

# Advanced Plumbing Unit 3

Content Area: **CTE**  
Course(s):  
Time Period: **January**  
Length: **MP 3 (45 Days)**  
Status: **Published**

## Unit Overview:

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### Unit 3: Advanced Drainage, Waste, and Vent (DWV) Systems

**Duration:** 45 instructional days (February – April)

#### Unit Overview

This unit provides students with advanced knowledge and skills for designing, installing, and troubleshooting DWV systems in residential and commercial applications. Students will work with PVC, ABS, and cast iron piping, with emphasis on proper venting, slope, and system layout. Instruction will include joining methods such as solvent welding, mechanical couplings, and no-hub connections, as well as fixture rough-in and installation. Students will learn how to interpret and apply New Jersey Plumbing Code requirements to ensure system safety, reliability, and compliance. Additionally, students will troubleshoot common DWV issues such as blockages, siphonage, and improper venting, using both traditional and modern diagnostic tools.

## Essential Questions:

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### Essential Questions

- How do slope, venting, and material choice affect DWV system performance?
- What are the best practices for preventing leaks and blockages in DWV systems?
- How does code compliance ensure system safety and environmental protection?

## Enduring Understandings:

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### Enduring Understandings

- Proper DWV design ensures safe and efficient removal of waste while preventing sewer gas infiltration.
- Material and fitting selection must align with code, application, and environmental factors.
- Accurate installation, inspection, and maintenance are critical to DWV system performance.

## **Standards/Indicators/Student Learning Objectives (SLOs):**

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### **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.7** Compare and contrast the building systems and components required for a construction project.
- **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.

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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.

## **Lesson Titles:**

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## **Lesson Titles (Individual and Groups)**

1. Introduction to DWV Systems
2. Materials Overview: PVC, ABS, and Cast Iron
3. Tools and Safety Practices for DWV Installation
4. Solvent Welding Techniques for PVC and ABS
5. No-Hub and Mechanical Couplings for Cast Iron
6. Understanding Fixture Units and Drainage Load Calculations
7. Proper Slope for Drainage Efficiency
8. Venting Principles and Code Requirements
9. Common Vent Types: Individual, Common, Wet, and Loop Vents
10. Interpreting DWV Blueprints and Schematics
11. Rough-In for Bathroom Groups
12. Rough-In for Kitchens and Utility Rooms
13. Installation of Cleanouts for Maintenance Access
14. Backwater Valves and Flood Protection Devices
15. Inspection and Testing Procedures for DWV Systems
16. Diagnosing and Correcting Siphonage Issues
17. Clearing Blockages and Obstructions
18. Preventing Sewer Gas Infiltration
19. Manufacturer Guidelines vs. Plumbing Code Requirements
20. Environmental Considerations in Wastewater Management
21. Insulating and Protecting Drainage Systems in Cold Climates
22. Using Cameras and Digital Tools for DWV Troubleshooting
23. Code Compliance Checklist for DWV Systems
24. Unit Review and Written Assessment
25. Hands-On Performance Assessment: DWV Installation

## Career Readiness, Life Literacies, & Key Skills:

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### Career Readiness, Life Literacies, and Key Skills

- **WRK.9.2.12.CAP.1** Analyze unemployment rates for workers with different levels of education.
- **WRK.9.2.12.CAP.3** Investigate how continuing education contributes to career growth.
- **WRK.9.2.12.CAP.6** Identify transferable skills in career choices.
- **WRK.9.2.12.CAP.7** Use online resources to examine licensing and certification requirements.
- **WRK.9.2.12.CAP.8** Determine job entrance criteria used by employers in various industry sectors.

WRK.9.2.12.CAP.1	Analyze unemployment rates for workers with different levels of education and how the economic, social, and political conditions of a time period are affected by a recession.
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.

## Inter-Disciplinary Connections:

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### Inter-Disciplinary Connections

- **ELA:** Reading and interpreting technical codes and blueprints.
- **Math:** Calculating slope and drainage capacity.
- **Science:** Understanding gravity flow, pressure, and gas laws in venting.
- **Technology:** Using specialized tools and diagnostic equipment.
- **Social Studies:** Understanding the public health impacts of proper waste disposal.

## Summative Assessment:

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### 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**

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### **Benchmark Assessments**

- Written exam on DWV system design and code compliance.
- Blueprint reading exercise with drainage and vent layout.
- Practical exam installing a code-compliant DWV system.

## **Alternative Assessment**

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### **Alternative Assessments**

- Video presentation on proper venting practices.
- Group project designing a DWV system for a multi-bathroom layout.
- Peer-reviewed hands-on troubleshooting demonstration.

## **Formative Assessment:**

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### 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:**

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### **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

Diifit

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](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:**

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### **Instructional Strategies**

- Direct instruction with diagrams and flow models to illustrate DWV principles
- Teacher-led demonstrations on cutting, fitting, and joining PVC, ABS, and cast iron piping
- Scaffolded practice where students first perform single fixture installations, then progress to multi-fixture systems
- Guided walkthroughs of venting requirements and trap placement using NJ Plumbing Code
- Use of clear pipe models to visualize water flow, venting, and siphon effects
- Problem-based learning activities using real-world DWV layout challenges

### **Learning Activities**

- Measuring and cutting pipe to precise lengths for various DWV components
- Mock-up construction of a bathroom DWV system from blueprints

- Simulation of common DWV problems such as trap siphonage and improper venting
- Code requirement comparison chart for different fixture types
- Vent sizing exercise using NJ Plumbing Code tables
- Peer critique sessions where groups evaluate each other's installations for slope, venting, and code compliance

### **Bloom's Taxonomy / DOK Levels**

- **Remember:** Identify the purpose of each DWV system component (DOK 1)
- **Understand:** Explain how proper venting prevents sewer gas entry (DOK 2)
- **Apply:** Install a multi-fixture DWV system following blueprint specifications (DOK 2)
- **Analyze:** Diagnose improper slope or venting in a mock-up system (DOK 3)
- **Evaluate:** Inspect a completed DWV installation for code compliance and functionality (DOK 3)
- **Create:** Design a DWV system layout for a two-bathroom residential building (DOK 4)

### **Modifications**

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#### **ELL Modifications:**

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- 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:**

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- 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**

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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:**

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\*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**

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### **Technology Materials**

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

### **Technology Literacy Standards**

- **TECH.9.4.2.IML.3** Use diverse sources to find information about codes and safety practices.
- **TECH.9.4.2.IML.4** Compare and contrast how technical information is shared.
- **TECH.9.4.2.TL.2** Create a document using a word processing application.
- **TECH.9.4.2.TL.6** Illustrate and communicate ideas using multiple digital tools.
- **TECH.9.4.2.TL.7** Collaborate digitally to complete technical tasks.

TECH.9.4.2.TL.2	Create a document using a word processing application.
TECH.9.4.2.TL.6	Illustrate and communicate ideas and stories using multiple digital tools (e.g., SL.2.5.).
TECH.9.4.2.TL.7	Describe the benefits of collaborating with others to complete digital tasks or develop digital artifacts (e.g., W.2.6., 8.2.2.ED.2).
TECH.9.4.2.IML.3	Use a variety of sources including multimedia sources to find information about topics such as climate change, with guidance and support from adults (e.g., 6.3.2.GeoGI.2, 6.1.2.HistorySE.3, W.2.6, 1-LSI-2).
TECH.9.4.2.IML.4	Compare and contrast the way information is shared in a variety of contexts (e.g., social, academic, athletic) (e.g., 2.2.2.MSC.5, RL.2.9).

## Computer Science and Design Thinking Standards

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### Computer Science and Design Thinking Standards

- **CS.9-12.8.1.12.AP.5** Decompose problems into smaller components using systematic analysis.
- **CS.9-12.8.1.12.AP.6** Create artifacts by combining data and procedures.
- **CS.9-12.8.1.12.CS.2** Model interactions between application software, system software, and hardware.
- **CS.9-12.8.2.12.ED.3** Evaluate several models of the same type of product and recommend improvements.
- **CS.9-12.8.2.12.ED.5** Evaluate the effectiveness of a product or system based on requirements and constraints.

CS.9-12.8.1.12.AP.5	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
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.2	Model interactions between application software, system software, and hardware.
CS.9-12.8.2.12.ED.3	Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
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).