Advanced Plumbing Unit 4

Content Area: **CTE**
Course(s):
Time Period: **April**
Length: **MP 4 (45 Days)**
Status: **Published**

Unit Overview:

Unit 4: Plumbing Fixtures, Appliances, Water Heaters, and Final Connections

Duration: 45 instructional days (April – June)

Unit Overview

This unit covers the installation, connection, and testing of plumbing fixtures, household appliances, and water heaters, from rough-in to final inspection. Students will learn how to install sinks, toilets, tubs, showers, faucets, dishwashers, washing machines, and both tank and tankless water heaters. Emphasis is placed on following manufacturer installation instructions, meeting New Jersey Plumbing Code requirements, and applying best practices for sealing, fastening, and connecting supply and waste lines. Students will practice leak detection, appliance hook-ups, and water heater safety features, including temperature and pressure relief valves. By the end of the unit, students will be able to complete final plumbing installations that are safe, code-compliant, and ready for inspection.

Essential Questions:

Essential Questions

1. How does proper fixture, appliance, and water heater installation contribute to the safety, efficiency, and performance of a plumbing system?
2. What are the key differences between tank and tankless water heaters in terms of installation, maintenance, and efficiency?
3. How do manufacturer specifications and the New Jersey Plumbing Code work together to guide installation?
4. What tools, techniques, and safety measures are necessary for leak-free, code-compliant connections?

Enduring Understandings:

Enduring Understandings

- Proper installation ensures the long-term performance and safety of fixtures, appliances, and water heaters.

- Tank and tankless water heaters have distinct advantages, installation requirements, and maintenance needs.
- Following the manufacturer's instructions and plumbing code is essential for passing inspections and avoiding hazards.
- Final connections require precision, safety awareness, and thorough testing.

Standards/Indicators/Student Learning Objectives (SLOs):

Standards / Indicators / Student Learning Objectives

Applicable Architecture & Construction Standards

Cluster: Architecture & Construction

- **9.3.12.AC.1** Use vocabulary, symbols, and formulas common to architecture and construction.
- **9.3.12.AC.3** Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
- **9.3.12.AC.6** Read, interpret, and use technical drawings, documents, and specifications to plan a project.

Pathway: Construction (AC-CST)

- **9.3.12.AC-CST.5** Apply practices and procedures required to maintain jobsite safety.
- **9.3.12.AC-CST.8** Demonstrate the construction crafts required for each phase of a construction project.
- **9.3.12.AC-CST.9** Safely use and maintain appropriate tools, machinery, equipment, and resources to accomplish construction project goals.

Pathway: Maintenance/Operations (AC-MO)

- **9.3.12.AC-MO.2** Use troubleshooting procedures when solving a maintenance problem in buildings.
- **9.3.12.AC-MO.3** Apply construction skills when repairing, restoring, or renovating existing buildings.

9.3.12.AC.1	Use vocabulary, symbols and formulas common to architecture and construction.
9.3.12.AC.3	Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
9.3.12.AC.6	Read, interpret and use technical drawings, documents and specifications to plan a project.
9.3.12.AC-CST.5	Apply practices and procedures required to maintain jobsite safety.
9.3.12.AC-CST.8	Demonstrate the construction crafts required for each phase of a construction project.

9.3.12.AC-CST.9	Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals.
9.3.12.AC-MO.2	Use troubleshooting procedures when solving a maintenance problem in buildings.
9.3.12.AC-MO.3	Apply construction skills when repairing, restoring or renovating existing buildings.

Lesson Titles:

Lesson Titles

1. Introduction to Final Connections and Fixture Installation
2. Overview of Plumbing Fixtures and Appliances
3. Water Heater Types, Components, and Safety Features
4. Manufacturer Guidelines and NJ Plumbing Code Requirements for Water Heaters
5. Tank Water Heater Installation Procedures
6. Tankless Water Heater Installation Procedures
7. TPR Valve Installation and Testing
8. Installing Sinks, Faucets, and Supply Lines
9. Installing Toilets and Wax Rings
10. Installing Tubs, Showers, and Drain Assemblies
11. Connecting Dishwashers to Water and Drain Systems
12. Installing Washing Machine Boxes and Hook-ups
13. Leak Testing for Fixtures, Appliances, and Water Heaters
14. Troubleshooting Installation Failures and Leaks
15. Final Inspection Preparation and Checklists
16. Safety Review and Project Wrap-Up

Career Readiness, Life Literacies, & Key Skills:

Career Readiness, Life Literacies, and Key Skills Standards

- **WRK.9.2.12.CAP.3** Investigate how continuing education contributes to one's career and personal growth.
- **WRK.9.2.12.CAP.6** Identify transferable skills in career choices and design alternative career plans

based on those skills.

- **WRK.9.2.12.CAP.7** Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements.
- **WRK.9.2.12.CAP.8** Determine job entrance criteria used by employers in various industry sectors.

Technology Literacy Standards

- **TECH.9.4.2.CT.3** Use a variety of types of thinking to solve problems.
- **TECH.9.4.2.TL.6** Illustrate and communicate ideas and stories using multiple digital tools.

WRK.9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
WRK.9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
WRK.9.2.12.CAP.7	Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest.
WRK.9.2.12.CAP.8	Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
TECH.9.4.2.CT.3	Use a variety of types of thinking to solve problems (e.g., inductive, deductive).
TECH.9.4.2.TL.6	Illustrate and communicate ideas and stories using multiple digital tools (e.g., SL.2.5.).

Inter-Disciplinary Connections:

Inter-Disciplinary Connections

- **ELA:** Students read and interpret manufacturer installation instructions, New Jersey Plumbing Code sections, and inspection checklists; write step-by-step installation procedures; and use technical vocabulary in oral presentations.
- **Math:** Apply measurements, fractions, and conversions when cutting pipe, setting fixture heights, and sizing water heater capacity based on demand.
- **Science:** Understand thermodynamics in water heating, water pressure principles, and the effects of temperature on pipe expansion and contraction.
- **Technology:** Use digital tools for creating installation diagrams, documenting projects, and researching manufacturer specifications and troubleshooting procedures.
- **Career Readiness:** Apply workplace safety, tool handling, and time management skills during practical fixture, appliance, and water heater installations.

Summative Assessment:

Summative Assessment

High-Stakes Assessments:

- **Comprehensive Exams:** Final exams covering a broad range of course material can assess students' understanding of key concepts and principles.
- **Capstone Project Presentations:** Formal presentations showcase students' project management skills, decision-making, and communication abilities.

Performance-Based Assessments:

- **Project Portfolio Reviews:** A portfolio compiled throughout the program can demonstrate a student's growth, technical skills, and problem-solving abilities in various areas of the plumbing trade.
- **Simulated Project Management Tasks:** Students could be presented with a realistic construction scenario where they must apply their knowledge and skills to develop solutions or make critical decisions.

Industry-Standard Certifications:

- Encouraging students to pursue industry certifications relevant to plumbing can demonstrate their commitment to the field and mastery of specific skills.

Considerations for Choosing Summative Assessments:

- **Alignment with Learning Outcomes:** Ensure the chosen assessments directly measure the program's overall learning objectives and desired competencies.
- **Depth vs. Breadth:** Balance the need to assess a broad range of knowledge with in-depth exploration of critical skills.
- **Authenticity:** Choose assessments that reflect real-world scenarios and tasks a plumber encounters.
- **Multiple Measures:** Utilize a combination of assessments to provide a holistic picture of student learning.
- **Faculty Collaboration:** Ensure consistency and fairness in assessments across different courses within the program.

Additional Tips:

- Develop clear rubrics outlining specific criteria for evaluating performance on each summative assessment.
- Provide students with ample opportunities to practice and refine their skills before summative assessments.
- Offer feedback on summative assessments to help students identify areas for improvement and guide their future learning.

- Alternate Assessment
- Benchmark
- Group Project Assessment
- Individual Project Assessment
- Marking Period Assessment
- Module Section Assessment

Benchmark Assessments

Benchmark Assessments

- Students will install and connect multiple residential plumbing fixtures and a water heater according to blueprint specifications and New Jersey Plumbing Code requirements.
- Assessment on fixture installation, appliance hookups, water heater safety, and code requirements.
- Students will perform and document water heater start-up, temperature adjustment, and safety checks, as well as functional testing of connected fixtures.
- Students interpret and apply fixture and water heater installation plans to ensure correct layout, connections, and compliance.

Alternative Assessment

Alternative Assessments

- Students create a video showing the complete installation of a water heater or selected plumbing fixture, explaining each step, tool used, and safety protocols followed.
- Students present their approach to diagnosing and repairing a malfunctioning fixture or water heater, including safety considerations.
- Students review each other's mock-ups of fixture and water heater installations, offering constructive technical feedback.
- Students compile a portfolio containing diagrams, photos, notes, and reflections on plumbing fixture and water heater installations, including documentation of problem-solving steps.

Formative Assessment:

Formative Assessment

In-Class Activities:

- **Quick Quizzes:** Short, unannounced quizzes at the beginning or end of class can assess comprehension of key concepts from previous lessons or gauge readiness for new material..
- **Think-Pair-Share:** Encourage individual reflection followed by partnered discussions and sharing key takeaways with the class. This promotes active learning and identifies common misconceptions.
- **Minute Papers:** Have students write a one-minute summary of the main points learned or lingering questions they have. This helps identify areas needing clarification.

Classroom Discussions & Activities:

- **Open-ended Questions:** Encourage students to think critically and elaborate on their understanding by posing open-ended questions throughout lessons.
- **Case Studies & Problem-solving:** Present real-world plumbing scenarios or problems for students to analyze and propose solutions. This assesses critical thinking and application of knowledge.
- **Role-playing Activities:** Simulate real-world situations like project meetings or client interactions to practice communication, negotiation, and problem-solving skills.

Peer-Based Assessment:

- **Peer Reviews:** Students can review each other's work, providing constructive feedback on project plans, presentations, or technical drawings. This fosters collaboration and self-assessment skills.
- **Group Work & Discussions:** Collaborative activities encourage students to explain concepts to one another, solidifying their understanding and identifying areas where they can learn from peers.

Technology-assisted Assessments:

- **Online Quizzes & Polls:** Utilize online platforms for short quizzes, polls, or concept checks to gauge student understanding in real-time and adjust instruction accordingly.
- **Self-assessment Tools:** Provide online quizzes or exercises where students can assess their own understanding of key concepts and identify areas for self-directed learning.

Benefits of Formative Assessment:

- **Improved Student Learning:** Provide ongoing feedback that helps students identify strengths, weaknesses, and adjust their learning strategies.
- **Informed Instruction:** Instructors gain valuable insights into student understanding, allowing them to adapt teaching methods and address misconceptions promptly.
- **Increased Student Engagement:** Active participation in formative assessments keeps students engaged and invested in the learning process.
- **Promotes Self-reflection:** Encourage students to reflect on their learning journey, identify areas for improvement, and take ownership of their learning.

- Anticipatory Set
- Exit Tickets
- Hands-On Activities (Individual & Groups)
- Hands-On Observations (Individual & Groups)
- Questioning, Scenarios, and Problem-Solving (Open Ended & Multiple Choice
- Warm-Up

Resources & Materials:

Resources & Materials

Plumbing Level 1 Book NCCER Fifth Edition

Plumbing Level 2 Book NCCER Fifth Edition

Plumbing Level 3 Book NCCER Fifth Edition

Google Classroom

Google Gemini

Promethean Board

Canva

Clever

Diffit

Kahoot

MagicSchool

https://www.youtube.com/

CBS Plumbing Trade

https://www.cbsnews.com/video/plying-their-trades/#

Run Time 7:20

Toilet

How The Toilet Changed History

Run Time 7:15

Toilet Parts: What They Are and Common Fixes (DIY) | Family Handyman.

Workplace Hazards Video Run Time

Top 6 Workplace Hazards Identified

Run Time 8:11

PPE Video

PPE - Safety Training Video Course - SafetyInfo.com

Run Time 10:49

NJ Master Plumbers Information

New Jersey Plumbing License Requirements

NJ Plumbing Wages

Plumber salary in New Jersey

Plumbing Trade Video

6 Lessons I Learned as a Plumbing Apprentice

Time 9:03

Plumbing Trade Video

Plumbers Can SPECIALISE In Many Area... Here Are The Different Types!

Run Time 8:23

Mike Rowe On The Trades

https://youtu.be/3h_pp8CHEQ0

Run Time 8:25

PPE

Plumbing PPE Plumbers Must NEVER Work Without!

Run Time 9:04

FATAL Plumbing Mistakes EVERY Plumber Needs To Know About!

Run Time 8:09

NJ One Call

New Jersey One Call

Power Tools

Let's learn about a couple of plumbing power tools - Plumbing Power Tools

Run Time 12:34

Types Of Hot/Cold Water Pipes And Fittings

PEX vs COPPER vs CPVC plumbing pipes

Run Time 16:55

Plastic Pipe

Gluing PVC Pipe & ABS Pipe [How To]

Run Time 8:16

Plastic Pipe

10 MISTAKES When Working With Plastic Pipes (PVC, CPVC & ABS) | GOT2LEARN

Run Time 8:26

IPS

When to Use Pipe dope, Teflon Tape, Neither or Both for Threaded Connection

Run Time 3:54

IPS

How to Use a Pipe Wrench

Run Time 4:31

IPS

RIDGID 300 Compact Threading Machine

Run Time 18:26

OSHA

Top OSHA 10 OSHA Violations of 2023 | And how to prevent similar citations.

Run Time 8:51

Ladder Safety

Run Time 4:33

Personal Protective Equipment Milwaukee

Old vs. new growth trees and the wood products they make

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK:

Instructional Strategies

- Direct instruction on fixture types, water heater varieties, components, and installation sequences
- Teacher-led demonstrations of toilet, sink, tub, shower, and water heater installation procedures
- Step-by-step guided practice for setting and sealing fixtures, as well as connecting and testing water heaters
- Use of manufacturer installation guides alongside NJ Plumbing Code references for all fixtures and water heaters
- Group projects assembling a complete bathroom installation and water heating system from supply

lines to fixtures

- Troubleshooting and repair labs for common fixture, appliance, and water heater issues

Learning Activities

- Hands-on installation of sinks, toilets, faucets, and water heaters with appropriate supply, waste, and vent connections
- Wax ring installation and replacement practice for toilets
- Appliance hook-up simulations for dishwashers, washing machines, and hot water heaters
- Leak testing for newly installed fixtures, appliances, and water heaters
- Fixture and water heater alignment, leveling, and anchoring exercises to ensure proper function and safety
- Final inspection checklist creation for fixture, appliance, and water heater installation projects
- Temperature and pressure relief valve (TPR) installation and testing for water heaters
- Discussion and demonstration of tank vs. tankless water heaters, including maintenance considerations

Bloom's Taxonomy / DOK Levels

- **Remember**: Identify components of common plumbing fixtures, appliances, and water heaters (DOK 1)
- **Understand**: Explain manufacturer specifications for fixture, appliance, and water heater installation (DOK 2)
- **Apply**: Install a fixture or water heater with proper water supply, waste, and safety connections (DOK 2)
- **Analyze**: Detect and correct installation errors in fixtures, appliances, and water heaters (DOK 3)
- **Evaluate**: Judge the quality of a completed fixture, appliance, and water heater installation against code and manufacturer requirements (DOK 3)
- **Create**: Plan and execute a complete installation project from rough-in to final inspection, including a water heater (DOK 4)

Modifications

ELL Modifications:

- Choice of test format (multiple-choice, essay, true-false)
- Continue practicing vocabulary
- Provide study guides prior to tests
- Read directions to the student
- Read test passages aloud (for comprehension assessment)
- Vary test formats

G&T Modifications:

- Alternate assignments/enrichment assignments
- Enrichment projects
- Extension activities
- Higher-level cooperative learning activities
- Pairing direct instruction with coaching to promote self-directed learning
- Provide higher-order questioning and discussion opportunities
- Provide texts at a higher reading level
- Tiered assignments
- Tiered centers

At Risk Modifications

The possible list of modifications/accommodations identified for Special Education students can be utilized for At-Risk students. Teachers should utilize ongoing methods to provide instruction, assess student needs, and utilize modifications specific to the needs of individual students. In addition, the following may be considered:

- Additional time for assignments
- Adjusted assignment timelines
- Agenda book and checklists
- Answers to be dictated
- Assistance in maintaining uncluttered space
- Books on tape
- Concrete examples
- Extra visual and verbal cues and prompts
- Follow a routine/schedule
- Graphic organizers
- Have students restate information
- No penalty for spelling errors or sloppy handwriting
- Peer or scribe note-taking

- Personalized examples
- Preferential seating
- Provision of notes or outlines
- Reduction of distractions
- Review of directions
- Review sessions
- Space for movement or breaks
- Support auditory presentations with visuals
- Teach time management skills
- Use of a study carrel
- Use of mnemonics
- Varied reinforcement procedures
- Work in progress check

IEP & 504 Modifications:

*All teachers of students with special needs must review each student's IEP. Teachers must then select the appropriate modifications and/or accommodations necessary to enable the student to appropriately progress in the general curriculum.

Possible Modifications/Accommodations: (See listed items below):

- Allow for redos/retakes
- Assign fewer problems at one time (e.g., assign only odds or evens)
- Differentiated center-based small group instruction
- Extra time on assessments
- Highlight key directions
- If a manipulative is used during instruction, allow its use on a test
- Opportunities for cooperative partner work
- Provide reteach pages if necessary
- Provide several ways to solve a problem if possible
- Provide visual aids and anchor charts
- Test in alternative site
- Tiered lessons and assignments
- Use of a graphic organizer
- Use of concrete materials and objects (manipulatives)
- Use of word processor

Technology Materials and Standards

Technology Materials

- Promethean Board
- Google For Educators
- Google Classroom
- Google Gemini
- MagicSchool
- Canva
- Clever
- Diffit

Technology Literacy Standards

- **TECH.9.4.2.TL.1** Identify the basic features of a digital tool and explain the purpose of the tool.
- **TECH.9.4.2.TL.2** Create a document using a word processing application.
- **TECH.9.4.2.TL.4** Navigate a virtual space to build context and describe the visual content.
- **TECH.9.4.2.TL.6** Illustrate and communicate ideas and project designs using multiple digital tools.
- **TECH.9.4.2.TL.7** Describe the benefits of collaborating with others to complete digital tasks or develop digital artifacts.

TECH.9.4.2.TL.1	Identify the basic features of a digital tool and explain the purpose of the tool (e.g., 8.2.2.ED.1).
TECH.9.4.2.TL.2	Create a document using a word processing application.
TECH.9.4.2.TL.4	Navigate a virtual space to build context and describe the visual content.
TECH.9.4.2.TL.5	Describe the difference between real and virtual experiences.
TECH.9.4.2.TL.6	Illustrate and communicate ideas and stories using multiple digital tools (e.g., SL.2.5.).

Computer Science and Design Thinking Standards

Computer Science and Design Thinking Standards

- **CS.9-12.8.1.12.AP.6** Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.
- **CS.9-12.8.1.12.CS.3** Compare the functions of application software, system software, and hardware.
- **CS.9-12.8.2.12.ED.5** Evaluate the effectiveness of a product or system based on factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance, and repair.
- **CS.9-12.8.2.12.NT.2** Redesign an existing product to improve form or function.
- **CS.9-12.8.2.12.ITH.2** Propose an innovation to meet future demands supported by analysis of potential costs, benefits, trade-offs, and risks.

CS.9-12.8.1.12.AP.6	Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.
CS.9-12.8.1.12.CS.3	Compare the functions of application software, system software, and hardware.
CS.9-12.8.2.12.ED.5	Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).

CS.9-12.8.2.12.NT.2	Redesign an existing product to improve form or function.
CS.9-12.8.2.12.ITH.2	Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation.