

PLUMBING II

COURSE DESCRIPTION

Plumbing II is a course in which students will extend their skills and knowledge related to residential and light commercial plumbing. Topics covered include physics principles, fuel piping systems, pressure reducers, backflow prevention devices, troubleshooting and repair, DWV piping, vents, and drainage. This course gives students a substantial skill and knowledge foundation typically required for apprentice plumbers.

It is strongly recommended that administration and guidance follow the scope and sequence and course recommendations as listed.

Recommended: Construction Core, Plumbing I, Algebra I, Geometry, and Physical Science

Recommended Credits: 2

Recommended Grade Level(s): 11th 12th

Number of Competencies in Course: 84

PLUMBING II

STANDARDS

- 1.0 Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.
- 2.0 Students will assume responsibility for the safety of themselves, their coworkers, and bystanders.
- 3.0 Students will use common equipment to calculate plumbing math problems.
- 4.0 Students will read and interpret commercial drawings.
- 5.0 Students will identify and install hangers, supports, structural penetrations, and fire stopping.
- 6.0 Students will install and test DWV piping.
- 7.0 Students will install roof, floor, and area drains.
- 8.0 Students will identify and describe types of valves.
- 9.0 Students will install and test water supply piping.
- 10.0 Students will install fixtures, valves, and faucets.
- 11.0 Students will describe, calculate, and demonstrate basic electricity.
- 12.0 Students will describe the process of installing water heaters and install them.
- 13.0 Students will identify fuel gas systems and connect appliances to fuel gas systems.
- 14.0 Students will service fixtures, valves, and faucets.

PLUMBING II

STANDARD 1.0

Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

LEARNING EXPECTATIONS

The student will:

- 1.1 Demonstrate leadership skills.
- 1.2 Use problem-solving techniques to address and propose solutions to school, community, and workplace problems.
- 1.3 Demonstrate the ability to work professionally with others.
- 1.4 Participate in SkillsUSA as an integral part of instruction.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 1.1A Exhibits integrity and pride in the practice and quality of work.
- 1.1B Keeps group work focused on task.
- 1.2A Determines the root causes of observed conflicts or problems.
- 1.2B Mediates disputes between parties.
- 1.3A Participates in a job shadowing experience.
- 1.3B Assembles a student team to solve an assigned problem.
- 1.4 Attends and participates in periodic meetings of SkillsUSA or similar organization.

SAMPLE PERFORMANCE TASKS

These are sample projects of the type and scale recommended to address one or more of the learning expectations for this standard. Other projects can be used at the instructor's discretion.

- Prepare a resume.
- Participate in various SkillsUSA or similar programs and/or competitive events.
- Attend a professional organization meeting, such as local Chamber of Commerce meeting.
- Participate in the American Spirit Award competition with SkillsUSA.
- Participate in job shadowing or internship program with local business or industry.
- Take an active role in a group project assigned by the instructor.
- Identify and detail a problem area in the school, community, or workplace, and propose solutions. If possible, and with appropriate approvals, implement or facilitate the solution.

INTEGRATION LINKAGES

Science; Computer Skills; Research and Writing Skills; Language Arts; Communication Skills; Leadership Skills; Teamwork Skills; English; Secretary's Commission on Achieving Necessary Skills (SCANS); SkillsUSA; SkillsUSA *Professional Development Program* (PDP); Associated Builders and Contractors (ABC); Associated General Contractors (AGC); MAVCC; National Center for Construction Education and Research (NCCER); United States Department of Labor; Tennessee Department of Labor and Workforce Development; Plumbing, Heating, and Cooling Contractors (PHCC)

PLUMBING II

STANDARD 2.0

Students will assume responsibility for the safety of themselves, their coworkers, and bystanders.

LEARNING EXPECTATIONS

The student will:

- 2.1** Exhibit and encourage in others a positive attitude regarding safety practices and issues.
- 2.2** Habitually inspect and use appropriate personal protective equipment for assigned tasks.
- 2.3** Inspect, maintain, and employ safe operating procedures with tools and equipment, such as soldering and brazing equipment, lifting equipment, and high pressure gas containers.
- 2.4** Exhibit a well-developed awareness of potential hazards to self and others.
- 2.5** Carry out responsibilities under HazCom (Hazard Communication) regulations.
- 2.6** Take action to protect coworkers and bystanders from hazards as required by regulations and Occupational Safety and Health Administration (OSHA) policies.
- 2.7** Report accidents and observed hazards and execute emergency response procedures as required by regulations, and Occupational Safety and Health Administration (OSHA) policies.
- 2.8** Demonstrate appropriate related safety procedures.
- 2.9** Pass with 100 % accuracy a written examination relating to plumbing safety issues.
- 2.10** Pass with 100% accuracy a performance examination relating to plumbing safety.
- 2.11** Maintain a portfolio record of written safety examinations and equipment examinations for which the student has passed an operational checkout by the instructor.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 2.1A** Includes safety procedures in activity plans.
- 2.1B** Exhibits an awareness of proper safety procedures by coworkers.
- 2.1C** Responds positively to instruction, advice, and correction regarding safety issues.
- 2.1D** Reports to school or work physically ready to perform to professional standards, such as rested, or not impaired by medications, drugs, or alcohol.
- 2.2** Selects, inspects, and uses the correct personal protective equipment for the assigned task.
- 2.3A** Checks soldering and brazing torches for leaks, prior to use.
- 2.3B** Inspects extension cords for the presence of a functional ground connection, prior to use.
- 2.3C** Properly caps and handles compressed gas, fuel, and refrigerant tanks.
- 2.4A** Is observant of personnel and activities in the vicinity of the work area.
- 2.4B** Warns nearby personnel, prior to starting potentially hazardous actions.
- 2.5A** Applies information from MSDSs (material safety data sheets) to protect self and others from the health hazards associated with assigned tasks.
- 2.5B** Reports hazards found on the job site to the supervisor and remedies the hazard as instructed.
- 2.6A** Monitors air quality during soldering and brazing operations.
- 2.6B** Provides and activates adequate ventilation equipment as required by the task.
- 2.7A** Reports all injuries and observed unguarded hazards to the immediate supervisor.
- 2.7B** Executes assigned tasks as described in emergency response procedures.
- 2.8A** Is observant of safety issues and concerns relevant to the construction industry.
- 2.8B** Complies with all safety guidelines and regulations set forth by industry and OSHA.
- 2.9** Passes with 100 % accuracy a written examination relating to plumbing safety issues.
- 2.10** Passes with 100% accuracy a performance examination relating to plumbing safety.
- 2.11** Maintains a portfolio record of written safety examinations and equipment examinations

for which the student has passed an operational checkout by the instructor.

SAMPLE PERFORMANCE TASKS

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- Prior to assigning a task using power tools, the instructor removes some required safety items and instructs students to perform an inspection of tools.
- Instruct a visitor to obviously approach the vicinity of a student conducting a hazardous activity and note the level of awareness demonstrated by the student.
- In a project requiring solvents or adhesives, introduce a new brand or type; require students to retrieve the MSDS and identify possible health hazards.

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PLUMBING II

STANDARD 3.0

Students will use common equipment to calculate plumbing math problems.

LEARNING EXPECTATIONS

The student will:

- 3.1** Calculate 45-degree offsets around obstructions.
- 3.2** Calculate rolling offsets using constants for the angled fittings.
- 3.3** Calculate various degree parallel offsets.
- 3.4** Calculate rolling offsets using a framing square.
- 3.5** Check the squareness of a corner using the 3-4-5 ratio.
- 3.6** Lay out square corners using the 3-4-5- ratio.
- 3.7** Use a framing square to find the travel.
- 3.8** Use a folding rule to find given angles.
- 3.9** Calculate various degree offsets.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 3.1** Demonstrates the steps needed to calculate a 45-degree offset around an obstruction. Create a list of tools/charts needed for this.
- 3.2** Determines the length of pipe fittings installed after calculating the offset.
- 3.3** Using appropriate charts, calculates, fabricates, and installs a 60-degree simple and parallel offset.
- 3.4** Calculates the rolling offset using a framing square.

SAMPLE PERFORMANCE TASKS

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Follow performance tasks in your test booklet.

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PLUMBING II

STANDARD 4.0

Students will read and interpret commercial drawings.

LEARNING EXPECTATIONS

The student will:

- 4.1 Interpret information from given site plans.
- 4.2 Verify dimensions shown on drawings and generate a request for information (RFI) when discrepancies are found.
- 4.3 Locate plumbing entry points, walls, and chases.
- 4.4 Use approved submittal data, floor plans, and architectural details to lay out fixture rough-ins, to develop estimates, and to establish general fixture locations.
- 4.5 Do a material takeoff for drainage, waste, and vent (DWV) and water supply systems from information shown on drawings.
- 4.6 Create an isometric drawing.
- 4.7 Recognize the need for coordination and shop drawings.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 4.1 Using a site plan, interprets or explains information as required by the instructor.
- 4.2 Write an RFI.
- 4.3 Using the site plan provided, locates plumbing entry points.
- 4.4 Uses cut sheets and floor plans to lay out fixture rough-ins.
- 4.5 Does a material takeoff for DWV and water supply systems. Sizes pipes according to the local code.
- 4.6 Creates an isometric drawing.

SAMPLE PERFORMANCE TASKS

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PLUMBING II

STANDARD 5.0

Students will identify and install hangers, supports, structural penetrations and fire stopping.

LEARNING EXPECTATIONS

The student will:

- 5.1 Install pipe hangers and supports correctly according to local applicable codes and manufacturer's specifications.
- 5.2 Modify structural members using the appropriate tools without weakening the structure.
- 5.3 Identify and install common types of fire-stopping materials used in penetrations through fire-rated structural members, walls, floors and ceilings.
- 5.4 Identify the hangers and supports used to install DWV and water supply systems and explain their applications.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 5.1 Installs pipe hangers and supports for DWV and water supply systems according to local applicable codes and manufacturer's specifications.
- 5.2 Modifies structural members using the appropriate tools and without weakening the structure.
- 5.3 Installs common types of fire-stopping materials in penetrations through fire-rated structural members, walls, floors, and ceilings.

SAMPLE PERFORMANCE TASKS

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PLUMBING II

STANDARD 6.0

Students will install and test DWV piping.

LEARNING EXPECTATIONS

The student will:

- 6.1** Develop a material takeoff from a given set of plans.
- 6.2** Use plans and fixture rough-in sheets to determine location of fixtures and route of the plumbing.
- 6.3** Locate the stack within the structure.
- 6.4** Install a DWV system using appropriate hangers and correct grade or slope.
- 6.5** Modify structural members using the appropriate tools without weakening the structure.
- 6.6** Install a building sewer and a building drain.
- 6.7** Test a DWV system.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 6.1** Develops a material takeoff from a given set of plans.
- 6.2** Uses plans and fixture rough-in sheets to determine location of fixtures and route of the plumbing.
- 6.3** Locates the stack within the structure.
- 6.4** Demonstrates an ability to install a DWV system using appropriated hangers and correct grade.
- 6.5** Modifies structural members using the appropriate tools without weakening the structure following the applicable code.
- 6.6** Demonstrates the ability to correctly size and install a building sewer and a building drain, and final connection.
- 6.7** Test a DWV system according to code.

SAMPLE PERFORMANCE TASKS

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Follow performance tasks in your test booklet.

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PLUMBING II

STANDARD 7.0

Students will install roof, floor, and area drains.

LEARNING EXPECTATIONS

The student will:

- 7.1 Use a surveyor's level or transit level to set the elevation of a floor or area drain.
- 7.2 Install a roof drain, a floor drain, and an area drain.
- 7.3 Install waterproof membranes and flashing.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 7.1 Uses a surveyor's level or transit level to set the elevation of a floor or area drain.
- 7.2 Installs a roof drain, a floor drain and an area drain.
- 7.3 Installs waterproof membranes and flashing.

SAMPLE PERFORMANCE TASKS

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PLUMBING II

STANDARD 8.0

Students will identify and describe types of valves.

LEARNING EXPECTATIONS

The student will:

- 8.1** Identify the basic types of valves.
- 8.2** Describe the differences in pressure ratings for valves.
- 8.3** Demonstrate the ability to service various types of valves.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 8.1** Identifies types of valves.
- 8.2** Identifies parts of valves.
- 8.3** Identifies applications of valves.

SAMPLE PERFORMANCE TASKS

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PLUMBING II

STANDARD 9.0

Students will install and test water supply piping.

LEARNING EXPECTATIONS

The student will:

- 9.1 Locate and size a water meter.
- 9.2 Develop a material takeoff from a given set of plans.
- 9.3 Use plans and fixture rough-in sheets to determine the location of fixtures and the route of water supplying pipe.
- 9.4 Modify structural members, using the appropriate tools, without weakening the structure.
- 9.5 Correctly size and install a water service line, including backflow prevention.
- 9.6 Test a water supply system.
- 9.7 Locate a water heater, water softener, and hose bibs.
- 9.8 Install a water distribution system using appropriate hangers.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 9.1 Demonstrates the ability to locate a water meter.
- 9.2 Develops a water supply piping material takeoff from a given set of plans.
- 9.3 Using instructor-provided plans and fixture rough-in sheets, determines location of fixtures and route of the water supply piping.
- 9.4 Describes procedures for modifying a structural member without weakening it, using the appropriate procedures and codes.
- 9.5 Demonstrates the ability to correctly size and install a water service line including backflow preventer.
- 9.6 Describes how to properly test a water supply system.

SAMPLE PERFORMANCE TASKS

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PLUMBING II

STANDARD 10.0

Students will install fixtures, valves, and faucets.

LEARNING EXPECTATIONS

The student will:

- 10.1** Describe the general procedures you should follow before installing any fixture.
- 10.2** Install bathtubs, shower stalls, valves and faucets.
- 10.3** Install lavatories, sinks, and pop-up drains.
- 10.4** Install water closets and urinals.
- 10.5** Protect fixtures.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 10.1** Demonstrates how to protect fixtures after delivery and before occupancy.
- 10.2** Demonstrates the ability to install bathtubs, shower stalls, valves, and bath-shower faucets.
- 10.3** Demonstrates the ability to install lavatories, sinks, sink faucets, and pop-up drains.
- 10.4** Demonstrates the ability to install water closets, urinals, and test valves.

SAMPLE PERFORMANCE TASKS

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INTEGRATION/LINKAGES

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PLUMBING II

STANDARD 11.0

Students will describe, calculate, and demonstrate basic electricity.

LEARNING EXPECTATIONS

The student will:

- 11.1** Make voltage, current, and resistance measurements using electrical test equipment.
Determine the positioning of leads. Test a fuse for continuity.
- 11.2** Describe the difference between series and parallel circuits.
- 11.3** Use the power formula to calculate how much power is consumed by a circuit.

- 11.4 State and demonstrate the safety precautions that must be followed when working on electrical equipment.
- 11.5 State how electrical power is generated and distributed.
- 11.6 Describe how voltage, current, resistance, and power are related.
- 11.7 Use Ohm's law to calculate how much is consumed by a circuit.
- 11.8 Recognize and describe the purpose and operation of the various electrical components used in plumbing equipment.
- 11.9 Explain and understand electrical symbols.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 11.1 Demonstrates use of an Ohmmeter.
- 11.2 Describes the difference between a series and a parallel circuit.
- 11.3 Demonstrates use of power formulas.
- 11.4 States and demonstrates performance requirements.

SAMPLE PERFORMANCE TASKS

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INTEGRATION LINKAGES

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PLUMBING II

STANDARDS 12.0

Students will describe the process of installing water heaters and install them.

LEARNING EXPECTATIONS

The student will:

- 12.1 Identify and explain the functions of the basic components of water heaters.
- 12.2 Install an electric water heater.
- 12.3 Install a gas water heater.
- 12.4 Describe the basic operation of water heaters.
- 12.5 Describe the safety hazards associated with water heaters.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 12.1** Identifies and explains the basic functions of the components of water heaters.
- 12.2** Demonstrates how to install an electric water heater.
- 12.3** Demonstrates how to install a gas water heater.

SAMPLE PERFORMANCE TASKS

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Follow performance tasks in your test booklet.

INTEGRATION LINKAGES

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PLUMBING II

STANDARDS 13.0

Students will identify fuel gas systems and connect appliances to fuel gas systems.

LEARNING EXPECTATIONS

The student will:

- 13.1** Connect appliances to the fuel gas system properly.
- 13.2** Design, size, purge, and test fuel gas systems.
- 13.3** Identify the major components of the following fuel systems and describe the function of each component: natural gas, LP gas (liquefied petroleum gas), fuel oil.
- 13.4** Identify the physical properties of each type of fuel.
- 13.5** Identify the safety precautions and potential hazards associated with each type of fuel system.
- 13.6** Apply local codes to various fuel gas systems.
- 13.7** Demonstrate familiarity with applicable fuel gas codes.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 13.1** Properly connects appliances to the fuel gas system.
- 13.2** Designs, sizes, purges, and tests fuel gas systems.

SAMPLE PERFORMANCE TASKS

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PLUMBING II

STANDARDS 14.0

Students will service fixtures, valves, and faucets.

LEARNING EXPECTATIONS

The student will:

14.1 Identify common repair and maintenance requirements for fixtures, valves, and faucets.

14.2 Identify the proper procedures for repairing and maintaining fixtures, valves, and faucets.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

14.1 Diagnoses the cause of problems in fixtures, valves, and faucets requiring repair or maintenance.

14.2 Repairs fixtures using the proper tools and replacement parts.

14.3 Use manufacturer's instructions to disassemble and reassemble a valve.

SAMPLE PERFORMANCE TASKS

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SAMPLING OF AVAILABLE RESOURCES

- *Core Curriculum*, National Center for Construction Education and Research (NCCER), Prentice Hall, Upper Saddle River, NJ; ©2000. Also known as the “Wheels of Learning” materials.
- *Plumbing Level One*, National Center for Construction Education and Research (NCCER), Prentice Hall, Upper Saddle River, NJ; ©2000. Also known as the “Wheels of Learning” materials.
- *Plumbing Level Two*, National Center for Construction Education and Research (NCCER), Prentice Hall, Upper Saddle River, NJ; ©2001. Also known as the “Wheels of Learning” materials.
- *Plumbing Level Three*, National Center for Construction Education and Research (NCCER), Prentice Hall, Upper Saddle River, NJ; ©1993. Also known as the “Wheels of Learning” materials.
- *Plumbing Level Four*, National Center for Construction Education and Research (NCCER), Prentice Hall, Upper Saddle River, NJ; ©1993. Also known as the “Wheels of Learning” materials.
- *Oxyacetylene Welding and Oxyfuel Cutting 3rd Edition*, MAVCC, Oklahoma Department of Vocational and Technical Education ©2004
- *Introduction to Plumbing*, MAVCC, Oklahoma Department of Vocational and Technical Education
- *Residential Plumbing*, MAVCC, Oklahoma Department of Vocational and Technical Education ©1998
- *Fundamentals of Construction*, MAVCC, Oklahoma Department of Vocational and Technical Education
- *Basic Drafting*, MAVCC, Oklahoma Department of Vocational and Technical Education
- *Modern Plumbing*, Goodheart-Willcox Company Inc. Tinley Park, IL. ©2005
- *Print Reading for Construction*, Walter C. Brown and Daniel P Dorfmuehler, Goodheart-Willcox, © 2005
- *Total Quality Curriculum*, National SkillsUSA
- *Professional Development Program (PDP)*, National SkillsUSA—www.vica.org
- Plumbing-Heating-Cooling-Contractors (PHCC), www.phccweb.org
- United States Department of Labor, www.dol.gov
- United States Department of Labor, Occupational Outlook Handbook, www.dol.gov (link)

- Secretary's Commission on Achieving Necessary Skills, www.dol.gov (link)
- Occupational Safety and Health Administration (OSHA), www.osha.gov
- Environmental Protection Agency (EPA), www.epa.gov
- National Safety Council, www.nsc.org
- National Skills Standards Board Institute, www.nssb.org
- Vocational Information Center, www.khake.com
- Power Tool Institute (PTI), www.powertoolinstitute.com
- Associated Builders and Contractors, www.abc.org
- Associated General Contractors of America, www.agcofamerica.org
- Building Officials and Code Administration International, www.bocai.org