

## 2012 Mississippi Curriculum Framework

### Postsecondary Plumbing Technology

(Program CIP: 46.0503 – Plumbing Technology/Plumber)

#### Direct inquiries to

LaNell Kellum, PhD  
Director for Career and Technical Education  
Mississippi Community College Board  
3825 Ridgewood Road  
Jackson, MS 39211  
601.432.6518  
[lkellum@mscjc.edu](mailto:lkellum@mscjc.edu)

Jo Ann Watts, MEd  
Instructional Design Specialist  
Research and Curriculum Unit  
P.O. Drawer DX  
Mississippi State, MS 39762  
662.325.2510  
[jo.watts@rcu.msstate.edu](mailto:jo.watts@rcu.msstate.edu)

#### Published by

Office of Career and Technical Education  
Mississippi Department of Education  
Jackson, MS 39205

Research and Curriculum Unit  
Mississippi State University  
Mississippi State, MS 39762

The Mississippi Department of Education, Office of Career and Technical Education does not discriminate on the basis of race, color, religion, national origin, sex, age, or disability in the provision of educational programs and services or employment opportunities and benefits. The following office has been designated to handle inquiries and complaints regarding the non-discrimination policies of the Mississippi Department of Education: Director, Office of Human Resources, Mississippi Department of Education, 359 North West Street, Suite 203, Jackson, Mississippi 39201, 601.359.3511.

## Acknowledgments

### Writing Team

Barry Evans, Hinds Community College, Pearl, MS

### RCU Staff

Jo Ann Watts, Instructional Design Specialist  
Scott Kolle, Project Manager  
Kristen Dechert, Editor

### Professional Curriculum Advisory Team

Chris Mills, Mills Plumbing, Richland, MS  
Darryl Jamison, VA Medical Center, Jackson, MS  
Mack Williams, Jackson, MS  
Bryan Sanders, Sanders Discount Plumbing, Richland, MS  
Darrell Hoffpauir, A. H. Deveney, Baton Rouge, LA

Standards in this document are based on information from the following organizations:

### Standards for Program Contren Learning Series Best Practices

Reprinted with permission from Contren Learning Series,  
Copyright 2005, National Center for Construction  
Education and Research, 352.334.0920,  
<http://www.nccer.org/index.asp>

### Related Academic Standards

CTB/McGraw-Hill LLC. (2005). *Tests of adult basic education, forms 9 and 10*. Monterey, CA: Author.  
Reproduced with permission of CTB/McGraw-Hill LLC.  
TABE is a registered trademark of The McGraw-Hill  
Companies, Inc. Copyright 2005 by CTB/McGraw-Hill  
LLC. Reproduction of this material is permitted for  
educational purposes only.

### 21st Century Skills

Reproduced with permission of the Partnership for 21st  
Century Skills. Further information may be found at  
[www.p21.org](http://www.p21.org)

## Preface

### Plumbing Technology Research Synopsis

Information listed at the end of each course was considered during the revision process. The NCCER Web site and the Contren content were especially useful in providing insight into trends and issues in the field. These references are suggested for use by instructors and students during the study of the topics outlined.

Industry advisory team members from colleges throughout the state were asked to give input related to changes to be made to the curriculum framework. Specific comments related to soft skills needed in this program include maintaining a positive attitude, being at work every day and on time, and having reading and writing skills to complete work orders and other forms related to the plumbing technician field. Occupational-specific skills stated include knowledge of the fundamentals, identification of basic parts, installation, and troubleshooting. Safety practices emphasized include practicing all agricultural technician safety rules and wearing the proper safety equipment.

### Needs of the Future Workforce

The plumbing occupation is projected to grow slightly slower than average in the United States, 10%, and slightly faster than average in Mississippi, 13% (EMSI, 2011). Job prospects will be very good for skilled individuals (U.S. Bureau of Labor Statistics, 2010).

### Plumbing Technology Employment Projections and Earnings

Region	2011 Jobs	2020 Jobs	Change	% Change	Openings	2011 Median Hourly Earnings
Regional Total	16,572	18,749	2,177	13%	5,259	\$18.19
National Total	1,323,688	1,453,250	129,562	10%	386,504	\$22.47

Source: EMSI Complete Employment – 2011.4

### Curriculum

The following national standards were referenced in each course of the curriculum:

- CTB/McGraw-Hill LLC *Tests of Adult Basic Education, Forms 9 and 10* Academic Standards
- *21st Century Skills*
- *Contren Best Practices from the National Center for Construction Education Research*

Industry and instructor comments, along with current research, were considered by the curriculum revision team during the revision process, and changes were made as needed and appropriate. Many of the skills and topics noted in the research were already included in the curriculum framework. Specific changes made to the curriculum at the October 12, 2011, curriculum revision meeting included the following:

- Removed references to Pipefitting (PPV/) to all courses except for Oxyfuel Cutting and Steam Traps
- Fundamentals of Plumbing/Pipefitting PPV/PCT 1113 Description: Job safety and health, including first aid. Also, occupational hazards and the scope of the OSHA law. Includes pipefitting and plumbing fittings, valves, hangers, and general trade fitting identification. Included are screwed, welded, flanged, soldered, brazed, glued, compression, and flared fittings. Identification and use of pipefitting and plumbing tools used in today's piping industry. **Changed to** Fundamentals of Plumbing PCT 1113 Description: This course includes basic safety, an introduction to construction math, and introduction to hand and power tools, an introduction to construction drawings, and rigging. (3 sch: 2 hr lecture, 2 hr lab)
- Integrated the Contren Core in PCT 1113 Fundamentals of Plumbing
- Pressure Boilers PPV/PCT 1411 changed to Low Pressure Boilers PCT 1411
- Reviewed competencies and objectives to ensure accuracy and appropriateness
- Clarified content that relates to the Contren Best Practices
- Updated the Recommended Tools and Equipment list to reflect the tool list for successful competition of Plumbing Technology theory and content

### Assessment

Students will be assessed using the MS-CPAS2 Assessment, unless an alternative assessment is approved.

Students are assessed using the Plumbing Technology MS-CPAS2 test. The MS-CPAS2 blueprint can be found at <http://www.rcu.msstate.edu/>.

- A student's technical skill attainment for completion of the Career Certificate will be assessed utilizing the MSCPAS Career Certificate (Y1) assessment score.
- A student's technical skill attainment for the Technical Certificate and/or the Associate of Applied Science degree will be assessed utilizing the student's MSCPAS Career Certificate (Y1) assessment and MSCPAS Technical Certificate (Y2) assessment.
- Timing of Y1 and Y2 Assessments:
  - A student may complete the Y1 assessment upon application for the Career Certificate.
  - A student may complete the Y2 assessment upon application for the Technical Certificate or the Associate of Applied Science Degree (scores for the Y1 and Y2 assessments are averaged.)
  - A student may complete both the Y1 and the Y2 assessment upon application for the Technical Certificate or the Associate of Applied Science Degree (scores for the Y1 and Y2 assessments are averaged.)

If there are questions regarding assessment of this program, please contact the Instructional Design Specialist at the Research and Curriculum Unit at 662.325.2510.

Alternate tests could be from NCCER or the International Code Council.

## Professional Learning

Instructors should participate in professional learning related to the following concepts:

- How to use the program Blackboard
- Differentiated instruction – To learn more about differentiated instruction, please go to [http://www.paec.org/teacher2teacher/additional\\_subjects.html](http://www.paec.org/teacher2teacher/additional_subjects.html) and click on Differentiated Instruction. Work through this online course and review the additional resources.
- 21<sup>st</sup> Century Skills – To learn more about 21<sup>st</sup> Century Skills, please go to <http://www.p21.org/> and click on Overview – 21<sup>st</sup> Skills Framework.
- Related Academics – To learn more about Related Academics, please go to <http://www.ctb.com/ctb.com/control/main?p=home> and click on the TABE logo and learn about the most up-to-date standards of the TABE exam.

## Program Exceptions

No program exceptions exist at this time.

## Articulation for Secondary to Postsecondary Programs

Articulation credit from secondary Plumbing to postsecondary Plumbing Technology is available upon implementation of this curriculum by the college. Secondary students who have completed the articulated secondary Plumbing courses may be awarded articulated college credit according to Mississippi Community College Board (MCCB) guidelines.

\*\*\*NOTE: Statewide Articulated Credit from secondary programs to postsecondary programs are outlined in the Mississippi Statewide Articulation Agreement that is revised annually and posted to the Mississippi Community College Board Career and Technical Education website (<http://www.mccb.edu/CareerTechEdu/ctDefault.aspx>)

Articulated Secondary Course	Articulated Postsecondary Course
[S] Plumbing  (Program CIP: 46.0503 – Plumbing Technology/Plumber)	PCT 1113 Fundamentals of Plumbing

## Statewide Guidelines on Articulated Credit

### *Eligibility*

- **To be eligible for articulated credit, a student must:**
  - Complete the articulated Secondary Career and Technical Education Program

- Score an 80 percent or higher on the Mississippi Career Planning and Assessment System (MS-CPAS2) in their secondary program of study
- **To be awarded articulated credit, a student must:**
  - Enroll in the community or junior college within 18 months of graduation
  - Articulated courses are transcribed immediately upon enrollment at a community college

### **How MS-CPAS2 will be documented**

- The Research and Curriculum Unit of Mississippi State University will provide MS-CPAS2 scores, CIP Codes, district codes, secondary pathway name, and college numbers (identified by each student as colleges of interest) to Mississippi Department of Education to place on student transcripts.
- The Research and Curriculum Unit of Mississippi State University will provide MS-CPAS2 scores, CIP Codes, district codes and college number to the MCCB.
- The MCCB will forward the list of students eligible for articulated credit to the colleges.

### **Transcripting of Articulated Credit**

- Articulated credit will be transcribed immediately upon college enrollment
- No grade will be given on the transcript for articulated courses, only hours granted will be transcribed (thus resulting in no change in quality points)

### **Time Limit**

- MS-CPAS2 scores will be accepted to demonstrate competencies for up to 18 months after high school graduation

### **Cost**

- No costs will be assessed on hours earned through articulated credit

### **Mississippi Workforce Advantage**

The primary purpose of career and technical education (CTE) and workforce education (WE) is to prepare present and future workers for high-wage, high-skill, and high-demand occupations in current or emerging professions. Additionally, CTE and WE programs aim to offer Mississippians opportunities that correspond to labor-market demands with multiple entrance and exit requirements that result in portable and stackable credentials for industry, certification-based training, and coursework. A **stackable credential** is a career or college certificate program

that builds, or “stacks,” with other certificate programs with the purpose of reengaging adults in school in order to prepare them for college and “next step”-level employment.

Through this collaborative initiative, CTE and WE curricula are developed in credit-bearing course hours and in WE modules to provide statewide standards for awarding college credit for technical, industry-recognized certificates. The designated WE curriculum module’s content articulates a specific number of college credits and aligns to all credit-bearing course competencies.

A secondary goal of Mississippi Workforce Advantage is to increase student and participant enrollment, participation, and completion of credit-bearing programs. Strategies to promote transition to and success within the credit-bearing program are essential to the goal of helping students earn credentials, certificates, and degrees. Ongoing professional development for all stakeholders will be offered to ensure success.

A copy of the CTE to WE curriculum modules is located on the RCU Web site at <http://www.rcu.msstate.edu/MCCB.aspx>

## Foreword

As the world economy continues to evolve, businesses and industries must adopt new practices and processes in order to survive. Quality and cost control, work teams and participatory management, and an infusion of technology are transforming the way people work and do business. Employees are now expected to read, write, and communicate effectively; think creatively, solve problems, and make decisions; and interact with each other and the technologies in the workplace. Career–technical programs must also adopt these practices in order to provide graduates who can enter and advance in the changing work world.

The curriculum framework in this document reflects these changes in the workplace and a number of other factors that impact local career–technical programs. Federal and state legislation calls for articulation between high school and community college programs, integration of academic and career skills, and the development of sequential courses of study that provide students with the optimum educational path for achieving successful employment. National skills standards, developed by industry groups and sponsored by the U.S. Department of Education and Labor, provide career and technical educators with the expectations of employers across the United States. All of these factors are reflected in the framework found in this document.

Referenced throughout the courses of the curriculum are the 21st Century Skills, which were developed by the Partnership for 21st Century Skills, a group of business and education organizations concerned about the gap between the knowledge and skills learned in school and those needed in communities and the workplace. A portion of the 21st Century Skills addresses learning skills needed in the 21st century, including information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills. Another important aspect of learning and working in the 21st century involves technology skills. The International Society for Technology in Education, developer of the National Educational Technology Standards (NETS), was a strategic partner in the Partnership for 21st Century Skills.

Each postsecondary program of instruction consists of a program description and a suggested sequence of courses that focus on the development of occupational competencies. The MS-CPAS2 blueprints are based upon the suggested course sequences to allow for Career Certificate (Y1) and Technical Certificate (Y2) assessments for all exit options. Please refer to the blueprint online. Each career–technical course in this sequence has been written using a common format, which includes the following components:

- Course Name – A common name that will be used by all community and junior colleges in reporting students
- Course Abbreviation – A common abbreviation that will be used by all community and junior colleges in reporting students
- Classification – Courses may be classified as the following:



- Career–technical core – A required career–technical course for all students
  - Area of concentration (AOC) core – A course required in an area of concentration of a cluster of programs
  - Career–technical elective – An elective career–technical course
  - Related academic course – An academic course that provides academic skills and knowledge directly related to the program area
  - Academic core – An academic course that is required as part of the requirements for an associate’s degree
- Description – A short narrative that includes the major purpose(s) of the course and the recommended number of hours of lecture and laboratory activities to be conducted each week during a regular semester
  - Prerequisites – A listing of any courses that must be taken prior to or on enrollment in the course
  - Corequisites – A listing of courses that may be taken while enrolled in the course
  - Competencies and Suggested Objectives – A listing of the competencies (major concepts and performances) and the suggested student objectives that will enable students to demonstrate mastery of these competencies

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75% of the time allocated to each course. The remaining 25% of each course should be developed at the local district level and may reflect the following:
  - Additional competencies and objectives within the course related to topics not found in the state framework, including activities related to specific needs of industries in the community college district
  - Activities that develop a higher level of mastery on the existing competencies and suggested objectives
  - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed or revised
  - Activities that include integration of academic and career–technical skills and course work, school-to-work transition activities, and articulation of secondary and postsecondary career–technical programs
  - Individualized learning activities, including work-site learning activities, to better prepare individuals in the courses for their chosen occupational areas
- Sequencing of the course within a program is left to the discretion of the local district. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors. Programs that offer an Associate of Applied Science Degree must include all of the required

Career Certificate courses, Technical Certificate courses **AND** a minimum of 15 semester hours of General Education Core Courses. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester. Each community college specifies the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science Degree at their college. The following 2012 SACS standard applies.

*Section 2.7.3 For degree completion in associate programs, the component constitutes a minimum of 15 semester hours or the equivalent. These credit hours are to be drawn from and include at least one course from each of the following areas: humanities/fine arts, social/behavioral sciences, and natural science/mathematics.*

In order to provide flexibility within the districts, individual courses within a framework may be customized by doing the following:

- Adding new competencies and suggested objectives to complement the existing competencies and suggested objectives in the program framework.
- Revising or extending the suggested objectives for individual competencies
- Adjusting the semester credit hours of a course to be up 1 hour or down 1 hour (after informing the Mississippi Community College Board [MCCB] of the change)

In addition, the curriculum framework as a whole may be customized by doing the following:

- Sequencing courses within the suggested course sequence reflecting the new assessment format
- Developing and adding a new course that meets specific needs of industries and other clients in the community or junior college district (with MCCB approval)
- Adding courses listed in the “Approved Career and Technical Electives List” as local certificate and degree completion requirements to meet specific needs of industries and other clients in the community. The “Approved Career and Technical Electives” are currently approved in the Uniform Course Numbering Book; therefore, MCCB approval is not required.

## Table of Contents

Acknowledgments.....	2
Preface.....	3
Foreword.....	8
Program Description.....	12
Suggested Course Sequence for Career Certificate Option.....	13
Suggested Course Sequence for Technical Certificate Option.....	14
Suggested Course Sequence for Associate Degree Option.....	15
Plumbing Technology Courses.....	19
Fundamentals of Plumbing.....	19
Blueprint Reading for Plumbing.....	26
Low Pressure Boilers.....	28
Tacking, Brazing, and Burning.....	29
Sketching.....	31
Rigging and Signaling.....	33
Piping Level/Transit.....	34
Drainage and Sewer Systems.....	35
Heating Devices.....	38
Gas Piping.....	40
Domestic Systems.....	42
Plumbing Fixtures Lab.....	45
Backflow Cross Connection.....	47
Advanced Plumbing Lab.....	48
Special Project in Plumbing.....	51
Supervised Work Experience in Plumbing.....	52
Work-Based Learning I, II, III, IV, V, and VI.....	53
Appendix A: Course References.....	54
Appendix B: Standards for Content Learning for the Plumbing Technology Program.....	59
Appendix C: Related Academic Standards.....	69
Appendix D: 21 <sup>st</sup> Century Skills.....	71

## Program Description

The Plumbing Technology program prepares a person for advanced placement in plumbing and related fields. Graduates of this program can take the journeyman exam and become employed as supervisors, instructors, material expeditors, inspectors, estimators, consultants, employers, or contractors. This document was developed with the use of the competencies and objectives as prepared by the National Center for Construction Education and Research, along with applicable national, state, and local codes.

The Plumbing Technology program offers a Career certificate, Technical certificate and/or an Associate of Applied Science Degree.

## Suggested Course Sequence

### Plumbing Technology

### Career Certificate Option

A Career Certificate will be awarded upon completion of the required courses for the Career Certificate option in Plumbing Technology.

<b>*PCT 1113</b>	<b>Fundamentals of Plumbing</b>	<b>3 sch: 2 hr. lecture, 2 hr. lab</b>
<b>*PCT 1333</b>	<b>Blueprint Reading for Plumbing</b>	<b>3 sch: 1 hr. lecture, 4 hr. lab</b>
<b>*PCT 1411</b>	<b>Low Pressure Boilers</b>	<b>1 sch: 2 hr. lab</b>
<b>*PCT 1443</b>	<b>Piping Level/Transit</b>	<b>3 sch: 1 hr. lecture, 4 hr. lab</b>
<b>*PCT 1513</b>	<b>Drainage and Sewer Systems</b>	<b>3 sch: 1 hr. lecture, 4 hr. lab</b>
<b>*PCT 1612</b>	<b>Heating Devices</b>	<b>2 sch: 1 hr. lecture, 2 hr. lab</b>
<b>*PCT 1622</b>	<b>Gas Piping</b>	<b>2 sch: 1 hr. lecture, 2 hr. lab</b>
<b>*PCT 1712</b>	<b>Domestic Systems</b>	<b>2 sch: 4 hr. lab</b>
<b>*PCT 1722</b>	<b>Plumbing Fixtures Lab</b>	<b>2 sch: 4 hr. lab</b>
<b>*PCT 1732</b>	<b>Backflow Cross Connection</b>	<b>2 sch: 1 hr. lecture, 2 hr. lab</b>
<b>*PCT 1743</b>	<b>Advanced Plumbing lab</b>	<b>3 sch: 1 hr. lecture, 4 hr. lab</b>
	Career/Technical Electives	4 sch
	Total Semester Credit Hours for a Career Certificate	30 sch

**\*These course competencies will be assessed in the MSCPAS2 Career certificate (Y1) assessment.**

Students who lack entry level skills in math, English, science, etc. will be provided related studies.

## Suggested Course Sequence

### Plumbing Technology

#### Technical Certificate Option

A Technical Certificate will be awarded upon completion of all required Career Certificate courses **AND** the following required Technical Certificate courses in the Plumbing Technology program.

	Career Certificate	30 sch
<b>*PCT 1213</b>	<b>Tacking, Brazing and Burning</b>	<b>3 sch: 1 hr. lecture, 4 hr. lab</b>
<b>*PCT 1323</b>	<b>Sketching</b>	<b>3 sch: 2 hr. lecture, 2 hr. lab</b>
<b>*PCT 1812</b>	<b>Rigging and Signaling</b>	<b>2 sch: 1 hr. lecture, 2 hr. lab</b>
DDT 2243	Cost Estimating	3 sch: See Appropriate CTE Program Description
	Career/Technical Elective	3 sch: See Appropriate CTE Program Description
PCT 1911	Special Project in Plumbing	1 sch: 2 hr. lab
	Total Semester Credit Hours for a Technical Certificate	45 sch

**\*These course competencies will be assessed in the MSCPAS2 Career certificate (Y1) assessment.**

## Suggested Course Sequence

### Plumbing Technology

#### Associate of Applied Science Degree Option

To receive the Associate of Applied Science Degree in Plumbing Technology, a student must complete all of the required Career Certificate courses, Technical Certificate courses **AND** a minimum of 15 semester hours of General Education Core Courses. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester. Each community college specifies the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science Degree at their college. The following 2012 SACS standard applies.

Section 2.7.3 For degree completion in associate programs, the component constitutes a minimum of 15 semester hours or the equivalent. These credit hours are to be drawn from and include at least one course from each of the following areas: humanities/fine arts, social/behavioral sciences, and natural science/mathematics.

A student must complete the following minimum credit requirements for the AAS Degree Option:

Career Certificate	30 credits minimum
Technical Certificate	15 credits minimum
General Education Core Courses	15 credits minimum
Total Semester Credit Hours for the Associate of Applied Science Degree	60 credits minimum hours earned as a compilation of Career, Technical, and Academic credit hours.

Approved Career–Technical elective courses have been included to allow community colleges and students to customize programs to meet the needs of industries and employers in their area.

In order to provide flexibility within the districts, individual courses within a framework may be customized by doing the following:

- Adding new competencies and suggested objectives to complement the existing competencies and suggested objectives in the program framework.
- Revising or extending the suggested objectives for individual competencies
- Adjusting the semester credit hours of a course to be up 1 hour or down 1 hour (**after informing the Mississippi Community College Board [MCCB] of the change**)

In addition, the curriculum framework as a whole may be customized by doing the following:

- Sequencing courses within the suggested course sequence to reflecting the new assessment format
- Developing and adding a new course that meets specific needs of industries and other clients in the community or junior college district (**with MCCB approval**)
- Adding courses listed in the “Approved Career and Technical Electives List” as local certificate and degree completion requirements to meet specific needs of industries and other clients in the community. The “Approved Career and Technical Electives” are currently approved in the Uniform Course Numbering Book; therefore, MCCB approval is **not** required.



APPROVED CAREER TECHNICAL ELECTIVES FOR  
PLUMBING TECHNOLOGY

BOT 1413	Business Accounting	3 sch: See Appropriate Program Description
BOT 1713	Mechanics of Communication	3 sch: See Appropriate Program Description
CST 1123	Basic Computer Systems	3 sch: See Appropriate Program Description
CPT 2133	Career Development	3 sch: See Appropriate Program Description
DDT 1213	Construction Materials	3 sch: See Appropriate Program Description
MMT 1313	Salesmanship	3 sch: See Appropriate Program Description
MMT 2213	Management	3 sch: See Appropriate Program Description
MMT 2513	Entrepreneurship	3 sch: See Appropriate Program Description
PCT 1323	Sketching	3 sch: 1 hr. lecture, 4 hr. lab
PCT 1213	Tacking, Brazing and Burning	3 sch: 2 hr. lecture, 2 hr. lab
PCT 1812	Rigging and Signaling	2 sch: 1 hr. lecture, 2 hr. lab
PCT 292(1-6)	Supervised Work Experience in Plumbing Technology	1-6 sch: 3-18 hr. externship
WBL 191(1-3) WBL 192(1-3) WBL 193(1-3) WBL 291(1-3) WBL 292(1-3) WBL 293(1-3)	Work-Based Learning	1-3 sch: 3-9 hr. externship
Other instructor approved electives that are listed in the MCCB approved CTE Uniform Course Numbering document.		

APPROVED ACADEMIC ELECTIVES FOR

## PLUMBING TECHNOLOGY

BAD 2413	Legal Environment of Business	3 sch: See Academic Program Description
Other instructor approved electives that are listed in the MCCB approved Academic Uniform Course Numbering document.		

## Plumbing Technology Courses

**Course Name:** Fundamentals of Plumbing

**Course Abbreviation:** PCT 1113

**Classification:** Career–Technical Core

**Description:** This course includes basic safety, an introduction to construction math, and introduction to hand and power tools, an introduction to construction drawings, and rigging. (3 sch: 2 hr lecture, 2 hr lab)

**Prerequisite:** None

### Competencies and Suggested Objectives

- |  |                                 |
|--|---------------------------------|
| <p>1. Describe general safety rules for working in a shop/lab and industry.</p> <ul style="list-style-type: none"> <li>a. Describe how to avoid on-site accidents.</li> <li>b. Explain the relationship between housekeeping and safety.</li> <li>c. Explain the importance of following all safety rules and company safety policies according to OSHA standards including addressing General Duty Clause and <i>1926 CFR Subpart C</i>.</li> <li>d. Explain the importance of reporting all on-the-job injuries, accidents, and near misses.</li> <li>e. Explain the need for evacuation policies and the importance of following them.</li> <li>f. Explain the employer's substances abuse policy and how it relates to safety.</li> <li>g. Explain the safety procedures when working near pressurized or high temperature.</li> </ul> | <p>DOK1, BSM, IPP, PLS, CDS</p> |
| <p>2. Identify and apply safety around welding operations.</p> <ul style="list-style-type: none"> <li>a. Use proper safety practices when welding or working around welding operations.</li> <li>b. Use proper safety practices when welding in or near trenches and excavations.</li> <li>c. Explain the term <i>proximity work</i>.</li> </ul>   | <p>DOK1, BSM, PLS</p>           |
| <p>3. Identify and explain use of various barriers and confinements.</p> <ul style="list-style-type: none"> <li>a. Explain the safety requirements for working in confined areas.</li> <li>b. Explain and practice lockout/tagout procedures.</li> <li>c. Explain the different barriers and barricades, and how they are used.</li> <li>d. Recognize and explain personal protective equipment.</li> <li>e. Inspect and care for personal protective equipment.</li> </ul>  | <p>DOK1, BSM, PLS</p>           |
| <p>4. Explain lifting, fall protection, and the use of ladders and scaffolds.</p> <ul style="list-style-type: none"> <li>a. Identify and explain the procedures for lifting heavy objects.</li> <li>b. Explain fall protection procedures.</li> <li>c. Inspect and safely work with various ladders and scaffolds.</li> </ul>  | <p>DOK1, BSM, PLS</p>           |
| <p>5. Explain the Material Safety Data Sheet (MSDS).</p> <ul style="list-style-type: none"> <li>a. Explain the function of the MSDS.</li> </ul>  | <p>DOK1, BSM, PLS</p>           |

b. Interpret the requirements of the MSDS.
6. Explain fires. <sup>DOK1, BSM, PLS</sup> a. Explain the process by which fires start. b. Explain fire prevention of various flammable liquids. c. Explain the classes of fire and the types of extinguishers.
7. Explain safety in and around electrical situations. <sup>DOK1, BSM, PLS</sup> a. Explain injuries when electrical contact occurs. b. Explain safety around electrical hazards. c. Explain action to take when an electrical shock occurs.
8. Apply basic mathematics for residential carpentry. <sup>DOK1, ICM</sup> a. Apply the four basic math skills with whole numbers, fractions, and percent. b. Use the metric system. c. Identify and read measuring tools. d. Solve basic algebraic equations. e. Calculate area and volume of simple geometric figures. f. Apply basic math to solve simple geometric figures and problems.
9. Demonstrate the use and maintenance of hand and power tools. <sup>DOK1, IHT, IPT, PLT</sup> a. Identify and discuss the use of common hand and power tools. b. Discuss rules of safety for hand and power tools. c. Select and demonstrate the use of tools. d. Explain the procedures for maintenance.
10. Read, analyze, and design a construction drawing. <sup>DOK1, BLU</sup> a. Identify terms and symbols commonly used on construction drawings. b. Interpret various symbols to locate various elements. c. Interpret a plan to determine layout. d. Interpret basic electrical specifications. e. Interpret electrical drawings, including site plans, floor plans, and detail drawings. f. Read equipment schedule. g. Explain basic layout of a construction drawing. h. Describe the information in a title block. i. Identify the lines used on construction drawings. j. Explain the architect's and engineer's scales. k. Design a construction drawing. l. Construct a structure based on a construction drawing.
11. Explain and identify safe rigging and equipment. <sup>DOK1, RIG</sup> a. Explain and practice safe rigging. b. Identify and explain rigging equipment. c. Inspect rigging equipment.
12. Describe employment opportunities and responsibilities. <sup>DOK1 EMP</sup> a. Describe employment opportunities including potential earnings, employee benefits, job availability, places of employment, working conditions, and educational

requirements.
b. Describe basic employee responsibilities.
13. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations. <small>DOK 2 COM</small>
14. Safely handle and store materials. <small>(DOK 1, IMH)</small>
a. Define a load.
b. Establish a pre-task plan prior to moving a load.
c. Use proper materials-handling techniques.
d. Choose appropriate materials-handling equipment for the task.
e. Recognize hazards and follow safety procedures required for materials handling.
15. Identify and discuss basic fittings and valves related to plumbing. <small>DOK1, PPF, CPF, CIF, CSF, TVA</small>
16. Identify and install hangers, supports, structural, penetrations, and fire stopping materials. <small>DOK1, HFP</small>

## STANDARDS

### *Contren Learning Series Best Practices*

#### **Contren Core**

##### **BSM – BASIC SAFETY (00101-09)**

- BSM1 Identify the responsibilities and personal characteristics of a professional craftsman.
- BSM2 Explain the role that safety plays in the construction crafts.
- BSM3 Describe what job-site safety means.
- BSM4 Explain the appropriate safety precautions around common job-site hazards.
- BSM5 Demonstrate the use and care of appropriate personal protective equipment.
- BSM6 Follow safe procedures for lifting heavy objects.
- BSM7 Describe safe behavior on and around ladders and scaffolds.
- BSM8 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
- BSM9 Describe fire prevention and fire fighting techniques.
- BSM10 Define safe work procedures around electrical hazards.

##### **ICM – INTRODUCTION TO CONSTRUCTION MATH (00102-09)**

- ICM1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
- ICM2 Use a standard ruler, a metric ruler to measure.
- ICM3 Add, subtract, multiply, and divide fractions.
- ICM4 Add, subtract, multiply, and divide decimals, with and without a calculator.
- ICM5 Convert decimals to percents and percents to decimals.
- ICM6 Convert fractions to decimals and decimals to fractions.
- ICM9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.

### IHT – INTRODUCTION TO HAND TOOLS (0103-09)

- IHT1 Recognize and identify some of the basic hand tools and their proper uses in the construction trade.
- IHT2 Safely use hand tools.
- IHT3 Describe the basic procedures for taking care of these tools.

### IPT – INTRODUCTION TO POWER TOOLS (00104-09)

- IPT1 Recognize and identify some of the basic hand tools used in the construction trade.
- IPT2 Use power tools safely.
- IPT3 Describe the basic procedures for taking care of these tools.

### BLU – INTRODUCTION TO CONSTRUCTION DRAWINGS (00105-09)

- BLU1 Recognize and identify basic blueprint terms, components, and symbols.
- BLU2 Relate information on blueprints to actual locations on the print.
- BLU3 Recognize different classifications of drawings.
- BLU4 Interpret and use drawing dimensions.

### COM – BASIC COMMUNICATION SKILLS (00107-0)

- COM1 Interpret information and instructions presented in both verbal and written form.
- COM2 Communicate effectively in on-the-job situations using verbal and written skills.
- COM3 Communicate effectively on the job using electronic communication devices.

### EMP– BASIC EMPLOYABILITY SKILLS (00108-09)

- EMP1 Explain the role of an employee in the construction industry.
- EMP2 Demonstrate critical thinking skills and the ability to solve problems using those skills.
- EMP3 Demonstrate knowledge of computer systems and explain common uses for computers in the construction industry.
- EMP4 Define effective relationship skills.
- EMP5 Recognize workplace issues such as sexual harassment, stress, and substance abuse.

### IMH– INTRODUCTION TO MATERIALS HANDLING (00109-09)

- IMH1 Define a load.

IMH2 Establish a pre-task plan prior to moving a load.

IMH3 Use proper materials-handling techniques.

IMH4 Choose appropriate materials-handling equipment for the task.

IMH5 Recognize hazards and follow safety procedures required for materials handling.

#### RIG – BASIC RIGGING (00106-09)

RIG1 Identify and describe the use of slings and common rigging hardware.

RIG2 Describe the basic inspection techniques and rejection criteria used for slings and hardware.

RIG3 Describe the basic hitch configurations and their proper connections.

RIG4 Describe basic load-handling safety practices.

RIG5 Demonstrate proper use of American National Standards Institute (ANSI) hand signals.

#### PLUMBING – LEVEL ONE

##### IPP – INTRODUCTION TO THE PLUMBING PROFESSION (02101-05)

IPP1 Describe the history of the plumbing profession.

IPP2 Identify the responsibilities of a person working in the construction industry.

IPP3 State the personal characteristics of a professional.

IPP4 Identify the stages of progress within the plumbing profession and its positive impact on society.

##### PLS – PLUMBING SAFETY (02102-05)

PLS1 Describe the common unsafe acts and unsafe conditions that cause accidents.

PLS2 Describe how to handle unsafe acts and unsafe conditions.

PLS3 Explain how the cost of accidents and illnesses affects everyone on site.

PLS4 Demonstrate the use and care of appropriate personal protective equipment.

PLS5 Identify jobsite hazardous work specific to plumbers.

PLS6 Demonstrate the proper use of ladders.

PLS7 Demonstrate how to maintain power tools safely.

PLS8 Explain how to work safely in and around a trench.

PLS9 Describe and demonstrate the lockout–tagout process.

##### PLT – PLUMBING TOOLS (02103-05)

PLT1 Identify the basic hand and power tools used in the plumbing trade.

- PLT2 Demonstrate the proper use of plumbing tools.
- PLT3 Demonstrate the ability to know when and how to select the proper tool(s) for tasks.
- PLT4 Demonstrate the proper maintenance for caring for hand and power tools.
- PLT5 Demonstrate how to prepare a surface for tool use.
- PLT6 Describe the safety requirements for using plumbing tools.

#### PPF – PLASTIC PIPE AND FITTINGS (02106-05)

- PPF1 Identify types of materials and schedules of plastic piping.
- PPF2 Identify proper and improper applications of plastic piping.
- PPF3 Identify types of fittings and valves used with plastic piping.
- PPF4 Identify and determine the kinds of hangers and supports needed for plastic piping.
- PPF5 Identify the various techniques used in hanging and supporting plastic piping.
- PPF6 Properly measure, cut, and join plastic piping.
- PPF7 Explain proper procedures for the handling, storage, and protection of plastic pipes.

#### CPF – COPPER PIPE AND FITTINGS (02107-05)

- CPF1 Identify the types of materials and schedules used with copper piping.
- CPF2 Identify the material properties, storage, and handling requirements of copper piping.
- CPF3 Identify the types of fittings and valves used with copper piping.
- CPF4 Identify the techniques used in hanging and supporting copper piping.
- CPF5 Properly measure, ream, cut, and join copper piping.
- CPF6 Identify the hazards and safety precautions associated with copper piping.

#### CIF – CAST-IRON PIPE AND FITTINGS (02108-05)

- CIF1 Recognize proper and improper applications of cast-iron piping.
- CIF2 Identify the material properties, storage, and handling requirements of carbon steel piping.
- CIF3 Identify the types of materials and schedules used in cast-iron piping.
- CIF4 Identify the types of fittings used with cast-iron piping.
- CIF5 Identify the various techniques used in handling and supporting cast-iron piping.
- CIF6 Properly measure, cut, and join cast-iron piping.
- CIF7 Identify the hazards and safety precautions associated with cast-iron piping.

#### CSF – CARBON STEEL PIPE AND FITTINGS (02109-05)

- CSF1 Recognize proper applications of carbon steel piping.
- CSF2 Identify the material properties, storage, and handling requirements of carbon steel piping.
- CSF3 Identify the various techniques used in hanging and supporting carbon steel piping.



CSF4 Properly measure, cut, groove, thread, and join carbon steel piping.

## **PLUMBING – LEVEL TWO**

### **HPF – HANGERS, SUPPORTS, STRUCTURAL PENETRATIONS, AND FIRE STOPPING (02203-05)**

HPF1 Identify the hangers and supports used to install DWV and water supply systems, and explain their applications.

HPF2 Install pipe hangers and supports correctly according to local applicable codes and manufacturer's specifications.

HPF3 Modify structural members using the appropriate tools without weakening the structure.

HPF4 Identify and install common types of fire-stopping materials used in penetrations through fire-rated structural members, walls, floors, and ceilings.

### **TVA – TYPES OF VALVES (02206-05)**

TVA1 Identify the basic types of valves.

TVA2 Describe the differences in pressure ratings for valves.

TVA3 Demonstrate the ability to service various types of valves.

## **PLUMBING – LEVEL FOUR**

### **CDS – CODES (02406-06)**

CDS1 Describe the model and local plumbing codes and their purposes.

CDS2 Explain the procedure for modifying plumbing codes.

CDS3 Use the local plumbing code to find and cite references.

**Course Name:** Blueprint Reading for Plumbing

**Course Abbreviation:** PCT 1333

**Classification:** Career–Technical Core

**Description:** An in-depth understanding of blueprint reading related to plumbing profession (3 sch: 1 hr lecture, 4 hr lab)

**Prerequisite:** None

<b>Competencies and Suggested Objectives</b>	
1. Identify and interpret various symbols, notes, and terms.	DOK1, IPD1-4, RCD1-3
a. Identify terms, symbols, abbreviations, and lines used on blueprints.	
b. Interpret notes, specifications, and dimensions.	
2. Identify, interpret, and locate details on mechanical, plumbing and structural blueprints.	DOK2, IPD1-4, RCD1-3
a. Identify the three basic views of a drawing.	
b. Identify the various lines used on drawings.	
c. Interpret dimensions and symbols.	
d. Interpret general and specific notes on drawings.	
e. Verify dimensions shown on drawings and generate an RFI when discrepancies are found.	
f. Locate details on drawings.	
g. Order materials needed as interpreted from specifications/blueprints.	
h. Interpret isometric views of plumbing drawings.	

## STANDARDS

*Contren Learning Series Best Practices*

### PLUMBING – LEVEL ONE

#### IPD – INTRODUCTION TO PLUMBING DRAWINGS (02105-05)

- IPD1 Identify pictorial (isometric and oblique), schematic, and orthographic drawings, and discuss how different views are used to depict information about objects.
- IPD2 Identify the basic symbols used in schematic drawings of pipe assemblies.
- IPD3 Explain the types of drawings that may be included in a set of plumbing drawings and the relationship among the different drawings.
- IPD4 Interpret plumbing-related information from a set of plumbing drawings.

**LEVEL TWO****RCD – READING COMMERCIAL DRAWINGS (02202-05)**

RCD1 Interpret information from given site plans.

RCD2 Verify dimensions shown on drawings and generate an RFI when discrepancies are found.

RCD3 Locate plumbing entry points, walls, and chases.

RCD4 Create an isometric drawing.

RCD5 Do a material takeoff for drainage, waste, and vent (DWV) and water supply systems from information shown on drawings.

RCD6 Use approved submittal data, floor plans, and architectural details to lay out fixture rough-ins, to develop estimates, and to establish general fixture locations.

RCD7 Recognize the need for coordination and shop drawings.

**Course Name:** Low Pressure Boilers

**Course Abbreviation:** PCT 1411

**Classification:** Career–Technical Core

**Description:** Introduction to safe operation of pressure boilers for heating, steam production, and water heating (1 sch: 2 hr lab)

**Prerequisite:** None

<b>Competencies and Suggested Objectives</b>	
1. Identify and explain various boiler fittings and accessories, including thermo expansion devices. <sup>DOK1, IWH1-2, STT</sup>	<ol style="list-style-type: none"> <li>Discuss the various types of boilers.</li> <li>Identify and explain various boiler, steam, and hot water fittings and piping.</li> <li>Identify and explain feed water accessories.</li> <li>Identify and explain steam and hot water accessories.</li> </ol>
2. Explain the operations of a boiler. <sup>DOK1 IWH1-2, STT</sup>	<ol style="list-style-type: none"> <li>Explain the operation of the draft controls.</li> <li>Explain the water treatment procedures.</li> <li>Identify and explain boiler and domestic water heater safety.</li> </ol>

## STANDARDS

*Contren Learning Series Best Practices*

### PLUMBING – LEVEL TWO

IWH – INSTALLING WATER HEATERS (02210-05)

IWH1 Describe the basic operation of water heaters.

IWH2 Identify and explain the functions of the basic components of water heaters.

### PIPEFITTING – LEVEL FOUR

STT – STEAM TRAPS (08404-07)

STT1 Identify types of steam traps.

STT2 Install steam traps.

STT3 Troubleshoot steam trap systems.

**Course Name:** Tacking, Brazing, and Burning

**Course Abbreviation:** PCT 1213

**Classification:** AOC Core (Plumbing Technical Certificate and Associate Degree) and Career–Technical Elective (Plumbing Career Certificate)

**Description:** Striking an arc; tacking metal together; setting up an oxyacetylene torch and burning, brazing, and soldering; and cutting straight and bevel angles on pipe. Safety procedures will be covered and emphasized. (3 sch: 1 hr lecture, 4 hr lab)

**Prerequisite:** None

<b>Competencies and Suggested Objectives</b>	
1. Demonstrate the safe layout and use of the electric arc machine and the oxyacetylene torch. DOK2, BSM12, OFC	<ul style="list-style-type: none"> <li>a. Lay out, set up, and test the electric arc machine.</li> <li>b. Lay out, set up, and test the oxyacetylene cutting torch.</li> </ul>
2. Tack weld pipes in different positions. DOK3, BSM12, OFC	<ul style="list-style-type: none"> <li>a. Tack weld pipe in a horizontal position.</li> <li>b. Tack weld pipe in a vertical position.</li> </ul>
3. Prepare, solder, braze, and test various joints. DOK2, BSM12, OFC	<ul style="list-style-type: none"> <li>a. Prepare and solder a joint.</li> <li>b. Prepare and braze a joint.</li> <li>c. Perform tests on all soldered and brazed joints.</li> </ul>

## STANDARDS

*Contren Learning Series Best Practices*

### Contren Core

BSM12 Identify other construction hazards on your job site, including hazardous material exposures, environmental elements, welding and cutting hazards, confined spaces, and fires.

### PIPEFITTING – LEVEL ONE

#### OFC – OXYFUEL CUTTING (08104-06)

OFC1 Identify and explain the use of oxyfuel cutting equipment.

OFC2 Set up oxyfuel equipment.

OFC3 Light and adjust an oxyfuel torch.

OFC4 Shut down oxyfuel cutting equipment.

OFC5 Disassemble oxyfuel equipment.

OFC6 Change empty cylinders.

OFC7 Perform oxyfuel cutting:

- Straight line and square shapes
- Bevels

**Course Name:** Sketching

**Course Abbreviation:** PCT 1323

**Classification:** AOC Core (Plumbing Technical Certificate Associate Degree) and Career–Technical Elective (Plumbing Career Certificate)

**Description:** Sketching, measuring, and recording required information to supplement oral descriptions and organize ideas to include individual piping components (3 sch: 1 hr lecture, 4 hr lab)

**Prerequisite:** None

<b>Competencies and Suggested Objectives</b>	
1. Identify, explain, and sketch various piping objects.	DOK2, IPD5-7, RCD4-7
a. Identify, explain, and sketch isometric and oblique drawings.	
b. Identify, explain, and sketch 2-D and principal views.	
2. Discuss and demonstrate the use of various scales used on piping drawings.	DOK1, IPD5-7, RCD4-7
a. Discuss and demonstrate the use of the architectural, engineering, and metric scale.	
3. Discuss and demonstrate freehand lettering.	DOK1, IPD5-7, RCD4-7
a. Discuss and demonstrate vertical lettering.	
b. Discuss and demonstrate lettering, numbers, and fractions.	
4. Sketch various pipes and piping drawings.	DOK2, IPD5-7, RCD4-7
a. Sketch views of a pipe drawing from given data.	
b. Sketch an isometric pipe drawing from plan and necessary views.	
c. Sketch different types of piping connections.	
d. Design and sketch a piping system.	
e. Draw pipe from a template.	

## STANDARDS

*Contren Learning Series Best Practices*

### PLUMBING – LEVEL ONE

IPD – INTRODUCTION TO PLUMBING DRAWINGS (02105-05)

IPD5 Sketch orthographic and schematic drawings.

IPD6 Use an architect's scale to draw lines to scale and to measure lines drawn to scale.

IPD7 Discuss how code requirements apply to certain drawings.

**LEVEL TWO****RCD – READING COMMERCIAL DRAWINGS (02202-05)**

RCD4 Create an isometric drawing.

RCD5 Do a material takeoff for drainage, waste, and vent (DWV) and water supply systems from information shown on drawings.

RCD6 Use approved submittal data, floor plans, and architectural details to lay out fixture rough-ins, to develop estimates, and to establish general fixture locations.

RCD7 Recognize the need for coordination and shop drawings.



**Course Name:** Rigging and Signaling

**Course Abbreviation:** PCT 1812

**Classification:** AOC Core (Plumbing Technical Certificate Associate Degree) and Career-Technical Elective (Plumbing Career Certificate)

**Description:** Basic use of hand signals, rigging, and equipment. (2 sch: 1 hr lecture, 2 hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Explain and identify safe signaling, rigging, and equipment.	DOK1, RIG
a. Explain and practice safe rigging and signaling.	
b. Identify and explain rigging equipment.	
c. Inspect rigging equipment.	
2. Describe and apply procedures and equipment for rigging and lifting.	DOK2, RIG
a. Select, inspect, use, and maintain a block and tackle.	
b. Select, inspect, use, and maintain a chain hoist.	
c. Select, inspect, use, and maintain come-alongs.	
d. Select, inspect, use, and maintain jacks.	
e. Select, inspect, use, and maintain a tugger.	
f. Identify and explain heavy rigging hardware.	
g. Inspect heavy rigging hardware.	
h. Read and interpret lifting capacity charts.	
i. Explain load balancing.	
j. Rig pipes and valves.	
k. Plan a rigging job.	

## STANDARDS

*Contren Learning Series Best Practices*

### CORE

#### RIG – BASIC RIGGING (00106-09)

- RIG1 Identify and describe the use of slings and common rigging hardware.
- RIG2 Describe the basic inspection techniques and rejection criteria used for slings and hardware.
- RIG3 Describe the basic hitch configurations and their proper connections.
- RIG4 Describe basic load-handling safety practices.
- RIG5 Demonstrate proper use of American National Standards Institute (ANSI) hand signals.

**Course Name:** Piping Level/Transit

**Course Abbreviation:** PCT 1443

**Classification:** AOC Core (Plumbing)

**Description:** Applications of the leveling instruments, shooting elevations, and grading pipes. (3 sch: 1 hr lecture, 4 hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Identify and set up a level and/or transit.	<sup>DOK1, IRD</sup>
a. Identify and explain the basic parts of a level/transit.	
b. Set up the level/transit, shoot elevations, and grade pipe.	
2. Measure, record, and lay out a soil pipe.	<sup>DOK2, IRD</sup>
a. Describe the use of the benchmark.	
b. Turn horizontal angles.	
c. Calculate the grade and percent of grade.	
d. Demonstrate differences in elevation between random points.	
e. Using a trencher, excavate, grade, and install a soil pipe.	

## STANDARDS

*Contren Learning Series Best Practices*

### PLUMBING – LEVEL TWO

IRD – INSTALLING ROOF, FLOOR, AND AREA DRAINS (02205-05)

IRD1 Use a surveyor's level or transit level to set the elevation of a floor or area drain.

IRD2 Install a roof drain, a floor drain, and an area drain.

IRD3 Install waterproof membranes and flashing.

**Course Name:** Drainage and Sewer Systems

**Course Abbreviation:** PCT 1513

**Classification:** AOC Core (Plumbing)

**Description:** Information and practical aspects of drainage and disposal systems and the International Plumbing Code. Included are the installation of the drainage system in a residential unit covering health aspects and the disposal of poisonous gases arising from the discharge of traps. Instruction is provided on elements of disposal systems, including sewer, septic tanks, tank size calculations, maintenance causes, and removal of sewer obstructions. (3 sch: 1-hr lecture, 4-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Identify and explain safety in drainage and sewer systems. <small>DOK1, DWV, ITP, TVE, SSS ISW</small>	<ol style="list-style-type: none"> <li>a. Identify and explain health department regulations for drainage and sewer systems.</li> <li>b. Identify and explain hazards of working in confined spaces in the presence of methane gas.</li> <li>c. Identify international plumbing code definitions.</li> <li>d. Identify local authority for plumbing installation.</li> <li>e. Identify approved traps and cleanouts.</li> </ol>
2. Identify various systems used in drainage and sewer systems. <small>DOK1, DWV, ITP, TVE, SSS ISW</small>	<ol style="list-style-type: none"> <li>a. Explain safety procedures.</li> <li>b. Identify components of individual sewer systems.</li> <li>c. Identify various types of vents and drains, including storm.</li> </ol>
3. Install various types of soil and waste pipes. <small>DOK3, DWV, ITP, TVE, SSS ISW</small>	<ol style="list-style-type: none"> <li>a. Install different types of traps.</li> <li>b. Install stacks according to functions.</li> </ol>
4. Identify various types of sewers. <small>DOK3, DWV, ITP, TVE, SSS ISW,</small>	<ol style="list-style-type: none"> <li>a. Differentiate between sanitary, storm, and combined sewers.</li> <li>b. Identify sanitary and storm sewers.</li> <li>c. Estimate the drainage fixture unit (DFU).</li> <li>d. Estimate the storm sewer fixture unit.</li> </ol>

## STANDARDS

*Contren Learning Series Best Practices*

### PLUMBING – LEVEL ONE

DWV – INTRODUCTION TO DRAIN, WASTE, AND VENT (DWV) SYSTEMS (02112-05)

- DWV1 Explain how waste moves from a fixture through the drain system to the environment.
- DWV2 Identify the major components of a drainage system and describe their functions.
- DWV3 Identify the different types of traps and their components, explain the importance of traps, and identify the ways that traps can lose their seals.
- DWV4 Identify the various types of drain, waste, and vent (DWV) fittings and describe their applications.
- DWV5 Identify significant code and health issues, violations, and consequences related to DWV systems.

## **PLUMBING – LEVEL TWO**

### **ITP – INSTALLING AND TESTING DWV PIPING (02207-05)**

- ITP1 Develop a material takeoff from a given set of plans.
- ITP2 Use plans and fixture rough-in sheets to determine the location of fixtures and the route of the plumbing.
- ITP3 Install a building sewer and a building drain.
- ITP4 Locate the stack within the structure.
- ITP5 Install a DWV system using appropriate hangers and correct grade or slope.
- ITP6 Modify structural members using the appropriate tools without weakening the structure.
- ITP7 Test a DWV system.

## **PLUMBING – LEVEL THREE**

### **TVE – TYPES OF VENTING (02206-05)**

- TVE1 Demonstrate an understanding of the scientific principles of venting.
- TVE2 Design vent systems according to local code requirements.
- TVE3 Sketch the different types of vents.
- TVE4 Construct given vent configurations.
- TVE5 Install the different types of vents correctly.

### **SSS – SIZING DWV AND STORM SYSTEMS (02306-06)**

- SSS1 Calculate drainage fixture units for waste systems.
- SSS2 Size building drains and sewers.
- SSS3 Size a vent system.
- SSS4 Identify and size special kinds of waste and vent systems.
- SSS5 Size roof drainage systems.

**PLUMBING – LEVEL FOUR**

ISW – INDIRECT AND SPECIAL WASTE (02404-06)

ISW1 Identify and install an indirect waste system.

ISW2 Identify and install an interceptor.

**Course Name:** Heating Devices

**Course Abbreviation:** PCT 1612

**Classification:** AOC Core (Plumbing)

**Description:** Information on local codes for installing and repairing water heaters, force air units, and floor furnaces. (2 sch: 1 hr lecture, 2 hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Identify and perform various functions on a hot water system. <sup>DOK3, IWH3-4,</sup>	
a. Identify and explain safety procedures.	
b. Identify and explain parts of a tank and tankless water heater.	
d. Install a tank and tankless water heater, including T&P valves.	
e. Replace a dip tube.	
f. Construct a venting system for gas water heaters.	
g. Perform repairs on gas and electric water heaters.	
2. Identify, install, troubleshoot, and perform various functions on heating systems. <sup>DOK3, HHS</sup>	
a. Identify and discuss the safety techniques of installing and maintaining heating systems.	
b. Troubleshoot and repair a force air heating system.	
c. Determine if the venting system for a force air heating system is adequate.	
d. Identify proper methods of venting appliances.	
e. Identify proper types of gas controls.	
f. Connect appliances to specifications.	
g. Adjust or replace ignition devices on gas appliances.	
3. Explain and discuss various functions of a forced heat system. <sup>DOK1, HHS</sup>	
a. Explain and discuss the operational procedures of a forced air heating system.	
b. Discuss and explain energy reclamation for different types of heating devices.	

## STANDARDS

*Contren Learning Series Best Practices*

### PLUMBING – LEVEL TWO

IWH – INSTALLING WATER HEATERS (02210-05)

IWH1 Describe the basic operation of water heaters.

IWH2 Identify and explain the functions of the basic components of water heaters.

IWH3 Install an electric water heater.

IWH4 Install a gas water heater.

IWH5 Describe the safety hazards associated with water heaters.

## **PLUMBING – LEVEL FOUR**

### **HHS – HYDRONIC AND SOLAR HEATING SYSTEMS (02405-06)**

HHS1 Describe the basic types of hydronic and solar heating systems and their components.

HHS2 Describe the procedures for rough-in, installation, and testing the piping in hydronic or solar heating systems.

HHS3 Lay out and build a hydronic or a solar heating system.

**Course Name:** Gas Piping

**Course Abbreviation:** PCT 1622

**Classification:** AOC Core (Plumbing)

**Description:** Information on standard gas codes. The safe installation of gas appliances and gas lines, according to codes, will be included. (2 sch: 1 hr lecture, 2 hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Identify and explain the various codes pertaining to gas and plumbing installation.	DOK1, CST, FGS
a. Identify local authority for gas installation.	
b. Identify International Fuel Gas Code definitions.	
c. Identify installation requirements for undiluted liquefied petroleum gas.	
d. Explain and utilize International Fuel Gas Code for installation requirements for specific appliances, residences, and apartments.	
e. Identify general regulations.	
2. Identify appliances and materials for gas and plumbing installations.	DOK1, CST, FGS
a. Identify approved gas appliances and materials.	
b. Identify approved joints and connections and methods of hanging and supporting.	
c. Apply approved methods for safely testing lines using a manometer.	
3. Explain, size, and install a gas system as per the principles of the British Thermal Unit (BTU).	DOK3, CST, FGS
a. Explain the BTU principles.	
b. Size using the longest length method.	
c. Install a gas piping system per given BTU requirements.	

## STANDARDS

*Contren Learning Series Best Practices*

### PLUMBING – LEVEL ONE

CST – CORRUGATED STAINLESS STEEL TUBING (02110-05)

CST1 Identify the common manufacturers of corrugated stainless steel tubing.

CST2 Recognize proper and improper applications of corrugated stainless steel tubing.

CST3 Identify the various techniques used in hanging and supporting corrugated stainless steel tubing.

CST4 Explain how to measure, cut, join, and groove corrugated stainless steel tubing properly.



CST5 Identify the material properties, storage, and handling requirements of corrugated stainless steel tubing.

## PLUMBING – LEVEL TWO

### FGS – FUEL GAS SYSTEMS (02211-05)

FGS1 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

FGS2 Identify the physical properties of each type of fuel.

FGS3 Identify the safety precautions and potential hazards associated with each type of fuel and system.

FGS4 Connect appliances to the fuel gas system properly.

FGS5 Apply local codes to various fuel gas systems.

FGS6 Design, size, purge, and test fuel gas systems.

FGS7 Demonstrate familiarity with applicable fuel gas codes.

**Course Name:** Domestic Systems

**Course Abbreviation:** PCT 1712

**Classification:** AOC Core (Plumbing)

**Description:** Information on the installation of a hot water system according to the unit fixture system. Also information on sizing and installation of a potable cold water system. (2 sch: 4 hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Estimate and install a hot water system.	DOK3, WDS, ITP, SWP, PWT, BRS SFA, PWS
a. Estimate a hot water supply fixture unit (HWSFU).	
b. Estimate the size of a hot water heater or storage tank.	
c. Explain and install a forced and natural circulating hot water system.	
2. Identify and install a potable cold water system.	DOK3, WDS, ITP, SWP, PWT, BRS SFA, PWS
a. Estimate a cold water supply fixture unit (CWSFU).	
b. Discuss safety precautions in installing and repairing potable water systems.	
c. Identify potable water and water mains.	
d. Identify and install a water treatment system.	
e. Identify and install water service and fixture branches and supplies.	
f. Identify and install water meters.	
g. Install a distribution system.	
h. Identify and install a water hammer arrester.	
i. Install a pressure-reducing valve and bypass.	

## STANDARDS

*Contren Learning Series Best Practices*

### PLUMBING – LEVEL ONE

#### WDS – INTRODUCTION TO WATER DISTRIBUTION SYSTEMS (02113-05)

WDS1 Describe the process by which water is distributed in municipal, residential, and private water systems.

WDS2 Identify the major components of a water distribution system and describe the function of each component.

WDS3 Explain the relationships between components of a water distribution system.

**PLUMBING – LEVEL TWO****ITP – INSTALLING AND TESTING WATER SUPPLY PIPING (02207-05)**

- ITP1 Develop a material takeoff from a given set of plans.
- ITP2 Use plans and fixture rough-in sheets to determine the location of fixtures and the route of the water supply piping.
- ITP3 Locate and size a water meter.
- ITP4 Locate a water heater, water softener, and hose bibs.
- ITP5 Install a water distribution system using appropriate hangers.
- ITP6 Modify structural members using the appropriate tools without weakening the structure.
- ITP7 Correctly size and install a water service line, including backflow prevention.
- ITP8 Test a water supply system.

**PLUMBING – LEVEL THREE****SWP – SIZING WATER SUPPLY PIPING (02302-06)**

- SWP1 Calculate pressure drops in a water supply system.
- SWP2 Size pipe for different acceptable flow rates.
- SWP3 Explain the difference between and advantages of a continuous-flow system and an intermittent-flow system.
- SWP4 Identify fixtures with high flow rates.
- SWP5 Explain how friction and flow impact a water supply system.
- SWP6 Lay out a water supply system.
- SWP7 Calculate developed lengths of branches for a given water supply system.
- SWP8 Calculate flow rates for high flow rate fixtures.

**PWT – POTABLE WATER TREATMENT (02303-06)**

- PWT1 Flush out visible contaminants from plumbing systems.
- PWT2 Disinfect a potable water plumbing system.
- PWT3 Identify common water problems and identify the basic equipment to solve them.
- PWT4 Practice methods used to soften water.
- PWT5 Analyze and measure water-conditioning problems.
- PWT6 Install water-conditioning equipment.

**PLUMBING – LEVEL FOUR****BRS – WATER PRESSURE BOOSTER AND RECIRCULATION SYSTEMS (02403-06)**

- BRS1 Explain the complete water pressure booster system and its components.

- BRS2 Explain the maintenance and basic troubleshooting processes for water pressure booster systems.
- BRS3 Describe the characteristics of the different recirculation systems.
- BRS4 Identify the basic components of a recirculation system.
- BRS5 Identify the location of various components within a recirculation system.
- BRS6 Install the basic components of a recirculation system.
- BRS7 Use the local plumbing code to find and cite requirements for recirculation systems.

#### SFA – SERVICING PIPING SYSTEMS, FIXTURES, AND APPLIANCES (02407-06)

- SFA1 Diagnose and address problems with water supply and quality.
- SFA2 Explain different types of corrosion and their effects on pipes.
- SFA3 Diagnose and solve fixture and appliance problems.
- SFA4 Troubleshoot and repair water heater problems.
- SFA5 Troubleshoot and repair DWV problems.

#### PWS – PRIVATE WATER SUPPLY WELL SYSTEMS (02408-06)

- PWS1 Identify the qualities of a good well.
- PWS2 Explain the operation of various types of pumps and well components.
- PWS3 Explain the installation of private water supply well system components.
- PWS4 Assemble and disassemble given components of private water supply well systems.

**Course Name:** Plumbing Fixtures Lab

**Course Abbreviation:** PCT 1722

**Classification:** AOC Core

**Description:** Information on the installation of the rough-in and finish fixtures used in the plumbing construction according to International Plumbing Code. (2 sch: 4 hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1.	Explain the procedures and install bathroom fixtures according to local, state, and/or international codes. <sup>DOK2, FXF, IFV, SFV, SFA</sup> a. Explain and install a lavatory, tub, and shower. b. Explain and install a water closet.
2.	Explain the procedures and install other fixtures according to local, state, and/or international codes. <sup>DOK2, FXF, IFV, SFV, SFA</sup> a. Explain and install washer boxes and an icemaker box. b. Explain and install urinals. c. Explain and install service sinks and mop sinks. d. Explain and install drinking fountains and a water filtering system. e. Explain and install a kitchen sink, garbage disposal, and dishwasher. f. Explain and identify other approved plumbing fixtures.

## STANDARDS

*Contren Learning Series Best Practices*

### PLUMBING – LEVEL ONE

FXF – FIXTURES AND FAUCETS (02111-05)

FXF1 Identify the basic types of materials used in the manufacture of plumbing fixtures.

FXF2 Discuss common types of sinks, lavatories, and faucets.

FXF3 Identify and discuss common types of bathtubs, bath-shower modules, shower stalls, and shower baths.

FXF4 Discuss common types of toilets, urinals, and bidets.

FXF5 Identify and describe common types of drinking fountains and water coolers.

FXF6 Discuss common types of garbage disposals and domestic dishwashers.

### PLUMBING – LEVEL TWO

IFV – INSTALLING FIXTURES, VALVES, AND FAUCETS (02208-05)

- IFV1 Describe the general procedures that should be followed before installing any fixture.
- IFV2 Install bathtubs, shower stalls, valves, and faucets.
- IFV3 Install water closets and urinals.
- IFV4 Install lavatories, sinks, and pop-up drains.
- IFV5 Protect fixtures.

#### SFV – SERVICING OF FIXTURES, VALVES, AND FAUCETS (02210-05)

- SFV1 Identify common repair and maintenance requirements for fixtures, valves, and faucets.
- SFV2 Identify the proper procedures for repairing and maintaining fixtures, valves, and faucets.

### **PLUMBING – LEVEL FOUR**

#### SFA – SERVICING PIPING SYSTEMS, FIXTURES, AND APPLIANCES (02407-06)

- SFA1 Diagnose and address problems with water supply and quality.
- SFA2 Explain different types of corrosion and their effects on pipes.
- SFA3 Diagnose and solve fixture and appliance problems.
- SFA4 Troubleshoot and repair water heater problems.
- SFA5 Troubleshoot and repair DWV problems.

**Course Name:** Backflow Cross Connection

**Course Abbreviation:** PCT 1732

**Classification:** AOC Core

**Description:** Information on the different types of backflow devices, and the installation and testing of the devices (2 sch: 1 hr lecture, 2 hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Define and explain backflow requirements.	DOK1, BFP
a. Define and explain the purpose and scope of backflow requirements.	
b. Define and explain the responsibility, liability, and authority for backflow preventions.	
c. Identify devices used to prevent backflow.	
2. Discuss, lay out, and test backflow devices.	DOK2, BFP
a. Discuss the principles of pressure as it applies to plumbing.	
b. Discuss backflow devices.	
c. Discuss a record-keeping system as required by state law.	
d. Lay out and test backflow devices as required by state law.	

## STANDARDS

*Contren Learning Series Best Practices*

### PLUMBING – LEVEL THREE

#### BFP – BACKFLOW PREVENTERS (02304-06)

BFP1 Explain the principle of backflow due to back siphonage or back pressure.

BFP2 Explain the hazards of backflow and demonstrate the importance of backflow preventers.

BFP3 Identify and explain the applications of the six basic backflow prevention devices.

BFP4 Install common types of backflow preventers.

**Course Name:** Advanced Plumbing Lab

**Course Abbreviation:** PCT 1743

**Classification:** AOC Core

**Description:** Additional study in the area of advanced plumbing in the commercial area (3 sch: 1 hr lecture, 4 hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Identify and explain various commercial components and fixtures. PDS	<sup>DOK1, FXF, IFV, SPS, CRP, ISW,</sup>
a. Identify and explain commercial hangers and supports.	
b. Identify and explain sump pumps and sewage ejectors.	
c. Identify and explain knee-action and/or foot pedal mixing valves.	
d. Identify and explain commercial plumbing fixtures with and without wall carriers.	
e. Identify and explain acid waste lines.	
2. Install various commercial components and fixtures according to required code(s). FXF, IFV, SPS, CRP, ISW, PDS	<sup>DOK2,</sup>
a. Install commercial hangers and supports.	
b. Install sump pumps and sewage ejectors.	
c. Install knee-action and/or foot pedal mixing valves.	
d. Install commercial plumbing fixtures with and without wall carriers	
e. Install acid waste lines.	
3. Describe and design a complete basic sewage treatment operation. PDS	<sup>DOK3, FXF, IFV, SPS, CRP, ISW,</sup>
a. Describe the functions of a septic tank, grease trap, and sewage treatment plant.	
b. Identify and describe the functions of aquatic-vegetation in the treatment of sewage.	
4. Identify and interpret business principles of plumbing.	<sup>DOK2, BPP</sup>

## STANDARDS

*Contren Learning Series Best Practices*

### PLUMBING – LEVEL ONE

#### FXF – FIXTURES AND FAUCETS (02111-05)

FXF1 Identify the basic types of materials used in the manufacture of plumbing fixtures.

FXF2 Discuss common types of sinks, lavatories, and faucets.



- FXF3 Identify and discuss common types of bathtubs, bath-shower modules, shower stalls, and shower baths.
- FXF4 Discuss common types of toilets, urinals, and bidets.
- FXF5 Identify and describe common types of drinking fountains and water coolers.
- FXF6 Discuss common types of garbage disposals and domestic dishwashers.

## **PLUMBING – LEVEL TWO**

### **IFV – INSTALLING FIXTURES, VALVES, AND FAUCETS (02208-05)**

- IFV1 Describe the general procedures that should be followed before installing any fixture.
- IFV2 Install bathtubs, shower stalls, valves, and faucets.
- IFV3 Install water closets and urinals.
- IFV4 Install lavatories, sinks, and pop-up drains.
- IFV5 Protect fixtures.

## **PLUMBING – LEVEL THREE**

### **SPS – SEWAGE PUMPS AND SUMP PUMPS (02307-06)**

- SPS1 Explain the functions, components, and operation of sewage and sump pumps.
- SPS2 Size a storm water sump by calculating the runoff from paved and unpaved land surfaces.
- SPS3 Size a sewage sump by calculating the sewage flow from a structure.
- SPS4 Install and adjust sensors, switches, and alarms in sewage and sump pumps.
- SPS5 Troubleshoot and repair sewage and sump pumps.
- SPS6 Using a detailed drawing, identify system components.
- SPS7 Install a sump pump.
- SPS8 Find local applicable code requirements for installation and use.

### **CRP – CORROSIVE-RESISTANT WASTE PIPING (02308-06)**

- CRP1 Discuss corrosive wastes and explain where they are found.
- CRP2 Discuss common types of materials used for corrosive-resistant waste piping.
- CRP3 Explain the methods of joining corrosive-resistant waste piping.
- CRP4 Discuss safety issues and hazard communications.

## **PLUMBING – LEVEL FOUR**

### **BPP – BUSINESS PRINCIPLES FOR PLUMBERS (02401-06)**

- BPP1 Identify and interpret a balance sheet and a profit loss statement.
- BPP2 Prepare a material takeoff as part of an estimate.

BPP3 Identify the business activities that affect profit and loss.

ISW – INDIRECT AND SPECIAL WASTE (02404-06)

ISW1 Identify and install an indirect waste system.

ISW2 Identify and install an interceptor.

PDS – PRIVATE WASTE DISPOSAL SYSTEMS (02409-06)

PDS1 Describe the types of private waste disposal systems.

PDS2 Discuss the installation and maintenance of private waste disposal systems.

PDS3 Discuss the local code requirements for private waste disposal systems.

**Course Name:** Special Project in Plumbing

**Course Abbreviation:** PCT 1911

**Classification:** Career–Technical Elective

**Description:** Practical application of skills and knowledge gained in other technical courses. The instructor works closely with the student to ensure that the selection of a project will enhance the student’s learning experience. (1 sch: 2 hr lab)

**Prerequisites:** Consent of Instructor

<b>Competencies and Suggested Objectives</b>
1. Develop a written plan that details the activities and projects to be completed. <ol style="list-style-type: none"> <li>a. Utilize a written plan that details the activities and projects to be completed.</li> <li>b. Perform written occupational objectives in the special project.</li> </ol>
2. Assess accomplishment of objectives. <ol style="list-style-type: none"> <li>a. Prepare a daily written assessment of accomplishment of objectives.</li> <li>b. Present weekly written reports to the instructor about activities performed and objectives accomplished.</li> </ol>
3. Utilize and follow a set of written guidelines for the special project. <ol style="list-style-type: none"> <li>a. Develop and follow a set of written guidelines for the special project.</li> </ol>

## **STANDARDS**

Specific standards for this course will depend upon the nature of the problem under investigation.

## **SUGGESTED REFERENCES**

Specific references for this course will depend upon the nature of the problem under investigation.

**Course Name:** Supervised Work Experience in Plumbing

**Course Abbreviation:** PCT 292(1-6)

**Classification:** Career–Technical Elective

**Description:** This course is a cooperative program between industry and education and is designed to integrate the student’s studies with industrial experience. Variable credit is awarded on the basis of semester hour per 45 industrial contact hours. (1-6 sch: 3-18 hr externship)

**Prerequisites:** Consent of Instructor

<b>Competencies and Suggested Objectives</b>
1. Apply technical skills needed to be a viable member of the workforce. <ol style="list-style-type: none"> <li>a. Prepare a description of technical skills to be developed.</li> <li>b. Develop technical skills needed to be a viable member of the workforce.</li> </ol>
2. Apply skills developed in other program area courses. <ol style="list-style-type: none"> <li>a. Perform skills developed in other program area courses.</li> </ol>
3. Apply human relationship skills. <ol style="list-style-type: none"> <li>a. Practice human relationship skills in the program.</li> </ol>
4. Apply and practice positive work habits and responsibilities. <ol style="list-style-type: none"> <li>a. Perform assignments to develop positive work habits and responsibilities.</li> </ol>
5. Work with the instructor and employer to develop written occupational objectives to be accomplished. <ol style="list-style-type: none"> <li>a. Perform written occupational objectives.</li> </ol>
6. Assess accomplishment of objectives. <ol style="list-style-type: none"> <li>a. Prepare daily written assessment of accomplishment of objectives.</li> <li>b. Present weekly written reports to the instructor about activities performed and objectives accomplished.</li> </ol>
7. Utilize a set of written guidelines. <ol style="list-style-type: none"> <li>a. Develop and follow a set of written guidelines.</li> </ol>

## STANDARDS

Specific standards for this course will depend upon the nature of the problem under investigation.

## SUGGESTED REFERENCES

Specific references for this course will depend upon the nature of the problem under investigation.

**Course Name:** Work-Based Learning I, II, III, IV, V, and VI

**Course Abbreviation:** WBL 191(1–3), WBL 192(1–3), WBL 193(1–3), WBL 291(1–3), WBL 292(1–3), and WBL 293(1–3)

**Classification:** Free Elective

**Description:** A structured workplace learning experience in which the student, program area teacher, work-based learning coordinator, and workplace supervisor/mentor develop and implement an educational training agreement. Designed to integrate the student’s academic and technical skills into a work environment. May include regular meetings and seminars with school personnel and employers for supplemental instruction and progress reviews. (1–3 sch: 3–9 hr externship)

**Prerequisite:** Concurrent enrollment in career–technical program area courses

<b>Competencies and Suggested Objectives</b>
<p>1. Apply technical skills and related academic knowledge needed to be a viable member of the workforce.</p> <ul style="list-style-type: none"> <li>a. Demonstrate technical skills necessary to complete job requirements.</li> <li>b. Demonstrate academic skills necessary to complete job requirements.</li> <li>c. Perform tasks detailed in an educational training agreement at the work setting.</li> </ul>
<p>2. Apply general workplace skills to include positive work habits necessary for successful employment.</p> <ul style="list-style-type: none"> <li>a. Demonstrate appropriate human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service.</li> <li>b. Utilize time, materials, and resource-management skills.</li> <li>c. Use critical-thinking skills, such as problem solving, decision making, and reasoning.</li> <li>d. Acquire, evaluate, organize, maintain, interpret, and communicate information.</li> </ul>

## STANDARDS

Specific standards for this course will depend upon the nature of the problem under investigation.

## SUGGESTED REFERENCES

Specific references for this course will depend upon the nature of the problem under investigation.

## Appendix A: Course References

All of the Plumbing Technology references listed under General Books and Trade Publications are used for all courses. Course-specific references are listed under the appropriate course number and name.

### General Books

International Code Council. (2012). *2012 International plumbing code*. Birmingham, AL: Author.

International Code Council. (2012). *2012 IPC fundamentals*. Birmingham, AL: Author.

International Code Council. (2012). *2012 International plumbing code commentary*. Birmingham, AL: Author.

National Center for Construction Education and Research. (2005). *Plumbing level 1*. Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (2005). *Plumbing level 2*. Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (2006). *Plumbing level 3*. Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (2006). *Plumbing level 4*. Upper Saddle River, NJ: Pearson Prentice Hall.

### Trade Publications

International Code Council. (n.d.). *Building safety journal*. Whittier, CA: International Code Council. Retrieved September 25, 2007, from <http://www.buildingsafetyjournal.org>

Greater Hattiesburg Home Builders Association. (n.d.). *Greater Hattiesburg Home Builders Association newsletter*. Hattiesburg, MS: Author.

AHRI. Retrieved October 12, 2011, from <http://www.ahrinet.org>

Greater Hattiesburg Home Builders Association. Retrieved October 12, 2011, from <http://www.hattiesburgbuilders.org/index.cfm>

International Code Council. Retrieved October 12, 2011, from <http://www.iccsafe.org/Accreditation/Pages/ThirdPartyContractorTradesExams.aspx>

Plumbing Heating Cooling Contractors Association. Retrieved October 12, 2011, from <http://www.phccweb.org>

### **PCT 1113 Fundamentals of Plumbing/Pipefitting**

National Center for Construction Education and Research. (2009). *Core curricula*. Upper Saddle River, NJ: Pearson Prentice Hall.

### **PCT 1732 Backflow and Cross Connection**

Mississippi State Department of Health – Division of Water Supply. (1998). *Cross connection control program reference manual for public water systems*. Jackson, MS: Author.

### **PCT 1722 Plumbing Fixtures Lab**

American Standard. (2006). *2005/2006 fixtures rough-in book*. Tyler, TX: American Standard Customer Care.

Eljer. (n.d.). *Eljer plumbing products rough-in measurements*. Dallas, TX: Author.

### **PCT 1743 Advanced Plumbing Lab**

American Standard. (2006). *2005/2006 fixtures rough-in book*. Tyler, TX: American Standard Customer Care.

Eljer. (n.d.). *Eljer plumbing products rough-in measurements*. Dallas, TX: Author.

Guest, J. R., D'Arcangelo, B., & D'Arcangelo, B. (1989). *Blueprint reading for plumbers residential and commercial*. Albany, NY: Delmar Publishers, Inc.

International Code Council. (2012). *2012 International fuel gas code*. Birmingham, AL: Author.

International Code Council. (2012). *2012 IFG fundamentals*. Birmingham, AL: Author.

International Code Council. (2012). *International fuel gas code commentary*. Birmingham, AL: Author.

International Code Council. (2012). *2012 International mechanical code*. Birmingham, AL: Author.

International Code Council. (2012). *2012 IMC fundamentals*. Birmingham, AL: Author.

International Code Council. (2012). *2012 International mechanical code commentary*. Birmingham, AL: Author.

### **PCT 1622 Gas Piping**

International Code Council. (2012). *2012 International fuel gas code*. Birmingham, AL: Author.

International Code Council. (2012). *2012 IFG fundamentals*. Birmingham, AL: Author.

International Code Council. (2012). *2012 International fuel gas code commentary*. Birmingham, AL: Author.

### **PCT 1612 Heating Devices**

Killinger, J., & Killinger, L. (2003). *Heating and cooling essentials*. Tinley Park, IL: Goodheart-Wilcox.

International Code Council. (2012). *2012 International fuel gas code*. Birmingham, AL: Author.

International Code Council. (2012). *2012 IFG fundamentals*. Birmingham, AL: Author.

International Code Council. (2012). *2012 International fuel gas code commentary*. Birmingham, AL: Author.

International Code Council. (2012). *2012 International mechanical code*. Birmingham, AL: Author.

International Code Council. (2012). *2012 IMC fundamentals*. Birmingham, AL: Author.

International Code Council. (2012). *2012 International mechanical code commentary*. Birmingham, AL: Author.

Stegmann, R. (2001). *Heating system basics*. Buffalo Grove, IL: TPC Training Systems.

### **PCT 1411 Low Pressure Boilers**

Killinger, J., & Killinger, L. (2003). *Heating and cooling essentials*. Tinley Park, IL: Goodheart-Wilcox.

International Code Council. (2012). *International fuel gas code*. Birmingham, AL: Author.

International Code Council. (2012). *2012 IFG fundamentals*. Birmingham, AL: Author.

International Code Council. (2012). *2012 International fuel gas code commentary*. Birmingham, AL: Author.

International Code Council. (2012). *2012 International mechanical code*. Birmingham, AL: Author.

International Code Council. (2012). *2012 IMC fundamentals*. Birmingham, AL: Author.

International Code Council. (2012). *2012 International mechanical code commentary*. Birmingham, AL: Author.

National Center for Construction Education and Research. (2007). *Pipefitting level 4*. Upper Saddle River, NJ: Pearson Prentice Hall.



Stegmann, R. (2001). *Heating system basics*. Buffalo Grove, IL: TPC Training Systems.

Steingress, F. M., & Walker, D. (2008). *Low pressure boilers*. Homewood, IL: American Technical Publishers.

### **PCT 1333 Blueprint Reading for Plumbing**

Guest, J. R., D'Arcangelo, B., & D'Arcangelo, B. (1989). *Blueprint reading for plumbers residential and commercial*. Albany, NY: Delmar Publishers, Inc.

Joyce, M. (2009). *Blueprint reading and drafting for plumbers*. Clifton Park, NY: Cengage Learning.

### **PCT 1323 Sketching**

Guest, J. R., D'Arcangelo, B., & D'Arcangelo, B. (1989). *Blueprint reading for plumbers residential and commercial*. Albany, NY: Delmar Publishers, Inc.

Joyce, M. (2009). *Blueprint reading and drafting for plumbers*. Clifton Park, NY: Cengage Learning.

### **PCT 1213 Tacking, Brazing, Burning**

Gellerman, M. (1995). *Welding fundamentals*. Albany, NY: Delmar Publishers, Inc.

National Center for Construction Education and Research. (2009). *Core curricula*. Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (2006). *Pipefitting level 1*. Upper Saddle River, NJ: Pearson Prentice Hall.

### **PCT 1812 Rigging and Signaling**

National Center for Construction Education and Research. (2009). *Core curricula*. Upper Saddle River, NJ: Pearson Prentice Hall.

### **PCT 2419 Special Project**

American Standard. (2006). *2005/2006 fixtures rough-in book*. Tyler, TX: American Standard Customer Care.

Eljer. (n. d.). *Eljer plumbing products rough-in measurements*. Dallas, TX: Author.

Guest, J. R., D'Arcangelo, B., & D'Arcangelo, B. (1989). *Blueprint reading for plumbers residential and commercial*. Albany, NY: Delmar Publishers, Inc.

International Code Council. (2012). *2012 International fuel gas code*. Birmingham, AL: Author.

International Code Council. (2012). *2012 IFG fundamentals*. Birmingham, AL: Author

International Code Council. (2012). *2012 International fuel gas code commentary*. Birmingham, AL: Author.

International Code Council. (2012). *2012 International mechanical code*. Birmingham, AL: Author.

International Code Council. (2012). *2012 IMC fundamentals*. Birmingham, AL: Author.

International Code Council. (2012). *2012 International mechanical code commentary*. Birmingham, AL: Author.

## Appendix B: Contren Learning for the Plumbing Technology Program<sup>1</sup> (taken from the National Center for Construction Education and Research)

### Contren Core

#### BSM – BASIC SAFETY (00101-09)

- BSM1 Identify the responsibilities and personal characteristics of a professional craftsman.
- BSM2 Explain the role that safety plays in the construction crafts.
- BSM3 Describe what job-site safety means.
- BSM4 Explain the appropriate safety precautions around common job-site hazards.
- BSM5 Demonstrate the use and care of appropriate personal protective equipment.
- BSM6 Follow safe procedures for lifting heavy objects.
- BSM7 Describe safe behavior on and around ladders and scaffolds.
- BSM8 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
- BSM9 Describe fire prevention and fire fighting techniques.
- BSM10 Define safe work procedures around electrical hazards.

#### ICM – INTRODUCTION TO CONSTRUCTION MATH (00102-09)

- ICM1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
- ICM2 Use a standard ruler, a metric ruler to measure.
- ICM3 Add, subtract, multiply, and divide fractions.
- ICM4 Add, subtract, multiply, and divide decimals, with and without a calculator.
- ICM5 Convert decimals to percents and percents to decimals.
- ICM6 Convert fractions to decimals and decimals to fractions.
- ICM9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.

#### IHT – INTRODUCTION TO HAND TOOLS (0103-09)

- IHT1 Recognize and identify some of the basic hand tools and their proper uses in the construction trade.
- IHT2 Safely use hand tools.
- IHT3 Describe the basic procedures for taking care of these tools.

#### IPT – INTRODUCTION TO POWER TOOLS (00104-09)

- IPT1 Recognize and identify some of the basic hand tools used in the construction trade.
- IPT2 Use power tools safely.
- IPT3 Describe the basic procedures for taking care of these tools.

---

<sup>1</sup> *Contren learning series*. Retrieved October 12, 2011, from <http://www.nccer.org/>

**BLU – INTRODUCTION TO CONSTRUCTION DRAWINGS (00105-09)**

- BLU1 Recognize and identify basic blueprint terms, components, and symbols.
- BLU2 Relate information on blueprints to actual locations on the print.
- BLU3 Recognize different classifications of drawings.
- BLU4 Interpret and use drawing dimensions.

**RIG – BASIC RIGGING (00106-09)**

- RIG1 Identify and describe the use of slings and common rigging hardware.
- RIG2 Describe the basic inspection techniques and rejection criteria used for slings and hardware.
- RIG3 Describe the basic hitch configurations and their proper connections.
- RIG4 Describe basic load-handling safety practices.
- RIG5 Demonstrate proper use of American National Standards Institute (ANSI) hand signals.

**PLUMBING****LEVEL ONE****IPP – INTRODUCTION TO THE PLUMBING PROFESSION (02101-05)**

- IPP1 Describe the history of the plumbing profession.
- IPP2 Identify the responsibilities of a person working in the construction industry.
- IPP3 State the personal characteristics of a professional.
- IPP4 Identify the stages of progress within the plumbing profession and its positive impact on society.

**PLS – PLUMBING SAFETY (02102-05)**

- PLS1 Describe the common unsafe acts and unsafe conditions that cause accidents.
- PLS2 Describe how to handle unsafe acts and unsafe conditions.
- PLS3 Explain how the cost of accidents and illnesses affects everyone on site.
- PLS4 Demonstrate the use and care of appropriate personal protective equipment.
- PLS5 Identify jobsite hazardous work specific to plumbers.
- PLS6 Demonstrate the proper use of ladders.
- PLS7 Demonstrate how to maintain power tools safely.
- PLS8 Explain how to work safely in and around a trench.
- PLS9 Describe and demonstrate the lockout–tagout process.

**PLT – PLUMBING TOOLS (02103-05)**

- PLT1 Identify the basic hand and power tools used in the plumbing trade.
- PLT2 Demonstrate the proper use of plumbing tools.

- PLT3 Demonstrate the ability to know when and how to select the proper tool(s) for tasks.
- PLT4 Demonstrate the proper maintenance for caring for hand and power tools.
- PLT5 Demonstrate how to prepare a surface for tool use.
- PLT6 Describe the safety requirements for using plumbing tools.

#### IPD – INTRODUCTION TO PLUMBING DRAWINGS (02105-05)

- IPD1 Identify pictorial (isometric and oblique), schematic, and orthographic drawings and discuss how different views are used to depict information about objects.
- IPD2 Identify the basic symbols used in schematic drawings of pipe assemblies.
- IPD3 Explain the types of drawings that may be included in a set of plumbing drawings and the relationship among the different drawings.
- IPD4 Interpret plumbing-related information from a set of plumbing drawings.
- IPD5 Sketch orthographic and schematic drawings.
- IPD6 Use an architect's scale to draw lines to scale and to measure lines drawn to scale.
- IPD7 Discuss how code requirements apply to certain drawings.

#### PPF – PLASTIC PIPE AND FITTINGS (02106-05)

- PPF1 Identify types of materials and schedules of plastic piping.
- PPF2 Identify proper and improper applications of plastic piping.
- PPF3 Identify types of fittings and valves used with plastic piping.
- PPF4 Identify and determine the kinds of hangers and supports needed for plastic piping.
- PPF5 Identify the various techniques used in hanging and supporting plastic piping.
- PPF6 Properly measure, cut, and join plastic piping.
- PPF7 Explain proper procedures for the handling, storage, and protection of plastic pipes.

#### CPF – COPPER PIPE AND FITTINGS (02107-05)

- CPF1 Identify the types of materials and schedules used with copper piping.
- CPF2 Identify the material properties, storage, and handling requirements of copper piping.
- CPF3 Identify the types of fittings and valves used with copper piping.
- CPF4 Identify the techniques used in hanging and supporting copper piping.
- CPF5 Properly measure, ream, cut, and join copper piping.
- CPF6 Identify the hazards and safety precautions associated with copper piping.

#### CIF – CAST-IRON PIPE AND FITTINGS (02108-05)

- CIF1 Recognize proper and improper applications of cast-iron piping.
- CIF2 Identify the material properties, storage, and handling requirements of carbon steel piping.
- CIF3 Identify the types of materials and schedules used in cast-iron piping.

- CIF4 Identify the types of fittings used with cast-iron piping.
- CIF5 Identify the various techniques used in handling and supporting cast-iron piping.
- CIF6 Properly measure, cut, and join cast-iron piping.
- CIF7 Identify the hazards and safety precautions associated with cast-iron piping.

#### CSF – CARBON STEEL PIPE AND FITTINGS (02109-05)

- CSF1 Recognize proper applications of carbon steel piping.
- CSF2 Identify the material properties, storage, and handling requirements of carbon steel piping.
- CSF3 Identify the various techniques used in hanging and supporting carbon steel piping.
- CSF4 Properly measure, cut, groove, thread, and join carbon steel piping.

#### CST – CORRUGATED STAINLESS STEEL TUBING (02110-05)

- CST1 Identify the common manufacturers of corrugated stainless steel tubing.
- CST2 Recognize proper and improper applications of corrugated stainless steel tubing.
- CST3 Identify the various techniques used in hanging and supporting corrugated stainless steel tubing.
- CST4 Explain how to measure, cut, join, and groove corrugated stainless steel tubing properly.
- CST5 Identify the material properties, storage, and handling requirements of corrugated stainless steel tubing.

#### FXF – FIXTURES AND FAUCETS (02111-05)

- FXF1 Identify the basic types of materials used in the manufacture of plumbing fixtures.
- FXF2 Discuss common types of sinks, lavatories, and faucets.
- FXF3 Identify and discuss common types of bathtubs, bath–shower modules, shower stalls, and shower baths.
- FXF4 Discuss common types of toilets, urinals, and bidets.
- FXF5 Identify and describe common types of drinking fountains and water coolers.
- FXF6 Discuss common types of garbage disposals and domestic dishwashers.

#### DWV – INTRODUCTION TO DRAIN, WASTE, AND VENT (DWV) SYSTEMS (02112-05)

- DWV1 Explain how waste moves from a fixture through the drain system to the environment.
- DWV2 Identify the major components of a drainage system and describe their functions.
- DWV3 Identify the different types of traps and their components, explain the importance of traps and identify the ways that traps can lose their seals.
- DWV4 Identify the various types of drain, waste, and vent (DWV) fittings and describe their applications.

DWV5 Identify significant code and health issues, violations, and consequences related to DWV systems.

#### WDS – INTRODUCTION TO WATER DISTRIBUTION SYSTEMS (02113-05)

WDS1 Describe the process by which water is distributed in municipal, residential, and private water systems.

WDS2 Identify the major components of a water distribution system and describe the function of each component.

WDS3 Explain the relationships between components of a water distribution system.

### LEVEL 2

#### RCD – READING COMMERCIAL DRAWINGS (02202-05)

RCD1 Interpret information from given site plans.

RCD2 Verify dimensions shown on drawings and generate an RFI when discrepancies are found.

RCD3 Locate plumbing entry points, walls, and chases.

RCD4 Create an isometric drawing.

RCD5 Do a material takeoff for drainage, waste, and vent (DWV) and water supply systems from information shown on drawings.

RCD6 Use approved submittal data, floor plans, and architectural details to lay out fixture rough-ins, to develop estimates, and to establish general fixture locations.

RCD7 Recognize the need for coordination and shop drawings.

#### HPF – HANGERS, SUPPORTS, STRUCTURAL PENETRATIONS, AND FIRE STOPPING (02203-05)

HPF1 Identify the hangers and supports used to install DWV and water supply systems, and explain their applications.

HPF2 Install pipe hangers and supports correctly according to local applicable codes and manufacturer's specifications.

HPF3 Modify structural members using the appropriate tools without weakening the structure.

HPF4 Identify and install common types of fire-stopping materials used in penetrations through fire-rated structural members, walls, floors, and ceilings.

#### ITP – INSTALLING AND TESTING WATER SUPPLY PIPING (02207-05)

ITP1 Develop a material takeoff from a given set of plans.

ITP2 Use plans and fixture rough-in sheets to determine the location of fixtures and the route of the plumbing.

- ITP3 Install a building sewer and a building drain.
- ITP4 Locate the stack within the structure.
- ITP5 Install a DWV system using appropriate hangers and correct grade or slope.
- ITP6 Modify structural members using the appropriate tools without weakening the structure.
- ITP7 Test a DWV system.

#### IRD – INSTALLING ROOF, FLOOR, AND AREA DRAINS (02205-05)

- IRD1 Use a surveyor's level or transit level to set the elevation of a floor or area drain.
- IRD2 Install a roof drain, a floor drain, and an area drain.
- IRD3 Install waterproof membranes and flashing.

#### TVA – TYPES OF VALVES (02206-05)

- TVA1 Identify the basic types of valves.
- TVA2 Describe the differences in pressure ratings for valves.
- TVA3 Demonstrate the ability to service various types of valves.

#### ITP – INSTALLING AND TESTING WATER SUPPLY PIPING (02207-05)

- ITP1 Develop a material takeoff from a given set of plans.
- ITP2 Use plans and fixture rough-in sheets to determine the location of fixtures and the route of the water supply piping.
- ITP3 Locate and size a water meter.
- ITP4 Locate a water heater, water softener, and hose bibbs.
- ITP5 Install a water distribution system using appropriate hangers.
- ITP6 Modify structural members using the appropriate tools without weakening the structure.
- ITP7 Correctly size and install a water service line, including backflow prevention.
- ITP8 Test a water supply system.

#### IFV – INSTALLING FIXTURES, VALVES, AND FAUCETS (02208-05)

- IFV1 Describe the general procedures that should be followed before installing any fixture.
- IFV2 Install bathtubs, shower stalls, valves, and faucets.
- IFV3 Install water closets and urinals.
- IFV4 Install lavatories, sinks, and pop-up drains.
- IFV5 Protect fixtures.

#### IWH – INSTALLING WATER HEATERS (02210-05)

- IWH1 Describe the basic operation of water heaters.
- IWH2 Identify and explain the functions of the basic components of water heaters.



- IWH3 Install an electric water heater.  
IWH4 Install a gas water heater.  
IWH5 Describe the safety hazards associated with water heaters.

#### FGS – FUEL GAS SYSTEMS (02211-05)

- FGS1 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
- FGS2 Identify the physical properties of each type of fuel.  
FGS3 Identify the safety precautions and potential hazards associated with each type of fuel and system.  
FGS4 Connect appliances to the fuel gas system properly.  
FGS5 Apply local codes to various fuel gas systems.  
FGS6 Design, size, purge, and test fuel gas systems.  
FGS7 Demonstrate familiarity with applicable fuel gas codes.

#### SFV – SERVICING OF FIXTURES, VALVES, AND FAUCETS (02210-05)

- SFV1 Identify common repair and maintenance requirements for fixtures, valves, and faucets.  
SFV2 Identify the proper procedures for repairing and maintaining fixtures, valves, and faucets.

### LEVEL 3

#### SWP – SIZING WATER SUPPLY PIPING (02302-06)

- SWP1 Calculate pressure drops in a water supply system.  
SWP2 Size pipe for different acceptable flow rates.  
SWP3 Explain the difference between and advantages of a continuous-flow system and an intermittent-flow system.  
SWP4 Identify fixtures with high flow rates.  
SWP5 Explain how friction and flow impact a water supply system.  
SWP6 Lay out a water supply system.  
SWP7 Calculate developed lengths of branches for a given water supply system.  
SWP8 Calculate flow rates for high flow rate fixtures.

#### PWT – POTABLE WATER TREATMENT (02303-06)

- PWT1 Flush out visible contaminants from plumbing systems.  
PWT2 Disinfect a potable water plumbing system.

PWT3 Identify common water problems and identify the basic equipment to solve them.

PWT4 Practice methods used to soften water.

PWT5 Analyze and measure water-conditioning problems.

PWT6 Install water-conditioning equipment.

#### BFP – BACKFLOW PREVENTERS (02304-06)

BFP1 Explain the principle of backflow due to back siphonage or back pressure.

BFP2 Explain the hazards of backflow and demonstrate the importance of backflow preventers.

BFP3 Identify and explain the applications of the six basic backflow prevention devices.

BFP4 Install common types of backflow preventers.

#### TVE – TYPES OF VENTING (02305-06)

TVE1 Describe the scientific principles of venting.

TVE2 Design vent systems according to local code requirements.

TVE3 Sketch the different types of vents.

TVE4 Construct given vent configurations.

TVE5 Install the different types of vents correctly.

TVE6 Select correct fittings for vents.

#### SSS – SIZING DWV AND STORM SYSTEMS (02306-06)

SSS1 Calculate drainage fixture units for waste systems.

SSS2 Size building drains and sewers.

SSS3 Size a vent system.

SSS4 Identify and size special kinds of waste and vent systems.

SSS5 Size roof drainage systems.

#### SPS – SEWAGE PUMPS AND SUMP PUMPS (02307-06)

SPS1 Explain the functions, components, and operation of sewage and sump pumps.

SPS2 Size a storm water sump by calculating the runoff from paved and unpaved land surfaces.

SPS3 Size a sewage sump by calculating the sewage flow from a structure.

SPS4 Install and adjust sensors, switches, and alarms in sewage and sump pumps.

SPS5 Troubleshoot and repair sewage and sump pumps.

SPS6 Using a detailed drawing, identify system components.

SPS7 Install a sump pump.

SPS8 Find local applicable code requirements for installation and use.

#### CRP – CORROSIVE-RESISTANT WASTE PIPING (02308-06)

- CRP1 Discuss corrosive wastes and explain where they are found.
- CRP2 Discuss common types of materials used for corrosive-resistant waste piping.
- CRP3 Explain the methods of joining corrosive-resistant waste piping.
- CRP4 Discuss safety issues and hazard communications.

## **LEVEL FOUR**

### **BPP – BUSINESS PRINCIPLES FOR PLUMBERS (02401-06)**

- BPP1 Identify and interpret a balance sheet and a profit loss statement.
- BPP2 Prepare a material takeoff as part of an estimate.
- BPP3 Identify the business activities that affect profit and loss.

### **BRS – WATER PRESSURE BOOSTER AND RECIRCULATION SYSTEMS (02403-06)**

- BRS1 Explain the complete water pressure booster system and its components.
- BRS2 Explain the maintenance and basic troubleshooting processes for water pressure booster systems.
- BRS3 Describe the characteristics of the different recirculation systems.
- BRS4 Identify the basic components of a recirculation system.
- BRS5 Identify the location of various components within a recirculation system.
- BRS6 Install the basic components of a recirculation system.
- BRS7 Use the local plumbing code to find and cite requirements for recirculation systems.

### **ISW – INDIRECT AND SPECIAL WASTE (02404-06)**

- ISW1 Identify and install an indirect waste system.
- ISW2 Identify and install an interceptor.

### **HHS – HYDRONIC AND SOLAR HEATING SYSTEMS (02405-06)**

- HHS1 Describe the basic types of hydronic and solar heating systems and their components.
- HHS2 Describe the procedures for rough-in, installation, and testing the piping in hydronic or solar heating systems.
- HHS3 Lay out and build a hydronic or a solar heating system.

### **CDS – CODES (02406-06)**

- CDS1 Describe the model and local plumbing codes and their purposes.
- CDS2 Explain the procedure for modifying plumbing codes.
- CDS3 Use the local plumbing code to find and cite references.

**SFA – SERVICING PIPING SYSTEMS, FIXTURES, AND APPLIANCES (02407-06)**

- SFA1 Diagnose and address problems with water supply and quality.
- SFA2 Explain different types of corrosion and their effects on pipes.
- SFA3 Diagnose and solve fixture and appliance problems.
- SFA4 Troubleshoot and repair water heater problems.
- SFA5 Troubleshoot and repair DWV problems.

**PWS – PRIVATE WATER SUPPLY WELL SYSTEMS (02408-06)**

- PWS1 Identify the qualities of a good well.
- PWS2 Explain the operation of various types of pumps and well components.
- PWS3 Explain the installation of private water supply well system components.
- PWS4 Assemble and disassemble given components of private water supply well systems.

**PDS – PRIVATE WASTE DISPOSAL SYSTEMS (02409-06)**

- PDS1 Describe the types of private waste disposal systems.
- PDS2 Discuss the installation and maintenance of private waste disposal systems.
- PDS3 Discuss the local code requirements for private waste disposal systems.

**PIPEFITTING****LEVEL ONE****OFC – OXYFUEL CUTTING (08104-06)**

- OFC1 Identify and explain the use of oxyfuel cutting equipment.
- OFC2 Set up oxyfuel equipment.
- OFC3 Light and adjust an oxyfuel torch.
- OFC4 Shut down oxyfuel cutting equipment.
- OFC5 Disassemble oxyfuel equipment.
- OFC6 Change empty cylinders.
- OFC7 Perform oxyfuel cutting:
  - Straight line and square shapes
  - Bevels

**LEVEL FOUR****STT – STEAM TRAPS (08404-07)**

- STT1 Identify types of steam traps.
- STT2 Install steam traps.
- STT3 Troubleshoot steam trap systems.

## Appendix C: Related Academic Standards<sup>2</sup>

Related Academic Standards								
	Course	PCT 1722	PCT 1732	PCT 1443	PCT 1743	PCT 1213	PCT 1323	PCT 1812
<b>21<sup>st</sup> Century Standards</b>								
R1		X	X	X	X	X	X	X
R2		X	X	X	X	X	X	X
R3		X	X	X	X	X	X	X
R4		X	X	X	X			X
R5		X	X	X	X	X	X	X
M1		X	X	X	X		X	X
M2		X	X	X	X	X	X	X
M3			X	X	X	X	X	X
M4				X	X	X	X	X
M5				X	X	X	X	X
M6				X	X	X	X	X
M7		X	X	X	X	X	X	X
M8		X		X	X		X	X
M9			X	X	X			
A1		X	X	X	X	X	X	X
A2				X	X	X	X	X
A3		X	X	X	X	X	X	X
A4				X	X	X	X	
A5		X	X	X	X		X	X
A6		X		X	X	X	X	X
A7		X	X	X	X	X	X	X
A8		X	X		X	X		X

### Reading

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)

<sup>2</sup> CTB/McGraw-Hill LLC. (2005). *Tests of adult basic education, forms 9 and 10*. Monterey, CA: Author.

Reproduced with permission of CTB/McGraw-Hill LLC. TABE is a registered trademark of The McGraw-Hill Companies, Inc. Copyright 2005 by CTB/McGraw-Hill LLC. Reproduction of this material is permitted for educational purposes only.

### Mathematics Computation

- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations

### Applied Mathematics

- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)

### Language

- L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

### Spelling

- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

## Appendix D: 21st Century Skills<sup>3</sup>

<b>21<sup>st</sup> Century Crosswalk for Plumbing</b>											
	Courses	PCT 1113	PCT 1513	PCT 1612	PCT 1712	PCT 1333	PCT 1411	PCT 1622	PCT 1722	PCT 1732	PCT 1443
<b>21<sup>st</sup> Century Standards</b>											
CS1		X	X	X	X	X	X	X	X	X	X
CS2		X	X	X	X	X	X	X	X	X	
CS3		X	X	X	X	X	X	X		X	
CS4		X	X	X	X	X	X	X	X	X	X
CS5		X	X	X	X	X	X	X	X	X	
CS6		X	X	X	X	X		X	X		
CS7		X	X	X	X	X	X	X	X	X	X
CS8		X	X	X	X	X	X	X		X	X
CS9		X	X	X	X	X	X	X		X	X
CS10				X	X		X	X		X	
CS11											
CS12		X	X	X	X	X	X	X		X	X
CS13		X	X	X	X	X	X	X		X	X
CS14		X	X	X	X	X		X		X	X
CS15		X	X	X	X	X	X	X		X	X
CS16		X	X	X	X	X	X	X		X	X

<sup>3</sup> *21st century skills.* (n.d.). Washington, DC: Partnership for 21st Century Skills.

21 <sup>st</sup> Century Crosswalk for Plumbing									
	Courses	PCT 1743	PCT 1213	PCT 1323	PCT 1812				
<b>21<sup>st</sup> Century Standards</b>									
CS1		X	X	X					
CS2		X	X	X					
CS3		X		X	X				
CS4		X	X	X	X				
CS5		X	X	X					
CS6		X	X	X	X				
CS7		X	X	X	X				
CS8		X	X	X	X				
CS9		X	X	X	X				
CS10		X							
CS11									
CS12		X	X	X	X				
CS13		X	X	X	X				
CS14		X	X	X	X				
CS15		X	X	X	X				
CS16		X	X	X	X				

### CS1 Global Awareness

- Using 21st century skills to understand and address global issues
- Learning from and working collaboratively with individuals representing diverse cultures, religions and lifestyles in a spirit of mutual respect and open dialogue in personal, work, and community contexts
- Understanding other nations and cultures, including the use of non-English languages

### CS2 Financial, Economic, Business and Entrepreneurial Literacy

- Knowing how to make appropriate personal economic choices
- Understanding the role of the economy in society
- Using entrepreneurial skills to enhance workplace productivity and career options

### CS3 Civic Literacy

- Participating effectively in civic life through knowing how to stay informed and understanding governmental processes
- Exercising the rights and obligations of citizenship at local, state, national and global levels
- Understanding the local and global implications of civic decisions



**CS4 Health Literacy**

1. Obtaining, interpreting and understanding basic health information and services and using such information and services in ways that enhance health
2. Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance, and stress reduction
3. Using available information to make appropriate health-related decisions
4. Establishing and monitoring personal and family health goals
5. Understanding national and international public health and safety issues

**CS5 Environmental Literacy**

1. Demonstrate knowledge and understanding of the environment and the circumstances and conditions affecting it, particularly as relates to air, climate, land, food, energy, water and ecosystems
2. Demonstrate knowledge and understanding of society's impact on the natural world (e.g., population growth, population development, resource consumption rate, etc.)
3. Investigate and analyze environmental issues and make accurate conclusions about effective solutions
4. Take individual and collective action towards addressing environmental challenges (e.g., participating in global actions, designing solutions that inspire action on environmental issues)

**CS6 Creativity and Innovation**

1. Think Creatively
2. Work Creatively with Others
3. Implement Innovations

**CS7 Critical Thinking and Problem Solving**

1. Reason Effectively
2. Use Systems Thinking
3. Make Judgments and Decisions
4. Solve Problems

**CS8 Communication and Collaboration**

1. Communicate Clearly
2. Collaborate with Others

**CS9 Information Literacy**

1. Access and Evaluate Information
2. Use and Manage Information

**CS10 Media Literacy**

1. Analyze Media
2. Create Media Products

**CS11 ICT Literacy**

1. Apply Technology Effectively

**CS12 Flexibility and Adaptability**

1. Adapt to change
2. Be Flexible

**CS13 Initiative and Self-Direction**

1. Manage Goals and Time
2. Work Independently
3. Be Self-directed Learners

**CS14 Social and Cross-Cultural Skills**

1. Interact Effectively with others
2. Work Effectively in Diverse Teams

**CS15 Productivity and Accountability**

1. Manage Projects
2. Produce Results

**CS16 Leadership and Responsibility**

1. Guide and Lead Others
2. Be Responsible to Others