

Water Supply & Sanitary Engineering (DI05006021)

Unit 4: Conveyance of water

Lecture 16: Pipe Joints and Laying of Pipes

GTU Diploma Engineering

Spigot and Socket (Bell and Spigot) Joint

- Most common joint for CI and DI pipes.
- One end of the pipe is enlarged (socket/bell), and the other is plain (spigot).
- The spigot is inserted into the socket. A rubber gasket (Tyton joint) is compressed between them to ensure watertightness.
- Historically, molten lead or cement mortar was used for sealing CI pipes.

Flanged Joint

- Used mostly in pumping stations, filter plants, and for connecting valves or meters.
- Pipe ends have flat rings (flanges) that are bolted together.
- A rubber or compressed fiber gasket is placed between the flanges to prevent leakage.
- Advantage: Easy to assemble and dismantle.
- Disadvantage: Rigid joint; cannot accommodate settlement or deflection.

Mechanical Joint (Gland Joint)

- Similar to the bell and spigot, but uses a bolted follower ring (gland) to compress a rubber gasket into the socket.
- Provides a very secure, watertight seal.
- Allows for some deflection and is highly resistant to vibration.
- Commonly used in locations subject to minor ground movement or heavy traffic vibrations.

Expansion and Flexible Joints

- Expansion Joints: Used in exposed pipelines (like steel mains on bridge crossings) to absorb thermal expansion and contraction.
- Flexible Joints (Ball and Socket): Allow large deflections (up to 15 degrees).
- Used for laying pipes across rivers, submerged outfalls, or in highly seismically active zones.

Joints for Plastic Pipes

- PVC Pipes: Typically joined using solvent cement (chemical welding) or push-on elastomeric ring joints.
- HDPE Pipes: Joined using Butt-Fusion (melting pipe ends and pressing them together) or Electro-fusion (using a special heated sleeve).
- HDPE joints become as strong as the pipe itself, eliminating weak leak points.

Laying of Pipes: Preparatory Works

- 1. Setting out the alignment on the ground.
- 2. Excavation of trenches to required depth and gradient.
- 3. Preparation of the trench bottom (bedding).
- Proper planning of underground utilities is essential to avoid damaging existing cables or sewers.

Trenching and Bedding

- Trench Width: Must be wide enough for workers to joint pipes (usually pipe outer diameter + 30-45 cm on each side).
- Bedding: The material on which the pipe rests. Crucial for structural support.
- Types of Bedding: Granular (sand/gravel), concrete cradle (for heavy loads), or shaping the native soil.
- Uneven bedding causes point loads, leading to pipe fracture, especially in brittle materials.

Lowering and Laying the Pipes

- Pipes are lowered into the trench using ropes, tripods, or excavators (never dropped).
- Laying usually proceeds in an uphill direction to allow water to drain away from the working area.
- Sockets should ideally face uphill.
- Pipe interiors must be inspected and cleaned of debris before jointing.

Thrust Blocks

- Water under pressure exerts massive dynamic and static thrust forces at changes in direction (bends, tees) or dead ends.
- Unrestrained joints can blow apart under this thrust.
- Thrust Blocks are mass concrete poured between the pipe fitting and the undisturbed trench wall to transfer the load to the soil.

Backfilling the Trench

- Initial Backfill: Done immediately around the pipe up to 30 cm above the crown using selected fine material. Hand-tamped.
- Main Backfill: Remaining trench depth filled with excavated soil in layers.
- Compaction is necessary to prevent future settlement of roads above the trench.
- Joints are left exposed during initial backfilling for pressure testing.

Testing of Pipelines

- Before commissioning, pipelines must be tested for watertightness.
- Hydraulic Testing: The isolated pipe section is filled with water slowly (to expel air) and pressurized using a hand pump.
- Test pressure is typically 1.5 times the maximum working pressure.
- Pressure must be maintained for a specified duration (e.g., 2 hours). Acceptable leakage rates are strictly defined by codes.

Disinfection of New Pipelines

- After successful pressure testing, the pipeline must be flushed and disinfected.
- A strong chlorine solution (e.g., 50 mg/L) is injected and left in the pipe for 24 hours.
- The heavily chlorinated water is then flushed out until residual chlorine drops to normal levels (0.2 - 0.5 mg/L).
- Bacteriological testing (Coliform test) is conducted before putting the line into public service.

Summary of Joints and Laying

- Joints like spigot-socket and mechanical joints allow slight flexibility, while flanged joints are rigid.
- Proper trenching, bedding, and thrust block construction are critical for structural stability.
- Hydraulic pressure testing and disinfection are mandatory final steps before commissioning a water main.