

Colorado CTE Course – Scope and Sequence

Course Name	Plumbing Technology II		Course Details	Credit: 1.0- 2.0 Prerequisite: Plumbing Technology I CTE Credential: CTE Architecture and Construction	
			Course = 0.50 Carnegie Unit Credit		
Course Description	In Plumbing Technology II, students will gain the advanced knowledge and skills needed to enter the industry as a plumber, building maintenance technician, or supervisor or prepare for a postsecondary degree in mechanical engineering. Students will acquire knowledge and skills in plumbing codes, industry workplace basics, and employer/customer expectations, including tool and jobsite safety, advanced plumbing mathematics, commercial drawings, basic electricity, hanger installation, supports and structural penetrations, roof drains, fixture installation, valves and faucets, and oxy-fuel safety. Students will also learn about setup, cutting, brazing, and welding water system sizing; gas, drain, waste and vent installation and testing; and water heater installation.				
Note:	This is a suggested scope and sequence for the course content. The content will work with any textbook or instructional resource. If locally adapted, make sure all essential knowledge and skills are covered.				
SCED Identification #	17058	Schedule calculation based on 60 calendar days of a 90-day semester. Scope and sequence allows for additional time for guest speakers, student presentations, field trips, remediation, or other content topics.			
All courses taught in an approved CTE program must include Essential Skills embedded into the course content. The Essential Skills Framework for this course can be found at https://www.cde.state.co.us/standardsandinstruction/essentialskills					
Instructional Unit Topic	Suggested Length of Instruction	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration
Professional Employability Skills		Demonstrates professional standards/employability skills as required by business and industry.	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to: (A) use industry standards to demonstrate oral		

			communication, written communication, leadership, teamwork, conflict management, customer service, professionalism, work ethic, integrity, multitasking, initiative, creativity, and how to follow directions; (B) demonstrate an understanding of the importance of showing up to work on time, maintaining appropriate personal appearance, working as a team member, and being honest; (C) demonstrate an understanding of the responsibilities of driving a company vehicle; (D) demonstrate an understanding of why and how listening is a critical skill; and (E) demonstrate an understanding of the importance of being a self-starter and of increasing one's		
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			knowledge and skills in a chosen career field.		
Career Development		Develop career understanding and readiness. Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.	The student reviews employer and customer expectations. The student is expected to: (A) identify job opportunities such as a plumber, building maintenance technician or supervisor, manager, and mechanical engineer and their accompanying job duties; (B) research careers along with the education, job skills, and experience required to achieve career goals; (C) identify the industries and associations that make up the modern plumbing profession; (D) demonstrate an understanding of how to properly treat company and customer property; (E) demonstrate an understanding of the importance of keeping the work area clean and	Continually reflect on coursework experiences and revise and refine the career plan generated in prior courses. Create a portfolio of work accomplished. Include photographs or illustrations and written descriptions of sequential progress in construction projects. Research local job and internship opportunities and requirements. Update resume and practice job interview skills.	Updates to ICAP SkillsUSA Personal and Employability Skills Framework SkillsUSA Plumbing Competition

			how that applies to job safety; and (F) demonstrate an understanding of the importance of using proper methods and techniques for the job being performed.		
Plumbing Tools and Measurements		Select and use tools and equipment appropriately for plumbing systems service and repair applications. Demonstrate an understanding of the scientific theories and physical properties of heat and matter. Apply academic standards to problem-solve issues related to plumbing installation and service. Demonstrate ways to measure and calculate absolute and gauge pressures according to industry standards.	The student identifies and demonstrates the use of hand and power tools such as pipe wrenches; rulers; measuring devices; drill bits; pipe stands; pipe vises; levels; pipe fabrication tools; and pipe cutting, threading, and reaming tools. The student is expected to: (A) demonstrate how to measure with a 6-foot folding rule and 25-foot measuring tape; (B) read and use rulers and measuring devices; (C) demonstrate how to measure end-to-end, center-to-center, and		

			end-to-center pipe measurements; and (D) identify and safely demonstrate the use of selected hand and power tools. (3) The student understands different types of drill bits used in the plumbing profession. The student is expected to: (A) explain the differences among and applications for masonry, twist steel, hole saw, paddle, and self-feeding wood bits; and (B) demonstrate the use and application of masonry, twist steel, hole saw, paddle, and self-feeding wood bits. (4) The student applies algebra and geometry to solve plumbing-related problems. The student is expected to:		
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			(A) demonstrate how to determine the volume of a cylinder; (B) demonstrate how to determine volume and length measurements using cubic feet and yards; (C) demonstrate how to determine fall and grades of a pipe; (D) demonstrate how to calculate simple and rolling offsets on parallel runs using constants; (E) demonstrate how to calculate pressure, velocity, friction, and flow; and (F) size a water system based on velocity limitations and pressure drop.		
Electrical Testing Equipment		Understand and apply electrical testing equipment for plumbing applications.	The student understands and applies electrical testing equipment. The student is expected to: (A) apply the use of a volt/ohm meter to	Identify the safety precautions that must be followed when working on electrical equipment.	

			different kinds of plumbing equipment; (B) install hangers and supports and make penetrations according to plumbing code; (C) demonstrate an understanding of how to choose the right hanger for the application; (D) choose and build pipe supports; (E) demonstrate an understanding of code standards on structural penetrations; and (F) size and install roof drains according to plumbing code.	Perform a continuity test on an electric water heater using an ohmmeter.	
Plumbing Fixtures		Understand installation procedures for common plumbing fixtures.	The student understands and applies how to install plumbing fixtures according to plumbing code. The student is expected to: (A) demonstrate how to install a toilet; and	Identify the pre-installation techniques to follow when installing fixtures and valves. a. Identify ADA requirements for installing fixtures.	

			(B) demonstrate how to install sinks and different faucets.		
Specifications and Blueprints		Understand and apply construction drawings and blueprints to plumbing applications.	The student learns plot plans, structural design, shop drawings, elevation drawings, as-built drawings, equipment arrangement drawings, pipe and instrumentation drawings, isometric drawings, and detail drawings. The student is expected to: (A) identify types of drawings; (B) identify and use drawing symbols associated with piping plans and details; (C) create field sketches; and (D) interpret drawing indexes and line lists.	Create drawings commonly used in the plumbing trade, including orthographic and isometric sketches. Explain the relationship between construction drawings and specifications. Describe how both the construction drawings and specifications provide information about the plumbing system for a building. Examine a set of commercial drawings to identify the types of information included on plumbing and electrical drawings such as the location and size of DWV and water distribution piping and the location of electrical fixtures.	
Valves		Understand plumbing valve components and their applications.	The student installs, stores, and handles various types of valves.	Select a valve for a specific application. a. Identify the pressure ratings for valves. b. Identify the materials used in	

			The student is expected to: (A) identify types of valves that start and stop flow; (B) identify types of valves that regulate flow; (C) identify valves that relieve pressure; (D) identify valves that regulate the direction of flow; (E) identify types of valve actuators; (F) explain how to properly store and handle valves; (G) explain valve locations and positions; (H) explain the factors that influence valve selection; and (I) interpret valve markings and nameplate information.	valves. c. Identify valve sizing requirements.	
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Oxyfuel Torch		Demonstrate the ability to identify and select the appropriate materials for the soldering and brazing of tubing.	The student understands and applies how to braze weld and cut with oxy-fuel torch. The student is expected to: (A) demonstrate an understanding of different parts of oxy-fuel equipment; (B) identify and implement the proper procedure for attaching and adjusting oxy fuel pressure regulators, gauges, hoses, and torches to oxy fuel bottles; (C) identify and apply fillers and fluxes for soldering and brazing; and (D) demonstrate an understanding of safety and safety equipment used with oxy-fuel equipment.		
Residential Installations		Demonstrate skills necessary to fabricate and service the tubing, piping, and fittings utilized in accordance with accepted industry standards.	The student understands and applies how to size, install, and test a residential water piping system according to		

		Understand the regulatory code applications and standards for construction plumbing systems.	plumbing code. The student is expected to: (A) identify what factors are critical for sizing a water system such as water pressure, velocity, friction, and flow; (B) identify what fixture units are and how they apply to sizing a water system; (C) install a water piping system; and (D) test a water piping system.		
Cross-connection Issues		Understand cross-contamination issues and hazards of plumbing systems.	The student understands what cross connections are and their degree of hazard and how to protect against them. The student is expected to: (A) identify different types of backflow such as gravity, back-pressure, and back siphonage; (B) demonstrate an understanding of degree of hazard such as toxic,		

			nontoxic, polluted, and contaminated; and (C) demonstrate an understanding of cross connection protection such as air gap, reduced pressure zone backflow preventer, double check valve assembly, pressure type vacuum breaker, and atmospheric type vacuum breaker.		
Natural Gas		Understands installation and testing of a natural gas system according to plumbing code.	The student understands and applies how to size, install, and test a natural gas system according to plumbing code. The student is expected to: (A) identify the factors involved in sizing a natural gas system; and (B) size, install, and test a natural gas system using carbon steel pipe and corrugated stainless steel tubing.	Identify the safety precautions and potential hazards associated with fuel systems. Discuss how local codes apply to various fuel gas systems. Perform an air test or visual inspection of a connected fuel gas system. Size and purge a fuel gas system. Verify the pressure and test the system.	
Drain, Waste, and Vent Systems		Understand how pipes, drains, traps, and vents work and the different types of materials used for drain waste and vent (DWV) piping.	The student understands how to size, install, and test a drain waste and vent (DWV) system according to plumbing	Complete a material takeoff for drainage, waste, and vent (DWV) and water supply systems from information shown on drawings. a. Create an isometric drawing.	

		Understand the installation and testing procedures for drain waste and vent (DWV) systems according to plumbing code.	code. The student is expected to: (A) identify different types of DWV fittings and their use; (B) size a DWV system; (C) identify and apply different materials used for a DWV system; (D) determine slope of a pipe using formulas; (E) demonstrate an understanding of how to test a DWV system; and (F) demonstrate an understanding of the different parts and their purpose of a DWV system such as stacks, vents, traps, building drain, and building sewer.	Locate plumbing entry points on the site plan provided. Demonstrate the ability to correctly size and install a building sewer and a building drain, and final connection.	
Water heaters		Understand proper installation of different types of water heaters and their parts according to plumbing code.	The student understands different types of water heaters, water heaters parts, and their proper installation according to plumbing code. The student is expected to: (A) demonstrate an understanding of storage	Identify the basic operation and components of various water heaters. Identify the safety hazards associated with water heaters. Install a water heater according to code specifications.	

			tank (electric and gas), point of use, on demand (electric and gas), and solar water heaters; (B) demonstrate an understanding of parts of the different heaters; and (C) demonstrate an understanding of the installation of a gas and electric water heater.		
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[CO CTE Academic Standards Resources](#) (Rubrics, integration strategies, etc) [CDE Colorado Academic Standards Online](#) (Online standards lookup tool)

Reading, Writing, & Communicating

Standard 1: Oral Expression and Listening

- **Prepared Graduate 1:** Collaborate effectively as group members or leaders who listen actively and respectfully; pose thoughtful questions, acknowledge the ideas of others; and contribute ideas to further the group's attainment of an objective.
- **Prepared Graduate 2:** Deliver effective oral presentations for varied audiences and varied purposes.

Standard 2: Reading for All Purposes

- **Prepared Graduate 4:** Read a wide range of informational texts to build knowledge and to better understand the human experience.

- **Prepared Graduate 5:** Understand how language functions in different contexts, command a variety of word-learning strategies to assist comprehension, and make effective choices for meaning or style when writing and speaking.

Standard 3: Writing and Composition .

- **Prepared Graduate 8:** Craft narratives using techniques specific to the genre.
- **Prepared Graduate 9:** Demonstrate mastery of their own writing process with clear, coherent, and error-free polished products.

Standard 4: Research Inquiry and Design

- **Prepared Graduate 10:** Gather information from a variety of sources; analyze and evaluate its quality and relevance; and use it ethically to answer complex questions.

Note: Mathematics and Science standards will be added in the future. Visit the [Colorado Academic Standards](#) page for the most current version