

Water Supply & Sanitary Engineering (DI05006021)

Unit 9: House Plumbing

Lecture 38: Plumbing Tools, Pipes, and Fittings

GTU Diploma Engineering

Agenda

- Introduction to House Plumbing
- Essential Plumbing Tools
- Types of Plumbing Pipes
- Common Pipe Fittings
- Selection Criteria for Pipes and Fittings
- Summary

Introduction to House Plumbing

- House plumbing involves the installation and maintenance of pipes, fixtures, and appliances for water supply and drainage.
- A proper plumbing system ensures the delivery of safe potable water and the sanitary removal of wastewater.
- Key requirements: No leakage, adequate pressure, prevention of backflow, and durability.
- It consists of two main subsystems: the water supply system (bringing fresh water in) and the drainage/vent system (taking wastewater out).

Essential Plumbing Tools: Measuring and Cutting

- Measuring Tape and Folding Rule: For accurate measurements of pipe lengths.
- Pipe Cutter: Provides clean, square cuts on copper, PVC, or steel pipes without deforming the pipe.
- Hacksaw: Used for cutting metal and plastic pipes when a pipe cutter is not suitable; requires filing to remove burrs.
- PVC Pipe Shears: Specifically designed for quick, clean cuts on plastic pipes up to 2 inches in diameter.

Essential Plumbing Tools: Gripping and Turning

- Pipe Wrench (Stillson Wrench): Has adjustable, toothed jaws designed to grip round metal pipes tightly when turned in one direction.
- Adjustable Wrench (Spanner): Used for hexagonal and square nuts and fittings; prevents rounding of the edges.
- Basin Wrench: A specialized tool with a long handle and swiveling jaw, used for reaching nuts securing faucets in tight spaces under sinks.
- Plier (Slip-Joint and Water Pump Pliers): Versatile tools for gripping pipes, nuts, and pulling wire or cotter pins.

Types of Plumbing Pipes: Metallic

- Galvanized Iron (GI) Pipes: Traditional pipes coated with zinc to prevent rust; heavy, prone to internal scaling and corrosion over time.
- Copper Pipes: Highly durable, biostatic (inhibits bacterial growth), and resistant to corrosion. Used for both hot and cold water but expensive.
- Cast Iron (CI) Pipes: Used primarily for drainage and waste venting; very heavy and sound-deadening.
- Stainless Steel Pipes: Used in areas requiring high corrosion resistance; rigid and expensive.

Types of Plumbing Pipes: Plastics (Polymers)

- Polyvinyl Chloride (PVC): Rigid, widely used for cold water supply and drainage. Not suitable for hot water.
- Chlorinated Polyvinyl Chloride (CPVC): Treated to withstand higher temperatures; used for both hot and cold water supply lines.
- Cross-linked Polyethylene (PEX): Flexible tubing that is easy to install, resistant to scale and chlorine. Ideal for retrofits and radiant heating.
- High-Density Polyethylene (HDPE): Extremely durable and flexible, commonly used for underground water mains and service connections.

Comparison of Pipe Materials

Concept 1

Concept 2

Copper vs. CPVC for Water Supply

Copper: Lifespan 50+ years, handles high heat/pressure, susceptible to acidic water, requires soldering.

CPVC: Lifespan 30-50+ years, handles hot water, immune to galvanic corrosion, joined by solvent cement, can become brittle over time.

GI vs. PVC for Drainage

GI/CI: Heavy, difficult to install, blocks noise well, susceptible to rust (GI).

PVC: Lightweight, very easy to cut/join, smooth interior flow, transmits water noise more easily.

Common Pipe Fittings: Directional Changes

- Elbows (Bends): Used to change the direction of the pipe. Common angles are 90 degrees and 45 degrees.
- Street Elbows: Have one male end and one female end, allowing connection directly to another fitting without a short piece of pipe.
- Tees: T-shaped fittings used to split a line into two, or combine two lines into one. Has one inlet and two outlets at 90 degrees.
- Y-Fittings (Wyes): Used primarily in drainage systems to allow a smooth flow into the main line at a 45-degree angle, reducing turbulence.

Common Pipe Fittings: Connections and Transitions

- Couplings: Short fittings used to connect two straight pieces of pipe of the same diameter.
- Reducers: Used to connect a larger diameter pipe to a smaller diameter pipe, maintaining flow efficiency.
- Unions: Similar to couplings but designed to be easily disconnected without cutting the pipe. Essential for installing pumps and water heaters.
- Nipples: Short lengths of pipe threaded at both ends, used to connect two female fittings.

Common Pipe Fittings: Closures

- Caps: Fits over the end of a male pipe or fitting to stop the flow. Commonly used for future expansion points or testing.
- Plugs: Fits into a female fitting (threaded or socket) to close the line.
- Cleanouts: A fitting with a removable plug found in drainage systems, allowing access for a plumber's snake to clear blockages.
- Valves: Regulate or stop the flow of water (e.g., Gate valve, Ball valve, Check valve). While considered fittings, they have moving parts.

Summary of Tools and Materials

- Plumbing requires specialized tools for measuring, cutting, and gripping.
- Pipe materials have evolved from GI and Lead to Copper, CPVC, and PEX, balancing cost, durability, and ease of installation.
- Fittings (Elbows, Tees, Unions) are essential for directing flow, changing pipe sizes, and allowing future maintenance.
- Selecting the right combination of pipes and fittings is fundamental to a reliable, leak-free house plumbing system.

Next Lecture Preview

- Jointing methods for different types of pipes (Threading, Soldering, Solvent Welding).
- Introduction to Traps in plumbing.
- Types of traps (P-trap, S-trap, Gully trap) and their functions.
- The concept of water seal and trap failure.