20082012 Mississippi Curriculum Framework

Postsecondary Plumbing Technology
(Program CIP: 46.0503 – Plumbing Technology/Plumber)

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

Standards for Program Contren® Learning Series Best Practices

Related Academic Standards

21st Century Skills
Reproduced with permission of the Partnership for 21st Century Skills. Further information may be found at www.21stcenturyskills.org, www.p21.org
Preface

Postsecondary Plumbing Technology Research Synopsis

Articles, books, Web sites, and other materials were considered during the revision process. Modern Plumbing, Contren® Learning Series Plumbing Levels One through Four, The NCCER Web site and the International Plumbing Code 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 included maintaining a positive attitude, being at work every day and on time, and having reading and writing skills, communication skills, and problem-solving skills to complete work orders and other forms related to the plumbing technician field. Occupational-specific skills stated included project plumbing, blueprint reading, boilers, and tacking and brazing include knowledge of the fundamentals, identification of basic parts, installation, and troubleshooting. Safety practices emphasized included personal include practicing all agricultural technician safety, as well as fire, electrical, chemical, jobsite, and rules and wearing the proper safety equipment safety.

Instructors from colleges throughout the state were also asked to give input on changes to be made to the curriculum framework. Specific comments related to this program included statements from Advisory Committee members including, “The graduates normally enter the field confident and eager to work.” Changes suggested for the curriculum included providing math skills necessary to complete the work and stressing employability skills.

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

<table>
<thead>
<tr>
<th>Region</th>
<th>2011 Jobs</th>
<th>2020 Jobs</th>
<th>Change</th>
<th>% Change</th>
<th>Openings</th>
<th>2011 Median Hourly Earnings</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Region</th>
<th>2011 Jobs</th>
<th>2020 Jobs</th>
<th>Change</th>
<th>% Change</th>
<th>Openings</th>
<th>2011 Median Hourly Earnings</th>
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</thead>
<tbody>
<tr>
<td>Regional Total</td>
<td>16,572</td>
<td>18,749</td>
<td>2,177</td>
<td>13%</td>
<td>5,259</td>
<td>$18.19</td>
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<tr>
<td>National Total</td>
<td>1,323,688</td>
<td>1,453,250</td>
<td>129,562</td>
<td>10%</td>
<td>386,504</td>
<td>$22.47</td>
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</table>

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 79 and 810* Academic Standards
- 21st Century Skills
- *Contren® Learning Series* *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 September 19-21, 2007, October 12, 2011, curriculum revision meeting included the following:

- **Competencies**: 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 were reviewed to ensure accuracy and appropriateness.**
- **The competency wording was strengthened using Bloom’s Taxonomy.**
- **Clarified content that relates to the Contren Best Practices**
- **Updated the Recommended Tools and Equipment list was reviewed to reflect the tool list for successful competition of Plumbing Technology theory and content**

Assessment

Students will be assessed using the Postsecondary MS-CPAS2 Assessment, unless an alternative assessment is approved.
Students are assessed using the Plumbing Technology CPAS-MS-CPAS2 test. The MS-CPAS2 blueprint can be found at http://www.rcu.msstate.edu/.

a. A student’s technical skill attainment for completion of the Career Certificate will be assessed utilizing the MSCPAS Career Certificate (Y1) assessment score.

b. 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.

c. Timing of Y1 and Y2 Assessments:
   a. A student may complete the Y1 assessment upon application for the Career Certificate.
   b. 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.)
   c. 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

It is suggested that instructors participate in professional learning related to the following concepts:

- **Computer skills for college credit** – To learn more about computer skills instruction such as keyboarding, word processing, PowerPoint, and so forth, please go to http://msvcc.blackboard.com/webapps/portal/frameset.jsp.
- **Computer skills for CEU credit** – 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 and click on Differentiated Instruction. Work through this online course and review the additional resources.
- **21st Century Skills** – To learn more about computer skills instruction such as keyboarding, word processing, PowerPoint, and so forth, 21st Century Skills, please go to https://cia.rcu.msstate.edu/OnlinePD/ and click on Overview – 21st Skills Framework.
- **Blackboard training** – Related Academics – To learn more about Blackboard training Related Academics, please go to https://cia.rcu.msstate.edu/OnlinePD/.
- **Contren** – Learning Series Certification – To http://www.ctb.com/ctb.com/control/main?p=home and click on the TABE logo and learn more about Contren Learning Series Certification, please contact Mike Barkett at mike@mcef.net.
• For the latest in online and yearly Connect training provided by the RCU, please go to http://info.rcu.msstate.edu/ for 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 Building Trades/Plumbing to postsecondary Plumber & Pipefitter/Steamfitter will be awarded Plumbing Technology is available upon implementation of this curriculum by the college. Courses to be secondary students who have completed the articulated include PPV/PCT 1113 – Fundamentals of Plumbing/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)

<table>
<thead>
<tr>
<th>Articulated Secondary Course</th>
<th>Articulated Postsecondary Course</th>
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</thead>
<tbody>
<tr>
<td>[S] Plumbing</td>
<td>PCT 1113 Fundamentals of Plumbing</td>
</tr>
<tr>
<td>(Program CIP: 46.0503 – Plumbing Technology/Plumber)</td>
<td></td>
</tr>
</tbody>
</table>

Statewide Guidelines on Articulated Credit

Eligibility

- To be eligible for articulated credit, a student must:
  - Complete the articulated Secondary vocational program, and Career and Technical Education Program
  - Score an 80 percent or higher on the Mississippi Career Planning and Assessment System (MS-CPASCPAS2) in his or her secondary program of study

- To be awarded articulated credit, a student must:
  - Complete application for articulated credit at the community or junior college;
  - Enroll in the community or junior college within 18 months of graduation; and


- successfully complete 12 non-developmental career-technical or academic credit hours in the corresponding articulated postsecondary career-technical program of study.

- 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 the SBCJC a list of all secondary CTE students scoring at or above 80 percent for the articulated programs MS-CPAS2 scores, CIP Codes, district codes and college number to the MCCB.
- The SBCJC MCCB will forward the list of students eligible for articulated credit to the colleges.

**Transcripting of Articulated Credit**

- Students must complete 12 non-developmental career-technical or academic credit hours in the articulated postsecondary career-technical program of study before the articulated credit is transcripted.
  - Articulated credit will be transcripted immediately upon college enrollment
  - No grade will be given on the transcript for articulated courses, only hours granted will be transcripted (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 Mississippian 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](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. Vocational–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 vocational–technical programs. Federal and state legislation calls for articulation between high school and community college programs, integration of academic and vocational 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 vocational 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. The need for these types of skills has been recognized for some time, and the 21st Century Skills are adapted in part from the 1991 report from the U.S. Secretary of Labor’s Commission on Achieving Necessary Skills (SCANS). Another important aspect of learning and working in the 21st century involves technology skills, and 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. Each vocational–technical blueprint is 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:
  - Vocational Career–technical core – A required vocational career–technical course for all students
  - Area of concentration (AOC) core – A course required in an area of concentration of a cluster of programs
  - Vocational Career–technical elective – An elective vocational 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 of 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 percent% of the time allocated to each course. The remaining 25 percent% 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 and/or revised
  - Activities that implement components of the Mississippi Tech Prep initiative, including integration of academic and vocational career–technical skills and coursework with work, school-to-work transition activities, and articulation of secondary and postsecondary vocational career–technical programs
  - Individualized learning activities, including worksite 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.

**Programs that offer an Associate of Applied Science**

For degree associate programs, the component constitutes a minimum of 15 semester credit hour academic core. Specific courses to be taken within this core are to be determined by the local district. Minimum academic core courses are as follows:

- 3 semester credit hours Math/Science Elective
- 3 semester or the equivalent. These credit hours Written Communications Elective
- 3 semester credit hours Oral Communications Elective
- 3 semester credit hours Humanities/Fine Arts Elective
- 3 semester credit hours Social/Behavioral Science Elective

It is recommended that courses in the academic core be spaced out over the entire length— are to be drawn from and include at least one course from each of the program, so that students complete some academic and vocational–technical courses each semester. Each community/junior college has the discretion to select the actual courses that are required to meet this academic core requirement.

Technical elective courses have been included to allow community colleges following areas: humanities/fine arts, social/behavioral sciences, and students to customize programs to meet the needs of industries and employers in their area 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 one hour or down one hour (after informing the State Board for Mississippi Community and Junior Colleges [SBCJCMCCB] of the change).

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

• resequencing 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 SBCJCMCCB approval).
• utilizing the technical elective options in many of the curricula to customize programs.
• 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.
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Program Description

The Plumbing Technology program prepares a person for advanced placement in plumbing and related fields. Graduates of this program can take the journeyperson 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 (NCCER), along with applicable national, state, and local codes.

Upon successful completion of a minimum of 32 semester hours of required courses, the student will be eligible to receive a certificate in plumbing. An associate’s degree program in plumbing is also available.

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

**Plumbing Technology**

**Certificate Option**

**FIRST YEAR**

**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.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>*PCT 1113</td>
<td>Fundamentals of Plumbing</td>
<td>3 sch:  2 hr. lecture, 2 hr. lab</td>
</tr>
<tr>
<td>*PCT 1333</td>
<td>Blueprint Reading for Plumbing</td>
<td>3 sch:  1 hr. lecture, 4 hr. lab</td>
</tr>
<tr>
<td>*PCT 1411</td>
<td>Low Pressure Boilers</td>
<td>1 sch:  2 hr. lab</td>
</tr>
<tr>
<td>*PCT 1443</td>
<td>Piping Level/Transit</td>
<td>3 sch:  1 hr. lecture, 4 hr. lab</td>
</tr>
<tr>
<td>Sch</td>
<td>Course Description</td>
<td>Credits</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>3</td>
<td>Fundamentals of Plumbing/Pipingfitting</td>
<td>PPV/PCT 1113</td>
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<tr>
<td>3</td>
<td>Drainage and Sewer Systems</td>
<td>PPV/PCT 1513</td>
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<tr>
<td>2</td>
<td>Plumbing Fixtures Lab</td>
<td>PPV/PCT 1722</td>
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<td>2</td>
<td>Backflow Cross Connection</td>
<td>PPV/PCT 1732</td>
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<td>2</td>
<td>Gas Piping</td>
<td>PPV/PCT 1622</td>
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<tr>
<td>2</td>
<td>Heating Devices</td>
<td>PPV/PCT 1612</td>
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<td>2</td>
<td>Domestic Systems</td>
<td>PPV/PCT 1712</td>
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Drainage and Sewer Systems

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<tr>
<th>Sch</th>
<th>Course Description</th>
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<tr>
<td>1</td>
<td>Pressure Boilers</td>
<td>PPV/PCT 1411</td>
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<tr>
<td>5</td>
<td>Vocational Technical Electives**</td>
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<td>3</td>
<td>Blueprint Reading for Plumbing</td>
<td>PPV/PCT 1333</td>
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<td>3</td>
<td>Piping Level/Transit</td>
<td>PPV/PCT 1443</td>
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<tr>
<td>3</td>
<td>Advanced Plumbing Lab</td>
<td>PPV/PCT 1743</td>
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15 Sch: 1 hr. lecture, 4 hr. lab
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<td>*PCT 1612</td>
<td>Heating Devices</td>
<td>2 sch: 1 hr. lecture, 2 hr. lab</td>
</tr>
<tr>
<td>*PCT 1622</td>
<td>Gas Piping</td>
<td>2 sch: 1 hr. lecture, 2 hr. lab</td>
</tr>
<tr>
<td>*PCT 1712</td>
<td>Domestic Systems</td>
<td>2 sch: 4 hr. lab</td>
</tr>
<tr>
<td>*PCT 1722</td>
<td>Plumbing Fixtures Lab</td>
<td>2 sch: 4 hr. lab</td>
</tr>
<tr>
<td>*PCT 1732</td>
<td>Backflow Cross Connection</td>
<td>2 sch: 1 hr. lecture, 2 hr. lab</td>
</tr>
<tr>
<td>*PCT 1743</td>
<td>Advanced Plumbing lab</td>
<td>3 sch: 1 hr. lecture, 4 hr. lab</td>
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<tr>
<td></td>
<td>Career/Technical Electives</td>
<td>4 sch</td>
</tr>
<tr>
<td></td>
<td>Total Semester Credit Hours for a Career Certificate</td>
<td>30 sch</td>
</tr>
</tbody>
</table>

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

Students who lack entry-level skills in math, English, science, and so forth will be provided related studies.
**APPROVED VOCATIONAL-TECHNICAL ELECTIVES**

3 sch — Sketching (PPV/PCT 1323)
3 sch — Tacking, Brazing, and Burning (PPV/PCT 1213)
2 sch — Rigging and Signaling (PPV/PCT 1812)
1–3 sch — Special Project in Plumbing [PPV/PCT 191(1–3)]
1–6 sch — Supervised Work Experience in Plumbing [PPV/PCT 192(1–6)]

Suggested Course Sequence*

Plumbing Technology

**ASSOCIATE’S DEGREE**

**FIRST YEAR**

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.

<table>
<thead>
<tr>
<th>3 sch</th>
<th>Career Certificate</th>
<th>30 sch</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 sch</td>
<td>Fundamentals of Plumbing/Piping (PPV/PCT 1113)</td>
<td>1 sch — Pressure Boilers (PPV/PCT 1411)</td>
</tr>
<tr>
<td>3 sch</td>
<td>Tacking, Brazing and Burning</td>
<td>2 sch — Gas Piping (PPV/PCT 1622)</td>
</tr>
<tr>
<td></td>
<td>Drainage and</td>
<td>2 sch — Plumbing Fixtures Lab (PPV/PCT 1722)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 sch — Backflow Cross</td>
</tr>
</tbody>
</table>

---

* Suggested Course Sequence

**Plumbing Technology**

**ASSOCIATE’S DEGREE**

**FIRST YEAR**

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.

<table>
<thead>
<tr>
<th>3 sch</th>
<th>Career Certificate</th>
<th>30 sch</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 sch</td>
<td>Fundamentals of Plumbing/Piping (PPV/PCT 1113)</td>
<td>1 sch — Pressure Boilers (PPV/PCT 1411)</td>
</tr>
<tr>
<td>3 sch</td>
<td>Tacking, Brazing and Burning</td>
<td>2 sch — Gas Piping (PPV/PCT 1622)</td>
</tr>
<tr>
<td></td>
<td>Drainage and</td>
<td>2 sch — Plumbing Fixtures Lab (PPV/PCT 1722)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 sch — Backflow Cross</td>
</tr>
<tr>
<td>Course</td>
<td>Credits</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Sewer Systems (PPV/PCT 1513)</td>
<td>2 sch</td>
<td>Heating Devices</td>
</tr>
<tr>
<td>Domestic Systems (PPV/PCT 1513)</td>
<td>2 sch</td>
<td>Domestic Systems</td>
</tr>
<tr>
<td>Construction Materials (DDT 1213)</td>
<td>3 sch</td>
<td>Construction Materials</td>
</tr>
<tr>
<td>Written Communications Elective</td>
<td>3 sch</td>
<td></td>
</tr>
<tr>
<td>Connection (PPV/PCT 1732)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tacking, Brazing, and Burning (PPV/PCT 1213)</td>
<td>3 sch</td>
<td></td>
</tr>
<tr>
<td>Oral Communications Elective</td>
<td>3 sch</td>
<td></td>
</tr>
<tr>
<td>Humanities/Fine Arts Elective</td>
<td>3 sch</td>
<td></td>
</tr>
<tr>
<td>Sketching</td>
<td>3 sch</td>
<td>2 hr. lecture, 2 hr. lab</td>
</tr>
<tr>
<td>Rigging and Signaling</td>
<td>2 sch</td>
<td>1 hr. lecture, 2 hr. lab</td>
</tr>
<tr>
<td>Cost Estimating</td>
<td></td>
<td>3 sch: See Appropriate CTE Program Description</td>
</tr>
<tr>
<td>Career/Technical Elective</td>
<td></td>
<td>3 sch: See Appropriate CTE Program Description</td>
</tr>
<tr>
<td>Special Project in Plumbing</td>
<td>1 sch</td>
<td>2 hr. lab</td>
</tr>
<tr>
<td>Total Semester Credit Hours for a Technical Certificate</td>
<td>45 sch</td>
<td></td>
</tr>
</tbody>
</table>
*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:

<table>
<thead>
<tr>
<th>Career Certificate</th>
<th>30 credits minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Certificate</td>
<td>15 credits minimum</td>
</tr>
<tr>
<td>General Education Core Courses</td>
<td>15 credits minimum</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3 sch</th>
<th>Blueprint Reading Total Semester Credit Hours for Plumbing (PCT 1333)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 sch</td>
<td>Sketching (PPV/PCT 1323)</td>
</tr>
<tr>
<td>3 sch</td>
<td>Piping Level/Transit (PPV/PCT 1443)</td>
</tr>
<tr>
<td>3 sch</td>
<td>Special Project in Plumbing [PPV/PCT 191(1–3)]</td>
</tr>
<tr>
<td>3 sch</td>
<td>Social/Behavioral the Associate of Applied Science Elective</td>
</tr>
<tr>
<td>15 sch</td>
<td>Degree</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3 sch</th>
<th>Advanced Plumbing Lab (PPV/PCT 1743)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 sch</td>
<td>Cost Estimating (DDT 2243)</td>
</tr>
<tr>
<td>2 sch</td>
<td>Rigging and Signaling (PPV/PCT 1812)</td>
</tr>
<tr>
<td>3 sch</td>
<td>Legal Environment of Business I (BAD 2413)</td>
</tr>
<tr>
<td>3 sch</td>
<td>Vocational Technical Elective**</td>
</tr>
<tr>
<td>3 sch</td>
<td>Math/Science Elective</td>
</tr>
</tbody>
</table>

17 sch | 60 credits minimum hours earned as a compilation of Career, Technical, and
* Students who lack entry-level skills in math, English, science, and so forth will be provided related studies.

**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 VOCATIONAL–CAREER TECHNICAL ELECTIVES FOR

1–3 sch—Special Project in Plumbing [PPV/PCT 191(1–3)]

1–6 sch—Supervised Work Experience in Plumbing [PPV/PCT 192(1–6)]


PLUMBING TECHNOLOGY Core Courses

Course Name: Fundamentals of Plumbing/Pipefitting

Course Abbreviation: PPV/PCT 1113

Classification: Vocational–Technical Core (Plumbing and Pipefitting)

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. (3 sch: 1-hr lecture, 4-hr lab)

Prerequisite: None

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
<th>Business Accounting</th>
<th>3 sch: See Appropriate Program Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOT 1413</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOT 1713</td>
<td>I. Identify and apply personal safety procedures and rules.</td>
<td>3 sch: See Appropriate Program Description</td>
</tr>
<tr>
<td></td>
<td>a. Identify and apply terms and definitions for safety.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Discuss provisions inspections and citations of OSHA and EPA.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Identify accidents, their causes, and their prevention.</td>
<td></td>
</tr>
<tr>
<td>2. Identify and discuss basic fittings related to plumbing and pipefitting. CST 1123</td>
<td>Basic Computer Systems</td>
<td>3 sch: See Appropriate Program Description</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>3. Identify basic tools and equipment and their safe use and maintenance.</td>
<td>Career Development</td>
<td>3 sch: See Appropriate Program Description</td>
</tr>
<tr>
<td>a. Identify hand and power tools.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Discuss safety factors and maintenance.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Identify basic equipment and discuss the safety factors in their use. CPT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Name</td>
<td>Credits</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>2133</td>
<td>Construction Materials</td>
<td>3 sch</td>
</tr>
<tr>
<td>DDT 1213</td>
<td>Salesmanship</td>
<td>3 sch</td>
</tr>
<tr>
<td>MMT 1313</td>
<td>Management</td>
<td>3 sch</td>
</tr>
<tr>
<td>MMT 2213</td>
<td>Entrepreneurship</td>
<td>3 sch</td>
</tr>
<tr>
<td>MMT 2513</td>
<td>Sketching</td>
<td>3 sch</td>
</tr>
<tr>
<td>PCT 1323</td>
<td>Tacking, Brazing and Burning</td>
<td>3 sch</td>
</tr>
<tr>
<td>PCT 1213</td>
<td>Rigging and Signaling</td>
<td>2 sch</td>
</tr>
<tr>
<td>PCT 1812</td>
<td>Special Project in Plumbing Technology</td>
<td>3 sch</td>
</tr>
<tr>
<td>PCT 291(1-3)</td>
<td>Supervised Work Experience in Plumbing Technology</td>
<td>1-6 sch</td>
</tr>
<tr>
<td>WBL 191(1-3)</td>
<td>Work-Based Learning</td>
<td>1-3 sch</td>
</tr>
</tbody>
</table>

Other instructor approved electives that are listed in the MCCB approved CTE Uniform Course Numbering document.

**STANDARDS**

Contren® Learning Series Best Practices

APPROVED ACADEMIC ELECTIVES FOR

PLUMBING — Level One TECHNOLOGY

INTRODUCTION TO THE PLUMBING PROFESSION

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.

PLUMBING SAFETY

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.

PLUMBING TOOLS

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.

PLASTIC PIPE AND FITTINGS

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.

COPPER PIPE AND FITTINGS
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.

CAST-IRON PIPE AND FITTINGS
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.

CARBON STEEL PIPE AND FITTINGS
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 Four

CODES

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.

Pipefitting—Level One

ORIENTATION TO THE TRADE

OTT1—Describe the types of work performed by pipefitters.

OTT2—Identify career opportunities available to pipefitters.

OTT3—Explain the purpose and objectives of an apprentice training program.

OTT4—Explain the responsibilities and characteristics of a good pipefitter.

OTT5—Explain the importance of safety in relation to pipefitting.

PIPEFITTING HAND TOOLS

PHT1—Describe the safety requirements that apply to the use of pipefitter hand tools.

PHT2—Explain how to care for selected pipefitter hand tools properly.

PHT3—Demonstrate how to use selected pipefitter hand tools safely and properly.

PHT4—Identify tools and state their uses.

PHT5—Use selected hand tools.

PIPEFITTING POWER TOOLS

PPT1—State the safety procedures that must be followed when working with power tools.

PPT2—Cut pipe using a portable band saw.

PPT3—Identify and explain the uses of portable grinders.

PPT4—Explain the proper and safe operation of machines used in pipe joint preparation:
   • Pipe threaders
   • Portable power drives
   • Pipe bevelers

PPT5—Perform selected pipe joint preparation operations using power tools.

Related Academic Standards

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 and paraphrase, compare and contrast, cause and effect)

R5—Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)

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)

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)

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)

S1—Vowel (short, long)

S2—Consonant (variant spelling, silent letter)
21st-Century Skills

CS1 — Global Awareness
CS2 — Financial, Economic, and Business Literacy
CS3 — Civic Literacy
CS4 — Information and Communication Skills
CS5 — Thinking and Problem-Solving Skills
CS6 — Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES


**Trade Publications**


**Web Sites**


Course Name: Blueprint Reading for Plumbing

Course Abbreviation: PPV/PCT 1333

Classification: Vocational–Technical Core (Plumbing)

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

Prerequisite: None

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
<th>Legal Environment of Business</th>
<th>3 sch: See Academic Program Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAD 2413</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Identify and interpret various symbols, notes, and terms.
   a. Identify terms, symbols, abbreviations, and lines used on blueprints.
   b. Interpret notes, specifications, and dimensions.

2. Identify, interpret, and locate details on piping and structural blueprints.
   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. Locate details on drawings.
   f. Order materials needed as interpreted from specifications/blueprints.
   g. Interpret isometric views of plumbing drawings. Other instructor approved electives that are listed in the MCCB approved Academic Uniform Course Numbering document.

STANDARDS

Contren® Learning Series Best Practices

Plumbing — Level One
INTRODUCTION TO PLUMBING DRAWINGS

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.

Level Two

READING COMMERCIAL DRAWINGS

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.

Related Academic Standards

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 and paraphrase, compare and contrast, cause and
effect)
R5—Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)
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)
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)
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)
S1—Vowel (short, long)
S2—Consonant (variant spelling, silent letter)
S3—Structural Unit (root, suffix)

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21st Century Skills

CS1—Global Awareness
CS2—Financial, Economic, and Business Literacy
CS3—Civic Literacy
CS4—Information and Communication Skills
CS5—Thinking and Problem-Solving Skills
CS6—Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES


Trade Publications


**Web-Sites**


Course Name: Pressure Boilers

Course Abbreviation: PPV/PCT 1411

Classification: Vocational–Technical Core (Pipefitting and Plumbing)

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

Prerequisite: None

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identify and explain various boiler fittings and accessories, including thermo expansion devices.</td>
</tr>
<tr>
<td>a. Discuss the various types of boilers.</td>
</tr>
<tr>
<td>b. Identify and explain various boiler, steam, and hot water fittings and piping.</td>
</tr>
<tr>
<td>c. Identify and explain feed water accessories.</td>
</tr>
<tr>
<td>d. Identify and explain steam and hot water accessories.</td>
</tr>
<tr>
<td>2. Explain the operations of a boiler.</td>
</tr>
<tr>
<td>a. Explain the operation of the draft controls.</td>
</tr>
<tr>
<td>b. Explain the water treatment procedures.</td>
</tr>
<tr>
<td>c. Identify and explain boiler safety.</td>
</tr>
</tbody>
</table>

STANDARDS

Contren® Learning Series Best Practices

Plumbing—Level Two

INSTALLING WATER HEATERS

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.

Pipefitting—Level Four

STEAM TRAPS

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

Related Academic Standards

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 and paraphrase, compare and contrast, cause and effect)
R5—Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)
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)
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)

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)

S1—Vowel (short, long)

S2—Consonant (variant spelling, silent letter)

S3—Structural Unit (root, suffix)

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21st Century Skills

CS1—Global Awareness

CS2—Financial, Economic, and Business Literacy

CS3—Civic Literacy

CS4—Information and Communication Skills

CS5—Thinking and Problem-Solving Skills

CS6—Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES


Trade Publications


Web-Sites


Pipefitting Technology Courses

Course Name: Tacking, Brazing, and Burning

Course Abbreviation: PPV/PCT 1213

Classification: AOC Core (Plumbing Associate’s Degree and Pipefitting) and Vocational–Technical Elective (Plumbing 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 flat steel and pipe. Safety procedures will be covered and emphasized. (3 seh: 1 hr lecture, 4 hr lab)

Prerequisite: None

Competencies and Suggested Objectives

1. Demonstrate the safe layout and use of the electric arc machine and the oxyacetylene torch.
   a. Lay out, set up, and test the electric arc machine.
   b. Lay out, set up, and test the oxyacetylene cutting torch.

2. Perform cuts on various shapes of steel and pipe with the oxyacetylene torch.
   a. Perform a square cut on steel and pipe with the oxyacetylene torch.
   b. Perform a bevel cut on steel and pipe with the oxyacetylene torch.

3. Demonstrate the safe use of various rods and positions.
   a. Using an E-6010 rod, tack weld flat, horizontal, and vertical open butt (bevel) joints.
   b. Using an E-7018 rod, tack weld flat, horizontal, and vertical open butt (bevel) joints.

4. Tack weld pipes in different positions.
   a. Tack weld pipe in horizontal and vertical positions.
   b. Tack weld pipe in an overhead position at a 45° angle (6G position).

5. Prepare, solder, braze, and test various joints.
   a. Prepare and solder a joint.
   b. Prepare and braze a joint.
c. Perform tests on all soldered and brazed joints.

**STANDARDS**

*Contren® Learning Series Best Practices*

Pipefitting—Level One

**OXYFUEL CUTTING**

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
  - Piercing and slot cutting
  - Bevels
  - Washing
OFC8—Operate a motorized, portable oxyfuel gas cutting machine.

**Related Academic Standards**

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 and paraphrase, compare and contrast, cause and effect)
R5—Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)
M1—Addition of Whole Numbers (no regrouping, regrouping)
M2—Subtraction of Whole Numbers (no regrouping, regrouping)
M3—Multiplication of Whole Numbers (no regrouping, regrouping)
CS4—Information and Communication Skills
CS5—Thinking and Problem-Solving Skills
CS6—Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES


Trade Publications


Web Sites


Course Name: Sketching

Course Abbreviation: PPV/PCT 1323

Classification: AOC Core (Plumbing Associate’s Degree and Pipefitting) and Vocational–Technical Elective (Plumbing 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

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

STANDARDS
INTRODUCTION TO PLUMBING DRAWINGS

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.

READING COMMERCIAL DRAWINGS

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.

Pipefitting—Level Two
DRAWINGS AND DETAIL SHEETS

DDS1—Identify parts of drawings.
DDS2—Identify types of drawings.
DDS3—Make field sketches.
DDS4—Interpret drawing indexes and line lists.

Related Academic Standards

R1—Interpret Graphic Information (forms, maps, reference sources)
R2—Words in Context (same and opposite meaning)
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A5—Measurement (money, time, temperature, length, area, volume)
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21st Century Skills

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CS6—Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES


**Trade Publications**


**Web-Sites**


Course Name: Rigging and Signaling

Course Abbreviation: PPV/PCT 1812

Classification: AOC Core (Plumbing Associate’s Degree and Pipefitting) and Vocational–Technical Elective (Plumbing Certificate)

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

Prerequisites: None

Competencies and Suggested Objectives

<table>
<thead>
<tr>
<th>1. Explain and identify safe signaling, rigging, and equipment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Explain and practice safe rigging and signaling.</td>
</tr>
<tr>
<td>b. Identify and explain rigging equipment.</td>
</tr>
<tr>
<td>e. Inspect rigging equipment.</td>
</tr>
<tr>
<td>2. Describe and apply procedures and equipment for rigging and lifting.</td>
</tr>
<tr>
<td>a. Select, inspect, use, and maintain a block and tackle.</td>
</tr>
<tr>
<td>b. Select, inspect, use, and maintain a chain hoist.</td>
</tr>
<tr>
<td>e. Select, inspect, use, and maintain come-alongs.</td>
</tr>
<tr>
<td>d. Select, inspect, use, and maintain jacks.</td>
</tr>
<tr>
<td>e. Select, inspect, use, and maintain a tugger.</td>
</tr>
<tr>
<td>f. Identify and explain heavy rigging hardware.</td>
</tr>
<tr>
<td>g. Inspect heavy rigging hardware.</td>
</tr>
<tr>
<td>h. Read and interpret lifting capacity charts.</td>
</tr>
<tr>
<td>i. Explain load balancing.</td>
</tr>
<tr>
<td>j. Rig pipes and valves.</td>
</tr>
<tr>
<td>k. Plan a rigging job.</td>
</tr>
</tbody>
</table>
Pipefitting—Level Three

RIGGING EQUIPMENT

RGE1 Identify and describe the uses of common rigging hardware and equipment.
RGE2 Perform a safety inspection on hooks, slings, and other rigging equipment.
RGE3 Describe common slings, and determine sling capacities and angles.
RGE4 Select, inspect, use, and maintain special rigging equipment:
  • Simple block and tackle
  • Chain hoists
  • Come-alongs
  • Jacks
  • Tuggers
RGE5 Inspect heavy rigging hardware.
RGE6 Tie knots used in rigging.

RIGGING PRACTICES

RGP1 Identify and use the correct hand signals to guide a crane operator.
RGP2 Identify basic rigging and crane safety procedures, and determine the center of gravity of a load.
RGP3 Identify the pinch points of a crane, and explain how to avoid them.
RGP4 Identify site and environmental hazards associated with rigging.
RGP5 Properly attach rigging hardware for routine lifts and pipe lifts.
RGP6 Identify the components of a lift plan.

Related Academic Standards

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 and paraphrase, compare and contrast, cause and effect)
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A6—Geometry (angles, Pythagorean theory)
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L1—Usage (pronoun, tense, subject-verb agreement, adjective, adverb)
L2—Sentence Formation (fragments, run-on, clarity)
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21st Century Skills

CS1 — Global Awareness
CS2 — Financial, Economic, and Business Literacy
CS3 — Civic Literacy
CS4 — Information and Communication Skills
CS5 — Thinking and Problem-Solving Skills
CS6 — Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES


Trade Publications


Web-Sites


Plumbing Technology Courses

Course Name: Piping Level/Transit Fundamentals of Plumbing

Course Abbreviation: PPV/PCT 14431113

Classification: AOC Core (Plumbing) and Vocational Career–Technical Elective (Pipefitting Certificate) Core

Description: Applications of the leveling instruments, shooting elevations. This course includes basic safety, an introduction to construction math, and introduction to hand and grading pipes, power tools, an introduction to construction drawings, and rigging. (3 sch: 1-2 hr lecture, 4-2 hr lab)

Prerequisites: None

Competencies and Suggested Objectives

1. Identify and set up a level and/or transit.

   1. Describe general safety rules for working in a shop/lab and industry. DOK1, BSM, IPP, PLS, CDS
      a. Identify and Describe how to avoid on-site accidents.
      b. Explain the basic parts of a level/transit relationship between housekeeping and safety.
      c. Set up the level/transit, shoot elevations, and grade pipe.
      d. Explain the importance of following all safety rules and company safety policies according to OSHA standards including addressing General Duty Clause and 1926 CFR Subpart C.
      e. Explain the importance of reporting all on-the-job injuries, accidents, and near misses.
      f. Explain the employer’s substances abuse policy and how it relates to safety.
      g. Explain the safety procedures when working near pressurized or high temperature.

2. Identify and apply safety around welding operations. DOK1, BSM, PLS

   a. Use proper safety practices when welding or working around welding operations.
   b. Use proper safety practices when welding in or near trenches and excavations.
   c. Explain the term proximity work.

3. Identify and explain use of various barriers and confinements. DOK1, BSM, PLS

   a. Explain the safety requirements for working in confined areas.
   b. Explain and practice lockout/tagout procedures.
   c. Explain the different barriers and barricades, and how they are used.
   d. Recognize and explain personal protective equipment.
   e. Inspect and care for personal protective equipment.

4. Explain lifting, fall protection, and the use of ladders and scaffolds. DOK1, BSM, PLS

   a. Identify and explain the procedures for lifting heavy objects.
   b. Explain fall protection procedures.
c. Inspect and safely work with various ladders and scaffolds.

5. Explain the Material Safety Data Sheet (MSDS).  
   a. Explain the function of the MSDS.  
   b. Interpret the requirements of the MSDS.

6. Explain fires.  
   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.  
   a. Explain injuries when electrical contact occurs.  
   b. Explain safety around electrical hazards.  
   c. Explain action to take when an electrical shock occurs.

2. Measure, record, and lay out a soil pipe.  
   a. Describe the use of.

8. Apply basic mathematics for residential carpentry.  
   a. Apply the four basic math skills with whole numbers, fractions, and percent.  
   b. Use the benchmark.

   b. Turn horizontal angles metric system.  
   c. Identify and read measuring tools.  
   d. Solve basic algebraic equations.  
   e. Calculate the area and volume geometric figures.  
   d. Demonstrate differences in elevation between random points.

   e. Using a trencher, excavate, grade, and install a soil pipe.

f. Apply basic math to solve simple geometric figures and problems.

9. Demonstrate the use and maintenance of hand and power tools.  
   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.  
    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.
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>k.</td>
<td>Design a construction drawing.</td>
</tr>
<tr>
<td>l.</td>
<td>Construct a structure based on a construction drawing.</td>
</tr>
<tr>
<td>11.</td>
<td>Explain and identify safe rigging and equipment. ( \text{DOK1, RIG} )</td>
</tr>
<tr>
<td>a.</td>
<td>Explain and practice safe rigging.</td>
</tr>
<tr>
<td>b.</td>
<td>Identify and explain rigging equipment.</td>
</tr>
<tr>
<td>c.</td>
<td>Inspect rigging equipment.</td>
</tr>
<tr>
<td>12.</td>
<td>Describe employment opportunities and responsibilities. ( \text{DOK1 EMP} )</td>
</tr>
<tr>
<td>a.</td>
<td>Describe employment opportunities including potential earnings, employee benefits, job availability, places of employment, working conditions, and educational requirements.</td>
</tr>
<tr>
<td>b.</td>
<td>Describe basic employee responsibilities.</td>
</tr>
<tr>
<td>13.</td>
<td>Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations. ( \text{DOK2 COM} )</td>
</tr>
<tr>
<td>14.</td>
<td>Safely handle and store materials. ( \text{DOK1, IMH} )</td>
</tr>
<tr>
<td>a.</td>
<td>Define a load.</td>
</tr>
<tr>
<td>b.</td>
<td>Establish a pre-task plan prior to moving a load.</td>
</tr>
<tr>
<td>c.</td>
<td>Use proper materials-handling techniques.</td>
</tr>
<tr>
<td>d.</td>
<td>Choose appropriate materials-handling equipment for the task.</td>
</tr>
<tr>
<td>e.</td>
<td>Recognize hazards and follow safety procedures required for materials handling.</td>
</tr>
<tr>
<td>15.</td>
<td>Identify and discuss basic fittings and valves related to plumbing. ( \text{DOK1, PPF, CPF, CIF, CSF, TVA} )</td>
</tr>
<tr>
<td>16.</td>
<td>Identify and install hangers, supports, structural, penetrations, and fire stopping materials. ( \text{DOK1, HFP} )</td>
</tr>
</tbody>
</table>

**STANDARDS**

*Contren® Learning Series Best Practices*

**Plumbing—Level Two**

**INSTALLING ROOF, FLOOR, AND AREA DRAINS**

**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.

**Related Academic Standards**

**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 and paraphrase, compare and contrast, cause and
______effect)
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CS2—Financial, Economic, and Business Literacy

CS3—Civic Literacy

CS4—Information and Communication Skills

CS5—Thinking and Problem-Solving Skills

CS6—Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES


Trade Publications


Web-Sites


Course Name: Drainage and Sewer Systems

Course Abbreviation: PPV/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

Competencies and Suggested Objectives

1. Identify and explain safety in drainage and sewer systems.
   a. Identify and explain health department regulations for drainage and sewer systems.
   b. Identify and explain hazards of working in confined spaces in the presence of methane gas.
   c. Identify international plumbing code definitions.
   d. Identify local authority for plumbing installation.
   e. Identify approved traps and cleanouts.

2. Identify various systems used in drainage and sewer systems.
   a. Explain safety procedures.
   b. Identify components of individual sewer systems.
   c. Identify various types of vents and drains, including storm.

3. Install various types of soil and waste pipes.
   a. Install different types of traps.
   b. Install stacks according to functions.

4. Identify various types of sewers.
   a. Differentiate between combined sewers.
b. Identify sanitary and storm sewers.

e. Estimate the drainage fixture unit (DFU).

STANDARDS

Contren® Learning Series Best Practices Core

Plumbing — Level One

INTRODUCTION TO DRAIN, WASTE, AND VENT (DWV) SYSTEMS

DWV1 Explain how waste moves from a fixture through the drain system to the environment.

DWV2 BSM — BASIC SAFETY (00101-09)

BSM1 Identify the major components of a drainage system and describe their functions of professional craftsperson.

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

INSTALLING AND TESTING DWV PIPING

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 BSM2 Explain the role that safety plays in the construction crafts.

BSM3 Describe what job-site safety means.

BSM4 Explain the 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

TYPES OF VENTING

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.

Plumbing—Level Four

INDIRECT AND SPECIAL WASTE

ISW1—Identify and install an indirect waste system.

ISW2—Identify and install an interceptor.

Related Academic Standards

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 and paraphrase, compare and contrast, cause and effect)

R5—Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)

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

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21st Century Skills

CS1—Global Awareness
CS2—Financial, Economic, and Business Literacy
CS3—Civic Literacy
CS4—Information and Communication Skills
CS5—Thinking and Problem-Solving Skills

CS6—Interpersonal and Self-Directional Skills

**SUGGESTED REFERENCES**


**Trade Publications**


**Web-Sites**


**Course Name:** Heating Devices

**Course Abbreviation:** PPV/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

### Competencies and Suggested Objectives

<table>
<thead>
<tr>
<th>1. Identify and perform various functions on a hot water system.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Identify and explain safety procedures.</td>
</tr>
<tr>
<td>b. Identify and explain parts of a tank and tankless water heater.</td>
</tr>
<tr>
<td>d. Install a tank and tankless water heater, including T&amp;P valves.</td>
</tr>
<tr>
<td>e. Replace a dip tube.</td>
</tr>
<tr>
<td>f. Construct a venting system for gas water heaters.</td>
</tr>
<tr>
<td>g. Perform repairs on gas and electric water heaters.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Identify, install, troubleshoot, and perform various functions on heating systems.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Identify and discuss the safety techniques of installing and maintaining heating systems.</td>
</tr>
<tr>
<td>b. Perform repairs on a floor furnace.</td>
</tr>
<tr>
<td>e. Determine if the venting system of a floor furnace is adequate.</td>
</tr>
<tr>
<td>d. Troubleshoot and repair a force air heating system.</td>
</tr>
<tr>
<td>e. Determine if the venting system for a force air heating system is adequate.</td>
</tr>
<tr>
<td>f. Identify proper methods of venting appliances.</td>
</tr>
<tr>
<td>g. Identify proper types of gas controls.</td>
</tr>
<tr>
<td>h. Connect appliances to specifications.</td>
</tr>
<tr>
<td>i. Adjust or replace ignition devices on gas appliances.</td>
</tr>
</tbody>
</table>
3. Explain and discuss various functions of a forced heat system.
   
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

Installing Water Heaters

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

HYDRONIC AND SOLAR HEATING SYSTEMS

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.

Related Academic Standards

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 and paraphrase, compare and contrast, cause and effect)

R5—Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)

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)

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)

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)

S1—Vowel (short, long)

S2—Consonant (variant spelling, silent letter)

S3—Structural Unit (root, suffix)
21st Century Skills

CS1—Global Awareness
CS2—Financial, Economic, and Business Literacy
CS3—Civic Literacy
CS4—Information and Communication Skills
CS5—Thinking and Problem-Solving Skills
CS6—Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES


Trade Publications


Web Sites


Course Name: Gas Piping

Course Abbreviation: PPV/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

Competencies and Suggested Objectives

<table>
<thead>
<tr>
<th>1. Identify and explain the various codes pertaining to gas and plumbing installation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Identify local authority for gas installation.</td>
</tr>
<tr>
<td>c. Identify installation requirements for undiluted liquefied petroleum gas.</td>
</tr>
<tr>
<td>d. Explain and utilize International Fuel Gas Code for installation requirements for specific appliances, residences, and apartments.</td>
</tr>
<tr>
<td>e. Identify general regulations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Identify appliances and materials for gas and plumbing installations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Identify approved gas appliances and materials.</td>
</tr>
<tr>
<td>b. Identify approved joints and connections and methods of hanging and supporting.</td>
</tr>
<tr>
<td>c. Apply approved methods for safely testing lines using a manometer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Explain, size, and install a gas system as per the principles of the British Thermal Unit (BTU).</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Explain the BTU principles.</td>
</tr>
<tr>
<td>b. Size and install a gas piping system per given BTU requirements.</td>
</tr>
</tbody>
</table>

STANDARDS

Contren® Learning Series Best Practices
Plumbing—Level One

CORRUGATED STAINLESS STEEL TUBING

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

FUEL GAS SYSTEMS

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 around common job-site hazards.

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.

FGS7BSM5 Demonstrate familiarity with applicable fuel gas codes.

Related Academic Standards

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 and paraphrase, compare and contrast, cause and effect)

R5—Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view, use and care)

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)

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)

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)

S1—Vowel (short, long)
21st Century Skills

CS1—Global Awareness
CS2—Financial, Economic, and Business Literacy
CS3—Civic Literacy
CS4—Information and Communication Skills
CS5—Thinking and Problem-Solving Skills
CS6—Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES


Trade Publications


**Web-Sites**


Course Name: Domestic Systems

Course Abbreviation: PPV/PCT-1712

Classification: AOC Core (Plumbing) and Vocational–Technical Elective (Pipefitting)

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

Competencies and Suggested Objectives

1. Estimate and install a hot water system.
   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.
   a. Discuss safety precautions in installing and repairing potable water systems.
   b. Identify potable water and water mains.
   c. Identify and install a water treatment system.
   d. Identify and install water service and fixture branches and supplies.
   e. Identify and install water meters.
   f. Install a distribution system.
   g. Identify and install a water hammer arrester.
   h. Install a pressure-reducing valve and bypass.

STANDARDS

Contren® Learning Series Best Practices

Plumbing—Level One
INTRODUCTION TO WATER DISTRIBUTION SYSTEMS

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

INSTALLING AND TESTING WATER SUPPLY PIPING

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.

Plumbing—Level Three

SIZING WATER SUPPLY PIPING

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.

POTABLE WATER TREATMENT

PWT1 Flush out visible contaminants from plumbing systems.
PWT2 Disinfect a potable water plumbing system.
PWT3 Identify common water problems, and identify the basic personal protective equipment to solve them.
PWT4 Practice methods used to soften water.
PWT5 Analyze BSM6 Follow safe procedures for lifting heavy objects.
BSM7 Describe safe behavior on and measure water-conditioning problems.
PWT6 Install water-conditioning equipment.

Plumbing—Level Four

SERVICING PIPING SYSTEMS, FIXTURES, AND APPLIANCES

SFA1 Diagnose around ladders and address problems with water supply and quality scaffolds.
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.

PRIVATE WATER SUPPLY WELL SYSTEMS

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.
Related Academic Standards

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 and paraphrase, compare and contrast, cause and effect)

R5—Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)

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)

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)

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)

S1—Vowel (short, long)

S2—Consonant (variant spelling, silent letter)

S3—Structural Unit (root, suffix)

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21st Century Skills

CS1—Global Awareness

CS2—Financial, Economic, and Business Literacy

CS3—Civic Literacy

CS4—Information and Communication Skills

CS5—Thinking and Problem-Solving Skills

CS6—Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES


**Trade Publications**


**Web-Sites**


Course Name: Plumbing Fixtures Lab

Course Abbreviation: PPV/PCT 1722

Classification: AOC Core (Plumbing) and Vocational–Technical Elective (Pipefitting)

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

Prerequisites: None

## Competencies and Suggested Objectives

<table>
<thead>
<tr>
<th>1. Explain the procedures, and install bathroom fixtures according to local, state, and/or international codes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Explain and install a lavatory, tub, and shower.</td>
</tr>
<tr>
<td>b. Explain and install a water closet and bidet.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Explain the procedures, and install other fixtures according to local, state, and/or international codes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Explain and install washer boxes and an icemaker box.</td>
</tr>
<tr>
<td>b. Explain and install urinals.</td>
</tr>
<tr>
<td>c. Explain and install service sinks and mop sinks.</td>
</tr>
<tr>
<td>d. Explain and install drinking fountains and a water filtering system.</td>
</tr>
<tr>
<td>e. Explain and install a kitchen sink, garbage disposal, and dishwasher.</td>
</tr>
<tr>
<td>f. Explain and identify other approved plumbing fixtures.</td>
</tr>
</tbody>
</table>

## STANDARDS

**Contren Learning Series Best Practices**

Plumbing—Level One

**FIXTURES AND FAUCETS**
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

INSTALLING FIXTURES, VALVES, AND FAUCETS

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.

SERVICING OF FIXTURES, VALVES, AND FAUCETS

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

SERVICING PIPING SYSTEMS, FIXTURES, AND APPLIANCES

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.
Related Academic Standards

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 and paraphrase, compare and contrast, cause and effect)
R5—Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)
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)
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)
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)

S1—Vowel (short, long)

S2—Consonant (variant spelling, silent letter)

S3—Structural Unit (root, suffix)

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21st Century Skills

CS1—Global Awareness

CS2—Financial, Economic, and Business Literacy

CS3—Civic Literacy

CS4—Information and Communication Skills

CS5—Thinking and Problem-Solving Skills

CS6—Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES


**Trade Publications**


**Web Sites**


**Course Name:** Backflow Cross Connection

**Course Abbreviation:** PPV/PCT-1732

**Classification:** AOC-Core (Plumbing)

**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

### Competencies and Suggested Objectives

<table>
<thead>
<tr>
<th>1. Define and explain backflow requirements.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Define and explain the purpose and scope of backflow requirements.</td>
</tr>
<tr>
<td>b. Define and explain the responsibility, liability, and authority for backflow preventions.</td>
</tr>
<tr>
<td>c. Identify devices used to prevent backflow.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Discuss, lay out, and test backflow devices.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Discuss the principles of pressure as it applies to plumbing.</td>
</tr>
<tr>
<td>b. Discuss backflow devices.</td>
</tr>
<tr>
<td>c. Discuss a record-keeping system.</td>
</tr>
<tr>
<td>d. Lay out and test backflow devices.</td>
</tr>
</tbody>
</table>

### STANDARDS

**Contren® Learning Series Best Practices**

**Plumbing—Level Three**

**BACKFLOW PREVENTERS**

**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**—the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).

**BFP3**—Identify and explain the applications of the six basic backflow prevention devices.
BFP4—Install common types of backflow preventers.

Related Academic Standards

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 and paraphrase, compare and contrast, cause and effect)
R5—Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)
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)
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 (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, fractions, algebraic operations) with and without a calculator.
A8—Estimation (rounding, estimation)
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)
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21st Century Skills

CS1—Global Awareness
CS2—Financial, Economic, and Business Literacy
CS3—Civic Literacy
CS4—Information and Communication Skills
CS5— Thinking and Problem-Solving Skills
CS6—Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES


*Trade Publications*


*Web-Sites*


**Course Name:** Advanced Plumbing Lab  
**Course Abbreviation:** PPV/PCT 1743  
**Classification:** AOC Core (Plumbing)  
**Description:** Additional study in the area of advanced plumbing in the commercial area (3 sch. 1-hr lecture, 4-hr lab)  
**Prerequisites:** None

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
</tr>
</thead>
</table>
| 1. Identify and explain various commercial components and fixtures.  
  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).  
  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.  
  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. |
STANDARDS

Contren® Learning Series Best Practices

Plumbing—Level One

FIXTURES AND FAUCETS

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

INSTALLING FIXTURES, VALVES, AND FAUCETS

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

SEWAGE PUMPS AND SUMP PUMPS

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.

CORROSIVE-RESISTANT WASTE PIPING

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

INDIRECT AND SPECIAL WASTE

ISW1—Identify and install an indirect waste system.

ISW2—Identify and install an interceptor.

PRIVATE WASTE DISPOSAL SYSTEMS

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.

Related Academic Standards

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 and paraphrase, compare and contrast, cause and effect)

R5—Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)
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)
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, ICM5 Convert decimals, to percents and percents to decimals.
ICM6 Convert fractions, algebraic operations) to decimals and decimals to fractions.
A8—Estimation (rounding, estimation)
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)
ICM9 Recognize some of a letter)
S1—Vowel (short, long)
S2—Consonant (variant spelling, silent letter)
S3—Structural Unit (root, suffix)
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21st Century Skills

CS1—Global Awareness
CS2—Financial, Economic, and Business Literacy
CS3—Civic Literacy
CS4—Information and Communication Skills
CS5—Thinking and Problem-Solving Skills
CS6—Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES


Trade Publications


Web-Sites


**Course Name:** Special Project in Plumbing  

**Course Abbreviation:** PPV/PCT 191(1-3)  

**Classification:** Vocational–Technical Elective (Plumbing)  

**Description:** Practical application of skills and knowledge gained in other technical courses. The instructor works closely with the student to ensure that basic shapes used in the selection of a project will enhance the student’s learning experience. (1–3 sch: 2–6 hr lab)  

**Prerequisites:** Consent of Instructor  

### Competencies and Suggested Objectives

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Develop a written plan that details the activities and projects to be completed.</td>
<td></td>
</tr>
<tr>
<td>a. Utilize a written plan that details the activities and projects to be completed.</td>
<td></td>
</tr>
<tr>
<td>b. Perform written occupational objectives in the special project.</td>
<td></td>
</tr>
<tr>
<td>2. Assess accomplishment of objectives.</td>
<td></td>
</tr>
<tr>
<td>a. Prepare a daily written assessment of accomplishment of objectives.</td>
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</tr>
<tr>
<td>b. Present weekly written reports to the instructor about activities performed and objectives accomplished.</td>
<td></td>
</tr>
<tr>
<td>3. Utilize and follow a set of written guidelines for the special project.</td>
<td></td>
</tr>
<tr>
<td>a. Develop and follow a set of written guidelines for the special project.</td>
<td></td>
</tr>
</tbody>
</table>

### STANDARDS

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

### SUGGESTED REFERENCES

Specific reference for this course will depend upon the nature of the problem under investigation.
**Course Name:** Supervised Work Experience in Plumbing

**Course Abbreviation:** PPV/PCT 192(1-6)

**Classification:** Vocational–Technical Elective (Plumbing)

**Description:** This course is a cooperative program between construction 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) apply basic geometry to measure them.

**Prerequisites:** Consent of Instructor

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Apply technical skills needed to be a viable member of the workforce.</td>
</tr>
<tr>
<td>a. Prepare a description of technical skills to be developed.</td>
</tr>
<tr>
<td>b. Develop technical skills needed to be a viable member of the workforce.</td>
</tr>
<tr>
<td>2. Apply skills developed in other program area courses.</td>
</tr>
<tr>
<td>a. Perform skills developed in other program area courses.</td>
</tr>
<tr>
<td>3. Apply human relationship skills.</td>
</tr>
<tr>
<td>a. Practice human relationship skills in the program.</td>
</tr>
<tr>
<td>4. Apply and practice positive work habits and responsibilities.</td>
</tr>
<tr>
<td>a. Perform assignments to develop positive work habits and responsibilities.</td>
</tr>
<tr>
<td>5. Work with the instructor and employer to develop written occupational objectives to be accomplished.</td>
</tr>
<tr>
<td>a. Perform written occupational objectives.</td>
</tr>
<tr>
<td>6. Assess accomplishment of objectives.</td>
</tr>
<tr>
<td>a. Prepare daily written assessment of accomplishment of objectives.</td>
</tr>
<tr>
<td>b. Present weekly written reports to the instructor about activities performed and objectives accomplished.</td>
</tr>
<tr>
<td>7. Utilize a set of written guidelines.</td>
</tr>
</tbody>
</table>
a. Develop and follow a set of written guidelines.

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 worksite learning experience in which the student, program area teacher, Work-Based Learning Coordinator, and worksite 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 hours externship)

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

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Apply technical skills and related academic knowledge needed to be a viable member of the workforce.</td>
</tr>
<tr>
<td>a. Demonstrate technical skills necessary to complete job requirements.</td>
</tr>
<tr>
<td>b. Demonstrate academic skills necessary to complete job requirements.</td>
</tr>
<tr>
<td>c. Perform tasks detailed in an educational training agreement at the worksite.</td>
</tr>
<tr>
<td>2. Apply general workplace skills to include positive work habits necessary for successful employment.</td>
</tr>
<tr>
<td>a. Demonstrate appropriate human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service.</td>
</tr>
<tr>
<td>b. Utilize time, materials, and resource management skills.</td>
</tr>
<tr>
<td>c. Use critical thinking skills such as problem solving, decision making, and reasoning.</td>
</tr>
<tr>
<td>d. Acquire, evaluate, organize, maintain, interpret, and communicate information.</td>
</tr>
</tbody>
</table>
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.
Recommended Tools and Equipment for Plumbing

CAPITALIZED ITEMS

1. Hydrostatic pump (1)
2. Power drivers (2)
3. Power vises (2)
4. Sewage jetter (1)
5. Sewer machine (1)
6. Welders with cables (2)
7. T drill with x-tra tool, 1/2 in.–1 1/4 in. (1)
8. Power cutter, 2 1/2-in.–8-in. pipe (1)
9. Drain camera (1)
10. Underground utility locator (1)
11. Trencher (1)
12. Electric jackhammer (1)

NON-CAPITALIZED ITEMS

1. Closet auger (1)
2. Scratch awls (5)
3. Welding aprons (5)
4. Wrecking bars (2)
5. Pry bars (2)
6. Nail pullers (5)
7. Spring tube benders, assorted sets 3/8 in.–3/4 in. (7)
8. 3/8 in. level benders (2 sets)
9. 1/4-in. through 7/8-in. tubing benders (2 sets)
10. Circular saw blades (2)
11. Hacksaw blades (2-pk)
12. Jigsaw blades—wood, metal (2-pk)
13. Reciprocating saw blades—wood, metal (2-pk)
14. Keyhole saw (1)
15. Butane bottles (2)
16. R-type acetylene bottles (4)
17. Acetylene bottles (2)
18. Oxygen bottles (2)
19. Disposable MAPP bottles (6)
20. Chalk lines (2)
21. “C” clamps (4)
22. Cold chisels (2 sets)
23. Wood chisels (2)
24. Cylinder trucks (2)
25. Bolt cutters (2)
26. Cast-iron snap cutters (2)
27. Midget copper cutters (3)
28. Medium copper cutters (3)
29. Large copper cutters (3)
30. Internal cutters (2)
31. Plastic cutters (2)
32. Plastic rat cutters (1)
33. Plastic pipe crimpers (1)
34. Steel cutters (4)
35. Three-wheel cutter (1)
36. 3/8 in. electric drill motors (2)
37. Right angle drill (1)
38. Drill bit sharpener (1)
39. Metal bits (2 sets)
40. Self-feeding bits (2 sets)
41. Electric drop cords (4)
42. Faucet handle pullers (2)
43. Seat removers (2)
44. Flat metal files (2)
45. 1/4 round files (2)
46. Three-sided files (2)
47. Wood rasp (2)

FlaringIHT – 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 (3 sets).

48. 6 ft folding rules (10)
49. Clear goggles (1 per student)
50. Cutting goggles (5)
51. Cutting/welding gloves (5)
52. Power grinders (2)
53. Disc grinders (2)
54. Grinder wheels (2)
55. Claw hammers, 12 oz (5)
56. Ball-peen hammers (2)
57. Sledge hammer (1)
58. Mallet (1)
59. Hexagon key (2 sets)
60. Water hoses, 100 ft (2)
61. 6 ft step ladder (1)
62. Extension ladder – 20 ft (1)
63. Torch lighters (5)
64. 24 in. carpenter levels (2)
65. Variable pitch levels (2)
66. Torpedo levels (4)
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>67.</td>
<td>Line levels (2)</td>
</tr>
<tr>
<td>68.</td>
<td>Level/transit, laser (1)</td>
</tr>
<tr>
<td>69.</td>
<td>Manometer and air pump (1)</td>
</tr>
<tr>
<td>70.</td>
<td>Color-coded nut drivers (2 sets)</td>
</tr>
<tr>
<td>71.</td>
<td>Oil cans, 16 oz (5)</td>
</tr>
<tr>
<td>72.</td>
<td>Oilers (2)</td>
</tr>
<tr>
<td>73.</td>
<td>Open end wrench set, 2-in. drive (2 sets)</td>
</tr>
<tr>
<td>74.</td>
<td>Pipe dies (3 sets)</td>
</tr>
<tr>
<td>75.</td>
<td>Three-way dies (1 set)</td>
</tr>
<tr>
<td>76.</td>
<td>Large rat dies (1 set)</td>
</tr>
<tr>
<td>77.</td>
<td>Pipe reamers (2)</td>
</tr>
<tr>
<td>78.</td>
<td>Needle nose pliers (4)</td>
</tr>
<tr>
<td>79.</td>
<td>Slip joint pliers (10)</td>
</tr>
<tr>
<td>80.</td>
<td>Locking pliers (10)</td>
</tr>
<tr>
<td>81.</td>
<td>Wire cutters (4)</td>
</tr>
<tr>
<td>82.</td>
<td>Vise grips (4)</td>
</tr>
<tr>
<td>83.</td>
<td>Punches (2)</td>
</tr>
<tr>
<td>84.</td>
<td>Plumb-bobs (5)</td>
</tr>
<tr>
<td>85.</td>
<td>Reciprocating saws (2)</td>
</tr>
<tr>
<td>86.</td>
<td>Jigsaws (2)</td>
</tr>
<tr>
<td>87.</td>
<td>7 1/2-in. circular saw (1)</td>
</tr>
<tr>
<td>88.</td>
<td>Hacksaws (5)</td>
</tr>
<tr>
<td>89.</td>
<td>PVC saws (5)</td>
</tr>
<tr>
<td>90.</td>
<td>Keyhole saws (5)</td>
</tr>
<tr>
<td>91.</td>
<td>Cutoff saw (1)</td>
</tr>
<tr>
<td>92.</td>
<td>Snips, left handed (5)</td>
</tr>
<tr>
<td>93.</td>
<td>Snips, right handed (5)</td>
</tr>
<tr>
<td>94.</td>
<td>Snips, straight (5)</td>
</tr>
<tr>
<td>95.</td>
<td>Shovel, round (4)</td>
</tr>
<tr>
<td>96.</td>
<td>Shovel, square (4)</td>
</tr>
<tr>
<td>97.</td>
<td>Shovel, sharpshooter (4)</td>
</tr>
<tr>
<td>98.</td>
<td>Swaging tools (2)</td>
</tr>
<tr>
<td>99.</td>
<td>Face shields (2)</td>
</tr>
<tr>
<td>100.</td>
<td>Welding shields (2)</td>
</tr>
<tr>
<td>101.</td>
<td>Socket set, 1/2-in. drive (2 sets)</td>
</tr>
<tr>
<td>102.</td>
<td>Assorted flat blade screwdrivers (1 set)</td>
</tr>
<tr>
<td>103.</td>
<td>Assorted Phillips head screwdrivers (1 set)</td>
</tr>
<tr>
<td>104.</td>
<td>Angle squares (5)</td>
</tr>
<tr>
<td>105.</td>
<td>Combination squares (5)</td>
</tr>
<tr>
<td>106.</td>
<td>T squares (5)</td>
</tr>
<tr>
<td>107.</td>
<td>Builders string (2 rolls)</td>
</tr>
<tr>
<td>108.</td>
<td>Sewer tape (2)</td>
</tr>
<tr>
<td>109.</td>
<td>Torches, MAPP gas (5)</td>
</tr>
<tr>
<td>110.</td>
<td>Torches, turbo (2)</td>
</tr>
<tr>
<td>111.</td>
<td>Torch, butane (1)</td>
</tr>
<tr>
<td>112.</td>
<td>Prest-O-Light torch (1)</td>
</tr>
</tbody>
</table>
113. Torches, oxyacetylene (2)
114. Rigid acetylene torch (1)
115. 25-ft tapes (15)
116. 100-ft tapes (2)
117. Tri-stand yoke vises (2)
118. Tri-stand chain vises (2)
119. Chain bench vises (2)
120. Yoke bench vises (2)
121. Machinist vises (2)
122. Welding vises (2)
123. Portable vises (2)
124. Basin wrenches (2)
126. Basket-strainer wrenches (4)
128. Offset wrenches: 2–14 in., 2–18 in. (4)
129. Angle wrenches: 2–6 in., 2–8 in. (4)
130. Chain wrenches: 2–18 in., 2–24 in. (4)
131. Strap wrenches (2)
132. Torque wrenches (2)
133. Spud wrenches (2)
134. 3 to 1 spud wrenches (2)
135. Wrap-a-rounds (2)
136. Chain hoist, 1 ton (1)
137. Come-a-long, 1 ton (1)
138. Assorted chains, ropes, pulleys, slings, and chokers
139. Electric torch (2)
140. 1/2-in. and 3/4-in. pex crimper (2)
141. Pex ring splitter (2)

RECOMMENDED INSTRUCTIONAL AIDS

It is recommended that instructors have access to the following items:

1. Scientific calculator (1)
2. Computer with operating software with multimedia kit (1)
3. Document projection camera (1)
4. TV–VCR/DVD (1)
5. Data projector (1)
6. Laptop computer (1)
7. Digital camera
8. Digital scanner
9. Interactive display board
**Assessment**

This program is assessed using the MS-CPAS. The following blueprint summary contains the courses that are measured when assessing this program. Courses are grouped into clusters, and a weight is given to each cluster to determine the number of items needed from each cluster. The numbers of C1s and C2s (item difficulty levels) are also indicated on the blueprint.

<table>
<thead>
<tr>
<th>CLUSTER/COMPETENCY</th>
<th>Level 1 (C1) Number</th>
<th>Level 2 (C2) Number</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster 1: Fundamentals</td>
<td>9</td>
<td>3</td>
<td>12</td>
<td>12%</td>
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<tr>
<td>PPV/PCT 1113 Fundamentals of Plumbing/Pipefitting</td>
<td></td>
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<tr>
<td>Cluster 2: Drainage and Sewer Systems</td>
<td>20</td>
<td>7</td>
<td>27</td>
<td>27%</td>
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<tr>
<td>PPV/PCT 1513 Drainage and Sewer Systems</td>
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<tr>
<td>PPV/PCT 1712 Domestic Systems</td>
<td></td>
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<tr>
<td>PPV/PCT 1732 Backflow-Cross-Connection</td>
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<tr>
<td>Cluster 3: Fixtures, Blueprint Reading, and Piping</td>
<td>32</td>
<td>10</td>
<td>42</td>
<td>42%</td>
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<tr>
<td>PPV/PCT 1722 Plumbing Fixtures Lab</td>
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<tr>
<td>PPV/PCT 1743 Advanced Plumbing Lab</td>
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<tr>
<td>PPV/PCT 1313 Blueprint Reading for Piping Trades</td>
<td></td>
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<tr>
<td>PPV/PCT 1443 Piping Level/Transit</td>
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<tr>
<td>Cluster 4: Gas Piping, Heating Devices, and Pressure</td>
<td>14</td>
<td>5</td>
<td>19</td>
<td>19%</td>
</tr>
<tr>
<td>Boilers</td>
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<tr>
<td>PPV/PCT 1622 Gas Piping</td>
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<tr>
<td>PPV/PCT 1612 Heating Devices</td>
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<td>PPV/PCT 1411 Pressure Boilers</td>
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<td>TOTAL QUESTIONS:</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>100%</td>
</tr>
</tbody>
</table>


Appendix A: Contren® Learning Series Best Practices for the Plumbing Technology Program (taken from the National Center for Construction Education and Research)

Plumbing

LEVEL ONE

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.

INTRODUCTION TO PLUMBING DRAWINGS
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, thread, and join carbon steel piping.

CORRUGATED STAINLESS STEEL TUBING

CST1 PLUMBING – LEVEL TWO

HPF – HANGERS, SUPPORTS, STRUCTURAL PENETRATIONS, AND FIRE STOPPING (02203-05)
HPF1 Identify the common manufacturers of corrugated stainless steel tubing.
CST2 Recognize proper hangers and improper supports used to install DWV and water supply systems, and explain their 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.

FIXTURES AND FAUCETS
Install pipe hangers and supports correctly according to local applicable codes and manufacturer’s specifications.

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

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)

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

Discuss common types of sinks, lavatories, and faucets.

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

Discuss common types of toilets, urinals, and bidets.

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

Discuss common types of garbage disposals and domestic dishwashers.

INTRODUCTION TO DRAIN, WASTE, AND VENT (DWV) SYSTEMS

Explain how waste moves from a fixture through the drain system to the environment.

Identify the major components of a drainage system, and describe their functions.

Identify the different types of traps and their components, explain the importance of traps, and identify the ways that traps can lose their seals.

Describe the differences in pressure ratings for valves.

Demonstrate the ability to service various types of drain, waste, and vent (DWV) fittings, and describe their applications.

Identify significant

PLUMBING – LEVEL FOUR

Describe the model and local plumbing codes and their purposes.

Explain the procedure for modifying plumbing codes.

Use the local plumbing code and health issues, violations, and consequences to find and cite references.
Course Name: Blueprint Reading for Plumbing

Course Abbreviation: PCT 1333

Classification: Vocational Career–Technical Core

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

Prerequisite: None

### Competencies and Suggested Objectives

<table>
<thead>
<tr>
<th>1. Identify and interpret various symbols, notes, and terms.</th>
<th>DOK1, IPD1-4, RCD1-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Identify terms, symbols, abbreviations, and lines used on blueprints.</td>
<td></td>
</tr>
<tr>
<td>b. Interpret notes, specifications, and dimensions.</td>
<td></td>
</tr>
</tbody>
</table>

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

### STANDARDS

Contren Learning Series Best Practices

PLUMBING – LEVEL ONE

IPD – INTRODUCTION TO WATER DISTRIBUTION SYSTEMS PLUMBING DRAWINGS (02105-05)

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

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.

HANGERS, SUPPORTS, STRUCTURAL PENETRATIONS, AND FIRE STOPPING

HPF1 Identify the hangers and supports used.

Course Name: Low Pressure Boilers

Course Abbreviation: PCT 1411

Classification: Vocational–Technical Core

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

Prerequisite: None

Competencies and Suggested Objectives

1. Identify and explain various boiler fittings and accessories, including thermo expansion devices. 
   a. Discuss the various types of boilers.
   b. Identify and explain various boiler, steam, and hot water fittings and piping.
   c. Identify and explain feed water accessories.
d. Identify and explain steam and hot water accessories.

2. Explain the operations of a boiler.  
   a. Explain the operation of the draft controls.
   b. Explain the water treatment procedures.
   c. Identify and explain boiler and domestic water heater safety.

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 Vocational 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

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Demonstrate the safe layout and use of the electric arc machine and the oxyacetylene torch. DOK2, BSM12, OFC</td>
</tr>
<tr>
<td>a. Lay out, set up, and test the electric arc machine.</td>
</tr>
<tr>
<td>b. Lay out, set up, and test the oxyacetylene cutting torch.</td>
</tr>
<tr>
<td>2. Tack weld pipes in different positions. DOK3, BSM12, OFC</td>
</tr>
<tr>
<td>a. Tack weld pipe in a horizontal position.</td>
</tr>
<tr>
<td>b. Tack weld pipe in a vertical position.</td>
</tr>
<tr>
<td>3. Prepare, solder, braze, and test various joints. DOK2, BSM12, OFC</td>
</tr>
<tr>
<td>a. Prepare and solder a joint.</td>
</tr>
<tr>
<td>b. Prepare and braze a joint.</td>
</tr>
<tr>
<td>c. Perform tests on all soldered and brazed joints.</td>
</tr>
</tbody>
</table>

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 Vocational 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

Competencies and Suggested Objectives

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
</tr>
</thead>
</table>
| 1. Identify, explain, and sketch various piping objects.  
  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.  
  a. Discuss and demonstrate the use of the architectural, engineering, and metric scale.  |
| 3. Discuss and demonstrate freehand lettering.  
  a. Discuss and demonstrate vertical lettering.  
  b. Discuss and demonstrate lettering, numbers, and fractions.  |
| 4. Sketch various pipes and piping drawings.  
  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, and explain 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 Vocational 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

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

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

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### Competencies and Suggested Objectives

1. Identify and set up a level and/or transit.  
   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.  
   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.

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### 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

Competencies and Suggested Objectives

<table>
<thead>
<tr>
<th>1. Identify and explain safety in drainage and sewer systems.</th>
<th>DOK1, DWV, ITP, TVE, SSS ISW</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Identify and explain health department regulations for drainage and sewer systems.</td>
<td>DOK1, DWV, ITP, TVE, SSS ISW</td>
</tr>
<tr>
<td>b. Identify and explain hazards of working in confined spaces in the presence of methane gas.</td>
<td>DOK1, DWV, ITP, TVE, SSS ISW</td>
</tr>
<tr>
<td>c. Identify international plumbing code definitions.</td>
<td>DOK1, DWV, ITP, TVE, SSS ISW</td>
</tr>
<tr>
<td>d. Identify local authority for plumbing installation.</td>
<td>DOK1, DWV, ITP, TVE, SSS ISW</td>
</tr>
<tr>
<td>e. Identify approved traps and cleanouts.</td>
<td>DOK1, DWV, ITP, TVE, SSS ISW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Identify various systems used in drainage and sewer systems.</th>
<th>DOK1, DWV, ITP, TVE, SSS ISW</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Explain safety procedures.</td>
<td>DOK1, DWV, ITP, TVE, SSS ISW</td>
</tr>
<tr>
<td>b. Identify components of individual sewer systems.</td>
<td>DOK1, DWV, ITP, TVE, SSS ISW</td>
</tr>
<tr>
<td>c. Identify various types of vents and drains, including storm.</td>
<td>DOK1, DWV, ITP, TVE, SSS ISW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Install various types of soil and waste pipes.</th>
<th>DOK3, DWV, ITP, TVE, SSS ISW</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Install different types of traps.</td>
<td>DOK3, DWV, ITP, TVE, SSS ISW</td>
</tr>
<tr>
<td>b. Install stacks according to functions.</td>
<td>DOK3, DWV, ITP, TVE, SSS ISW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Identify various types of sewers.</th>
<th>DOK3, DWV, ITP, TVE, SSS ISW</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Differentiate between sanitary, storm, and combined sewers.</td>
<td>DOK3, DWV, ITP, TVE, SSS ISW</td>
</tr>
<tr>
<td>b. Identify sanitary and storm sewers.</td>
<td>DOK3, DWV, ITP, TVE, SSS ISW</td>
</tr>
<tr>
<td>c. Estimate the drainage fixture unit (DFU).</td>
<td>DOK3, DWV, ITP, TVE, SSS ISW</td>
</tr>
<tr>
<td>d. Estimate the storm sewer fixture unit.</td>
<td>DOK3, DWV, ITP, TVE, SSS ISW</td>
</tr>
</tbody>
</table>

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.

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.

MODULE 02204-05

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.

INSTALLING ROOF, FLOOR, AND AREA DRAINS

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.

PLUMBING – LEVEL THREE

TVE – TYPES OF VALVES, VENTING (02206-05)
TVA1 Identify the basic types of valves.

TVA2 Describe the differences in pressure ratings for valves.

TVA3 TVE1 Demonstrate an understanding of the ability scientific principles of venting.
TVE2 Design vent systems according to service various local code requirements.
TVE3 Sketch the different types of vents.
TVE4 Construct given vent configurations.
TVE5 Install the different types of valves vents correctly.

INSTALLING AND TESTING WATER SUPPLY PIPING

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 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 a water meter special kinds of waste and vent systems.

ITP4 Locate a water heater, water softener

SSS5 Size roof drainage systems.

PLUMBING – LEVEL FOUR

ISW – INDIRECT AND SPECIAL WASTE (02404-06)

ISW1 Identify and hose bibbs.

ITP5 Install a water distribution install an indirect waste system using appropriate hangers.
ITP6 Modify structural members using the appropriate tools without weakening the structure.

ITP7 Correctly size ISW2 Identify and install a water service line, including backflow prevention an interceptor.
ITP8 Test a water supply system.

INSTALLING FIXTURES, VALVES, AND FAUCETS

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.

INSTALLING WATER HEATERS
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

Competencies and Suggested Objectives

1. Identify and perform various functions on a hot water system. DOK3, IWH3-4,
   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. DOK3, HHS
   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. DOK1, HHS
   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

### Competencies and Suggested Objectives

1. Identify and explain the various codes pertaining to gas and plumbing installation. DOK1, CST, FGS
   - a. Identify local authority for gas installation.
   - 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.

SERVICING OF FIXTURES, VALVES, AND FAUCETS

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
**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

---

### Competencies and Suggested Objectives

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

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**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.

BACKFLOW PREVENTERS

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.

TYPES OF VENTING

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.

SIZING DWV AND STORM SYSTEMS

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.

SEWAGE PUMPS AND SUMP PUMPS

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.
CORROSIVE-RESISTANT WASTE PIPING

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.

COMPRESSED AIR

COA1—Identify the components of compressed air systems.

COA2—Discuss the installation of compressed air systems and their components and accessories.

COA3—Describe the applications of compressed air systems.

COA4—Identify the different methods of conditioning compressed air.

COA5—Identify the types, functions, and capacities of different air compressor systems.

COA6—Identify the safety issues related to compressed air systems.

COA7—Install a basic compressed air system.

PLUMBING – LEVEL FOUR

BUSINESS PRINCIPLES FOR PLUMBERS

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.

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

Competencies and Suggested Objectives

<table>
<thead>
<tr>
<th>Competency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Explain the procedures and install bathroom fixtures according to local, state, and/or international codes. &lt;br&gt;a. Explain and install a lavatory, tub, and shower. &lt;br&gt;b. Explain and install a water closet.</td>
</tr>
<tr>
<td>2.</td>
<td>Explain the procedures and install other fixtures according to local, state, and/or international codes. &lt;br&gt;a. Explain and install washer boxes and an icemaker box. &lt;br&gt;b. Explain and install urinals. &lt;br&gt;c. Explain and install service sinks and mop sinks. &lt;br&gt;d. Explain and install drinking fountains and a water filtering system. &lt;br&gt;e. Explain and install a kitchen sink, garbage disposal, and dishwasher. &lt;br&gt;f. Explain and identify other approved plumbing fixtures</td>
</tr>
</tbody>
</table>

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

### Competencies and Suggested Objectives

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

### 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

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

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 191(1-3)

Classification: Vocational 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. (1–3 sch: 2–6 hr lab)

Prerequisites: Consent of Instructor

Competencies and Suggested Objectives

<table>
<thead>
<tr>
<th>1. Develop a written plan that details the activities and projects to be completed.</th>
<th>2. Assess accomplishment of objectives.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Utilize a written plan that details the activities and projects to be completed.</td>
<td>a. Prepare a daily written assessment of accomplishment of objectives.</td>
</tr>
<tr>
<td>b. Perform written occupational objectives in the special project.</td>
<td>b. Present weekly written reports to the instructor about activities performed and objectives accomplished.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Utilize and follow a set of written guidelines for the special project.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Develop and follow a set of written guidelines for the special project.</td>
<td></td>
</tr>
</tbody>
</table>

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 192(1-6)

**Classification:** Vocational 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

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Apply technical skills needed to be a viable member of the workforce.</td>
</tr>
<tr>
<td>a. Prepare a description of technical skills to be developed.</td>
</tr>
<tr>
<td>b. Develop technical skills needed to be a viable member of the workforce.</td>
</tr>
<tr>
<td>2. Apply skills developed in other program area courses.</td>
</tr>
<tr>
<td>a. Perform skills developed in other program area courses.</td>
</tr>
<tr>
<td>3. Apply human relationship skills.</td>
</tr>
<tr>
<td>a. Practice human relationship skills in the program.</td>
</tr>
<tr>
<td>4. Apply and practice positive work habits and responsibilities.</td>
</tr>
<tr>
<td>a. Perform assignments to develop positive work habits and responsibilities.</td>
</tr>
<tr>
<td>5. Work with the instructor and employer to develop written occupational objectives to be accomplished.</td>
</tr>
<tr>
<td>a. Perform written occupational objectives.</td>
</tr>
<tr>
<td>6. Assess accomplishment of objectives.</td>
</tr>
<tr>
<td>a. Prepare daily written assessment of accomplishment of objectives.</td>
</tr>
<tr>
<td>b. Present weekly written reports to the instructor about activities performed and objectives accomplished.</td>
</tr>
<tr>
<td>7. Utilize a set of written guidelines.</td>
</tr>
<tr>
<td>a. Develop and follow a set of written guidelines.</td>
</tr>
</tbody>
</table>

**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


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 vocational career–technical program area courses

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Apply technical skills and related academic knowledge needed to be a viable member of the workforce.</td>
</tr>
<tr>
<td>a. Demonstrate technical skills necessary to complete job requirements.</td>
</tr>
<tr>
<td>b. Demonstrate academic skills necessary to complete job requirements.</td>
</tr>
<tr>
<td>c. Perform tasks detailed in an educational training agreement at the work setting.</td>
</tr>
<tr>
<td>2. Apply general workplace skills to include positive work habits necessary for successful employment.</td>
</tr>
<tr>
<td>a. Demonstrate appropriate human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service.</td>
</tr>
<tr>
<td>b. Utilize time, materials, and resource-management skills.</td>
</tr>
<tr>
<td>c. Use critical-thinking skills, such as problem solving, decision making, and reasoning.</td>
</tr>
<tr>
<td>d. Acquire, evaluate, organize, maintain, interpret, and communicate information.</td>
</tr>
</tbody>
</table>

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


Trade Publications


PCT 1113 Fundamentals of Plumbing/Pipefitting


PCT 1732 Backflow and Cross Connection


PCT 1722 Plumbing Fixtures Lab


PCT 1743 Advanced Plumbing Lab


PCT 1622 Gas Piping


PCT 1612 Heating Devices


PCT 1411 Low Pressure Boilers


**PCT 1333 Blueprint Reading for Plumbing**


**PCT 1323 Sketching**


**PCT 1213 Tacking, Brazing, Burning**


**PCT 1812 Rigging and Signaling**


**PCT 2419 Special Project**


Appendix B: Contren Learning for the Plumbing Technology Program
(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 craftsperson.
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.

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 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.

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
ORIENTATION TO THE TRADE

OTT1 Describe the types of work performed by pipefitters.
OTT2 Identify career opportunities available to pipefitters.
OTT3 Explain the purpose and objectives of an apprentice training program.
OTT4 Explain the responsibilities and characteristics of a good pipefitter.
OTT5 Explain the importance of safety in relation to pipefitting.

PIPEFITTING HAND TOOLS

PHT1 Describe the safety requirements that apply to the use of pipefitter hand tools.
PHT2 Explain how to care for selected pipefitter hand tools properly.
PHT3 Demonstrate how to use selected pipefitter hand tools safely and properly.
PHT4 Identify tools, and state their uses.
PHT5 Use selected hand tools.

PIPEFITTING POWER TOOLS

PPT1 State the safety procedures that must be followed when working with power tools.
PPT2 Cut pipe using a portable band saw.
PPT3 Identify and explain the uses of portable grinders.
PPT4 Explain the proper and safe operation of machines used in pipe joint preparation.
• Pipe threaders
• Portable power drives
• Pipe bevelers

PPT5—Perform selected pipe joint preparation operations using power tools.

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
  • Piercing and slot cutting
  • Bevels
  • Washing
OFC8 Operate a motorized, portable oxyfuel gas cutting machine.

Level Two

PIPING SYSTEMS

PIS1—Identify and explain the types of piping systems.
PIS2—Identify piping systems according to color-coding.
PIS3—Explain the effects and corrective measures for thermal expansion in piping systems.
PIS4—Explain types and applications of pipe insulation.

DRAWINGS AND DETAIL SHEETS

DDS1—Identify parts of drawings.
DDS2—Identify types of drawings.
DDS3—Make field sketches.
DDS4—Interpret drawing indexes and line lists.

THREADED PIPE FABRICATION

TPF1—Identify and explain the materials used in threaded piping systems.
TPF2—Identify and explain pipe fittings.
TPF3—Read and interpret screwed fitting joint drawings.
TPF4—Identify and explain types of threads.
TPF5—Determine pipe lengths between joints.
TPF6—Thread and assemble piping and valves.
TPF7—Calculate offsets.

SOCKET WELD PIPE FABRICATION
SWP1 Identify and explain types of socket weld piping materials.
SWP2 Identify and explain socket weld fittings.
SWP3 Read and interpret socket weld piping drawings.
SWP4 Determine pipe lengths between socket weld fittings.
SWP5 Fabricate socket weld fitting to pipe.

BUTT WELD PIPE FABRICATION

BWP1 Identify butt weld piping materials and fittings.
BWP2 Read and interpret butt weld piping drawings.
BWP3 Prepare pipe ends for fit-up.
BWP4 Determine pipe lengths between fittings.
BWP5 Select and install backing rings.
BWP6 Perform alignment procedures for various types of fittings.

Level Three

RIGGING EQUIPMENT

RGE1 Identify and describe the uses of common rigging hardware and equipment.
RGE2 Perform a safety inspection on hooks, slings, and other rigging equipment.
RGE3 Describe common slings and determine sling capacities and angles.
RGE4 Select, inspect, use, and maintain special rigging equipment:
  • Simple block and tackle
  • Chain hoists
  • Come-alongs
  • Jacks
  • Tuggers
RGE5 Inspect heavy rigging hardware.
RGE6 Tie knots used in rigging.

RIGGING PRACTICES

RGP1 Identify and use the correct hand signals to guide a crane operator.
RGP2 Identify basic rigging and crane safety procedures and determine the center of gravity of a load.
RGP3 Identify the pinch points of a crane and explain how to avoid them.
RGP4 Identify site and environmental hazards associated with rigging.
RGP5 Properly attach rigging hardware for routine lifts and pipe lifts.
RGP6 Identify the components of a lift plan.

STANDARDS AND SPECIFICATIONS

SAS1 Understand and interpret pipefitting standards and codes.
SAS2 Read and interpret pipefitting specifications.
SAS3 Identify pipe and components according to specifications.

INTRODUCTION TO ABOVEGROUND PIPE INSTALLATION
INS1—Store pipe and materials.
INS2—Identify types of flanges.
INS3—Identify types of gaskets used with flanges.
INS4—Lay out and cut gaskets.
INS5—Explain the location of flange bolt holes.
INS6—Install pipe with flanged connections.
INS7—Lay out and install pipe sleeves and floor penetrations.
INS8—Read and interpret spool sheets.
INS9—Explain how to erect spools in a piping system.

PIPE HANGERS AND SUPPORTS

PHS1—Identify types of pipe hangers and supports.
PHS2—Identify and interpret pipe support drawings and symbols.
PHS3—Determine field placement of hangers.
PHS4—Identify and install concrete fasteners.
PHS5—Fabricate angle iron brackets to support pipe.
PHS6—Identify and explain the types of spring can supports.
PHS7—Identify and explain the types of variable spring can supports.
PHS8—Identify and explain the types of constant spring can supports.
PHS9—Explain the storing and handling procedures for spring can supports.
PHS10—Explain how to install spring can supports.
PHS11—Maintain spring can supports.

TESTING PIPING SYSTEMS AND EQUIPMENT

TPS1—Perform pretest requirements.
TPS2—Perform service and flow tests.
TPS3—Perform head pressure tests.
TPS4—Perform hydrostatic tests.
TPS5—Explain how to perform steam blow tests.
TPS6—Explain nondestructive examinations (NDE).

LEVEL FOUR
ADVANCED PIPE FABRICATION

APF1—Calculate simple piping offsets.
APF2—Calculate three-line, 45° equal spread offsets around a vessel.
APF3—Calculate three-line, 45° unequal spread offsets.
APF4—Fabricate tank heating coils.
APF5—Perform mitering procedures.
APF6—Lay out three- and four-piece mitered turns.
APF7—Lay out 45° laterals, using references.
APF8—Fabricate dummy legs and trunnions out of pipe, using references.
APF9—Perform geometric layout of pipe laterals and supports.
STT – STEAM TRAPS (08404-07)

STT1  Identify types of steam traps.
STT2  Install steam traps.
STT3  Troubleshoot steam trap systems.
# Appendix BC: Related Academic Standards

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<th>Related Academic Standards</th>
<th>Course</th>
<th>PCT 1722</th>
<th>PCT 1732</th>
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</table>

## 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 and/or paraphrase, compare and/or contrast, cause-and-effect)

---

Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)

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 CD: 21st Century Skills

21st Century Crosswalk for Plumbing

<table>
<thead>
<tr>
<th>21st Century Standards</th>
<th>PCT 1113</th>
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## 21st Century Crosswalk for Plumbing

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### CS1 Global Awareness
1. Using 21st century skills to understand and address global issues
2. 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
3. Promoting the study of non-English language as a tool for understanding other nations and cultures, including the use of non-English languages

### CS2 Financial, Economic, and Business and Entrepreneurial Literacy
1. Knowing how to make appropriate personal economic choices
2. Understanding the role of the economy and the role of business in the economy in society
   - Applying appropriate 21st century skills to function as a productive contributor within an organizational setting
   - Integrating oneself within and adapting continually to the nation’s evolving economic and business environment
3. Using entrepreneurial skills to enhance workplace productivity and career options
CS3 Civic Literacy

- Being an informed citizen to participate effectively in government
  1. Participating effectively in civic life through knowing how to stay informed and understanding governmental processes
  2-3. Exercising the rights and obligations of citizenship at local, state, national, and global levels
  4-3. Understanding the local and global implications of civic decisions
- Applying 21st century skills to make intelligent choices as a citizen

CS4 Information Health Literacy

1. Obtaining, interpreting and Communication Skills understanding basic health information and services and using such information and services in ways that enhance health

- Information and media literacy skills: Analyzing, accessing, managing, integrating, evaluating, and creating information in a variety of forms and media; understanding the role of media in society
  2. Communication skills: Understanding, managing, preventive physical and creating effective oral, written, mental health measures, including proper diet, nutrition, exercise, risk avoidance, and multimedia communication in a variety of forms and contexts; stress reduction

CS5 Thinking and Problem-Solving Skills

- Critical thinking and systems thinking: Exercising sound reasoning in understanding and making complex choices, understanding the interconnections among systems
- Problem identification, formulation, and solution: Ability to frame, analyze, and solve problems
- Creativity and intellectual curiosity: Developing, implementing, and communicating new ideas to others, staying open and responsive to new and diverse perspectives

CS6 Interpersonal and Self-Directional Skills

- Interpersonal and collaborative skills: Demonstrating teamwork and leadership, adapting to varied roles and responsibilities, working productively with others, exercising empathy, respecting diverse perspectives
- Self-direction: Monitoring one’s own understanding and learning needs, locating appropriate resources, transferring learning from one domain to another
- Accountability and adaptability: Exercising personal responsibility and flexibility in personal, workplace, and community contexts; setting and meeting high standards and goals for oneself and others; tolerating ambiguity
- Social responsibility: Acting responsibly with the interests of the larger community in mind; demonstrating ethical behavior in personal, workplace, and community contexts

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
2012 Mississippi Curriculum Framework

Postsecondary Plumbing Technology
(Program CIP: 46.0503 – Plumbing Technology/Plumber)

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Mississippi State, MS 39762

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

Standards for Program Contren Learning Series Best Practices

Related Academic Standards

21st Century Skills
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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

<table>
<thead>
<tr>
<th>Region</th>
<th>2011 Jobs</th>
<th>2020 Jobs</th>
<th>Change</th>
<th>% Change</th>
<th>Openings</th>
<th>2011 Median Hourly Earnings</th>
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<td>Regional Total</td>
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<td>National Total</td>
<td>1,323,688</td>
<td>1,453,250</td>
<td>129,562</td>
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<td>$22.47</td>
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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/](http://www.rcu.msstate.edu/).

a. A student’s technical skill attainment for completion of the Career Certificate will be assessed utilizing the MSCPAS Career Certificate (Y1) assessment score.
b. 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.
c. Timing of Y1 and Y2 Assessments:
  a. A student may complete the Y1 assessment upon application for the Career Certificate.
  b. 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.)
  c. 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.
- **Related Academics** – To learn more about Related Academics, please go to [http://www.ctb.com/ctb.com/control/main?p=home](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)

<table>
<thead>
<tr>
<th>Articulated Secondary Course</th>
<th>Articulated Postsecondary Course</th>
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<tr>
<td>[S] Plumbing (Program CIP: 46.0503 – Plumbing Technology/Plumber)</td>
<td>PCT 1113 Fundamentals of Plumbing</td>
</tr>
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</table>

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 transcripted immediately upon college enrollment
- No grade will be given on the transcript for articulated courses, only hours granted will be transcripted (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:
  o 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
  o Activities that develop a higher level of mastery on the existing competencies and suggested objectives
  o Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed or revised
  o 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
  o 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.
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Program Description

The Plumbing Technology program prepares a person for advanced placement in plumbing and related fields. Graduates of this program can take the journeyperson 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.

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

*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.

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

*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:

<table>
<thead>
<tr>
<th>Course Type</th>
<th>Minimum Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Career Certificate</td>
<td>30 credits minimum</td>
</tr>
<tr>
<td>Technical Certificate</td>
<td>15 credits minimum</td>
</tr>
<tr>
<td>General Education Core Courses</td>
<td>15 credits minimum</td>
</tr>
<tr>
<td>Total Semester Credit Hours for the Associate of Applied Science Degree</td>
<td>60 credits minimum hours earned as a compilation of Career, Technical, and Academic credit hours.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOT 1413</td>
<td>Business Accounting</td>
<td>3 sch:</td>
<td>See Appropriate Program Description</td>
</tr>
<tr>
<td>BOT 1713</td>
<td>Mechanics of Communication</td>
<td>3 sch:</td>
<td>See Appropriate Program Description</td>
</tr>
<tr>
<td>CST 1123</td>
<td>Basic Computer Systems</td>
<td>3 sch:</td>
<td>See Appropriate Program Description</td>
</tr>
<tr>
<td>CPT 2133</td>
<td>Career Development</td>
<td>3 sch:</td>
<td>See Appropriate Program Description</td>
</tr>
<tr>
<td>DDT 1213</td>
<td>Construction Materials</td>
<td>3 sch:</td>
<td>See Appropriate Program Description</td>
</tr>
<tr>
<td>MMT 1313</td>
<td>Salesmanship</td>
<td>3 sch:</td>
<td>See Appropriate Program Description</td>
</tr>
<tr>
<td>MMT 2213</td>
<td>Management</td>
<td>3 sch:</td>
<td>See Appropriate Program Description</td>
</tr>
<tr>
<td>MMT 2513</td>
<td>Entrepreneurship</td>
<td>3 sch:</td>
<td>See Appropriate Program Description</td>
</tr>
<tr>
<td>PCT 1323</td>
<td>Sketching</td>
<td>3 sch:</td>
<td>1 hr. lecture, 4 hr. lab</td>
</tr>
<tr>
<td>PCT 1213</td>
<td>Tacking, Brazing and Burning</td>
<td>3 sch:</td>
<td>2 hr. lecture, 2 hr. lab</td>
</tr>
<tr>
<td>PCT 1812</td>
<td>Rigging and Signaling</td>
<td>2 sch:</td>
<td>1 hr. lecture, 2 hr. lab</td>
</tr>
<tr>
<td>PCT 291(1-3)</td>
<td>Special Project in Plumbing Technology</td>
<td>3 sch:</td>
<td>2–6 hr. lab</td>
</tr>
<tr>
<td>PCT 292(1-6)</td>
<td>Supervised Work Experience in Plumbing Technology</td>
<td>1-6 sch:</td>
<td>3-18 hr. externship</td>
</tr>
<tr>
<td>WBL 191(1-3)</td>
<td>Work-Based Learning</td>
<td>1-3 sch:</td>
<td>3-9 hr. externship</td>
</tr>
</tbody>
</table>

Other instructor approved electives that are listed in the MCCB approved CTE Uniform Course Numbering document.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAD 2413</td>
<td>Legal Environment of Business</td>
<td>3 sch</td>
<td>See Academic Program Description</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Competency Description</th>
<th>DOK, BSM, PLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Describe general safety rules for working in a shop/lab and industry.</td>
<td>DOK1, BSM, IPP, PLS, CDS</td>
</tr>
<tr>
<td></td>
<td>a. Describe how to avoid on-site accidents.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Explain the relationship between housekeeping and safety.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Explain the importance of following all safety rules and company safety policies according to OSHA standards including addressing General Duty Clause and 1926 CFR Subpart C.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Explain the importance of reporting all on-the-job injuries, accidents, and near misses.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e. Explain the need for evacuation policies and the importance of following them.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f. Explain the employer’s substances abuse policy and how it relates to safety.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>g. Explain the safety procedures when working near pressurized or high temperature.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Identify and apply safety around welding operations.</td>
<td>DOK1, BSM, PLS</td>
</tr>
<tr>
<td></td>
<td>a. Use proper safety practices when welding or working around welding operations.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Use proper safety practices when welding in or near trenches and excavations.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Explain the term proximity work.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Identify and explain use of various barriers and confinements.</td>
<td>DOK1, BSM, PLS</td>
</tr>
<tr>
<td></td>
<td>a. Explain the safety requirements for working in confined areas.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Explain and practice lockout/tagout procedures.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Explain the different barriers and barricades, and how they are used.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Recognize and explain personal protective equipment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e. Inspect and care for personal protective equipment.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Explain lifting, fall protection, and the use of ladders and scaffolds.</td>
<td>DOK1, BSM, PLS</td>
</tr>
<tr>
<td></td>
<td>a. Identify and explain the procedures for lifting heavy objects.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Explain fall protection procedures.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Inspect and safely work with various ladders and scaffolds.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Explain the Material Safety Data Sheet (MSDS).</td>
<td>DOK1, BSM, PLS</td>
</tr>
<tr>
<td></td>
<td>a. Explain the function of the MSDS.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>6.</strong> Explain the requirements of the MSDS.</td>
<td>b. Interpret the requirements of the MSDS.</td>
<td></td>
</tr>
<tr>
<td><strong>6.</strong> Explain fires.</td>
<td>a. Explain the process by which fires start.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Explain fire prevention of various flammable liquids.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Explain the classes of fire and the types of extinguishers.</td>
<td></td>
</tr>
<tr>
<td><strong>7.</strong> Explain safety in and around electrical situations.</td>
<td>a. Explain injuries when electrical contact occurs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Explain safety around electrical hazards.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Explain action to take when an electrical shock occurs.</td>
<td></td>
</tr>
<tr>
<td><strong>8.</strong> Apply basic mathematics for residential carpentry.</td>
<td>a. Apply the four basic math skills with whole numbers, fractions, and percent.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Use the metric system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Identify and read measuring tools.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Solve basic algebraic equations.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e. Calculate area and volume of simple geometric figures.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f. Apply basic math to solve simple geometric figures and problems.</td>
<td></td>
</tr>
<tr>
<td><strong>9.</strong> Demonstrate the use and maintenance of hand and power tools.</td>
<td>a. Identify terms and symbols commonly used on construction drawings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Interpret various symbols to locate various elements.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Interpret a plan to determine layout.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Interpret basic electrical specifications.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e. Interpret electrical drawings, including site plans, floor plans, and detail drawings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f. Read equipment schedule.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>g. Explain basic layout of a construction drawing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>h. Describe the information in a title block.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>i. Identify the lines used on construction drawings.</td>
<td></td>
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<tr>
<td></td>
<td>j. Explain the architect’s and engineer’s scales.</td>
<td></td>
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<tr>
<td></td>
<td>k. Design a construction drawing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>l. Construct a structure based on a construction drawing.</td>
<td></td>
</tr>
<tr>
<td><strong>10.</strong> Read, analyze, and design a construction drawing.</td>
<td>a. Explain and practice safe rigging.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Identify and explain rigging equipment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Inspect rigging equipment.</td>
<td></td>
</tr>
<tr>
<td><strong>11.</strong> Explain and identify safe rigging and equipment.</td>
<td>a. Describe employment opportunities including potential earnings, employee benefits, job availability, places of employment, working conditions, and educational</td>
<td></td>
</tr>
<tr>
<td><strong>12.</strong> Describe employment opportunities and responsibilities.</td>
<td></td>
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</tr>
</tbody>
</table>
STANDARDS

Contren Learning Series Best Practices

Contren Core

BSM – BASIC SAFETY (00101-09)

BSM1 Identify the responsibilities and personal characteristics of a professional craftsperson.
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

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

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

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identify and explain various boiler fittings and accessories, including thermo expansion devices. DOK1, IWH1-2, STT</td>
</tr>
<tr>
<td>a. Discuss the various types of boilers.</td>
</tr>
<tr>
<td>b. Identify and explain various boiler, steam, and hot water fittings and piping.</td>
</tr>
<tr>
<td>c. Identify and explain feed water accessories.</td>
</tr>
<tr>
<td>d. Identify and explain steam and hot water accessories.</td>
</tr>
<tr>
<td>2. Explain the operations of a boiler. DOK1 IWH1-2, STT</td>
</tr>
<tr>
<td>a. Explain the operation of the draft controls.</td>
</tr>
<tr>
<td>b. Explain the water treatment procedures.</td>
</tr>
<tr>
<td>c. Identify and explain boiler and domestic water heater safety.</td>
</tr>
</tbody>
</table>

**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

Competencies and Suggested Objectives

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Demonstrate the safe layout and use of the electric arc machine and the oxyacetylene torch.</td>
<td>DOK2, BSM12, OFC</td>
</tr>
<tr>
<td>a. Lay out, set up, and test the electric arc machine.</td>
<td></td>
</tr>
<tr>
<td>b. Lay out, set up, and test the oxyacetylene cutting torch.</td>
<td></td>
</tr>
<tr>
<td>2. Tack weld pipes in different positions.</td>
<td>DOK3, BSM12, OFC</td>
</tr>
<tr>
<td>a. Tack weld pipe in a horizontal position.</td>
<td></td>
</tr>
<tr>
<td>b. Tack weld pipe in a vertical position.</td>
<td></td>
</tr>
<tr>
<td>3. Prepare, solder, braze, and test various joints.</td>
<td>DOK2, BSM12, OFC</td>
</tr>
<tr>
<td>a. Prepare and solder a joint.</td>
<td></td>
</tr>
<tr>
<td>b. Prepare and braze a joint.</td>
<td></td>
</tr>
<tr>
<td>c. Perform tests on all soldered and brazed joints.</td>
<td></td>
</tr>
</tbody>
</table>

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

Competencies and Suggested Objectives

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

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

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

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

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

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

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identify and explain safety in drainage and sewer systems.</td>
</tr>
<tr>
<td>a. Identify and explain health department regulations for drainage and sewer systems.</td>
</tr>
<tr>
<td>b. Identify and explain hazards of working in confined spaces in the presence of methane gas.</td>
</tr>
<tr>
<td>c. Identify international plumbing code definitions.</td>
</tr>
<tr>
<td>d. Identify local authority for plumbing installation.</td>
</tr>
<tr>
<td>e. Identify approved traps and cleanouts.</td>
</tr>
<tr>
<td>2. Identify various systems used in drainage and sewer systems.</td>
</tr>
<tr>
<td>a. Explain safety procedures.</td>
</tr>
<tr>
<td>b. Identify components of individual sewer systems.</td>
</tr>
<tr>
<td>c. Identify various types of vents and drains, including storm.</td>
</tr>
<tr>
<td>3. Install various types of soil and waste pipes.</td>
</tr>
<tr>
<td>a. Install different types of traps.</td>
</tr>
<tr>
<td>b. Install stacks according to functions.</td>
</tr>
<tr>
<td>4. Identify various types of sewers.</td>
</tr>
<tr>
<td>a. Differentiate between sanitary, storm, and combined sewers.</td>
</tr>
<tr>
<td>b. Identify sanitary and storm sewers.</td>
</tr>
<tr>
<td>c. Estimate the drainage fixture unit (DFU).</td>
</tr>
<tr>
<td>d. Estimate the storm sewer fixture unit.</td>
</tr>
</tbody>
</table>

**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

### Competencies and Suggested Objectives

1. Identify and perform various functions on a hot water system.  
   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.  
   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.  
   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

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

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

Competencies and Suggested Objectives

1. Estimate and install a hot water system.  
   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.  
   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 Examine 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

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

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

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

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

**Competencies and Suggested Objectives**

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

**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 191(1-3)

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. (1–3 sch: 2–6 hr lab)

Prerequisites: Consent of Instructor

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Develop a written plan that details the activities and projects to be completed.</td>
</tr>
<tr>
<td>a. Utilize a written plan that details the activities and projects to be completed.</td>
</tr>
<tr>
<td>b. Perform written occupational objectives in the special project.</td>
</tr>
<tr>
<td>2. Assess accomplishment of objectives.</td>
</tr>
<tr>
<td>a. Prepare a daily written assessment of accomplishment of objectives.</td>
</tr>
<tr>
<td>b. Present weekly written reports to the instructor about activities performed and objectives accomplished.</td>
</tr>
<tr>
<td>3. Utilize and follow a set of written guidelines for the special project.</td>
</tr>
<tr>
<td>a. Develop and follow a set of written guidelines for the special project.</td>
</tr>
</tbody>
</table>

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 192(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

<table>
<thead>
<tr>
<th>Competencies and Suggested Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Apply technical skills needed to be a viable member of the workforce.</td>
</tr>
<tr>
<td>a. Prepare a description of technical skills to be developed.</td>
</tr>
<tr>
<td>b. Develop technical skills needed to be a viable member of the workforce.</td>
</tr>
<tr>
<td>2. Apply skills developed in other program area courses.</td>
</tr>
<tr>
<td>a. Perform skills developed in other program area courses.</td>
</tr>
<tr>
<td>3. Apply human relationship skills.</td>
</tr>
<tr>
<td>a. Practice human relationship skills in the program.</td>
</tr>
<tr>
<td>4. Apply and practice positive work habits and responsibilities.</td>
</tr>
<tr>
<td>a. Perform assignments to develop positive work habits and responsibilities.</td>
</tr>
<tr>
<td>5. Work with the instructor and employer to develop written occupational objectives to be accomplished.</td>
</tr>
<tr>
<td>a. Perform written occupational objectives.</td>
</tr>
<tr>
<td>6. Assess accomplishment of objectives.</td>
</tr>
<tr>
<td>a. Prepare daily written assessment of accomplishment of objectives.</td>
</tr>
<tr>
<td>b. Present weekly written reports to the instructor about activities performed and objectives accomplished.</td>
</tr>
<tr>
<td>7. Utilize a set of written guidelines.</td>
</tr>
<tr>
<td>a. Develop and follow a set of written guidelines.</td>
</tr>
</tbody>
</table>

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


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

### Competencies and Suggested Objectives

<table>
<thead>
<tr>
<th>1. Apply technical skills and related academic knowledge needed to be a viable member of the workforce.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Demonstrate technical skills necessary to complete job requirements.</td>
</tr>
<tr>
<td>b. Demonstrate academic skills necessary to complete job requirements.</td>
</tr>
<tr>
<td>c. Perform tasks detailed in an educational training agreement at the work setting.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Apply general workplace skills to include positive work habits necessary for successful employment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Demonstrate appropriate human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service.</td>
</tr>
<tr>
<td>b. Utilize time, materials, and resource-management skills.</td>
</tr>
<tr>
<td>c. Use critical-thinking skills, such as problem solving, decision making, and reasoning.</td>
</tr>
<tr>
<td>d. Acquire, evaluate, organize, maintain, interpret, and communicate information.</td>
</tr>
</tbody>
</table>

### 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


Trade Publications


PCT 1113 Fundamentals of Plumbing/Pipefitting

PCT 1732 Backflow and Cross Connection

PCT 1722 Plumbing Fixtures Lab


PCT 1743 Advanced Plumbing Lab


PCT 1622 Gas Piping

PCT 1612 Heating Devices


PCT 1411 Low Pressure Boilers


**PCT 1333 Blueprint Reading for Plumbing**


**PCT 1323 Sketching**


**PCT 1213 Tacking, Brazing, Burning**


**PCT 1812 Rigging and Signaling**


**PCT 2419 Special Project**


Appendix B: Contren Learning for the Plumbing Technology Program\textsuperscript{5}  
(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 craftsperson.
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.

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 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.

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

#### Related Academic Standards

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<tr>
<th>Course</th>
<th>PCT 1722</th>
<th>PCT 1732</th>
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#### 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)

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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

<table>
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<th>21st Century Crosswalk for Plumbing</th>
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## 21st Century Crosswalk for Plumbing

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### CS1 Global Awareness

1. Using 21st century skills to understand and address global issues
2. 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
3. Understanding other nations and cultures, including the use of non-English languages

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

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

### CS3 Civic Literacy

1. Participating effectively in civic life through knowing how to stay informed and understanding governmental processes
2. Exercising the rights and obligations of citizenship at local, state, national and global levels
3. 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