Plumbing

Exam Information

Exam number
516

Items
65

Points
75

Prerequisites
None

Recommended course length
One semester

National Career Cluster
Architecture & Construction

Manufacturing

Performance standards
Included (Optional)

Certificate available
Yes

Description

The Plumbing industry certification exam assesses learners on their ability to apply technical knowledge and skills to lay out, assemble, install, and maintain piping, fixtures, and piping systems for steam, hot water, heating, cooling, draining, lubricating, sprinkling, and industrial processing systems. Learners demonstrate their understanding of material selection and the use of tools to cut, bend, join, and weld pipes. The exam is based on the current National Center for Construction Education and Research (NCCER) task list.

Exam Blueprint

Standard	Percentage of exam
1. Plumbing Trade	10%
2. Plumbing Tools	10%
3. Plumbing Math	10%
4. Plumbing Drawings	6%
5. Plastic Pipe & Fittings	15%
6. Copper Pipe & Fittings	13%
7. DWV	10%
8. Water Distribution Systems	12%
9. Fixtures & Faucets	12%
10. Professional Skills	2%

Standard 1

Students will practice plumbing safety.

Objective 1 Learn safe working habits and procedures in a construction environment. Pass relevant safety tests with 100 percent.

1. Personal safety
2. Tool and equipment safety.
3. Workplace safety
4. Personal protective equipment (PPE).

Objective 2 Explain the purpose of OSHA and how it promotes safety on the job.

Objective 3 Identify and demonstrate proper use of relevant machines and equipment.

1. Pipe threading machine
2. Scissor lift
3. Propress
4. B tank
5. Turbo Torches

Objective 4 Identify and demonstrate proper use of relevant hand and power tools.

Objective 5 Demonstrate the proper maintenance procedures to be used for hand and power tools.

Objective 6 Explain safe and proper use of a fire extinguisher.

Objective 7 Comply with safety rules for working with plumbing-related chemicals.

1. Chemical manufacturers provide a Safety Data Sheets (SDS) for each chemical they produce.
2. Identify the location of and navigate through SDS for critical information.
3. Store and dispose of chemicals in properly labeled containers.

Performance Skills

1. Pass relevant safety tests with 100% accuracy.
2. Demonstrate proper use of ladders.
3. Demonstrate proper use and maintenance of power and hand tools
4. Locate the Safety Data Sheets (SDS) and demonstrate proper navigation.
5. Use concepts and practices to solve, mitigate, and manage potential hazards.
6. Personal protective equipment

Standard 1 Performance Evaluation included below (Optional)

Standard 2

Students will receive an orientation to the plumbing trade.

Objective 1 Describe the history of the plumbing trade.

1. Origins
2. Water systems
3. Drainage systems

Objective 2 Identify the stages and evolution within the plumbing trade.

1. Water systems
2. Drainage systems

Standard 2 Performance Evaluation included below (Optional)

Standard 3

Students will be able to understand and demonstrate the use of plumbing math.

Objective 1 Solve whole and fractional/decimal problems (two- and three-digits).

1. Addition
2. Subtraction
3. Multiplication
4. Division

Objective 2 Solve conversion problems.

1. Fraction-to-decimal
2. Decimal-to-fraction
3. Decimal-to-percent
4. Percent-to-decimal

Objective 3 Identify basic rations, proportions, and volumes.

1. Fluids: gallon, liter, quart
2. Units of measure: psi, kpa, foot, lbs, newton meters, inch

Objective 4 Solve basic linear-measurement problems.

1. Measure using the Imperial system

Performance Skills

1. Identify the parts of a fitting and use common pipe measuring techniques.
2. Use fitting dimension tables and a framing square to determine fitting allowances and pipe makeup.

3. Calculate end-to-end measurements by figuring fitting allowances and pipe makeup.
4. Use a framing square to find the center of fittings.
5. Figure 45-degree offsets and travel using the Pythagorean Theorem.
6. Figure 45-degree offsets and travel using a framing square or tape measure.
7. Use a ruler or measuring tape to measure within a sixteenth (1/16) of an inch.

Standard 4

Students will be able to understand and use plumbing drawings.

Objective 1 Identify pictorial (isometric and oblique), schematic, and orthographic drawings, and discuss how different views are used to depict information about objects.

Objective 2 Explain the types of drawings that may be included in a set of plumbing drawings and the relationship between the different drawings.

Objective 3 Discuss how local code requirements apply to certain drawings.

Performance Skills

1. Use an architect's scale to draw lines to scale and to measure lines drawn to scale.
2. Show a proper layout of a standard bathroom.
3. Identify construction symbols and interpret plumbing-related information from a set of plumbing drawings.

Standard 4 Performance Evaluation included below (Optional)

Standard 5

Students will understand and demonstrate the use of plastic pipe and fittings.

Objective 1 Compare the common types of materials and schedules of plastic piping.

Objective 2 Distinguish between the common types of fittings used with plastic piping.

Objective 3 Determine the kinds of hangers and supports needed for plastic piping.

Objective 4 Compare the various techniques used in hanging and supporting plastic piping.

Objective 5 Identify the hazards and safety precautions associated with plastic piping.

Standard 5 Performance Evaluation included below (Optional)

Performance Skills

1. Demonstrate the ability to properly measure, cut and join plastic piping.
2. Follow basic safety precautions for the installation,operation and maintenance of plastic tubing.
3. Demonstrate the process of joining ABS and PVC plastic pipes.

Standard 6

Students will select the correct types of materials for copper piping systems.

Objective 1 Select the correct types of materials for copper piping systems.

Objective 2 Identify types of fittings and valves and their uses.

Objective 3 Select the correct hanger or support for the application.

Performance Skills

1. Correctly measure, cut, ream, and join copper piping.
2. Determine the proper location of water systems.
3. Select the appropriate personal protective equipment for working with copper piping.

Standard 6 Performance Evaluation included below (Optional)

Standard 7

Students will be able to understand drain, waste, and vent (DWV) systems.

Objective 1 Explain how waste moves from a fixture through the drain system to the environment.

Objective 2 Distinguish between the major components of a drainage system and describe their functions.

Objective 3 Compare types and parts of traps and explain the importance of traps, and how traps lose their seals.

Objective 4 Identify the various types of DWV fittings and describe their application.

Performance Skills

1. Demonstrate the proper gluing techniques of a DWV system.
2. Demonstrate the proper cutting of plastic pipes.

Standard 7 Performance Evaluation included below (Optional)

Standard 8

Students will understand water distribution systems.

Objective 1 Discuss how water moves from the source, through the water distribution system, and to the fixture.

Objective 2 Explain the relationships between the components of a water distribution system.

1. Plumbing fixtures
2. Plumbing appliances and appurtenances

Performance Skills

1. Assess proper sizing of water system piping per fixture unit.

Standard 8 Performance Evaluation included below (Optional)

Standard 9

Students will understand and demonstrate the use of fixtures and faucets.

Objective 1 Identify the basic types of materials used in the manufacture of plumbing fixtures.

Objective 2 Discuss common types of fixtures.

1. Sinks
2. Lavatories
3. Bathtubs
4. Bath-shower modules
5. Shower stalls
6. Shower baths
7. Toilets, urinals, and bidets

Objective 3 Discuss the various types of faucets.

1. Sinks
2. Lavatories
3. Manufacturers

4. Cost
5. Design

Objective 4 Explain the common types of drinking fountains and water coolers.

Objective 5 Discuss common types of garbage disposals and domestic dishwashers.

Performance Skills

1. Identify all components needed for installation.
2. Install fixtures and faucets.
3. Demonstrate faucet repair.

Standard 9 Performance Evaluation included below (Optional)

Standard 10

Students will be encouraged to participate in a relevant CTSO (Career & Technical Student Organization) through the demonstration of electrician workplace and career readiness skills. These standards will not appear on state skill certification exams, but should be taught throughout the duration of the course.

Objective 1 Students will display personal skills related to the essential values, personality traits, and personal characteristics for success in the electrician profession and life.

1. **Integrity** - demonstrate honesty and personal responsibility for actions.
2. **Work ethic** - demonstrate tenacity, hard work, excellence, punctuality, meet deadlines; and be self-directed when completing tasks in the electrician professional setting.
3. **Professionalism** - demonstrate maturity, self-confidence; and a positive image when working with teammates or clients on electrical installations.
4. **Responsibility** - demonstrate dependability, consistency, and personal well-being when safely completing electrical tasks.
5. **Adaptability/Flexibility** - foster creativity, new ideas, and resilience when working to solve problems in electrical installations.
6. **Self-motivated** - demonstrate a willingness to learn, independence, initiative, and a positive attitude when approaching new information

Objective 2 Students will display workplace skills related to the essential attitudes and abilities for success in the electrician profession.

1. **Communication** - Demonstrates skills in listening and speaking; communicates professionally with teammates, supervisors, and customers in relation to electrical installations.
2. **Decision making** - Analyzes key facts, data, and situations to employ reasoning skills for completing installation tasks.
3. **Teamwork** - Builds trusting relationships, works cooperatively with others and utilizes individual strengths of team members when completing installation tasks.
4. **Planning, organizing, and management** - Designs, prepares, and implements creative

tasks within a desired timeframe; Sets priorities and responds to changing priorities.

5. **Leadership** - Builds positive relationships and mitigates conflict.

Objective 3 Students will display technical skills that are grounded in design that deliver essential knowledge and competencies for success in the industry.

1. **Computer and technology literacy**
2. **Job specific skills**
3. **Safety and health**
4. **Service orientation** - responds to internal and external customers; demonstrates focus and presence; attends to personal matters away from the classroom.
5. **Professional development** - demonstrates openness to learn, grow, and change in the construction industry.

***SkillsUSA PDP requirements - recommended**

Plumbing

Performance assessments may be completed and evaluated at any time during the course. The following performance skills are to be used in connection with the associated standards and exam. To pass the performance standard the student must attain a performance standard average of 8 or higher on the rating scale. Students may be encouraged to repeat the objectives until they average 8 or higher.

Student's Name: _____

Class: _____

Performance standards rating scale

0	Limited skills	2	→	4	Moderate skills	6	→	8	High skills	10

Standard 1 – Plumbing Trade Score:

- Understand and demonstrate their knowledge of the plumbing trade.
    - Describe the history of the plumbing trade.
    - Identify the stages of progress within the plumbing trade.
    - Identify responsibilities of a person working in the construction industry.
    - Explain the importance of safety in the construction industry.

Standard 2 – Plumbing Tools Score:

- Understand and demonstrate the use of plumbing tools
    - Identify the basic hand and power tools used in the plumbing trade.
    - Demonstrate the proper maintenance procedures to be used for hand and power tools.
    - Explain safety as it applies to plumbing tools.

Standard 3 – Plumbing Math Score:

- Understand and demonstrate the use of plumbing math
    - Identify the parts of a fitting and use common pipe measuring techniques.
    - Use fitting dimension tables and a framing square to determine fitting allowances and pipe makeup.
    - Calculate end-to-end measurements by figuring fitting allowances and pipe makeup.
    - Use a framing square to find the center of fittings.
    - Figure 45-degree offsets and travel using the Pythagorean Theorem.Figure 45-degree offsets and travel using a framing square or tape measure.
    - Use a ruler or measuring tape to measure within a sixteenth (1/16) of an inch.

Standard 4 – Plumbing Drawings Score:

- Understand and use plumbing drawings.
    - Identify pictorial (isometric and oblique), schematic, and orthographic drawings, and discuss how different views are used to depict information about objects.
    - Explain the types of drawings that may be included in a set of plumbing drawings and the relationship between the different drawings.
    - Interpret plumbing-related information from a set of plumbing drawings.
    - Use an architect's scale to draw lines to scale and to measure lines drawn to scale.
    - Discuss how local code requirements apply to certain drawings.

Standard 5 – Plastic Pipe & Fittings Score:

- Understand and demonstrate the use of plastic pipe and fittings
    - Identify the common types of materials and schedules of plastic piping.

- Identify the common types of fittings used with plastic piping.
- Identify and determine the kinds of hangers and supports needed for plastic piping.
- Identify the various techniques used in hanging and supporting plastic piping.
- Demonstrate the ability to properly measure, cut, and join plastic piping.
- Follow basic safety precautions for the installation, operation, and maintenance of plastic tubing.
- Identify the hazards and safety precautions associated with plastic piping

Standard 6 – Copper Pipe & Fittings **Score:**

- Understand and demonstrate the use of copper pipe and fittings.
  - Select the correct types of materials for copper piping systems.
  - Identify types of fittings and valves and their uses.
  - Select the correct hanger or support for the application.
  - Select the appropriate personal protective equipment for working with copper piping.
  - Correctly measure, cut, ream, and join copper piping.

Standard 7 – DWV **Score:**

- Understand drain, waste, and vent (DWV) systems
  - Explain how waste moves from a fixture through the drain system to the environment.
  - Identify the major components of a drainage system and describe their functions.
  - Identify types and parts of traps and explain the importance of traps and how traps lose their seals.
  - Identify the various types of DWV fittings and describe their application.

Standard 8 – Water Distribution Systems **Score:**

- Understand water distribution systems.
  - Discuss how water moves from the source, through the water distribution system, and to the fixture.
  - Identify the major components of water distribution systems and describe the function of each component.
  - Explain the relationships between the components of a water distribution system

Standard 9 – Fixture & Faucets **Score:**

- Understand and demonstrate the use of fixtures and faucets
  - Identify the basic types of materials used in the manufacture of plumbing fixtures.
  - Discuss common types of sinks, lavatories, and faucets.
  - Discuss common types of bathtubs, bath-shower modules, shower stalls, and shower baths.
  - Discuss common types of toilets, urinals, and bidets.
  - Discuss common types of drinking fountains and water coolers.
  - Discuss common types of garbage disposals and domestic dishwashers.

Performance standard average score:

Evaluator Name: _____

Evaluator Title: _____

Evaluator Signature: _____

Date: _____