, lavatories, sinks, water closets, and urinals; reviews the installation of associated valves, faucets, and components; and discusses how to connect appliances such as dishwashers, food-waste disposers, refrigerators and ice makers, and washing machines.

Task Number 98

Troubleshoot a gas or electric water heater.

Definition

Troubleshooting should include procedures outlined in the heater's maintenance manual.

Process/Skill Questions

- What are the common problems with gas and electric water heaters?
- Why should you never solder a fitting close to a water heater connection?
- What is a dielectric union?
- Why is it absolutely necessary to consult local code regarding electrical work?

NCCER Plumbing Standards

Level 2, Module 02209-13: Installing Water Heaters
Module Nine (02209-13) provides an introduction to gas-fired, electric, tankless, heat pump, and indirect water heaters, components, and applications; reviews proper installation and testing techniques; and covers the latest code requirements for water heaters.

Installing Natural Gas Piping Systems

Task Number 99

Identify the local gas code for installation requirements.

Definition
Identification should include procedures for acquiring the resource and reading the code.

Process/Skill Questions

- Why is the gas code especially important when installing gas piping?
- Where can you locate the current gas code?
- Does a person need to be licensed to install natural gas piping?

NCCER Plumbing Standards

Level 2, Module 02211-13: Fuel Gas and Fuel Oil Systems
Module Eleven (02211-13) provides trainees with an introduction to the techniques required for the safe handling of natural gas, liquefied petroleum gas, and fuel oil, and also reviews fuel gas and fuel oil safety precautions and potential hazards, applications, systems installation, and testing.

Task Number 100

Identify the different types of natural gas distribution materials.

Definition

Identification should include

- pipe wrought from iron or steel (galvanized or black), or yellow brass containing not more than 75 percent copper, or internally tinned or equivalently treated copper
- approved PE (polyethlene) pipe for exterior buried piping systems when used with factory assembled steel risers.

Process/Skill Questions

- Why is it important to be aware of the types of natural gas distribution materials?
- Why does copper pipe not meet code in some areas?

NCCER Plumbing Standards

Level 2, Module 02211-13: Fuel Gas and Fuel Oil Systems
Module Eleven (02211-13) provides trainees with an introduction to the techniques required for the safe handling of natural gas, liquefied petroleum gas, and fuel oil, and also reviews fuel gas and fuel oil safety precautions and potential hazards, applications, systems installation, and testing.

Task Number 101

Describe testing and purging procedures.

Definition
Description of testing should include

- explaining when and why the test should be conducted (after rough-in)
- explaining why a soap and water solution is applied to joints (bubbles will indicate a leak)
- understanding when and how to use a manometer
- referring to local and state gas codes for specific testing requirements.

Description of purging should include

- explaining when and why the purge should be conducted (after the test)
- understanding ventilation requirements
- disconnecting the gas pipe from the appliance
- conducting the purge according to local and state gas codes.

Process/Skill Questions

- Why should the test occur after rough-in but before the building is completed?
- What are some safety precautions that are important when installing appliances?
- How often should plumbers test piping installations?

Task Number 102

Describe the installation of a gas appliance.

Definition

Description should include the

- size of the system required
- location of the storage container
- type of storage container needed
- kind of regulator needed and where it should be located
- customer service line requirements
- inspections and tests required and when one should request them
- appliance location and the type of venting system.

Process/Skill Questions

- Why should the local LP gas supplier be consulted before the installation begins?
- How are gas supply lines typically identified on building blueprints?

NCCER Plumbing Standards

Level 2, Module 02211-13: Fuel Gas and Fuel Oil Systems

Module Eleven (02211-13) provides trainees with an introduction to the techniques required for the safe handling of natural gas, liquefied petroleum gas, and fuel oil, and also reviews fuel gas and fuel oil safety precautions and potential hazards, applications, systems installation, and testing.
### SOL Correlation by Task

<table>
<thead>
<tr>
<th>Task</th>
<th>English: 11.5, 11.8, 12.5, 12.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comply with federal, state, and local safety legal requirements.</td>
<td>History and Social Science: GOVT.1, GOVT.7, GOVT.8, GOVT.9, GOVT.14, GOVT.15, GOVT.16</td>
</tr>
<tr>
<td>Identify PPE (personal protective equipment) requirements.</td>
<td>English: 11.5, 12.5</td>
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<tr>
<td>Maintain a safe working environment.</td>
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<tr>
<td>Explain safe working practices around electrical hazards.</td>
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<tr>
<td>Identify emergency first-aid procedures.</td>
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<tr>
<td>Identify the types of fires and the methods used to extinguish them.</td>
<td>English: 11.5, 12.5, Science: CH.1</td>
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<tr>
<td>Inspect course-specific hand and power tools to visually identify defects.</td>
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<tr>
<td>Demonstrate lifting and carrying techniques.</td>
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<tr>
<td>Demonstrate safe laddering techniques.</td>
<td>English: 11.5, 12.5</td>
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<tr>
<td>Demonstrate safe scaffolding techniques.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Report personal injuries and environmental and equipment safety violations to the appropriate authority.</td>
<td>English: 11.1, 12.1, History and Social Science: GOVT.1, GOVT.7, GOVT.8, GOVT.9, GOVT.14, GOVT.15, GOVT.16</td>
</tr>
<tr>
<td>Pass a safety exam for lab/site safety and the use of tools and equipment specific to the construction industry.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Calculate the area of a room and the volume of a tank.</td>
<td>Mathematics: G.9, G.13</td>
</tr>
<tr>
<td>Calculate the slope of a pipe.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Develop fitting/material lists based on drawings.</td>
<td>Mathematics: G.3</td>
</tr>
<tr>
<td>Lay out plumbing systems and fixture rough-ins.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Complete a material takeoff for drain, waste, and vent (DWV) and water supply systems.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Task</td>
<td>Grade Level</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Join copper pipe (tubing) to fittings using the flare method.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Join dissimilar materials.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Identify types of anchors and straps.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Install backing and ledger supports for various plumbing fixtures.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Describe the installation of pipe sleeves through a concrete or masonry wall.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Identify common types of fire-stopping materials and assemblies.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Construct a no-hub cast-iron pipe assembly.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Rough-in a DWV assembly of PVC/ABS, for the following: water closet, lavatory, bathtub, shower, kitchen or bar sink, washing machine, indirect waste.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Calculate and set waste and soil pipes to level and gradient.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Install a water closet flange.</td>
<td>Mathematics: G.3</td>
</tr>
<tr>
<td>Describe the use of a backwater valve.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Demonstrate the boring and notching of structural members of the building.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Test a drainage system by performing a standing water test.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Install various types of bathtubs, shower stalls, and shower pans.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Rough-in a water distribution system of hard-drawn copper, CPVC (chlorinated polyvinyl chloride), and PEX (cross-linked polyethylene) for the following fixtures: washing machine, lavatory, kitchen sink, tank-type water closet, bathtub and/or shower, ice maker, hose bib.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Identify procedures and materials for installing a building's water service.</td>
<td>English: 11.5, 11.6, 12.5, 12.6</td>
</tr>
<tr>
<td>Identify types of main shutoff valves.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Install a main shutoff valve.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Perform an air- or water-pressure test.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Insulate water lines.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Identify the need for backflow prevention devices.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Install nail guards for the protection of piping.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Install lavatory (wall hung and cabinet installation).</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Install tank-type water closet.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Install a kitchen sink.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Install a garbage disposal.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Install a dishwasher.</td>
<td>English: 11.5, 12.5</td>
</tr>
</tbody>
</table>
Install a gas water heater.  
Install an electric water heater.  
Trim a tub and shower valve.  
Install various fixture shutoff valves.  
Connect icemaker lines.  
Install kitchen sink continuous waste.  
Describe the installation and operation of a tankless water heater.  
Identify how voltage, current, resistance, and power are related.  
Science: PH.11  
Describe the use of an electricity testing meter.  
Identify the purpose and operation of the various electrical components used in plumbing equipment.  
Replace and adjust the water closet fill valve.  
Troubleshoot a flushometer.  
Repair or replace a two-handled faucet, both compression and washerless types.  
Repair or replace various single-lever faucets.  
Repair or replace a tub diverter.  
Troubleshoot a gas or electric water heater.  
Identify the local gas code for installation requirements.  
Identify the different types of natural gas distribution materials.  
Describe testing and purging procedures.  
Describe the installation of a gas appliance.  

Green Building Infusion Units

The Green Building Infusion Unit (GBIU) was designed to encourage teachers to infuse instructional units on green building knowledge and skills into designated CTE courses. The infusion unit is not mandatory, and, as such, the tasks/competencies are marked as “optional,” to be taught at the instructor’s discretion.  

Entrepreneurship Infusion Units

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.”
Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- College and Work Readiness Assessment (CWRA+)
- Core: Introductory Craft Skills Entry-Level Assessment
- Customer Service Examination
- Customer Service Specialist (CSS) Examination
- ICC Certificates of Completion Examinations
- International Code Council Residential Plumbing Inspector (P1) Examination
- National Career Readiness Certificate Assessment
- Plumbing Assessment
- Plumbing Examination
- Plumbing Level One Entry-Level Assessment
- Plumbing-Heating-Cooling Contractors Educational Foundation Examinations
- Pre-Apprenticeship Certificate Training (PACT) Core Examinations
- Professional Communications Certification Examination
- Workplace Readiness Skills for the Commonwealth Examination

Concentration sequences: A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.

- Plumbing I (8551/36 weeks, 140 hours)

Career Cluster: Architecture and Construction

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Occupations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Construction Manager</td>
</tr>
<tr>
<td></td>
<td>General Contractor</td>
</tr>
<tr>
<td></td>
<td>Plumber, Pipefitter</td>
</tr>
<tr>
<td>Design/Pre-Construction</td>
<td>Building Code Inspector</td>
</tr>
<tr>
<td></td>
<td>Cost Estimator</td>
</tr>
<tr>
<td>Maintenance and Operations</td>
<td>Plumber, Pipefitter</td>
</tr>
</tbody>
</table>