Florida Department of Education
Curriculum Framework

Program Title: **Plumbing**
Program Type: **Career Preparatory**
Career Cluster: **Architecture & Construction**

Career Certificate Program	
Program Number	C500500
CIP Number	0646050312
Grade Level	30, 31
Standard Length	1080 Hours
Teacher Certification	Refer to the **Program Structure** section.
CTSO	SkillsUSA
SOC Codes (all applicable)	47-3015 - Helpers—Pipelayers, Plumbers, Pipefitters, and Steamfitters 47-2152 - Plumbers, Pipefitters, and Steamfitters
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

Purpose

The purpose of the programs in this cluster is to prepare students for employment or advanced training in a variety of pipe occupations.

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Architecture and Construction career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Architecture and Construction career cluster.

The content includes but is not limited to reading construction documents, understanding building codes in the pipe trades, plumbing pipe-cutting-and-joining skills and plumbing layout and installation.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points. The recommended sequence allows students to complete specified portions of the program for employment or to remain for advanced training. A student who completes the applicable competencies at any occupational completion point may either continue with the training program or terminate as an occupational completer.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	BCV0508	Helper, Plumber, Pipefitter	PLUMBIN @7 7G BLDG CONST ¶ 7 ¶ G TEC CONSTR ¶ 7 ¶ G	360 Hours	47-3015
B	BCV0540	Residential Plumber		240 Hours	47-2152
C	BCV0562	Commercial Plumber		240 Hours	47-2152
D	BCV0596	Plumbing Applications		240 Hours	47-2152

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0   Describe career and training opportunities in the pipe-trade industry.
02.0   Demonstrate a basic knowledge of the pipe-trade industry.
03.0   Identify the use and care of basic tools in the pipe-trade industry.
04.0   Demonstrate the importance of health, safety and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
05.0   Demonstrate mathematics knowledge and skills.
06.0   Use oral and written communication skills in creating, expressing and interpreting information and ideas.
07.0   Read and interpret construction documents.
08.0   Read and interpret basic pipe-trade codes.
09.0   Demonstrate knowledge of basic plumbing skills.
10.0   Cut and join pipes.
11.0   Demonstrate knowledge of plumbing codes.
12.0   Read and interpret construction documents and specifications.
13.0   Lay out and coordinate a job.
14.0   Install first rough (underground).
15.0   Install second rough (first floor and above).
16.0   Trim out plumbing.
17.0   Explain the importance of employability and entrepreneurship skills.
18.0   Install hot-water-heating and circulating-systems.
19.0   Install interceptors and separators.
20.0   Install a storm drainage system.
21.0   Explain the principles of backflow cross and connection control.
22.0   Explain the process of installing a medical gas system. (optional)
23.0   Explain how Liquid Propane Gas (LPG) and natural gas systems work.
24.0   Repair, service and maintain plumbing systems.
25.0   Explain how to connect residential plumbing to a municipal sewer lateral. (optional)
26.0   Apply plumbing applications to swimming pools and spas. (optional)
27.0   Identify systems and their components.
28.0   Adapt a system design.
29.0   Conduct a site assessment.
30.0   Maintain and troubleshoot a solar thermal system.
31.0   Install solar collectors.

Florida Department of Education
Student Performance Standards

Program Title: Plumbing
Career Certificate Program Number: C500500

Course Number: BCV0508 **Occupational Completion Point: A** **Plumber Helper – 360 Hours – SOC Code 47-3015**

01.0	Describe career and training opportunities in the pipe-trade industry--The student will be able to:
	01.01 Obtain information on current and future job opportunities in the pipe-trade industry and discuss its trends.
	01.02 Describe career ladders (entry, intermediate and technical-level careers) in each of the pipe-trade-industry programs and preparation requirements.
	01.03 Describe advanced-training opportunities, including apprenticeship programs in each of the pipe-trade-industry programs.
02.0	Demonstrate a basic knowledge of the pipe-trade industry--The student will be able to:
	02.01 Discuss the history of pipe trades.
	02.02 Identify pipes, fittings, materials and equipment related to the pipe trades.
	02.03 Identify fixtures and appliances for plumbing, fire-sprinkler fitting, pipe fitting and gas fitting jobs.
	02.04 Define the terms used in the pipe-trade industry.
03.0	Identify the use and care of basic tools in the pipe-trade industry--The student will be able to:
	03.01 Identify and use the basic tools, equipment and materials of the pipe-trade industry.
	03.02 Demonstrate the procedures/techniques for the selection, use, care and storage of tools and equipment.
	03.03 Compare the various tools used for plumbing and pipe fitting.
	03.04 Identify tools and equipment and the safety hazards associated with them.
04.0	Demonstrate the importance of health, safety and environmental management systems in organizations and their importance to organizational performance and regulatory compliance --The student will be able to:
	04.01 Explain the importance of following safety precautions when working in the pipe-trade industry.
	04.02 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.

	04.03	Observe safety precautions.
	04.04	Identify safe working practices and safe working conditions in the pipe-trade industry.
	04.05	Explain emergency procedures to follow in response to workplace accidents.
	04.06	Demonstrate Cardiopulmonary Resuscitation (CPR) techniques.
	04.07	Demonstrate an understanding of when and how to use first aid.
	04.08	Describe "Right-to-Know" Law as recorded in (29 CFR-1910.1200).
05.0	Demonstrate mathematics knowledge and skills--The students will be able to:	
	05.01	Solve problems for volume, weight, area, circumference and perimeter measurements for rectangles, squares and cylinders.
	05.02	Measure tolerances on horizontal and vertical surfaces, using millimeters, centimeters, feet and inches.
	05.03	Analyze and apply data and measurements to solve problems and interpret documents.
	05.04	Solve pipe-trade-related basic math problems, such as piping offset and metric conversion.
	05.05	Calculate material length and bend pipe by hand.
06.0	Demonstrate science knowledge and skills--The student will be able to:	
	06.01	Describe molecular action as a result of temperature and pressure extremes, chemical reaction and moisture content.
	06.02	Identify health-related problems that may result from exposure to work-related chemicals and hazardous materials and describe the proper precautions for handling such materials.
	06.03	Discuss environmental concerns related to hazardous waste and chemical disposal.
	06.04	Explain pressure measurement in terms of Pounds per Square Inch (PSI), inches of mercury and KPA.
	06.05	Explain how to use alternating-current meters and instruments in the pipe trades.
07.0	Read and interpret construction documents --The student will be able to:	
	07.01	Read and interpret measuring devices.
	07.02	Draw and interpret basic isometric sketches.
	07.03	Identify the basic symbols used in the pipe trades.
	07.04	Read and interpret manufacturers' schematics and specifications.

	07.05	Illustrate roof drains, leaders and drainage systems.
08.0	Read and interpret basic pipe-trade codes--The student will be able to:	
	08.01	Describe the importance of following the local, state and national codes for plumbing, gas fitting and/or pipe fitting.
	08.02	Read and interpret current standards and codes for plumbing, gas fitting and/or pipe fitting.
	08.03	Read and interpret basic building codes in the pipe-trade industry.

Course Number: BCV0540
Occupational Completion Point: B
Residential Plumber -- 240 Hours – SOC Code 47-2152

09.0	Demonstrate knowledge of basic plumbing skills--The student will be able to:	
	09.01	Explain the basic theory and principles of plumbing.
	09.02	Identify:
		a. Pipe and fitting
		b. Pipe-joining methods
		c. Plumbing fixtures, appliances, materials and equipment
		d. Valves by type, size, materials and application
10.0	Cut and join pipes--The student will be able to:	
	10.01	Join different types of pipes (including PVC, galvanized, steel, plastic, copper and cast-iron pipes) according to plumbing codes and specifications using various methods including brazing, clamping, compression, threading, flange, flaring, gasket joint, gluing and soldering.
	10.02	Measure, mark and cut different types of pipes using various pipe cutters including one- and four-wheel steel pipe cutters, hack saw and tubing cutter.
	10.03	Thread a steel pipe with a power-driven vise stand or a pipe-threading machine.
	10.04	Demonstrate proficiency in using the tools, following safety practices and procedures.
11.0	Demonstrate knowledge of plumbing codes--The student will be able to:	
	11.01	Describe and explain the purpose of plumbing codes.
	11.02	Apply the basic theory and principles of plumbing in relation to the codes.

	11.03	Read and locate information in the applicable plumbing codes.
	11.04	Define and explain the terms used in the plumbing codes.
	11.05	Explain why the code may supersede the manufacturer's specifications.
12.0	Read and interpret construction documents and specifications--The student will be able to:	
	12.01	Recognize and identify plumbing symbols.
	12.02	Identify basic plumbing systems from the blueprint.
	12.03	From the blueprints and specifications, identify the plumbing fixtures and materials required for the plumbing job.
	12.04	Relate the blueprint to all applicable (local, state and federal) plumbing codes.
	12.05	Cross-reference all working drawings to determine the location and elevation of the piping system and duct work.
	12.06	Demonstrate trade-related computer skills for blueprints and specifications.
13.0	Lay out and coordinate a job--The student will be able to:	
	13.01	Identify specifications.
	13.02	Make a list of materials required to lay out a job.
	13.03	Determine the work aids required and the sequence of installations, according to building plans, specifications and working drawings.
14.0	Install the first rough (underground)--The student will be able to:	
	14.01	Lay out a job on site underground and establish a starting point according to codes and specifications, coordinating with other crafts.
	14.02	Install building drain, waste, vent, storm drainage and water-heating-and-circulating systems.
	14.03	Install distribution systems.
	14.04	Install a temporary water service with backflow prevention.
	14.05	Test and inspect the first rough.
15.0	Install the second rough (first floor and above)--The student will be able to:	
	15.01	Lay out a job on site for the first floor and above according to codes and specifications, coordinating with other crafts.
	15.02	Cut openings in walls and floors to accommodate the pipe and fittings.

	15.03	Install hangers and supports.
	15.04	Install building-drain, waste vent, storm-drainage; and water-heating-and-circulating systems.
	15.05	Install distribution systems.
	15.06	Test and inspect the second rough.
16.0	Trim out plumbing--The student will be able to:	
	16.01	Distribute and place fixtures, appliances and equipment, including safety devices and control.
	16.02	Trim out and install job-site fixtures, appliances and equipment including closet flanges, supply stops on water pipes, lavatory, water closets, showers, kitchen sinks, garbage disposal, ice makers, dishwashers and water heaters.
	16.03	Install backflow assemblies as required.
	16.04	Test and inspect the final installation.
17.0	Explain the importance of employability and entrepreneurship skills--The students will be able to:	
	17.01	Identify and demonstrate positive work behaviors needed to be employable.
	17.02	Develop personal career plan that includes goals, objectives and strategies.
	17.03	Examine licensing, certification and industry credentialing requirements.
	17.04	Maintain a career portfolio to document knowledge, skills and experience.
	17.05	Evaluate and compare employment opportunities that match career goals.
	17.06	Identify and exhibit traits for retaining employment.
	17.07	Identify opportunities and research requirements for career advancement.
	17.08	Research the benefits of ongoing professional development.
	17.09	Examine and describe entrepreneurship opportunities as a career planning option.

Course Number: BCV0562
Occupational Completion Point: C
Commercial Plumber -- 240 Hours – SOC Code 47-2152

18.0	Install hot-water-heating and circulating systems--The student will be able to:

	18.01	Explain the basic theory of domestic hot-water-heating.
	18.02	Design, size and lay out a system.
	18.03	Identify the equipment and materials needed for the job in accordance with job specifications and plumbing codes.
	18.04	Test and inspect the system.
19.0	Install interceptors and separators--The student will be able to:	
	19.01	Identify various types of interceptors and separators.
	19.02	Explain the theory and function of various interceptors and separators.
	19.03	Install and maintain lint and grease traps, gas and oil separators, sand and sediment interceptors.
20.0	Install a storm-drainage system--The student will be able to:	
	20.01	Explain the theory of roof drains, leaders and the storm-drainage system.
	20.02	Size and lay out a storm-drainage system.
	20.03	Identify the materials needed to install a storm-drainage system in accordance with job specifications and plumbing codes.
	20.04	Lay out a job on site according to job specifications and plumbing codes, coordinating with other trades.
	20.05	Test and inspect the systems.
21.0	Explain the principles of backflow and cross-connection control--The student will be able to:	
	21.01	Define backflow and cross-connection control.
	21.02	Describe the importance of backflow and cross-connection control to the health of the public.
	21.03	Identify the proper devices and assemblies for individual applications.
	21.04	Explain the "degree of hazard" principle and how it relates to the installation of devices and assemblies.

Course Number: BCV0596 **Occupational Completion Point: D** **Plumbing Applications -- 240 Hours – SOC Code 47-2152**

22.0	Explain the process of installing a medical gas system (optional)--The student will be able to:	
	22.01	Explain the procedures for:

	a.	Installing a medical gas system in a health-care facility according to applicable plumbing codes.
	b.	Connecting medical equipment, safety devices and controls.
	c.	Testing and inspecting medical gas systems to make sure there is no cross connection and the system is pure.
23.0	Explain how Liquid Propane Gas (LPG) gas and natural gas systems work--The student will be able to:	
	23.01	Identify materials approved for the installation of LPG and natural gas systems.
	23.02	Explain how to size and lay out a job on site according to plumbing codes and manufacturer's specifications.
	23.03	Install distribution systems, including equipment, safety devices and controls.
	23.04	Test and inspect the systems.
24.0	Repair, service and maintain plumbing systems--The student will be able to:	
	24.01	Troubleshoot and diagnose plumbing systems.
	24.02	Repair and replace water service and sanitary lines.
	24.03	Repair and replace water closets, ball cocks, flush valves, floats, lift rods, ball stoppers and trip levers.
	24.04	Repair leaks in traps and faucets.
	24.05	Repair and replace sink strainers.
	24.06	Repair and replace water heaters.
	24.07	Replace and repair fixture water-supply pipes.
	24.08	Reseal water closets to flanges.
	24.09	Test and inspect repaired systems.
	24.10	Clear obstructions from kitchen sink, water closet, bathtub, lavatory and sewer lines, using chemicals and tools.
25.0	Demonstrate how to connect residential plumbing to a municipal sewer lateral (optional)--The student will be able to:	
	25.01	Describe who is allowed (according to municipal codes) to tap into a sewer line.
	25.02	Excavate from the building drain to a sewer lateral.
	25.03	Connect the house drain to the sewer main.

	25.04	Test and inspect the system.
26.0	Apply plumbing applications to swimming pools and spas (optional)--The student will be able to:	
	26.01	Understand piping materials and methods of installation.
	26.02	Select pumps based on swimming pool volume and pump specifications.
	26.03	Determine type of filtration system based on volume and use.
	26.04	Install water-heating-and-circulating systems for swimming pools, hot tubs and spas.
27.0	Identify systems and their components--The student will be able to:	
	27.01	Identify components specific to an active direct solar system. (For example, this would include: collector, tank, pump, controller, sensors, isolation and drain valves, pressure and temperature relief valves, air vent, piping, insulation, flashing, etc. This would apply to the components relevant to each specific type of system.)
	27.02	Identify components specific to an active indirect solar system.
	27.03	Identify components specific to a passive direct solar system.
	27.04	Identify components specific to a passive indirect solar system.
	27.05	Identify components specific to a swimming pool heating solar system.
28.0	Adapt a system design--The student will be able to:	
	28.01	Determine active direct system components' location and system layout and configuration.
	28.02	Determine active indirect system components' location and system layout and configuration.
	28.03	Determine passive direct system components' location and system layout.
	28.04	Determine passive indirect system components' location and system layout and configuration.
	28.05	Determine solar pool system components' location and system layout and configuration.
	28.06	Determine installation sequence to optimize use of time and materials.
	28.07	Inspect all provided system components for damage prior to installation.
29.0	Conduct a site assessment--The student will be able to:	
	29.01	Determine the required installation area, orientation and tilt for proposed collector installation.
	29.02	Establish whether there is suitable installation area with unobstructed solar access for installing collector.

	29.03	Determine the extent of current and future shading for any proposed collector location using typical sun path calculators or similar methods.
	29.04	Determine suitable location for installing all subsystem components (all valves and ancillary equipment required for complete system installation).
	29.05	Verify that system to be installed is appropriate for the building and climate.
	29.06	Verify with the homeowner the proposed location of the collector and other major components.
30.0	Maintain and troubleshoot a solar thermal system--The student will be able to:	
	30.01	Demonstrate proficiency in using tools and materials required for maintenance and troubleshooting.
	30.02	Interpret installation manual, wiring diagrams, drawings and other specifications to plan maintenance or repair work.
	30.03	Determine evaluation points for system monitoring, maintenance and troubleshooting (i.e., sensor calibration, heat exchanger fluid integrity, pump operation).
	30.04	Identify cause of problems based on evaluation results.
	30.05	Determine what repairs or system modifications are needed to restore the system to its baseline operating conditions.
	30.06	Perform any identified repairs or modifications to restore system to manufacturer's or operator's satisfaction.
31.0	Install solar collectors--The student will be able to:	
	31.01	Identify specific manufacturer's mounting design and materials.
	31.02	Identify different collector mounting methods suitable for roof types or other installation areas.
	31.03	Identify different system (in the case of ICS and thermosiphon systems, due to extra weight and components) mounting methods suitable for roof type.
	31.04	Identify locations for roof/ wall, foundation penetrations and structural attachments.
	31.05	Determine multi-collector piping strategy.
	31.06	Install collector mounting device to installation area.
	31.07	Lift collectors to installation area Psychomotor.
	31.08	Attach mounting bracket and struts (if required) to collector.
	31.09	Secure collector to collector mounting device.
	31.10	Connect collector to piping.

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student. Access MyCareerShines by visiting: www.mycareershines.org.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills (if applicable)

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml