Injection Grouting – An In-Depth Overview

Injection grouting is a specialized process used to **fill cracks, voids, honeycombs, and joints** in concrete or masonry structures. It is primarily used for **structural rehabilitation**, **leak sealing**, and **strength enhancement** by injecting a flowable material (called grout) into the affected areas under pressure. Once cured, the grout restores the structural integrity and prevents the ingress of water or chemicals.

Purpose of Injection Grouting

- Restore **load-bearing capacity** of cracked or weakened concrete
- Seal **leakage paths** in underground structures, water tanks, and basements
- Fill **voids or honeycombs** caused by poor concrete compaction
- Enhance **durability and waterproofing**
- Prevent **further deterioration** due to water, chemical, or environmental exposure

---

Common Types of Injection Grouting

1. **Cementitious Grouting**
    - **Material:** Fine cement-based grouts, sometimes with additives like non-shrink agents
    - **Applications:** Large voids, honeycombs, masonry cracks, baseplate grouting
    - **Limitations:** Not suitable for very fine cracks (<0.2 mm) or structures subject to movement
2. **Polyurethane (PU) Grouting**
    - **Material:** Hydrophobic or hydrophilic polyurethane resins
    - **Applications:** Active water leak sealing in tunnels, basements, lift pits, and water tanks
    - **Features:** Rapid reaction with water to form foam or gel; highly effective for leak arrest

3. Epoxy Grouting

- **Material:** Low-viscosity epoxy resins
- **Applications:** Structural bonding of fine cracks in concrete beams, columns, slabs, foundations
- **Features:** High strength, excellent adhesion, and chemical resistance

4. Acrylic Grouting

- **Material:** Acrylic gels
- **Applications:** Soil stabilization, curtain grouting behind tunnel linings, waterproofing underground structures
- **Features:** Very low viscosity, deep penetration, flexible sealing

5. Microfine Cement Grouting

- **Material:** Ultra-fine cement particles
- **Applications:** Soil injection, structural voids, foundation grouting
- **Features:** Improved penetration compared to standard cement grout

Application Procedure

1. **Inspection and Diagnosis**
    - Identify the type and extent of cracks or voids
    - Determine the appropriate grouting material based on site conditions
2. **Surface Preparation**
    - Clean surface and remove loose debris, dirt, paint, or coatings
3. **Drilling and Installation of Packers**
    - Drill holes at specific intervals along the crack or void
    - Install injection packers (nipples or ports) to direct grout into the structure

4. **Injection**
    - Use a grout pump to inject the material at controlled pressure
    - Start from the lowest point (in vertical applications) or one end (in horizontal applications)
    - Monitor flow and ensure full penetration
5. **Curing**
    - Allow appropriate curing time as per manufacturer specifications
    - Remove packers and seal holes if necessary
6. **Finishing**
    - Grind or finish the surface for aesthetic or functional requirements

---

Advantages of Injection Grouting

- **Minimally invasive** repair technique
- **Restores structural strength** without demolition
- **Effective waterproofing** of active leaks
- **Compatible with different substrates**—concrete, masonry, rock, soil
- **Extends service life** of deteriorating structures
- **Reduces long-term maintenance costs**

Typical Applications

- Cracks in **slabs, columns, beams, walls, tunnels, and dams**
- **Basements**, water tanks, swimming pools, and podiums for waterproofing
- **Industrial floors** with dynamic loading
- **Bridges and flyovers** with movement joints or cracks
- **Heritage structure restoration** where conventional repairs are not viable
- **Soil stabilization** and curtain grouting in underground works

Selection Criteria for Grouting Material

Criteria	Epoxy	PU (Hydro)	Cementitious	Acrylic Gel
Crack width suitability	0.2–2 mm	0.1–5 mm	>0.5 mm	<0.2 mm
Structural reinforcement	Yes	No	Moderate	No
Water sealing	Limited	Excellent	Moderate	Excellent
Flexibility	Rigid	Flexible	Rigid	Flexible
Pot life and cure time	Short	Very short	Long	Adjustable