

Water Supply & Sanitary Engineering (DI05006021)

Unit 9: House Plumbing

Lecture 40: Drainage Plan, Operations, and Safety

GTU Diploma Engineering

Agenda

- Principles of House Drainage
- Systems of Plumbing (Two-pipe, One-pipe, Single Stack)
- The Drainage Plan and Layout
- Routine Plumbing Operations and Maintenance
- Safety Precautions in Plumbing
- Unit 9 Summary

Principles of House Drainage

- The drainage system should remove wastewater and human excreta rapidly and efficiently.
- Pipes should be laid in straight lines as far as possible, with uniform gradients to ensure self-cleansing velocity.
- Inspection chambers (manholes) should be provided at every change of direction or gradient.
- The entire system must be well-ventilated to prevent the buildup of explosive or toxic gases and to protect trap water seals.

Systems of Plumbing: Two-Pipe System

- The most traditional and safest system.
- Consists of two separate vertical pipes (stacks):
 - 1. Soil Pipe: Carries human waste from water closets (WCs).
 - 2. Waste Pipe: Carries sullage (greywater) from baths, sinks, and basins.
- Both pipes have their own separate vent pipes, resulting in 4 vertical pipes overall in larger buildings.
- Waste pipe connects to the drain via a gully trap to separate it from soil gases.

Systems of Plumbing: One-Pipe System

- A streamlined system to reduce pipework.
- Soil and waste from all fixtures are discharged into a single vertical 'Soil and Waste Pipe'.
- All fixture traps are fully ventilated using a separate common vent pipe to prevent siphonage.
- Requires deep seal traps on all fixtures since soil and waste are mixed immediately.
- Reduces the number of vertical pipes from four to two (one main stack + one vent stack).

Systems of Plumbing: Single Stack System

- The most economical and modern system for certain building types.
- Uses only ONE vertical pipe which acts as both the soil/waste discharge and the vent.
- Relies strictly on limiting the length and slope of branch pipes to prevent trap siphonage, eliminating the need for a separate vent pipe.
- Requires strict adherence to design codes (e.g., maximum distance of fixture from the stack).

The Drainage Plan Layout

- A plumbing drawing or drainage plan indicates the exact routing of supply and drainage lines.
- Key elements shown: Location of fixtures, routing of horizontal drains, location of stacks (vertical pipes), inspection chambers, and connection to municipal sewer.
- Testing the System: Before concealing pipes in walls or trenches, they must be tested for leaks.
- Smoke Test or Peppermint Test is used to check for gas leaks in drainage pipes. Water test is used for underground drains.

Routine Plumbing Operations and Maintenance

- Clearing Blockages: Using a plunger, plumbing snake (auger), or hydro-jetting to clear clogs in traps and main lines.
- Repairing Leaks: Replacing worn-out washers or O-rings in faucets (taps), tightening compression nuts, or cutting and replacing a section of broken pipe.
- Winterization: Draining pipes in cold climates to prevent freezing and bursting.
- Checking Valves: Exercising main shut-off valves periodically to ensure they don't seize due to scaling.

Safety in Plumbing: Chemical and Biological Hazards

- Biological Hazards: Exposure to raw sewage, bacteria (E. coli), and viruses. Plumbers must wear heavy-duty gloves, eye protection, and ensure personal hygiene.
- Chemical Hazards: Exposure to strong drain cleaners (acids/alkalis), solvent cements, and fluxes. Work areas must be well-ventilated.
- Sewer Gases: Confined spaces like manholes can contain toxic hydrogen sulfide or explosive methane, displacing oxygen. Proper ventilation and gas detectors are required before entry.

Safety in Plumbing: Physical and Fire Hazards

- Fire Hazards: Using a propane torch for soldering near wooden studs. Always use a heat shield and have a fire extinguisher nearby.
- Eye and Hand Protection: Sparks from cutting tools, flying debris, and sharp pipe edges require safety goggles and cut-resistant gloves.
- Ergonomic Hazards: Working in awkward positions under sinks or lifting heavy cast iron pipes. Proper lifting techniques are essential.
- Electrical Safety: Mixing water and electricity is dangerous. Ensure power is shut off when working near electrical appliances like water heaters.

Comparison of Plumbing Systems

Concept 1

Concept 2

Two-Pipe System: 4 Pipes total, Excellent hygiene, High cost, High space requirement.

One-Pipe System: 2 Pipes total, Good hygiene (fully vented), Medium cost, Medium space requirement.

Single Stack System: 1 Pipe total, Requires precise design to prevent siphonage, Low cost, Low space requirement.

Unit 9 Summary

- House plumbing is a vital engineering subsystem requiring specialized tools and materials (PEX, PVC, CPVC, Copper).
- Secure jointing methods and the implementation of traps (water seals) are fundamental to protecting public health inside a dwelling.
- Drainage plans must prioritize rapid waste removal and trap protection through proper venting.
- Plumbing operations carry biological, chemical, and physical risks; strict adherence to safety protocols is non-negotiable.

Next Lecture Preview

- We will begin Unit 10.
- Introduction to broader concepts in sanitary engineering and public health.
- Looking beyond the house to municipal infrastructure.