Maryland CTE Programs of Study

Plumbing I (2025)

GENERAL REQUIREMENTS. This course is recommended for students in Grades 10-12. 1

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INTRODUCTION 2

A Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions. 2.A

B The Construction Career Cluster prepares students for careers in designing, planning, and building sustainable infrastructure. This field includes architects, engineers, construction managers, and skilled trades professionals. 2.B

C The Plumbing Program of Study prepares students for a career in the plumbing trade through a comprehensive three-course sequence. Students learn essential skills such as measuring and cutting different types of pipe, installing fixtures and appliances, assembling water supply and drainage systems, and interpreting building plans. The program emphasizes hands-on experience with industry-standard tools and materials while teaching students to calculate measurements, perform system testing, and ensure all work meets building codes and safety requirements. Through progressive skill development, students gain experience with both residential and commercial plumbing applications, including installation, maintenance, and troubleshooting of various plumbing systems. Upon successful completion of the program, graduates earn three industry-recognized certifications: NCCER Core, OSHA 30 Construction, and NCCER Plumbing Levels 1 and 2, preparing them to enter the workforce with verified skills and knowledge. 2.C

D Plumbing I builds upon core construction knowledge to introduce students to fundamental Plumbing theory and hands-on applications in the Plumbing trade. Students work with various piping materials including plastic, copper, cast iron, and steel, while learning proper measurement, cutting, and joining techniques. The curriculum covers essential topics such as plumbing safety, tools and equipment usage, basic mathematics, and drawing interpretation. Students gain hands-on experience with drain, waste, and vent (DWV) systems, water distribution systems, and plumbing fixtures. The course emphasizes proper nstallation techniques, code requirements, and industry best practices. Upon :ompletion, students will be able to identify and properly use plumbing tools,

Skip to main content

install basic plumbing systems, and understand fundamental plumbing principles and safety protocols. 2.D

E **Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.** 2.E

F **Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.** 2.F

KNOWLEDGE AND SKILLS 3

A **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:** 3.A

1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work. 3.A.1
2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn. 3.A.2
3. Employ effective reading, writing, and technical documentation skills. 3.A.3
4. Solve problems using critical thinking techniques and structured troubleshooting methodologies. 3.A.4
5. Demonstrate leadership skills and collaborate effectively as a team member. 3.A.5
6. Implement safety procedures, including proper handling of hardware and following OSHA guidelines. 3.A.6
7. Exhibit an understanding of legal and ethical responsibilities in the construction field, following applicable laws and best practices for safety. 3.A.7
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting. 3.A.8

B **The student identifies various career pathways in the Plumbing field. The student is expected to:** 3.B

1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles as an Carpenter or in the Plumbing field. 3.B.1
2. Create a professional resume and portfolio that reflect skills, projects, certifications, and recommendations. 3.B.2
3. Demonstrate effective interview skills for roles in the Plumbing field. 3.B.3

C **The student identifies the issues associated with Plumbing hazards found on a jobsite. The student is expected to:** 3.C

1. Demonstrate safe working procedures in a construction environment. 3.C.1

Skip to main content

2 Explain the purpose of the Occupational Safety and Health Administration (OSHA) and how it promotes safety on the job. 3.C.2

3 Identify Plumbing hazards and how to avoid or minimize them in the workplace. 3.C.3

4 Explain safety issues concerning lockout and tagout procedures, personal protection using assured grounding and isolation programs, confined space entry, respiratory protection, and fall protection. 3.C.4

D The student integrates core academic skills into Plumbing construction practices. The student is expected to: 3.D

1 Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards. 3.D.1

2 Apply mathematical concepts including basic geometric principles, measuring techniques, and conversion between different measurement systems. Students learn to calculate pipe lengths, fitting allowances, and end-to-end dimensions for basic pipe installations. Mathematical concepts are applied to determine proper sizing for water supply lines, pipe grade calculations for drainage systems, and basic material takeoff calculations from construction drawings. 3.D.2

3 Use scientific principles including physical properties of different piping materials (plastic, copper, cast iron, and steel) and their applications. The curriculum covers fundamental concepts of water pressure, flow, and gravity in relation to drain, waste, and vent (DWV) systems. Basic principles of hydraulics are introduced through the study of water distribution systems. Students learn about the effects of temperature on different materials and basic principles of water treatment and distribution. 3.D.3

E The student demonstrates understanding of the plumbing profession and workplace safety. The student is expected to: 3.E

1 Describe the history and current state of the plumbing profession. 3.E.1

2 Identify career opportunities and professional characteristics in plumbing. 3.E.2

3 Explain the causes and costs of workplace accidents and how they may be prevented in practice. 3.E.3

4 Demonstrate proper setup and clean-up of work sites to minimize potential injuries and damage of surrounding areas. 3.E.4

5 Demonstrate proper use of personal protective equipment (PPE). 3.E.5

6 Apply hazard communication and work zone safety procedures. 3.E.6

7 Implement proper safety precautions for hand and power tools. 3.E.7

8 Identify specific safety hazards encountered in existing building repairs; i.e. asbestos, lead, mold, etc. 3.E.8

9 Demonstrate emergency response procedures for repair situations that include water damage control, gas leaks, and other common residential and commercial applications. 3.E.9

Skip to main content

10 Identify safety protocols specific to occupied building repairs and renovations. 3.E.10

11 Demonstrate understanding of trenching, confined space, and underground work safety. 3.E.11

12 Execute proper lockout/tagout procedures. 3.E.12

F The student identifies and properly uses plumbing tools and equipment. The student is expected to: 3.F

1 Identify and demonstrate proper use of basic diagnostic and hand tools in plumbing to include pipe cameras, leak detectors, moisture meters, etc. 3.F.1

2 Demonstrate basic drain clearing techniques and use of related tools/equipment. 3.F.2

3 Select and use appropriate measuring and layout tools. 3.F.3

4 Demonstrate proper use of leveling tools and techniques. 3.F.4

5 Apply proper techniques for cutting tools and pipe assembly tools. 3.F.5

6 Operate power tools safely according to manufacturer specifications. 3.F.6

7 Perform proper maintenance and storage of hand and power tools. 3.F.7

G The student applies mathematical concepts in plumbing applications. The student is expected to: 3.G

1 Perform calculations using whole numbers, fractions, and decimals. 3.G.1

2 Demonstrate mathematical conversions and use of the metric system. 3.G.2

3 Demonstrate the use of common measuring tools and techniques. 3.G.3

4 Calculate squares and square roots in plumbing applications. 3.G.4

5 Identify parts of fittings and related dimensions. 3.G.5

6 Calculate pipe lengths using various measurement methods. 3.G.6

7 Determine end-to-end dimensions using fitting allowances. 3.G.7

8 Perform cost analysis comparing repair vs. replace where applicable. 3.G.8

Skip to main content

H **The student interprets plumbing drawings and documentation. The student is expected to:** 3.H

1. Identify elements and components of construction drawings. 3.H.1
2. Interpret drawing scales, dimensions, and symbols. 3.H.2
3. Explain the role of construction documents in plumbing. 3.H.3
4. Create mechanical, site, isometric and/or orthographic drawings applicable to the industry. 3.H.4
5. Read and interpret plumbing-specific drawings including submittals and fixture drawings. 3.H.5
6. Create modification plans that integrate new components with existing systems. 3.H.6

I **The student demonstrates proficiency with piping materials and installation techniques. The student is expected to:** 3.I

1. Identify and explain applications for different piping materials to include modern and historical industry related materials; i.e. plastic, copper, cast iron, steel, lead, terra cotta, orangeberg piping, etc. 3.I.1
2. Interpret pipe sizing and labeling conventions for various materials. 3.I.2
3. Select appropriate fittings and valves for different applications. 3.I.3
4. Apply proper measuring, cutting, and joining techniques for each pipe material. 3.I.4
5. Install and support horizontal and vertical pipe runs. 3.I.5
6. Perform pressure testing on installed piping systems. 3.I.6
7. Identify and effectively work with historical materials that are no longer used in new construction, but are still prevalent in homes, offices, and buildings. 3.I.7

J **The student understands plumbing fixtures and their applications. The student is expected to:** 3.J

1. Identify materials used in manufacturing plumbing fixtures. 3.J.1
2. Describe common bathroom and kitchen fixtures. 3.J.2
3. Explain operating principles of water closets and other fixtures. 3.J.3
4. Compare different types of faucets including compression and non-compression. 3.J.4
5. Demonstrate knowledge of fixture installation requirements. 3.J.5

K **The student comprehends drain, waste, and vent (DWV) systems. The student is expected to:** 3.K

1. Explain the benefits and components of DWV systems. 3.K.1
2. Identify types and parts of traps and their installation requirements. 3.K.2
3. Select and apply appropriate DWV fittings for various applications. 3.K.3

Skip to main content

4 Describe sewer connections and waste disposal systems. 3.K.4

5 Apply plumbing codes related to DWV system construction. 3.K.5

6 Create isometric drawings of DWV systems. 3.K.6

L The student analyzes water distribution systems. The student is expected to: 3.L

1 Describe municipal, residential, and private water distribution systems. 3.L.1

2 Explain water sources and treatment processes. 3.L.2

3 Identify and explain functions of system components. 3.L.3

4 Apply backflow prevention principles and methods. 3.L.4

5 Select appropriate valves for water distribution systems. 3.L.5

6 Calculate proper sizing for main supply lines. 3.L.6

7 Create isometric drawings of water distribution systems. 3.L.7