

8.9 UPVC (Unplasticized Polyvinyl Chloride) Pipes

■ Raw Material and Composition

- **Materials:** PVC resin without added plasticizers, plus stabilizers and pigments.
 - * UPVC pipes are manufactured through an extrusion process where a raw material blend, primarily PVC resin, is melted, shaped, and then cooled. The process involves mixing the resin with additives, feeding the mixture into an extruder, and then forcing it through a die to create the desired pipe shape.
- **Properties:** Results in a more rigid and stable material ideal for long-term applications.



• Manufacturing Process

- **Process:**
 - * Manufactured using a similar extrusion process to PVC.
 - * Formulated to achieve higher rigidity and structural integrity.

1. Raw Material Preparation: UPVC resin, along with stabilizers, lubricants, and other additives, are precisely mixed to create a homogeneous compound.



2. Extrusion: The mixture is fed into an extruder, where it's heated and melted. The molten material is then forced through a die, which gives it the desired shape and size.

3. Cooling and Sizing: After extrusion, the newly formed pipe is cooled (often with water or air) to solidify the material and maintain its shape. Sizing tools are used to ensure the pipe meets the required specifications.

4. Cutting and Finishing:

- * The extruded pipe is then cut to the desired length and may undergo further finishing processes, such as surface treatment or quality control checks.
 - * UPVC pipes are a popular choice for various applications, including plumbing and water systems, due to their durability, strength, and resistance to corrosion.
- **Finishing:** Often features smoother surfaces and precise dimensional tolerances.

■ Advantages and Disadvantages

- **Strength & Durability:**
 - * High chemical resistance and excellent rigidity.
 - * Low maintenance over long service periods.
- **Longevity:** Very long lifespan when installed in appropriate conditions.
- **Efficiency:** Excellent flow characteristics due to smooth interior surfaces.
- **Transportability:** Lightweight relative to metallic alternatives.
- **Cost:** Typically higher than PVC due to enhanced properties.
- **Disadvantages:**
 - * Less impact resistance compared to more flexible pipes.
 - * Can be brittle under extreme stress or impact.

■ Causes of Defects/Deterioration & Identification

- **Physical Causes:** Stress cracking from improper handling, excessive bending, or impact.
- **Chemical Causes:** UV degradation if exposed without protective measures.
- **Identification:**
 - * Visually: Inspect for fine cracks, chips, or discoloration.
 - * Mechanically: Impact and tensile tests can indicate compromised material properties.

■ Preventive Measures

- **Handling:** Ensure careful installation to avoid mechanical shocks.
- **UV Protection:** Use UV-resistant coatings or provide shielding in outdoor installations.
- **Installation:** Adhere to manufacturer-recommended bending and jointing practices.
- **Maintenance:** Regular physical inspections to catch minor defects before they escalate.

■ Methods of Jointing

- **Solvent Weld Joint:** Adhesive joins create permanent bond.
- **Rubber Ring Push-Fit Joint:** Socketed joints with elastomeric seals.
- **Threaded Connections:** For installation with metallic systems.

■ Common Appliances/Accessories

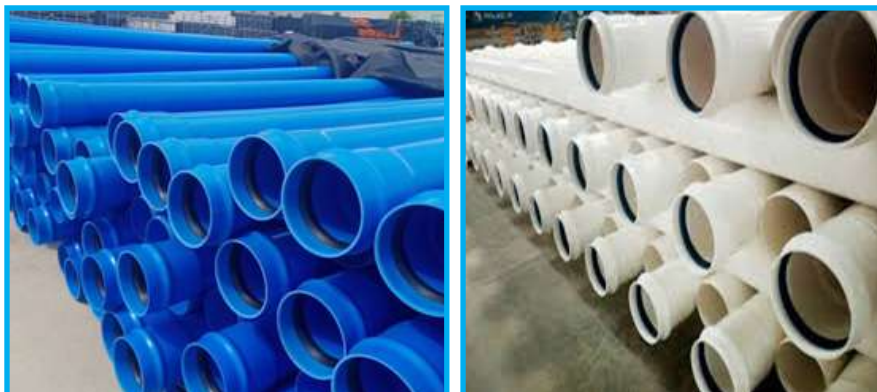
- UPVC elbows, tees, reducers, Pipe clamps and clips, End plugs and caps Valves (check, ball, butterfly) Vent fittings Threaded adaptors



8.10 OPVC (Oriented Polyvinyl Chloride) Pipes

■ Raw Material and Composition

- **Materials:**
 - * Unplasticized PVC (uPVC) base resin
 - * No plasticizers (rigid)
 - * Additives include:
 - » Impact modifiers
 - » Heat stabilizers
 - » Titanium dioxide (for UV resistance)
 - » Lubricants and processing aids
- **Properties:** Molecules are realigned through stretching (orientation), giving the pipe superior strength and flexibility compared to conventional uPVC.



■ Manufacturing Process

- **Process:**
 1. Extrusion of uPVC into pipe form.
 2. Heating to orientation temperature (~100–130°C).
 3. Axial/Biaxial Stretching to align molecular chains for increased strength.
 4. Rapid Cooling to freeze molecular orientation.
 5. Post-Processing: Cutting, finishing, and quality testing.
- **Finishing:** Pipes have smooth surfaces, uniform wall thickness, and high impact resistance.

■ Advantages and Disadvantages

- **Strength & Durability**
 - * Very high impact resistance.
 - * Enhanced tensile and burst strength due to orientation.
 - * Excellent for high-pressure applications.
- **Longevity:** Life expectancy of 50+ years under normal conditions.
- **Efficiency**
 - * Smooth bore for low-friction, high-flow performance.
 - * Lower energy loss compared to metal pipes.
- **Transportability:** Lightweight; easy to handle, transport, and install.
- **Cost:** Higher than uPVC initially, but lower lifecycle cost due to strength and fewer failures.
- **Disadvantages**
 - * Limited to ~60°C fluid temperatures.
 - * Susceptible to UV degradation if uncoated and exposed to sunlight.
 - * May weaken at joints if not properly cut or aligned.
 - * Not suitable for hot water or high-temperature fluids.



■ Causes of Defects/Deterioration & Identification

- **Physical Causes**
 - * Mechanical damage during transportation or installation.
 - * Poor trench bedding causing point loading.
 - * Over-tightened or misaligned joints.
- **Chemical Causes**
 - * UV degradation due to prolonged sun exposure without protection.
 - * Chemical attack in highly aggressive soil or wastewater without proper lining.
- **Identification**
 - * **Visually:**
 - » Surface cracks or splits, especially at joints.
 - » Discoloration or whitening (UV damage).
 - » Ovality or deformation in pipe shape.
- **Mechanically:**
 - * Hydrostatic Testing for internal pressure leaks.
 - * Ultrasonic Thickness Gauging for wall uniformity.
 - * Drop Impact Test to check impact strength.
 - * Deflection Gauging for deformation due to backfill loads.

■ Preventive Measures

- **Handling:** Avoid dropping or dragging pipes; use proper lifting methods.
- **UV Protection:**
 - * Use factory-coated OPVC or apply UV-protective paints for exposed installations.
 - * Avoid long-term exposure before installation.
- **Installation:**
 - * Use correct bedding material (e.g., compacted sand).
 - * Follow manufacturer guidelines for pipe cutting, joining, and alignment.
 - * Ensure proper thrust blocking near bends, tees, and valves.
- **Maintenance:**
 - * Regular site inspections.
 - * Monitor for pressure drops and visible leaks.
 - * Ensure joints remain sealed and flexible over time.

■ Difference Between uPVC and OPVC Pipes

Parameter	uPVC Pipes	OPVC Pipes
Full Form	Unplasticized Polyvinyl Chloride	Oriented Polyvinyl Chloride
Raw Material	Rigid PVC resin without plasticizers + stabilizers	Same uPVC base, but further molecularly oriented
Manufacturing Process	Direct extrusion into pipe form	Extruded uPVC pipe is heated, stretched, and cooled to reorient molecules
Molecular Structure	Random molecular structure	Molecules aligned (oriented) for strength and flexibility
Strength	Good mechanical strength	2–4× higher tensile and impact strength than uPVC
Flexibility	Rigid and less flexible	Significantly more flexible due to orientation
Impact Resistance	Moderate	Excellent — resists cracking from mechanical shock
Hydraulic Efficiency	High — smooth bore	Very high — smoother internal surface, lower friction losses

Thermal Resistance	Up to ~60°C	Same — up to ~60°C
Pressure Handling	Suitable for moderate pressures	Ideal for high-pressure applications
Installation Ease	Lightweight and easy to handle	Even lighter than uPVC, quicker to install (push-fit available)
Cost	Moderate	Slightly higher initially, lower life-cycle cost due to strength and longevity
UV Resistance	Needs protection in outdoor use	Also needs UV protection unless factory-treated
Durability / Lifespan	40–50 years	50+ years due to orientation benefits
Typical Uses	Residential plumbing, conduit, sewage lines	High-pressure water supply lines, irrigation, municipal piping
Jointing	Solvent cement or rubber ring joints	Push-fit gasket or rubber ring joints (no solvent welding needed)
Disadvantages	Brittle under impact, especially at low temps	Requires careful cutting/jointing to preserve orientation layer



Comprehensive Pipe Comparison Table

Feature	HDPE	GI Pipe	DI Pipe	CI Pipe	Mild Steel (MS)	PVC	PPR	CPVC	uPVC
Material	HD Polyethylene	Steel + Zinc	Ductile Iron	Cast Iron	Mild Carbon Steel	Polyvinyl Chloride	Polypropylene RCP	Chlorinated PVC	Unplasticized PVC
Flexibility	High	Low	Moderate	Very Low	Low	Low	Moderate	Moderate	Low
Corrosion Resistance	Excellent	Moderate	Very Good	Moderate	Poor	Excellent	Excellent	Excellent	Excellent
Strength	Moderate	Moderate	Very High	High	High	Low to Moderate	Moderate	Moderate to High	Moderate
Pressure Rating	Up to 16 bar	~7–10 bar	Up to 64 bar	Up to 10 bar	Up to 25 bar	6–10 bar	10–20 bar	6–15 bar	6–10 bar
Temp Limit (°C)	-40 to 60	Up to 100	Up to 70	Up to 70	Up to 300	0 to 60	Up to 95	Up to 93	Up to 60
Joining Method	Fusion	Threaded/Welded	Push-on/Flanged	Spigot & Socket	Welding/Flanged	Solvent Cement	Heat Fusion	Solvent Cement	Solvent Cement
Durability (Years)	50+	20–25	75–100	50–70	25–50	20–30	50	40–50	30–40
Cost	Moderate	Low to Moderate	High	Moderate	Moderate to High	Very Low	Moderate	Moderate to High	Low to Moderate
Weight	Light	Heavy	Heavy	Very Heavy	Heavy	Very Light	Light	Light	Light
Installation Ease	Easy	Moderate	Moderate	Labor-Intensive	Labor-Intensive	Easy	Easy	Easy	Easy
Chemical Resistance	Excellent	Poor	Moderate	Low	Poor	Good	Excellent	Excellent	Excellent
Applications	Water, Gas, Sewer	Water, Old Use	Water Mains, Fire	Sewer, Drainage	Industrial, Fire	Plumbing, Agri	Hot/Cold Water, HVAC	Hot Water, Plumbing	Cold Water, Drain
Indian Standards	IS 4984	IS 1239, IS 3589	IS 8329	IS 1536, IS 3989	IS 1239, IS 3589	IS 4985	IS 15801	IS 15778	IS 13592



For more information and videos regarding installation and repairing of Different types of Pipes and Jointing this link can be referred:



https://www.youtube.com/watch?v=N_7Hz_XIBb-w&list=PLK4mHeDEpPCKWEB-dYjJnpCVSaYee_3b5W



9. Types of defects in Concrete

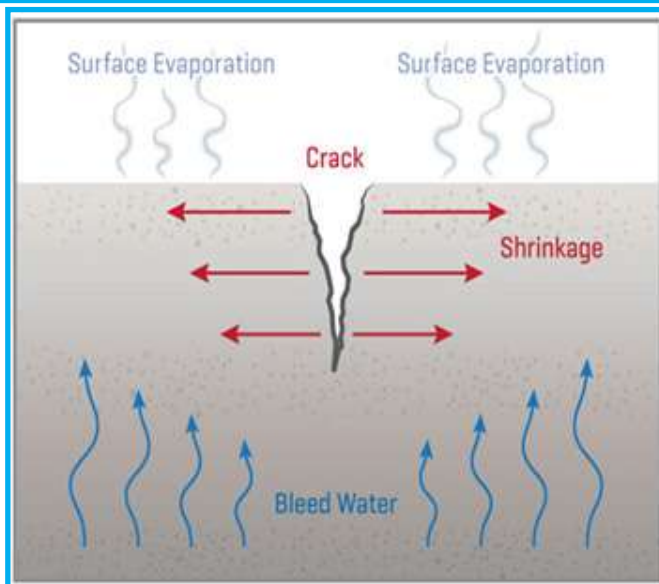
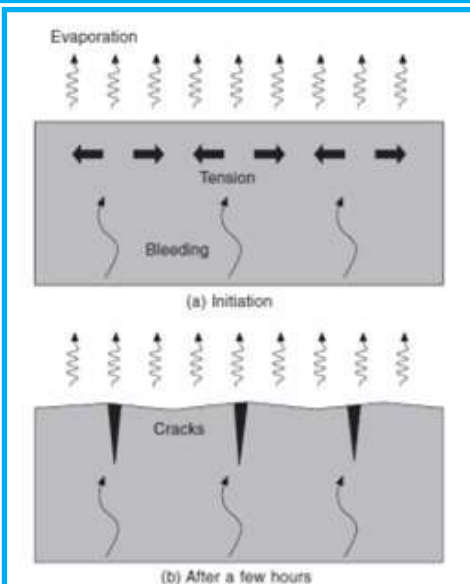
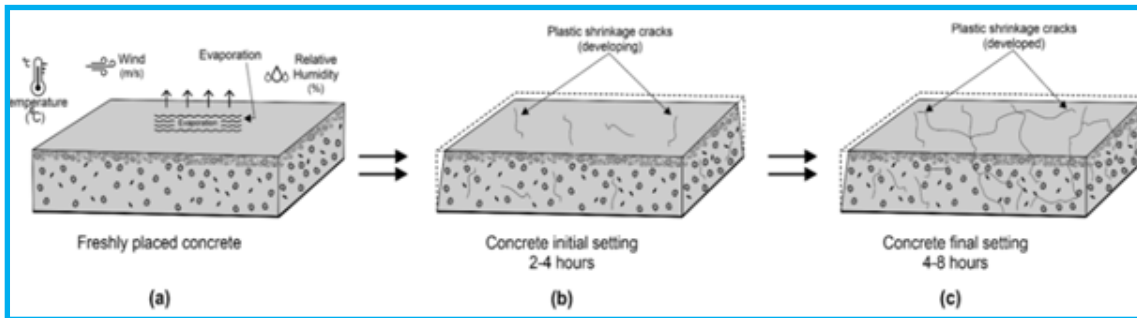
Plastic Shrinkage Cracks

- **Description:**
 - Occur in the plastic (fresh) state of concrete, typically within the first few hours after placement.
- **Causes:**
 - Rapid evaporation of surface water due to high temperature, wind, or low humidity.
 - Inadequate or delayed finishing that exposes the surface too early.
 - Excess water in the mix or improper admixture usage.
- **Identification:**
 - **Physical:**
 - * Visible fine cracks on the concrete surface shortly after placement.
 - * Areas where the surface appears to lose moisture prematurely.
 - **Mechanical:**
 - * Not typically measured by instruments since they appear early; however, moisture meters can confirm high evaporation rates.
- **Nature & Impact:**
 - **Nature:** Non-structural; usually limited to the surface.
 - **Impact:**
 - * Primarily an aesthetic issue.
 - * If severe or deep, they can potentially provide pathways for water ingress, which may affect durability.
- **Preventive Measures:**
 - **Before Concreting:**
 - * Use an optimized water-cement ratio and quality admixtures (retarders) to control setting time.
 - * Prepare formwork to reduce wind exposure.
 - **During/After Concreting:**
 - * Initiate curing immediately by covering the surface with wet burlap or plastic sheeting.
 - * Use curing compounds if water curing is not possible.
- **Rectification Methods:**
 - **Surface Preparation:**
 - * Clean the affected area thoroughly (remove dust and loose particles).
 - * Moisten the surface to prevent further water loss during the repair.
 - **Patching or Overlays:**
 - * For fine cracks, apply a thin layer of polymer-modified concrete or cementitious overlay that bonds to the existing surface.
 - * If cracks are slightly more pronounced, a repair mortar can be used to fill and seal the crack.
 - **Sealing:** Once cured, apply a penetrating sealer or surface coating to prevent moisture ingress.
 - **Re-Curing (if applicable):** If the cracks are still in the early stages, consider reintroducing moisture (e.g., wet burlap or curing compound) to minimize further cracking.





Plastic Shrinkage Crack in concrete



Settlement Cracks

Description:

- Cracks that appear due to uneven settling or differential movement in the concrete mass.

Causes:

- Inadequate or uneven compaction of the subgrade or base.
- Differential settlement due to uneven load distribution or poor foundation design.

Identification:

- Physical:**
 - Visible cracks developing after the concrete has hardened, often in areas corresponding to uneven subgrade support.
 - Irregular crack patterns that may follow the direction of settlement.
- Mechanical:**
 - Use leveling instruments and settlement markers to track differential movement over time.

Nature & Impact:

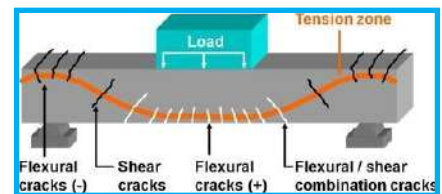
- Nature:** Can be both structural (if settlement is severe) and non-structural.
- Impact:**
 - May compromise the overall alignment and level of the structure.
 - Severe settlement cracks can lead to structural instability.

Preventive Measures:

- Before Concreting:**
 - Ensure proper subgrade preparation and compaction.
 - Design for uniform load distribution with proper reinforcement.
- During/After Concreting:**
 - Monitor and adjust placement techniques to ensure even settlement.
 - Regularly inspect and repair early signs of differential settlement.

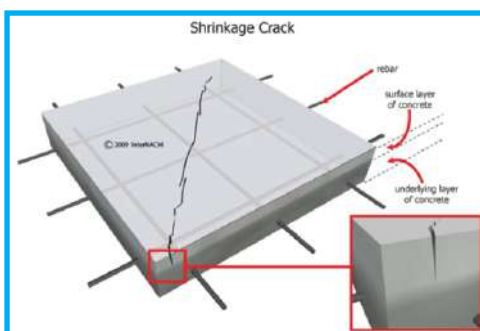
Rectification Methods:

- Assessment:** Conduct a thorough inspection using leveling instruments or settlement markers to determine if the movement is continuing or if the crack has stabilized.
- Crack Repair:**
 - For non-structural cracks, clean the crack and fill it with an epoxy or polyurethane injection system to restore continuity and limit moisture ingress.
 - Use surface patching mortar for shallow cracks that do not compromise overall stability.
- Structural Remedy:**
 - For severe or ongoing settlement problems, underpinning or additional reinforcement may be required. This might include installing new support systems to redistribute loads.
 - Consult a structural engineer to assess the need for remedial underpinning or foundation stabilization methods.
- Monitoring:** Once repaired, monitor the repaired area over time with settlement markers to ensure that the underlying issue has been resolved.



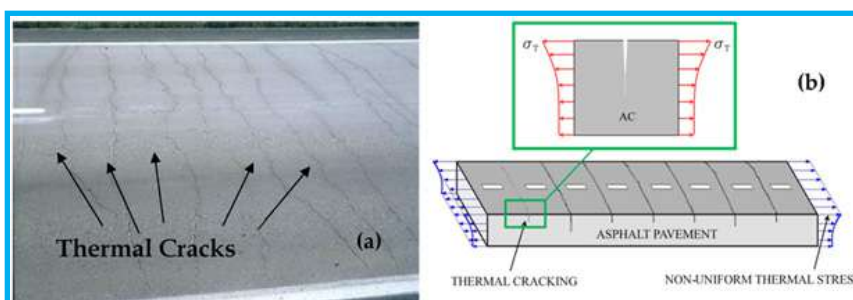
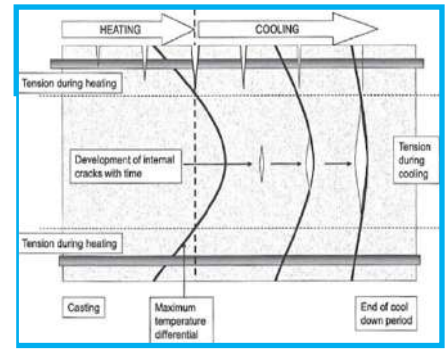
Drying Shrinkage Cracks

- **Description:** Cracks that develop gradually as the concrete loses moisture over an extended period.
- **Causes:**
 - Excess water in the mix leading to a high water-cement ratio.
 - Insufficient curing which accelerates moisture loss.
 - Long-term drying without appropriate control measures.
- **Identification:**
 - **Physical:**
 - * Fine, hairline cracks that develop over large surface areas.
 - * Often appear weeks after placement.
 - **Mechanical:**
 - * Moisture meters can detect abnormal drying rates.
 - * Ultrasonic pulse velocity tests may highlight regions of reduced density.
- **Nature & Impact:**
 - **Nature:** Primarily non-structural; typically affects the surface.
 - **Impact:**
 - * Can lead to permeability issues, allowing ingress of water and chemicals.
 - * Affects durability over the long term.
- **Preventive Measures:**
 - **Before Concreting:**
 - * Use a controlled water-cement ratio and proper mix design.
 - * Incorporate shrinkage-reducing admixtures.
 - **During/After Concreting:**
 - * Ensure thorough curing (preferably water curing) for at least 7–14 days.
 - * Apply surface sealers to reduce moisture loss.
- **Rectification Methods:**
 - **Cleaning:** Remove dirt and loose particles from the crack using a stiff brush and compressed air if necessary.
 - **Crack Filling:**
 - * Inject a low-viscosity epoxy or fill with high-performance sealant designed for hairline cracks.
 - * For extensive hairline networks, consider applying a surface re-seal (such as a penetrating sealer or overlay) to bond the micro-cracks.
 - **Surface Sealing:** Apply a high-quality surface sealer or coating that can provide a barrier to further moisture loss or ingress.
 - **Long-term Curing Aids:** If drying has been premature, consider applying moisture-retaining compounds or surface treatments to reduce further shrinkage.



Thermal Cracks

- **Description:** Cracks resulting from temperature gradients within the concrete mass.
- **Causes:**
 - Rapid changes in temperature during curing or service (e.g., sudden exposure to cold or heat).
 - Large temperature differences between the core and surface.
- **Identification:**
 - **Physical:**
 - * Visible cracks often aligned with regions of significant temperature variation.
 - * May appear near joints or thick sections.
 - **Mechanical:**
 - * Infrared thermography can detect uneven temperature distribution.
 - * Temperature sensors embedded in the structure can provide data.
- **Nature & Impact:**
 - **Nature:** Can be non-structural if minor, but severe thermal cracking can affect structural integrity.
 - **Impact:**
 - * Can cause stress concentrations that reduce durability.
 - * Repeated thermal cycling may lead to progressive damage.
- **Preventive Measures:**
 - **Before Concreting:**
 - * Design the mix to control heat of hydration (use low-heat cement).
 - * Plan concrete pours to avoid massive sections that develop significant thermal gradients.
 - **During/After Concreting:**
 - * Implement temperature control measures such as insulation or pre-cooling aggregates.
 - * Use proper curing methods to minimize temperature differences.
- **Rectification Methods:**
 - **Inspection & Monitoring:** Use infrared thermography or temperature sensors to assess the extent and pattern of thermal cracking.
 - **Repairing Minor Cracks:** Clean the crack and fill with an epoxy or cement-based repair mortar that is suitable for the temperature conditions.
 - **For Larger Cracks or Repetitive Cracking:**
 - * Remove any delaminated or loose sections of concrete.
 - * Place a repair patch with a mix designed to accommodate thermal movement (potentially including fiber reinforcement to control cracking).
 - **Temperature Control Measures:** Post-repair, implement insulation or temperature-moderating strategies (such as pre-cooling aggregates) to reduce further thermal stresses.



Structural Cracks

■ Description:

- Cracks due to overload, design deficiencies, or excessive stresses beyond the material capacity.

■ Causes:

- Overloading or unexpected loads on the structure.
- Design errors or inadequate reinforcement detailing.
- Poor construction practices leading to weak zones.

■ Identification:

- **Physical:**
 - * Visible cracks that are wide and extend through the depth of the member.
 - * Often appear in high-stress areas such as beams, columns, or slabs.
- **Mechanical:**
 - * Rebound hammer tests can indicate loss of surface hardness.
 - * Crack width monitors and strain gauges can quantify crack progression.

■ Nature & Impact:

- **Nature:** Structural and critical.
- **Impact:**
 - * Directly reduces load-bearing capacity.
 - * Can lead to catastrophic failure if not addressed promptly.

■ Preventive Measures:

- **Before Concreting:**
 - * Ensure a robust design with proper load calculations and reinforcement detailing.
 - * Use quality materials and correct mix proportions.
- **During/After Concreting:**
 - * Implement proper curing and protect the structure from overloading during early stages.
 - * Conduct regular inspections and repair minor cracks immediately.

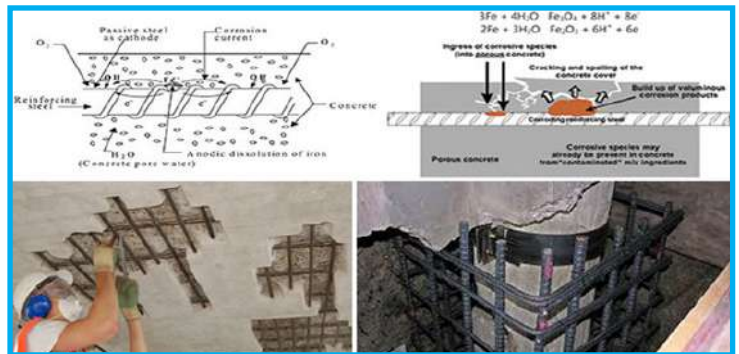
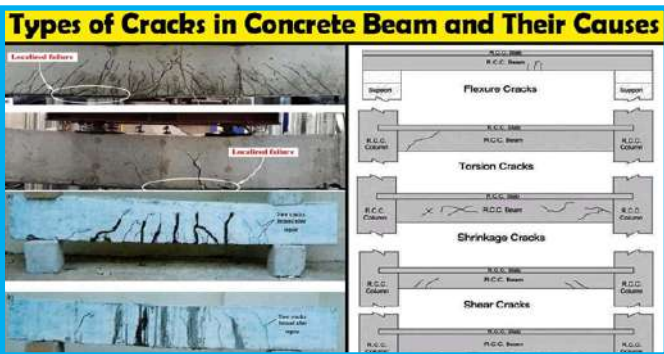
■ Rectification Methods:

- **Immediate Evaluation:** Engage a qualified structural engineer to assess the severity, underlying causes, and risk of failure.
- **Crack Injection:** For active cracks that require stabilization, inject high-strength epoxy resin into the crack to restore continuity and bond the concrete.
- **Stitching or Reinforcement:**
 - * Where cracks are large or extend through significant cross-sections, consider stitching with stainless steel bars or installing external reinforcement systems.
 - * Under certain conditions, additional reinforcement or even section replacement may be necessary.
- **Surface Repair and Corrosion Protection:** After stabilization, repair the surface using a compatible concrete patching material and apply a corrosion inhibitor or protective coating to ensure longevity.
- **Preventive Structural Strengthening:** Evaluate the overall design and load conditions. Reinforce adjacent areas if necessary to distribute loads more evenly.





Structural Cracks in concrete



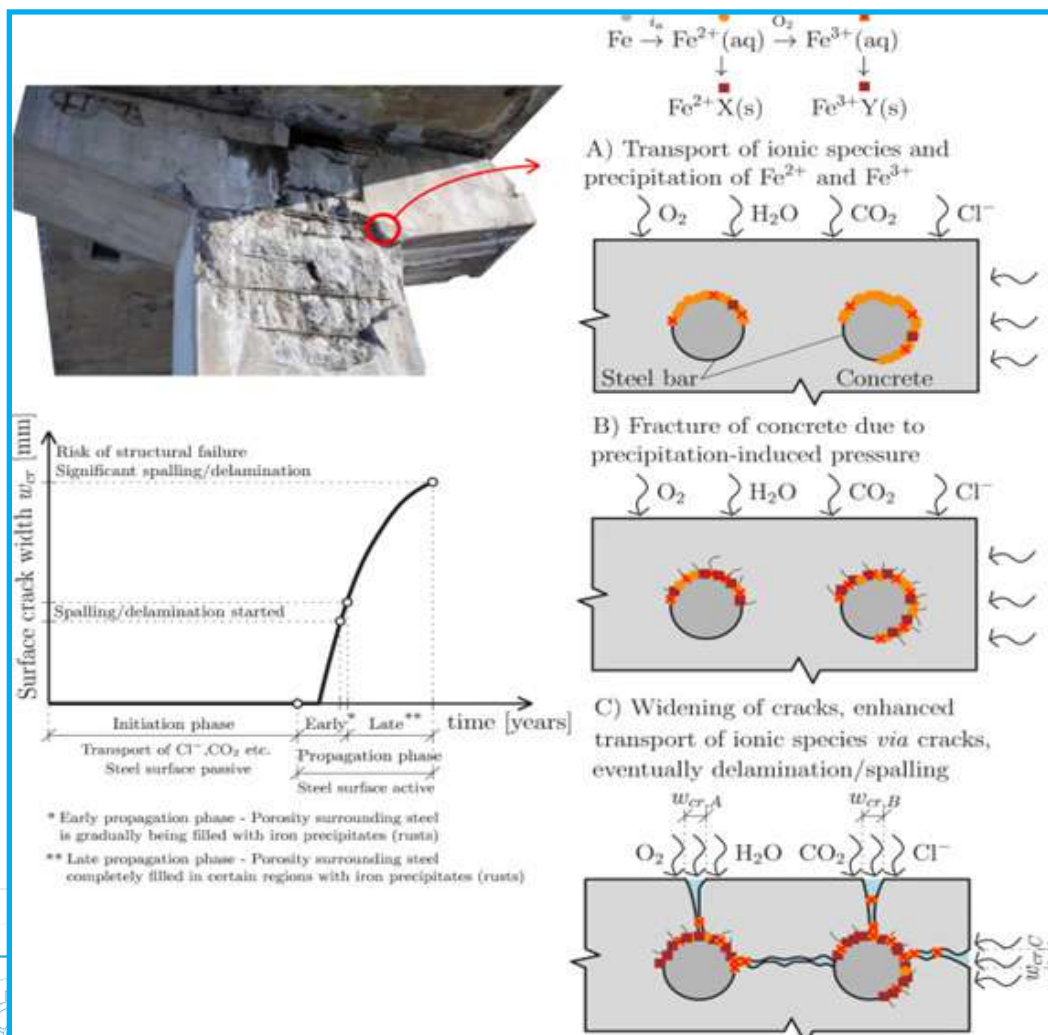
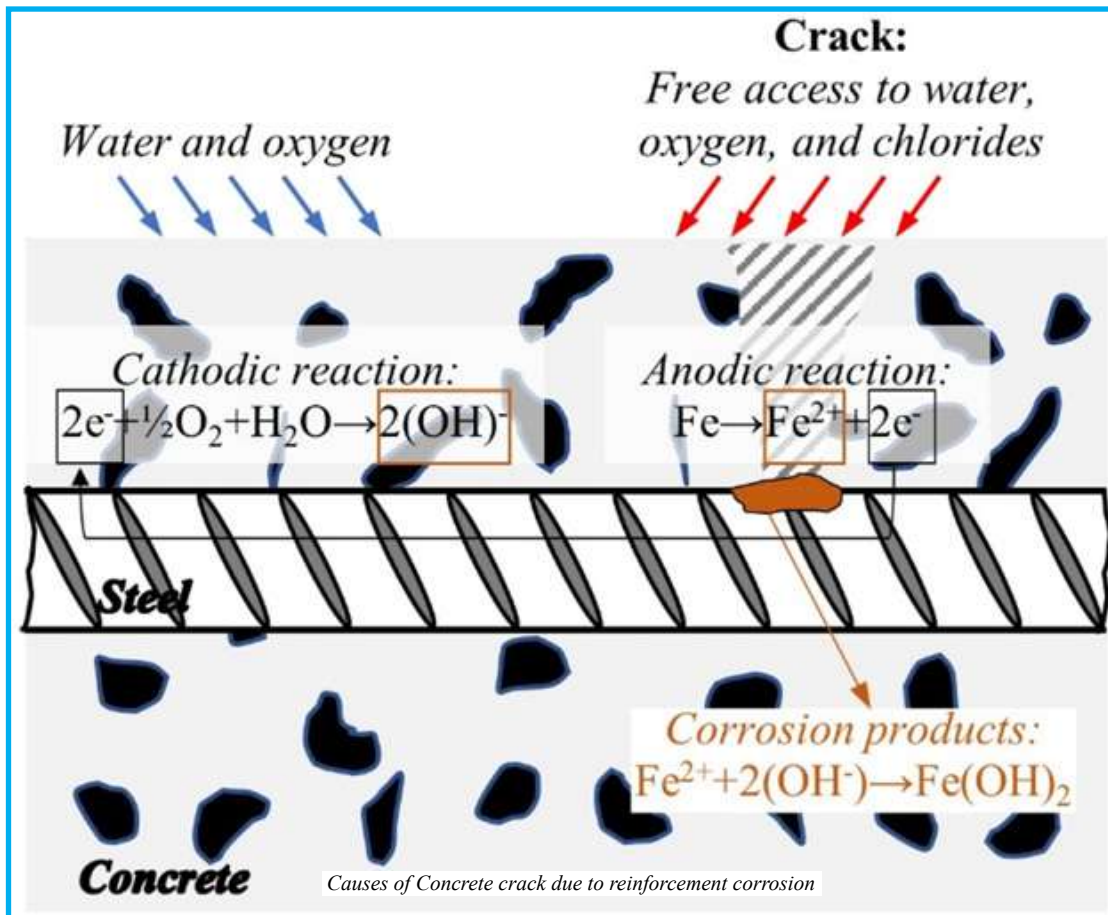
Repairing of Structural Cracks in concrete

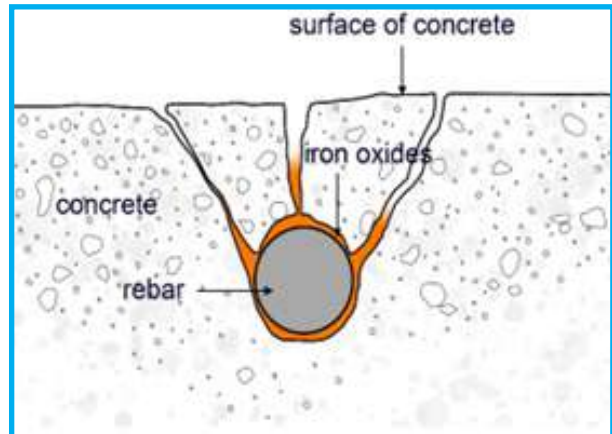


Cracks Due to Corrosion of Reinforcement

- **Description:**
 - Cracks that develop as a result of the corrosion of embedded reinforcement.
- **Causes:**
 - Ingress of chlorides (from deicing salts or seawater) and carbonation.
 - Inadequate cover or poor-quality concrete that allows moisture penetration.
- **Identification:**
 - **Physical:**
 - * Rust stains and discoloration on the concrete surface.
 - * Cracks forming around the area where reinforcement is corroding.
 - **Mechanical:**
 - * Use cover meters to check reinforcement depth.
 - * Ultrasonic pulse velocity (UPV) tests can detect internal anomalies.
- **Nature & Impact:**
 - **Nature:** Both internal and structural.
 - **Impact:**
 - * Leads to reduced cross-sectional area of reinforcement, compromising strength.
 - * Accelerates deterioration and reduces the durability of the concrete.
- **Preventive Measures:**
 - **Before Concreting:**
 - * Ensure adequate concrete cover and use high-quality, low-permeability concrete.
 - * Consider corrosion inhibitors or epoxy-coated reinforcement.
 - **During/After Concreting:**
 - * Apply surface sealers to reduce moisture and chloride ingress.
 - * Regular maintenance and early intervention upon detection.
- **Rectification Methods:**
 - **Diagnosis:**
 - * Use cover meters and ultrasonic pulse velocity tests to identify the extent of corrosion.
 - * Determine whether the corrosion is localized or widespread.
 - **Surface Preparation:**
 - * Remove deteriorated and loose concrete around the corroded reinforcement.
 - * Clean the exposed reinforcement using methods such as wire brushing or sandblasting.
 - **Repair and Protection:**
 - * Treat the reinforcement with corrosion inhibitors or apply epoxy coatings.
 - * Fill the removed areas with a high-performance repair mortar designed for compatibility with existing concrete.
 - **Long-term Preventive Measures:**
 - * Consider cathodic protection systems or additional waterproofing if the environment is highly corrosive.
 - * Re-establish adequate concrete cover during repairs to protect the reinforcement.



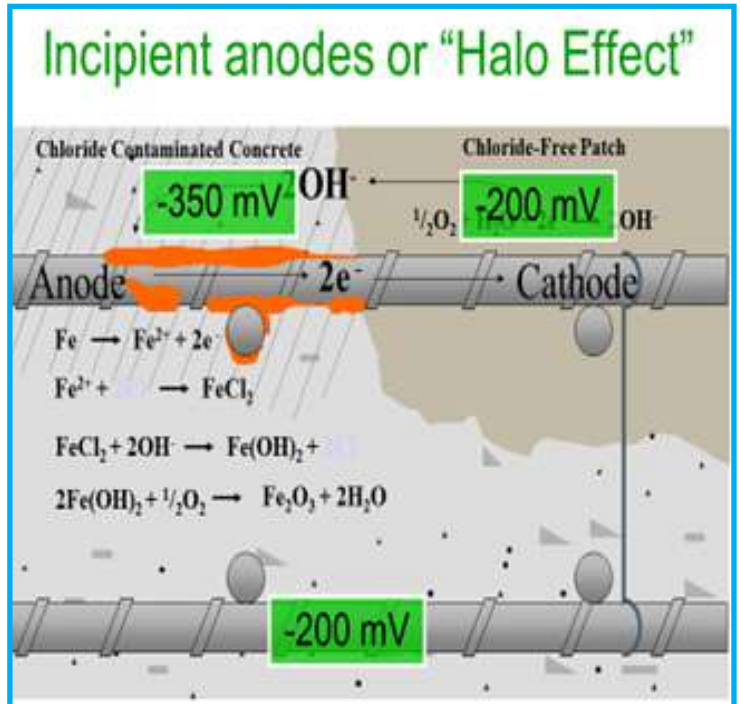




Concrete crack due to embedded reinforcement corrosion



Repairing
of Corrosion
Damaged
Concrete



Rectification Concrete crack due to embedded reinforcement by additional concreting and cathodic protection



Honeycombing

■ Description:

- Voids or pockets within the concrete due to incomplete compaction.

■ Causes:

- Inadequate vibration or improper compaction during placement.
- Poor quality mix or segregation of the mix components.

■ Identification:

- **Physical:**
 - * Rough, uneven surface with visible voids or pockets.
 - * Localized areas where the concrete appears less dense.
- **Mechanical:**
 - * Core sampling reveals voids and inconsistent density.
 - * UPV tests can show areas of lower velocity indicating voids.



■ Nature & Impact:

- **Nature:** Typically, non-structural but can become critical if extensive.
- **Impact:**
 - * Weakens the bond between concrete and reinforcement.
 - * Reduces overall durability and can lead to water ingress.

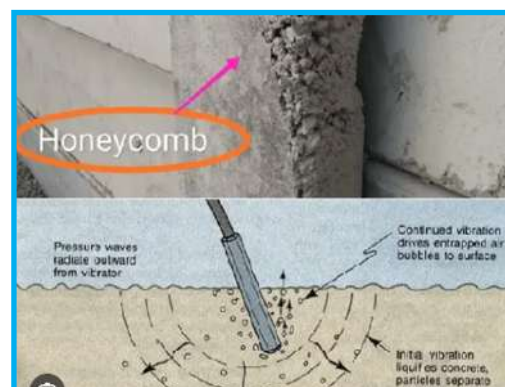
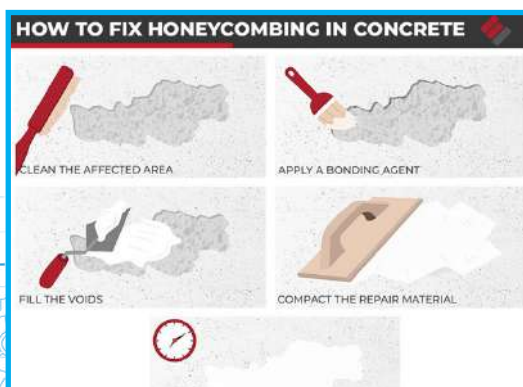
■ Preventive Measures:

- **Before Concreting:**
 - * Use a well-designed mix with proper aggregate grading.
 - * Ensure mix consistency to prevent segregation.
- **During/After Concreting:**
 - * Ensure adequate compaction using vibrators.
 - * Perform regular quality control checks during placement.



■ Rectification Methods:

- **Removal of Unsound Concrete:**
 - * Identify the honeycombed areas through core sampling or visual inspection.
 - * Remove loose and unsound concrete using chipping hammers or concrete saws.
- **Surface Preparation and Cleaning:** Thoroughly clean the surface and remove all dust, debris, and contaminants.
- **Patch Repairs:**
 - * Use a non-shrink repair mortar or polymer-modified patching material, ensuring proper consolidation by vibratory methods during placement.
 - * Ensure proper curing of the patch material for it to integrate with the surrounding concrete.
- **Prevention in Repairs:**
 - * Re-evaluate compaction practices for future pours to avoid recurrence.
 - * Consider using self-compacting concrete in areas prone to honeycombing.



Efflorescence

- **Description:**
 - White, powdery deposits on the concrete surface resulting from soluble salts.
- **Causes:**
 - Migration of water-soluble salts from cement or aggregates to the surface.
 - Excess moisture and poor curing conditions.
- **Identification:**
 - **Physical:**
 - * Easily visible white deposits on the surface.
 - * Generally found on walls, floors, or other exposed surfaces.
 - **Mechanical:** Primarily identified by visual inspection; moisture meters can confirm excessive water movement.
- **Nature & Impact:**
 - **Nature:** Primarily cosmetic and superficial.
 - **Impact:** Does not directly affect structural strength, but may indicate moisture problems that could lead to other issues.
- **Preventive Measures:**
 - **Before Concreting:**
 - * Use low-alkali cement and quality aggregates.
 - * Design the mix to reduce excess free water.
 - **During/After Concreting:**
 - * Apply proper curing techniques and moisture barriers.
 - * Clean the surface and seal if necessary.
- **Rectification Methods:**
 - **Cleaning:**
 - * Brush or wash the surface with a mild acid solution (for example, diluted vinegar) to dissolve and remove the salt deposits.
 - * Rinse thoroughly and allow to dry.
 - **Moisture Control:** Identify and correct sources of excessive moisture that promote salt migration (improve drainage, fix leaks, etc.).
 - **Surface Sealing:** Apply a water-repellent sealer that allows the concrete to breathe while preventing further salt deposits.
 - **Preventive Treatments:**
 - * Consider using low-alkali cement and quality aggregates in any repair work to reduce salt content.
 - * Ensure proper curing after repair to minimize moisture movement.





Scaling and Spalling

■ Description:

- Surface flaking or chipping (spalling) of the concrete, often at the edges or in areas of high exposure.

Causes:

- Freeze-thaw cycles causing internal expansion and contraction.
- Corrosion of reinforcement leading to expansion and surface delamination.
- Poor finishing practices.

■ Identification:

- **Physical:**
 - * Visible flakes or chips on the surface, especially along edges and corners.
 - * Areas where the surface appears to be delaminating.
- **Mechanical:**
 - * Rebound hammer tests may show reduced surface hardness.
 - * Infrared thermography can detect underlying delamination.

■ Nature & Impact:

- **Nature:** Both surface and structural if extensive spalling exposes reinforcement.
- **Impact:**
 - * Leads to loss of cover and potential corrosion of reinforcement.
 - * Reduces durability and may compromise overall strength if severe.

■ Preventive Measures:

- **Before Concreting:**
 - * Design for air entrainment in mixes to enhance freeze-thaw resistance.
 - * Use proper finishing techniques.
- **During/After Concreting:**
 - * Ensure effective curing and apply surface sealers.
 - * Protect concrete from harsh environmental exposures immediately after placement.

■ Rectification Methods:

- **Cleaning and Removal:**
 - * Remove all loose or spalled concrete using chiseling or wire brushing.
 - * Ensure that only sound concrete remains, particularly around areas where reinforcement is exposed.
- **Surface Patching:**
 - * Apply a high-strength repair mortar or polymer-modified patching compound to fill the voids and restore a smooth surface.
 - * Use bonding agents to enhance the adhesion between the repair material and the existing concrete.
- **Reapplication of Protective Layers:** After repair, apply corrosion inhibitors (if reinforcement is exposed) followed by a protective sealer to guard against future freeze-thaw damage.
- **Addressing Underlying Causes:** Improve the concrete's resistance to freeze-thaw cycles by ensuring proper air entrainment in mix designs during subsequent repairs or repouring.



Crazing

■ Description:

- A network of very fine, hairline cracks on the surface, often forming a pattern similar to a spider web.

■ Causes:

- Rapid surface drying or over-finishing that removes moisture too quickly.
- Inadequate curing conditions during the early setting phase.

■ Identification:

- **Physical:**
 - * Visible, fine cracks spread over the surface.
 - * Typically appears shortly after the concrete has set.
- **Mechanical:** Primarily detected by visual inspection; not usually measured with instruments since the cracks are very fine.

■ Nature & Impact:

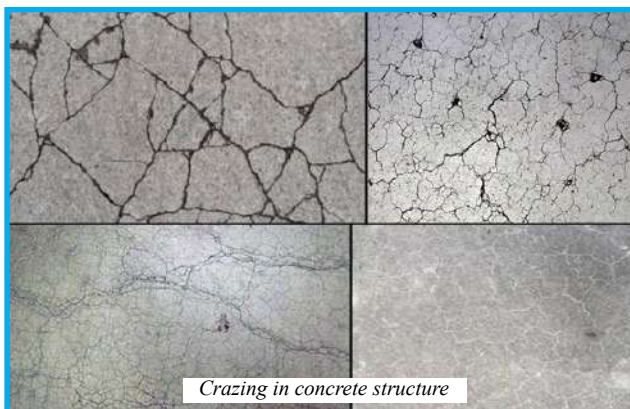
- **Nature:** Generally non-structural and primarily aesthetic.
- **Impact:**
 - * Minimal impact on strength; mainly affects appearance.
 - * May indicate potential moisture loss issues that, if uncorrected, could lead to other defects.

■ Preventive Measures:

- **Before Concreting:**
 - * Ensure a proper water-cement ratio and a balanced mix design.
 - * Plan for controlled finishing methods.
- **During/After Concreting:**
 - * Implement proper curing techniques to maintain moisture.
 - * Use curing compounds to slow down the drying process.

■ Rectification Methods:

- **Surface Preparation:**
 - * Clean the crazed surface to remove dust, efflorescence, and any contaminants.
 - * Lightly abrade the surface if necessary to improve bonding of repair materials.
- **Sealing the Cracks:**
 - * Apply a high-quality, penetrating sealer or a surface hardener that fills the micro-cracks and forms a uniform surface film.
 - * In some cases, a thin overlay with a polymer-modified cementitious material can be applied to restore a uniform appearance.
- **Cosmetic Restoration:** For significant aesthetic issues, consider repainting with a concrete-specific coating that is designed to cover minor surface imperfections.
- **Monitoring:** Although crazing typically does not affect structural integrity, monitor for any signs of moisture ingress which might lead to secondary problems.



10. Physical checks of coarse aggregate, fine aggregate, cement and admixture by a site engineer at site

Coarse aggregates are a crucial component of concrete, playing a vital role in its strength, durability, and workability. They add significant volume to the mix, reducing the amount of expensive cement needed, and contribute to the overall structural integrity of the concrete. Coarse aggregates also influence water resistance, shrinkage control, and dimensional stability.

Here's a more detailed look at the importance of coarse aggregates in concrete:

1. Strength and Durability:

- Coarse aggregates, like crushed stone or gravel, provide the bulk of concrete's strength and durability.
- They resist deformation and wear, contributing to the long-term performance of concrete structures.
- The type, size, and shape of coarse aggregates can significantly affect the compressive strength and resistance of concrete.

2. Volume and Cost-Effectiveness:

- Coarse aggregates make up a large portion of concrete by volume, reducing the amount of cement needed to achieve a given mix.
- This makes concrete more cost-effective as cement is a more expensive component than aggregates.

3. Workability:

- The size and shape of coarse aggregates influence the workability of the concrete mix.
- Properly graded coarse aggregates allow for a dense mix that is easy to place and finish.

4. Shrinkage and Cracking Control:

- Coarse aggregates help control shrinkage, a natural process where concrete shrinks during curing.
- They reduce the risk of cracking by minimizing tensile stresses caused by shrinkage.

5. Thermal and Elastic Properties:

- Coarse aggregates contribute to concrete's thermal and elastic properties, which are important for structural integrity and performance.
- They help maintain dimensional stability and prevent cracking under various temperature conditions.

6. Water Resistance:

- Coarse aggregates help improve the water resistance of concrete by reducing the amount of water needed for a given mix.
- They also help maintain the structural integrity of concrete when exposed to moisture or water.
- In summary, coarse aggregates are essential for providing strength, durability, and workability to concrete. They also influence its volume, shrinkage, thermal properties, and water resistance, making them a vital component in concrete construction.

Thumb rules to check the quality of coarse aggregate at site by a site engineer

Site engineers can often rely on practical thumb rules for quick assessments of coarse aggregate quality on-site. Here are some effective thumb rules:

1. Visual Inspection

- Rule: Check for color uniformity and absence of impurities.
- What to Look For: Clean, uniformly colored aggregate without visible dirt, clay, or organic materials.

2. Shape and Texture

- Rule: Prefer angular aggregates over rounded ones.
- What to Look For: Pick up a handful; angular shapes should predominate, indicating good interlocking properties.

3. Size Consistency:

- Rule: Aggregate should conform to the specified grading.
- What to Look For: Use a sieve or your hands to estimate that a mix of sizes (10 mm, 20 mm) is present without excessive fines.

4. Absorption Test:

- Rule: Perform a quick absorption check.
- What to Look For: Immerse a sample in water for a few hours; if it feels noticeably heavier, it may have high absorption, which could affect the mix.

5. Soundness Check:

- Rule: Tap two stones together.
- What to Look For: A clear ringing sound indicates good quality; dull sounds might suggest weaker, porous material.

6. Wet Density Check:

- Rule: Estimate bulk density by weight.
- What to Look For: For a bucket of aggregate, a weight that feels consistent with expected values (about 1.5 to 1.7 tons/m³ for normal aggregates) suggests reasonable quality.

7. Cleanliness Test:

- Rule: Conduct a simple wash test.
- What to Look For: Rinse a sample in water; if the water becomes muddy or retains a lot of fines, the aggregate may not be clean enough.

8. Weight Test:

- Rule: Lift a sample and assess its heft.
- What to Look For: Heavier aggregates often indicate better density and quality, which are desirable for strength.

9. Fines Content Estimation:

- Rule: Check for excess fines by hand.
- What to Look For: If fine particles adhere significantly to your hands, this may indicate high silt or clay content, which should be avoided.

10. Moisture Content Estimation:

- Rule: Feel the aggregate.
- What to Look For: The aggregate should feel dry; if it's noticeably damp, adjust water content in your mix design accordingly.



These thumb rules provide a quick, practical approach for site engineers to ensure the quality of coarse aggregate before proceeding with construction activities. For detailed assessment, more precise laboratory tests should be conducted as needed.

Physical parameters to be noted for coarse aggregate by a site engineer

When evaluating coarse aggregate for construction, a site engineer must assess several physical properties to ensure the material meets specifications and contributes to the structural integrity of the project. Here are the key physical properties to consider, along with explanations and examples:

1. Size and Grading

- Definition: Coarse aggregates typically range from 4.75 mm to 75 mm in size. Grading refers to the distribution of particle sizes within the aggregate.
- Importance: Proper grading ensures better compaction and reduces voids, improving the strength and durability of concrete.
- Example: A well-graded aggregate might contain particles of various sizes, like a mix of 10 mm, 20 mm, and 40 mm stones, which helps fill gaps and achieve a denser mix.

2. Shape and Surface Texture

- Definition: Aggregate particles can be angular, rounded, or flaky, and their surface can be smooth or rough.
- Importance: Angular aggregates typically provide better interlocking and bond with the cement paste, enhancing strength. However, they may also make mixing more difficult.
- Example: Angular aggregates like crushed stone have better bonding than rounded aggregates, which can slip past each other in a mix.

3. Specific Gravity and Bulk Density

- Definition: Specific gravity is the ratio of the density of the aggregate to the density of water. Bulk density measures the weight of the aggregate per unit volume, including voids.
- Importance: These properties affect the concrete's overall weight and strength. Higher specific gravity often indicates denser, stronger aggregates.
- Example: An aggregate with a specific gravity of 2.6 is typically heavier and may contribute to a stronger concrete mix than one with a specific gravity of 2.4.

4. Absorption and Moisture Content

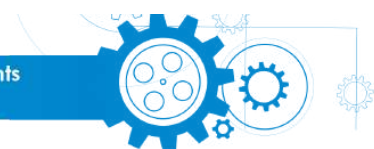
- Definition: Absorption is the percentage of water the aggregate can hold in its pores, while moisture content refers to the amount of water currently in the aggregate.
- Importance: High absorption can lead to mix inconsistencies if not accounted for, affecting water-cement ratios.
- Example: If coarse aggregate has an absorption of 2%, it means that for every 100 kg of dry aggregate, it can absorb 2 kg of water, which must be included in the concrete mix design.

5. Cleanliness and Contaminants

- Definition: Coarse aggregates should be free from harmful materials like clay, silt, organic matter, and other impurities.
- Importance: Contaminants can weaken concrete, affecting its durability and strength.
- Example: Aggregates should pass a wash test, where a sample is rinsed to check for the amount of fines and impurities removed. Excessive fines can hinder bonding.

6. Soundness

- Definition: Soundness measures the aggregate's resistance to weathering and chemical attack, often tested using cycles of freezing and thawing.
- Importance: Poor soundness can lead to aggregate degradation over time, compromising concrete durability.
- Example: Aggregates that pass a soundness test (like sodium sulphate or magnesium sulphate tests) are less likely to break down in harsh weather conditions.



7. Geological Origin and Mineral Composition

- Definition: The type of rock from which the aggregate is derived can significantly affect its properties.
- Importance: Different rocks have varied strengths, durability, and resistance to environmental factors.
- Example: Basalt aggregates are often stronger and more durable than limestone aggregates, which can be more susceptible to weathering.



Conclusion

A thorough assessment of these physical properties ensures the coarse aggregate used in concrete contributes to a strong, durable structure. Site engineers should perform tests in accordance with established standards (like ASTM or AASHTO) to ensure the quality of aggregates.

Importance of fine aggregate in concrete mixes

Fine aggregate, like sand, is crucial in concrete for several reasons: it improves workability by making the mix more fluid and easier to handle, it helps achieve a lower water-cement ratio, which leads to stronger concrete and reduces shrinkage, and it enhances cohesion by providing more surface area for the cement paste to bond with. Fine aggregate also contributes to durability by filling voids between coarse aggregates, creating a denser matrix resistant to environmental damage.

Elaboration:

1. Workability:

Fine aggregates contribute to the ease of mixing, handling, and placing of concrete. Optimal particle size distribution in fine aggregates improves the mix's fluidity and reduces water demand.

2. Water-Cement Ratio:

By filling voids between coarse aggregates, fine aggregates allow for a lower water-cement ratio. This leads to stronger concrete with reduced shrinkage and cracking.

3. Cohesion:

Fine aggregates have a higher surface area than coarse aggregates, requiring more cement paste to bind them together. This increased surface area helps to prevent segregation and bleeding in the mix, ensuring a more cohesive concrete.

4. Durability:

Fine aggregates, especially when used in conjunction with coarse aggregates, create a denser concrete matrix. This denser matrix is more resistant to water penetration and environmental degradation, enhancing the durability of the concrete.

5. Aesthetic Appeal:

The texture and color of fine aggregates can significantly impact the visual characteristics of the concrete. This is particularly important in applications where aesthetics is crucial, such as architectural and decorative finishes.

Thumb rules to check the quality of fine aggregate at site by a site engineer

Here are some effective thumb rules for site engineers to quickly assess the quality of fine aggregate (sand) on-site:

1. Visual Inspection

- Rule: Check for color uniformity and cleanliness.
- What to Look For: Fine aggregate should be free from clay, silt, and organic matter. It should have a consistent color without any dark stains or debris.

2. Texture and Granulation

- Rule: Feel the texture between your fingers.
- What to Look For: The sand should feel gritty and should not be too fine or powdery. A mixture of different granule sizes is preferable.

3. Moisture Content

- Rule: Grab a handful and squeeze.
- What to Look For: If the sand clumps together but breaks apart easily, it has an appropriate moisture content. If it's overly wet or dry, adjustments may be needed.

4. Silt and Clay Content

- Rule: Perform a simple wash test.
- What to Look For: Rinse a small sample in water; if the water becomes muddy or the sample retains a lot of fine particles after washing, it indicates high silt or clay content, which is undesirable.

5. Specific Gravity and Bulk Density

- Rule: Lift a sample and estimate weight.
- What to Look For: A heavier sample (around 1.6 to 1.8 tons/m³) typically indicates better quality and density.

6. Grading Check

- Rule: Use a sieve for a quick size check.
- What to Look For: Ensure the sand passes through a 4.75 mm sieve but retains enough coarser particles to meet specifications for grading.

7. Soundness Check

- Rule: Tap the sand with your hand.
- What to Look For: A sharp sound indicates good quality, while a dull thud might suggest the presence of excess fines or organic material.

8. Compatibility with Coarse Aggregate

- Rule: Mix a small sample with coarse aggregate.
- What to Look For: The fine aggregate should blend well without excessive segregation, indicating compatibility with the coarse aggregate.



9. Plasticity Test

- Rule: Form a ball with the sand.
- What to Look For: If it holds shape without excessive moisture, it is less likely to be too clayey, which can negatively affect workability.

10. Odor Test

- Rule: Smell the sand.
- What to Look For: Any unusual odor (like organic material) can indicate contamination, which should be avoided.

These thumb rules provide a quick and practical way for site engineers to assess fine aggregate quality. For more precise evaluations, laboratory tests should be conducted when necessary.



Physical parameters to be noted for fine aggregate by a site engineer

When evaluating fine aggregate (sand) for construction, site engineers must assess several key physical properties to ensure the material is suitable for use in concrete and mortar. Here are the important physical properties to observe, along with explanations and examples:

1. Grading

- Definition: Grading refers to the distribution of different particle sizes within the fine aggregate.
- Importance: Proper grading helps achieve better workability and strength in concrete. It reduces voids and ensures a denser mix.
- Example: Well-graded fine aggregate should include a variety of particle sizes, ideally ranging from very fine sand (0.075 mm) to coarser sand (up to 4.75 mm). A well-graded sample might include particles that pass through a 2.36 mm sieve but retain some on a 0.6 mm sieve.

2. Fineness Modulus (FM)

- Definition: The fineness modulus is an index number representing the average size of the particles in a fine aggregate sample.
- Importance: A lower FM indicates finer aggregates, while a higher FM indicates coarser aggregates. The FM helps in proportioning concrete mixes.
- Example: An FM of around 2.3 to 3.1 is generally suitable for concrete. For instance, if a fine aggregate sample has an FM of 2.5, it is considered appropriate for most concrete applications.

3. Shape and Texture

- Definition: Fine aggregates can be angular, rounded, or flaky, and their surface can be smooth or rough.
- Importance: Angular and rough-textured particles provide better interlocking and bonding with cement paste, enhancing the concrete's strength.
- Example: Natural river sand tends to be rounded and smooth, while crushed sand has a more angular and rough texture. Crushed sand may provide better strength but may require more water in the mix due to its surface texture.

4. Cleanliness

- Definition: Fine aggregates should be free from harmful impurities, including clay, silt, organic matter, and dust.
- Importance: Contaminants can weaken the concrete and affect its durability.
- Example: Fine aggregate passing through a wash test should not yield excessive amounts of fines (clay or silt). If a sample is rinsed and the water turns muddy, it indicates a high clay content.

5. Absorption and Moisture Content

- Definition: Absorption is the ability of the aggregate to take in water, while moisture content refers to the amount of water present in the aggregate.
- Importance: High absorption can affect the water-cement ratio in concrete, impacting workability and strength.
- Example: If a sample has an absorption capacity of 1.5%, it means that for every 100 kg of dry aggregate, it can absorb 1.5 kg of water. This needs to be factored into the mix design.

6. Specific Gravity

- Definition: Specific gravity is the ratio of the density of the aggregate to the density of water.
- Importance: Specific gravity influences the overall weight and strength of the concrete mix.
- Example: A specific gravity of about 2.5 to 2.7 is typical for fine aggregates. If the specific gravity is found to be 2.65, it suggests a reasonably dense and strong aggregate.

7. Soundness

- Definition: Soundness refers to the aggregate's resistance to weathering and degradation under freeze-thaw conditions.
- Importance: Unsound aggregates can lead to cracking and deterioration of concrete over time.
- Example: Fine aggregates should pass soundness tests using sodium sulfate or magnesium sulfate to ensure they can withstand environmental stresses.

Conclusion

Evaluating these physical properties helps site engineers determine the quality of fine aggregates for construction. Regular testing and adherence to standards (such as ASTM or AASHTO) ensure that the aggregates used contribute to the strength and durability of concrete

Thumb rules to check the quality of cement at site by a site engineer

Cement plays a crucial role in concrete, serving as the primary binding agent that holds the entire structure together. It acts as a glue, reacting with water to form a hardened paste that binds aggregates (like sand and gravel) into a cohesive mass. This hardening process, known as hydration, is what gives concrete its strength and durability.

Here's a more detailed look at cement's role:

- **Binding Agent:**

Cement is the key component that binds the aggregates in concrete, forming a strong, durable material.

- **Hydration:**

When cement is mixed with water, it undergoes a chemical reaction called hydration, which causes it to harden and bind the aggregates together.

- **Strength and Durability:**

The hardened cement paste provides the strength and durability that make concrete suitable for various construction applications.

- **Versatile Material:**

Concrete, with cement as its binder, can be shaped into various forms and used in structures like buildings, bridges, dams, and roads.





1. Visual Inspection

- Rule: Check the appearance of the cement.
- What to Look For: The cement should be uniform in color, typically gray. It should not have any lumps or clumps, which indicate moisture absorption.

2. Smell Test

- Rule: Smell the cement.
- What to Look For: Fresh cement should have a faint, earthy smell. A strong, sour odor may indicate contamination or spoilage.

3. Feel Test

- Rule: Take a small amount of cement in your hand.
- What to Look For: The cement should feel smooth and powdery. If it feels gritty or coarse, it may contain impurities.

4. Water Reaction Test

- Rule: Mix a small amount of cement with water.
- What to Look For: When mixed with water, quality cement should form a paste that does not separate easily. If it clumps quickly or doesn't form a cohesive paste, it may be of poor quality.

5. Setting Time Check

- Rule: Use a small quantity to check initial setting time.
- What to Look For: Quality cement should have a normal initial setting time of about 30 to 60 minutes. If it sets too quickly or too slowly, it may not meet specifications.

6. Lump Test

- Rule: Break a lump of cement (if present).
- What to Look For: Good quality cement should break easily into a fine powder. Hard lumps indicate moisture damage.

7. Hydration Test

- Rule: Add a small amount of cement to water and observe.
- What to Look For: A good quality cement should gradually hydrate and develop heat. Excessive fizzing or reaction may indicate poor quality or contamination.

8. Weight Test

- Rule: Estimate the weight of a bag of cement.
- What to Look For: A standard bag should weigh approximately 50 kg (or 110 lbs). If it feels significantly lighter, it may be underweighted or mixed with filler.

9. Packaging Check

- Rule: Inspect the bag and packaging.
- What to Look For: Ensure the bags are intact and properly sealed. Look for manufacturer details, expiration dates, and any signs of damage.

10. Storage Conditions

- Rule: Assess how cement is stored on-site.
- What to Look For: Cement should be stored in a dry, well-ventilated area, elevated off the ground. If it's exposed to moisture, it can lose quality.

These thumb rules provide a quick way for site engineers to assess the quality of cement before use. For more precise evaluations, laboratory tests should be conducted as needed.

- **Cost-Effective:**

Concrete, with cement as a key ingredient, is a relatively inexpensive construction material, contributing to its widespread use.

Physical parameters to be noted for cement by a site engineer

When evaluating cement for construction projects, site engineers need to assess several critical physical properties to ensure that the material meets performance standards. Here are the key physical properties to observe, along with explanations and examples:

1. Fineness

- Definition: Fineness refers to the particle size distribution of cement.
- Importance: Finer cement has a larger surface area, leading to better hydration and strength development. However, overly fine cement may increase the risk of shrinkage.
- Example: The fineness of cement is typically measured using a sieve analysis, with good quality cement passing through a 90-micron sieve by a specific percentage (usually more than 90%).

2. Setting Time

- Definition: This is the time it takes for cement to begin hardening after mixing with water.
- Importance: Initial and final setting times are crucial for planning construction schedules and ensuring proper workability.
- Example: Ordinary Portland Cement (OPC) generally has an initial setting time of about 30 to 60 minutes and a final setting time of about 3 to 6 hours. If a cement batch sets too quickly, it may not be usable for certain applications.

3. Consistency (Workability)

- Definition: This refers to the ability of cement paste to flow and fill molds.
- Importance: Proper consistency is essential for achieving good workability in concrete mixes.
- Example: The standard consistency can be measured using the Vicat apparatus, where a certain percentage of water is added to cement until a specific penetration depth is reached (usually around 26-30% of the weight of cement).

4. Compressive Strength

- Definition: This is the ability of cement to withstand axial loads without failure.
- Importance: High compressive strength is crucial for structural integrity.
- Example: Standard tests (like the cube test) indicate that good quality cement should achieve a compressive strength of at least 33 MPa (Megapascals) at 28 days for OPC.

5. Density

- Definition: Density is the mass of cement per unit volume.
- Importance: It influences the weight of concrete and the design of structures.
- Example: The density of ordinary cement typically ranges from 1,440 to 1,600 kg/m³. A significantly lower density could indicate poor quality or the presence of impurities.



6. Soundness

- Definition: Soundness measures the ability of cement to maintain its volume after setting without cracking or changing shape.
- Importance: Unsound cement can expand and lead to structural issues.
- Example: The soundness test is commonly performed using the Le Chatelier method, where a small sample of cement is subjected to water and heat. Good quality cement should show no expansion beyond specific limits.

7. Heat of Hydration

- Definition: This refers to the heat released during the hydration process of cement.
- Importance: It affects temperature control in large pours and can influence setting times.
- Example: Different types of cement (like low heat cement) are formulated to produce less heat during hydration, which is particularly useful in mass concrete applications.

8. Color

- Definition: The color of cement can vary based on its composition.
- Importance: While not a definitive quality indicator, color can provide insight into the raw materials used.
- Example: Ordinary Portland Cement is typically gray. A significantly lighter or darker shade could suggest contamination or variations in raw materials.

9. Chemical Composition

- Definition: The chemical makeup of cement affects its properties and performance.
- Importance: Specific compositions determine the suitability of cement for different environmental conditions.
- Example: The presence of compounds like tricalcium silicate (C3S) contributes to strength, while the presence of tricalcium aluminate (C3A) affects setting time and durability. Testing the chemical composition helps ensure compliance with standards like ASTM or EN.

Conclusion

Assessing these physical properties is essential for ensuring the quality of cement used in construction. Site engineers should perform regular tests in accordance with established standards to ensure that the cement meets required specifications for strength, durability, and workability.

Thumb rules to check the quality of water at site by a site engineer

Here are some practical thumb rules for site engineers to quickly assess the quality of water used in construction:

1. Visual Inspection

- Rule: Check the appearance of the water.
- What to Look For: Water should be clear and free from visible impurities such as dirt, oil, or organic matter. Cloudiness or discoloration indicates contamination.

2. Smell Test

- Rule: Smell the water.
- What to Look For: Good quality water should have no unpleasant odors. A foul smell may indicate contamination or the presence of organic substances.

3. Taste Test (Cautiously)

- Rule: Use caution; taste is less common but can be informative.
- What to Look For: If safe, a neutral taste indicates quality water. A salty or chemical taste suggests contamination.

4. pH Level Check

- Rule: Use pH test strips or a portable pH meter.
- What to Look For: Ideally, water should have a pH between 6.5 and 8.5. Extreme pH levels can affect concrete quality and durability.

5. Total Dissolved Solids (TDS)

- Rule: Use a TDS meter if available.
- What to Look For: TDS levels should ideally be below 1,000 mg/L for good quality water. High TDS can adversely affect concrete strength.

6. Chloride Content

- Rule: Check for chloride concentration.
- What to Look For: Chloride levels should be below 500 mg/L for most concrete applications. Higher levels can lead to corrosion of reinforcement steel.

7. Presence of Suspended Solids

- Rule: Allow a sample to settle in a clear container.
- What to Look For: Any significant sediment at the bottom indicates high suspended solids, which can affect the mixing and setting of concrete.

8. Temperature Check

- Rule: Measure the water temperature.
- What to Look For: Water temperature should ideally be between 5°C and 30°C (41°F and 86°F). Extreme temperatures can affect hydration rates and setting times.

9. Freezing Point Test

- Rule: Observe if the water freezes at standard conditions.
- What to Look For: If the water freezes at a significantly higher temperature than expected, it may contain impurities.

10. Test for Contaminants

- Rule: If feasible, conduct tests for specific contaminants.
- What to Look For: Tests for harmful bacteria (like E. coli), heavy metals, or other pollutants should be performed if there's any suspicion of contamination.

These thumb rules provide a quick way for site engineers to evaluate water quality before use in concrete and other construction activities. For more precise assessments, laboratory testing should be conducted as necessary.

Thumb rules to check the quality of admixture at site by a site engineer

Admixtures are crucial for concrete's performance, enhancing its workability, strength, and durability. They improve concrete's flow, making it easier to handle and place. Admixtures also reduce the water content needed, leading to increased strength and durability while controlling setting times.

Here's a more detailed look at why admixtures are important:

1. Improved Workability:

- Admixtures enhance the flow and consistency of concrete, making it easier to pour, place, and finish.
- This can save time and labor costs in construction.
- For example, superplasticizers improve concrete's workability without reducing its compressive strength or increasing the water-cement ratio.

2. Enhanced Strength and Durability:

- Admixtures can reduce the need for cement while improving strength and durability.
- They can also reduce early heat of hydration and overcome thermal cracking problems.
- Specific admixtures, like shrinkage reducers, help prevent cracking and improve overall durability.

3. Controlled Setting Time:

- Admixtures allow for the control of setting and hardening times, which is crucial in various construction projects and environmental conditions.
- Accelerators can speed up the process, while retarders delay it.



4. Other benefits:

- Admixtures can improve concrete's resistance to freeze-thaw cycles and other environmental factors.
- They can also provide specific properties like corrosion inhibition, waterproofing, or coloring.

Here are some practical thumb rules for site engineers to quickly assess the quality of concrete admixtures on-site:

1. Visual Inspection

- Rule: Examine the appearance of the admixture.
- What to Look For: The admixture should be uniform in color and consistency. There should be no separation, sediment, or lumps. A clear or consistent liquid indicates good quality.

2. Smell Test

- Rule: Check for any unusual odors.
- What to Look For: Good quality admixtures typically have a neutral or mild smell. A strong chemical odor may indicate degradation or contamination.

3. Packaging Check

- Rule: Inspect the packaging of the admixture.
- What to Look For: Ensure that the containers are sealed properly, without any damage or leaks. Check for expiration dates and manufacturer information.

4. Density Check

- Rule: Estimate the density of the admixture.
- What to Look For: Admixtures should have a density consistent with product specifications. A significant deviation from the expected density could indicate a problem.

5. Compatibility Test

- Rule: Conduct a small-scale mix test.
- What to Look For: Mix a small sample of the admixture with a small batch of concrete. Observe for any separation or adverse effects, which could indicate incompatibility.

6. Viscosity Test

- Rule: Perform a simple viscosity test.
- What to Look For: Admixtures should flow easily. If it is too thick or gel-like, it may be compromised or unsuitable for use.

7. Documentation Verification

- Rule: Check technical data sheets and compliance documents.
- What to Look For: Ensure that the admixture complies with relevant standards (like ASTM or EN) and that the data sheets provide appropriate performance specifications.

8. Stability Check

- Rule: Observe the admixture over time.
- What to Look For: Good quality admixtures should remain stable over time without any visible changes, such as settling or phase separation.

9. Field Test

- Rule: If applicable, perform a field trial mix.
- What to Look For: Conduct a trial pour to assess the effect of the admixture on workability, setting time, and strength. Ensure that it meets project specifications.

10. Manufacturer Reputation

- Rule: Consider the source of the admixture.
- What to Look For: Use admixtures from reputable manufacturers with a history of quality products. Check reviews or certifications if available.

These thumb rules provide a quick way for site engineers to evaluate the quality of concrete admixtures before use. For more precise assessments, laboratory tests and adherence to project specifications should be conducted as necessary.



Importance of water cement ratio in concrete

The water-cement (w/c) ratio is a critical factor in determining the quality and performance of concrete. Here's why it matters:

1. Strength Development:

- Explanation: The w/c ratio affects the hydration process of cement. A lower ratio typically results in higher strength because there is less water to dilute the cement particles, allowing for better bonding.
- Example: A w/c ratio of 0.4 will generally produce stronger concrete than a ratio of 0.6.

2. Workability:

- Explanation: Higher water content increases the workability of concrete, making it easier to mix and place. However, excessive water can weaken the concrete.
- Example: A concrete mix with a w/c ratio of 0.5 may be easier to work with than one with a ratio of 0.35, but the latter will be stronger.

3. Durability:

- Explanation: The w/c ratio influences porosity. Lower ratios lead to denser concrete, reducing permeability and enhancing durability against environmental factors.
- Example: Concrete with a w/c ratio of 0.4 will generally be more durable than that with a ratio of 0.7, which is more prone to cracking and water ingress.

4. Setting Time:

- Explanation: The amount of water in the mix affects the setting time. More water can lead to slower setting, which may not be suitable for all applications.
- Example: A high w/c ratio can delay the initial setting time, which may complicate scheduling and workflow.

Checking and Maintaining Water-Cement Ratio at Site

Site engineers can use several methods to check and control the water-cement ratio effectively:

1. Mix Design Calculation:

- Rule: Prepare a detailed mix design before starting work.
- Action: Calculate the required amount of cement and water based on the desired w/c ratio and total volume of concrete needed.

2. Use of Measuring Equipment:

- Rule: Utilize calibrated measuring devices.
- Action: Use accurate scales for measuring cement and a calibrated container or flow meter for water. This ensures precise control of the w/c ratio.



3. Water Addition Monitoring:

- Rule: Control water addition during mixing.
- Action: Monitor the amount of water added throughout the mixing process. Adjust as necessary to maintain the predetermined w/c ratio.

4. Consistency Tests:

- Rule: Perform slump tests on-site.
- Action: Conduct slump tests to assess workability. If the slump is too high, it may indicate an excessive water content, prompting adjustments in the mix.

5. Sample Testing:

- Rule: Take samples of mixed concrete for testing.
- Action: Test concrete samples at different stages (before pouring) to ensure the w/c ratio is within specified limits. Use compression tests for strength validation.

6. Monitoring Environmental Conditions:

- Rule: Consider temperature and humidity.
- Action: Be aware that environmental conditions can affect evaporation rates and concrete hydration. Adjust the w/c ratio accordingly, especially in hot or windy conditions.

7. Admixture Use:

- Rule: Utilize admixtures when needed.
- Action: Use water-reducing admixtures to achieve desired workability with a lower w/c ratio, maintaining strength without excessive water.

8. Record Keeping:

- Rule: Maintain detailed records of mix proportions.
- Action: Keep logs of all materials used, including water and cement amounts, to track adherence to the specified w/c ratio.

Conclusion

Maintaining the correct water-cement ratio is essential for achieving the desired strength, workability, and durability of concrete. By implementing careful planning, precise measurements, and ongoing monitoring, site engineers can effectively control this critical aspect of concrete production on-site.

Importance of using admixture for preparing concrete

Using admixtures in concrete preparation is essential for enhancing various properties of the concrete mix, improving performance, and meeting specific project requirements. Here are some key reasons why admixtures are important:

1. Workability Improvement

- Explanation: Admixtures can enhance the workability of concrete, making it easier to mix, transport, and place.
- Benefit: This is especially important for complex shapes or congested reinforcement areas, where higher workability allows for better flow and compaction.

2. Strength Enhancement

- Explanation: Certain admixtures, like superplasticizers, allow for a lower water-cement (w/c) ratio without compromising workability.
- Benefit: Lower w/c ratios lead to higher strength and durability in the cured concrete.

3. Setting Time Control

- Explanation: Admixtures can modify the setting time of concrete, either accelerating or delaying it as needed.
- Benefit: This is crucial in hot weather to prevent quick setting or in cold conditions to ensure adequate time for finishing.

4. Durability Improvement

- Explanation: Admixtures can enhance the durability of concrete against environmental factors, including chemical attacks, freeze-thaw cycles, and abrasion.
- Benefit: This results in longer-lasting structures with reduced maintenance costs.

5. Reduced Permeability

- Explanation: Certain admixtures help in reducing the permeability of concrete.
- Benefit: Lower permeability minimizes the ingress of water and aggressive chemicals, protecting embedded reinforcement and extending the lifespan of structures.

6. Color and Aesthetic Enhancements

- Explanation: Coloring agents and other aesthetic admixtures can be added to concrete to achieve specific colors and finishes.
- Benefit: This allows for creative architectural designs without sacrificing structural integrity.

7. Controlled Shrinkage and Expansion

- Explanation: Some admixtures are designed to control shrinkage or expansion, helping to minimize cracking.
- Benefit: This is particularly important in large pours or when using certain types of aggregates.

8. Improved Bonding

- Explanation: Admixtures can enhance the bonding between concrete and other materials, such as steel reinforcements or existing concrete surfaces.
- Benefit: This improves the overall performance of the structure, particularly in repair and overlay applications.

9. Environmental Benefits

- Explanation: Some admixtures allow for the use of recycled materials and by-products, reducing the environmental impact of concrete production.
- Benefit: This aligns with sustainable construction practices and reduces waste.

10. Cost Efficiency

- Explanation: Admixtures can lead to cost savings by optimizing the mix design, reducing the need for excess cement, and minimizing the potential for repair or maintenance.
- Benefit: This results in better overall project economics while achieving high-quality concrete.

Conclusion

Admixtures play a crucial role in modern concrete technology, allowing engineers and contractors to tailor concrete properties to meet specific requirements and environmental challenges. Their use not only enhances the performance and durability of concrete but also supports sustainable construction practices and cost-effectiveness.



https://www.youtube.com/watch?v=_dJRrF-pOh7c&list=PLK4mHeDEp-PCIpOEyU1k09783JD50DzhJe





স্বাগতম



মহানগর ন্যাকেনডনী
কোকসান্দার বিটিআর(সেমস)

PART

C

11. Process involved in Repairs and Replacements of Single Village PWSS

CPRD-FC/1/2026-FC-CP&RD-Commissionerate Of Panchayat & Rural Development Department

I/1425840/2026



GOVERNMENT OF ASSAM
COMMISSIONERATE OF PANCHAYAT AND RURAL DEVELOPMENT
PANJABARI, GUWAHATI-37.

Email: ruralassam@yahoo.co.in
Telephone: 0361-2333645

No.E-742017/I/1425840/2026

06-02-2026

SOP on utilisation of 15th FC Funds for Repair & Maintenance of Rural Piped Water Supply Schemes developed under Jal Jeevan Mission in & Community Sanitation Assets under SBM-G, Assam

In pursuance of the Operational Guidelines for the implementation of the recommendations of the Fifteenth Finance Commission (FC-XV) on Rural Local Bodies, and the Ministry of Jal Shakti letter dated 25.08.2021 (File No. W- 11042/52/2020-JJM.II-DDWS), SBM-G guideline (File No. S-11011/2/2020/SBM-DDWS Dated 14.07.2020) sharing the Manual for Utilisation of 15th Finance Commission tied grants to Rural Local Bodies/PRI for water and sanitation via Ministry of Finance letter dated 14.07.2021 (File No. 15(2) FC- XV/FCD/2020-25), and with a view to ensuring long-term sustainability of Jal Jeevan Mission and Swachh Bharat Abhiyan-Grameen assets in Assam, using Finance Commission (FC) funds, the following Standard Operating Procedure (SOP) is laid out enumerating the procedures for fund requisition (claims), utilisation, and verification of expenditure for Operations and Maintenance (O&M) prospects of handed over JJM and SBM-G Community assets.

1. Process for Fund Requisition (Claims)

1.1 Repair and maintenance needs shall be identified by any Water User Committee (WUC)/Swajal Mitra/GP during routine operations, inspections, or in response to service disruptions at the scheme level. Once identified, Sectional Officer of Public Health Engineering Department (SO(PHED)) shall be intimated and requested to examine the scheme/assets.

1.2 The identified repair or maintenance needs shall be technically examined by the concerned SO(PHED), who shall certify the requirement and mandatorily prepare and sign the cost estimates in accordance with the available Manuals on Repairs and Replacements under PWSS etc., clearly specifying the nature of defects and the scope of works proposed. In case there is a cost overrun during execution, cost escalation up to 10% is permitted provided necessary funds are present and the appropriate sanctioning authorities approval is taken. However, where if the costs exceed more than 10% of the estimate, SO shall be held liable for such cost overruns.



A. For Assets under JJM

1.3.1 A meeting of WUC shall be called and all members shall be briefed on the nature of defects, the scope of works proposed and cost estimate prepared by SO(PHED) to take resolution on:

1.3.2 If sufficient funds available in WUC Bank Account: The WUC shall first utilise its own funds after passing a resolution with a minimum 50% quorum of WUC members.

1.3.3 If sufficient funds not available in WUC Bank Account: The signed resolution of the WUC must clearly mention need for fund requisition from the Gram Panchayat (GP), supported by following CPRD-FC/1/2026-FC-CP&RD-Commissionerate Of Panchayat & Rural Development Department I/1404482/2026 documents:

- a . Cost estimate prepared and certified by the concerned SO (PHED), as outlined under Section 1.2.
- b. Signed Copy of WUC bank account statement (by WUC President/ Secretary) evidencing insufficiency of available balance along with the past records of resolution, through which earlier expenditure from the WUC bank account have been made in the last 3 years.
- c. Utilization and Verification Certificate (UVC) signed by concerned Executive Engineer & BDO for works executed through FC funds in the last 3 years as per the **Annexure 1**, if applicable.

1.4 All the documents as listed under section 1.3, along with signed resolution of WUC for fund requisition shall be submitted to the GP Secretary and GP President for processing in accordance with the prescribed financial slabs described under subsequent sections from 1.5 to 1.7 and summarized at Table 1.

1.5 Requisitions up to ₹1 lakh per instance, within an annual cap of ₹5lakh per PWSS, may be approved jointly by the GP Secretary and GP President, if the fund requisition request is submitted in accordance with section 1.3.

1.6 Prior approval of the District Water & Sanitation Mission (DWSM), chaired by the District Commissioner (DC), shall be mandatory in either of the following cases:

- a) any single requisition exceeding ₹1 lakh and up to ₹5 lakh per PWSS; or
- b) any requisition that causes the cumulative annual requirement to that PWSS to exceed ₹5 lakh, so long as FC fund at GP level are available.

1.7 Any of the following shall require DWSM approval, along with the DC determining the funding source:

- a) any single requisition exceeding ₹5 lakh; or
- b) any subsequent requisition where FC funds at GP level are exhausted, irrespective of amount.

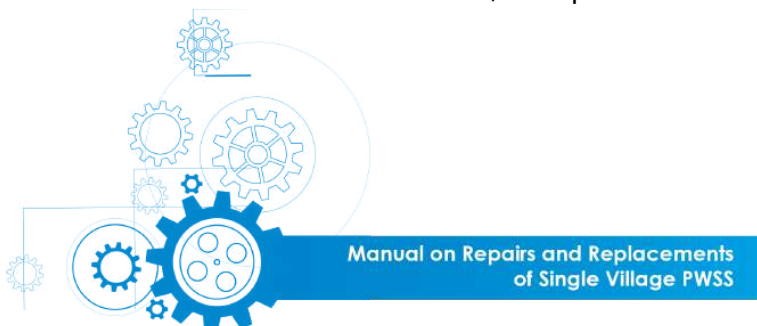


Table 1: Summarised Fund Slabs and Approval Chain

Sl. No	Approval Level	Expenditure through	One-time Requisition Limit (per PWSS)	Cumulative Annual Limit (per PWSS)
1	GP	FC fund at GP level	Up to ₹1 lakh	Up to ₹5 lakh
2	GP + DWSM	FC fund at GP level	Above ₹1 lakh and up to ₹5 lakh	Beyond ₹5 lakh (till FC fund at GP level exhausted)
3	DWSM	FC fund at AP/ZP level, based on discretion of DC	Above ₹5 lakh	If FC fund at GP level exhausted

1.8 In cases as mentioned at section 1.7, DC shall preferably approve expenditure from FC funds at Anchalik Panchayat (AP) level first, and thereafter from FC funds at Zilla Parishad (ZP) level , as applicable.

B. For Community Assets under SBM-G :

Various community assets, viz., MCFs, waste collection vehicles, community compost units, PWMUs, Community Sanitary Complexes, and end-of-drainage treatment systems/soak pits will require routine and preventive work, minor repairs, and major repairs. These repair and maintenance activities shall be carried out by GPs for GP-level assets and APs for Block level assets to ensure the regular functioning of the assets. Finance Commission grants available at the GP level will be used for these GP-owned assets. In the case of Plastic Waste Management Units (PWMUs), repair and maintenance shall be supported through Finance Commission grants available at the Anchalik Panchayat level.

In case the repair estimate is above 1 Lakh, DC shall preferably approve expenditure from FC funds at Anchalik Panchayat (AP) level first, and thereafter from FC funds at Zilla Parishad (ZP) level, as applicable.

Detailed list of Repair and Maintenance framework of SBM-G assets in Annexure 4.

2. Process for Expenditure and Execution

2.1 All GPs must constitute one standing **Repairing Construction Committee for Water & Sanitation Assets** at the GP level where GP fund will be utilized which shall comprise the following members and composition:

- Chairperson: Any person of the GP/VCDC/MAC nominated by the GP
- President/VCDC Chairperson/MAC Chairperson having a minimum educational qualification of HSLC
- Member: SO(PHED) concerned
- Member Secretary: GP Secretary

In addition, the following members, based on the PWSS for which the expenditure is being planned, will be co-opted as members of the Construction Committee

- e. Member: Ward Member concerned/Any other person from the VCDC/MAC
- f. Member: WUC President/Secretary of the concerned PWSS
- g. Member: Accredited Engineer of GP/Block
- h. Member: Swajal Mitra of the PWSS
- i. Member: Any other member of the WUC

Additionally, the following members, based on the type of SBM G assets for which the expenditure is being planned, will be co-opted as members of the construction committee:

- j. Member: Ward Member concerned/Any other person from the VCDC/MAC
- k. Member: President/Secretary of the party handling the asset
- l. Member: Accredited Engineer of GP/Block
- m. Member: Any Swajal Mitra in the GP
- n. Member: Any other member of the party handling the asset

2.2 All AP must constitute one standing **Repairing Construction Committee for Water & Sanitation Assets** at the AP level where AP fund will be utilized which shall comprise the following members and composition:

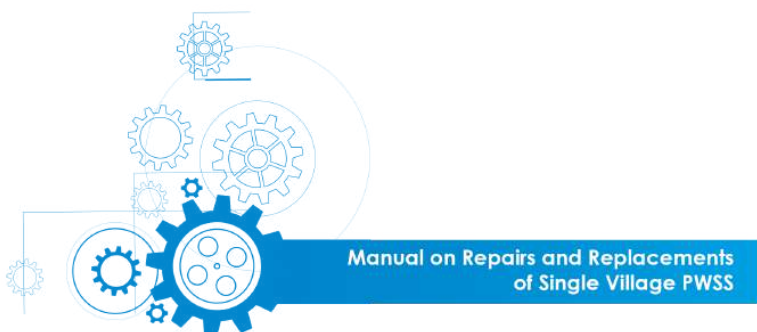
- a. Chairperson: Any person of the AP nominated by the AP President having a minimum educational qualification of HSLC
- b. Member: Assistant Executive Engineer (PHED) concerned Division
- c. Member Secretary: BDO

In addition, the following members, based on the PWSS for which the expenditure is being planned, will be co-opted as members of the Construction Committee

- d. Member: AP Member of concerned AP
- e. Member: WUC President/Secretary of the concerned PWSS
- f. Member: Assistant Executive Engineer/ Assistant Engineer of the Block
- g. Member: Swajal Mitra of the PWSS
- h. Member: Any other member of the WUC

Additionally, the following members, based on the type of SBM G assets for which the expenditure is being planned, will be co-opted as members of the construction committee:

- i. Member: AP member of concerned AP
- j. Member: President/Secretary of the party handling the asset
- k. Member: Assistant Executive Engineer/ Assistant Engineer of the Block



- l. Member: Any Swajal Mitra in the GP
- m. Member: Any other member of the party handling the asset.

2.3 All ZP must constitute one standing **Repairing Construction Committee for Water & Sanitation Assets** at the ZP level where ZP fund will be utilized which shall comprise the following members and composition:

- a. Chairperson: Any person of the ZP nominated by the ZP President having a minimum educational qualification of HSLC
- b. Member: Executive Engineer (PHED) concerned Division
- c. Member Secretary: CEO,ZP

In addition, the following members, based on the PWSS for which the expenditure is being planned, will be co-opted as members of the Construction Committee

- e. Member: ZPC Member of concerned
- f. Member: WUC President/Secretary of the concerned PWSS
- g. Member: Executive Engineer of ZP/ Assistant Executive Engineer
- h. Member: Swajal Mitra of the Scheme
- i. Member: Any other member of the WUC

Additionally, the following members, based on the type of SBM G assets for which the expenditure is being planned, will be co-opted as members of the construction committee:

- j. Member: ZPC Member of concerned
- k. Member: President/Secretary of the party handling the asset
- l. Member: Executive Engineer of ZP/Assistant Executive Engineer
- m. Member: Any Swajal Mitra in the GP
- n. Member: Any other member of the party handling the asset.

2.4 The Construction Committees as mentioned at *section 2.1, 2.2, & 2.3* shall function as construction committees for all expenditure made from FC funds of the PRIs for the purpose of O&M of PWSS constructed under JJM and community sanitation assets under SBM-G.

2.5 Upon approval of the GP/DWSM or both, as outlined under *section 1*, the concerned GP/AP/ZP shall direct the Construction Committee to undertake necessary activities, in writing.

2.6 The committees must ensure that all the utilisation of approved funds happen in alignment with the expenditure guideline outlined in the Manual on Repairs and Replacements in coherence with the procurement rules laid down in the Assam Public Procurement Rules

2.7 The Construction Committees shall execute the approved works within 30 days of sanction. However, if the execution encounters delay, then the following procedure may be followed:



2.7.1 If execution is delayed beyond 30 days , prior approval of the GP President shall be obtained to continue the work up to 45 days from the date of approval.

2.7.2 If the delay continues beyond 45 days , further continuation of the work up to 60 days from date of approval shall require prior approval of the DWSM.

2. 7.3 If the work remains incomplete beyond 60 days , GP Secretary, Accredited Engineer (P&RD),BDO, Assistant Engineer (in case AP funds are utliized), CEO,ZP and Executive Engineer of ZP/ Assistant Executive Engineer (in case ZP funds are utliized) shall be held accountable and shall submit a written explanation along with a corrective action plan to the DWSM. The work shall be completed within the next 30 days, failing which the DWSM may initiate appropriate disciplinary action.

2.8 Disbursement of funds for approved works shall be made through the Construction Committees on a milestone basis, as mentioned below-

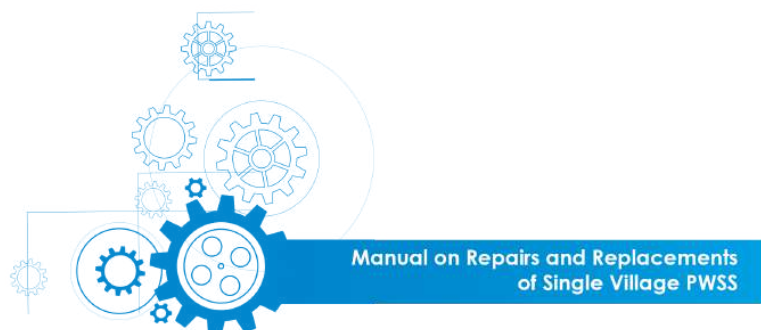
- a. 30% of the approved amount shall be released at the onset of
- b. work,
- c. Next 30% of the approved amount during implementation of work upon achievement of 50% physical progress. Half (50%) of physical progress to be ascertained by concerned SO (PHED) per the format in Annexure-1
- d. Further 30% of the approved amount on completion of work, upon production of Work Completion Certificate as per the format in Annexure-2 and
- e. Remaining 10% of the approved amount after one month of successful completion of the work executed and upon production of Utilisation and Verification certificate duly signed by AEE/EE (PHED) and Block Development Officer (BDO) as per the format in **Annexure-3**

3. Process for Verification and Subsequent Claims

3.1 A Utilisation and Verification Report shall be prepared by the AEE/Executive Engineer (PHED) and BDO within 30 days of final completion of the approved work and copy shall be mandatorily shared with the GP and the DWSM for procedural compliance and for release of the final payment tranche, as outlined under section 2.4(d).

3.2 The Utilisation and Verification Report shall mandatorily include:

- a. Technical certification of work quality, signed by the AEE/EE (PHED)
- b. Work Completion Certificate as per Annexure -2, supported by bills; and



c. Photographic evidence of the completed work

3.3 The Utilisation and Verification Report shall be a necessary enclosure for any future fund requisition submitted by the WUC / Jal Mitra from the concerned PWSS.

3.4 Record keeping including all original documents shall be maintained at the Gram Panchayat level, with copies shared with the WUC and the EE (PHED).

3.5 The Jal Mitra shall ensure that the Utilisation and Verification Report and supporting documents are uploaded on the designated digital portal, with facilitation support from the SO (PHED), for audit, monitoring, and inspection purposes.

4. Others

4.1 If the funds are exhausted at the GP, AP, and ZP levels. Required fund may be pursued through allocation from SOPD funds by PHED for execution of Repairing & Maintenance works, with appropriate approvals, so that critical water supply services are not disrupted.

4.2 In case of 6th scheduled areas where financial autonomy over the FC fund lies with the councils. The Councils will be responsible the execution of Repairing & Maintenance works of the PWSS in those areas.

Digitally signed by
BALLEPU KALYAN CHAKRAVARTHY
Date: 09-02-2026 13:48:16

Additional Chief Secretary to GoA
Panchayat & Rural Development Deptt.
Assam

Digitally signed by
SYEDAIN ABBASI

Date: 06-02-2026

16:51:55

Special Chief Secretary to GoA

Public Health Engineering Deptt
Assam

Memo No.E-742017/I/1425840/2026-A

06-02-2026

Copy to:

1. The Commissioner, Panchayat & Rural Development, Assam, Panjabari, Juripar. Guwahati-37 for information & necessary action.
2. The Mission Director, JJM for kind information.
3. All Principal Secretaries, 6" Scheduled Areas, for information and necessary action.
4. All District Commissioners. For information and necessary action.
5. The Director, Golap Borbara State Institution of Panchayat & Rural Development. Assam. Khanapara, Guwahati-22 for information & necessary action.
6. All Chief Executive Officers of Zilla Parishads for information and



- necessary action.
7. All Project Directors, DRDA for 6" Scheduled Areas for information and necessary action.
 8. P.S. of Hon'ble Minister, Panchayat & Rural Development, Dispur, Ghy- 6 for kind appraisal of Hon'ble Minister, Panchayat & Rural Development, Dispur.
 9. P.S. of Hon'ble Minister, Public Health Engineering Deptt, Dispur, Ghy-6 for kind appraisal of Hon'ble Minister, Public Health Engineering Deptt., Dispur.

Digitally signed by
MUNINDRA SHARMA
Secretary to the Govt. of
Assam
14:45:41
Panchayat & Rural

Annexure - 1: Half (50%) Work Completion Certificate

Name of Asset: _____
 Village / GP / Block / District: _____
 PHED Division: _____
 Sectional Officer (PHED): _____
 Construction Committee: _____
 Type of Work: _____
 Approval Reference No. & Date: _____
 Work & Cost Details
 Brief Description of Work Executed:
 Materials & Labor Used (As per Actual Bills)

Sl. No.	Material	Unit	Quantity	Unit Price	Total Price
1					
2					
3					
4					
Total Sum					

Approved Cost (₹): _____
 Expenditure Incurred till Date (₹): _____

Verification Checklist

- Bills / vouchers attached (as applicable)
 Photographs of work executed attached

Certification

Certified that the above work has achieved 50% physical completion and subsequent payments can be issued.

Sectional Officer (PHED)

Name:

Signature:

Date:

Annexure - 2: Work Completion Certificate

Name of PWSS: _____
 Village / GP / Block / District: _____
 PHED Division: _____
 Construction Committee: _____
 Type of Work: _____
 Approval Reference No. & Date: _____
 Work & Cost Details
 Description of Work Executed:
 Materials & Labor Used (As per Actual Bills)

Sl. No.	Material	Unit	Quantity	Unit Price	Total Price
1					
2					
3					
4					
Total Sum					

Approved Cost (₹): _____
 Total Expenditure Incurred (₹): _____
 Completion Verification Checklist

- All approved works completed
- Bills / vouchers attached
- Photographs of completed work attached
- Work conforms to approved estimates and standards

Completion Certification

Certified that the above work has been completed in full and is fit for operation.

Signatures

Sectional Officer (PHED)

Name: _____ Signature: _____ Date: _____

Assistant Engineer (P&RD)

Name: _____ Signature: _____ Date: _____

Chairperson, Construction Committee

Name: _____ Signature: _____ Date: _____

GP Secretary

Name: _____ Signature: _____ Date: _____



Annexure -3: Utilisation and Verification Certificate

Name of Scheme (PWSS): _____

Village / GP: _____

Block: _____

District: _____

This is to certify that an amount of ₹ _____ (*Rupees* _____ *only*) was utilised for repair / maintenance works under the above-mentioned Piped Water Supply Scheme (PWSS) confirming to approved sum outlined below.

The administrative approval for the said works was accorded vide Approval Order / Work Order No. _____ dated _____, sanctioning an amount of ₹ _____ for the proposed works.

The repair / maintenance works commenced on _____ (date) and were completed on _____ (date), as per the Work Completion Certificate duly signed by the members of the Construction Committee constituted for the said works.

It is hereby further certified that:

The stipulated repair / maintenance works have been completed satisfactorily. The PWSS has remained operational for a continuous period of one month following completion of the works. The quality of work executed has been verified and found to be in order.

Certification

Certified that the utilisation of funds is in accordance with the approved provisions and that the repair/maintenance works have been completed and verified as stated above.

Signature: _____

Name: _____

Designation: AEE/ Executive Engineer (PHED)

BDO

Division: _____

Date: _____

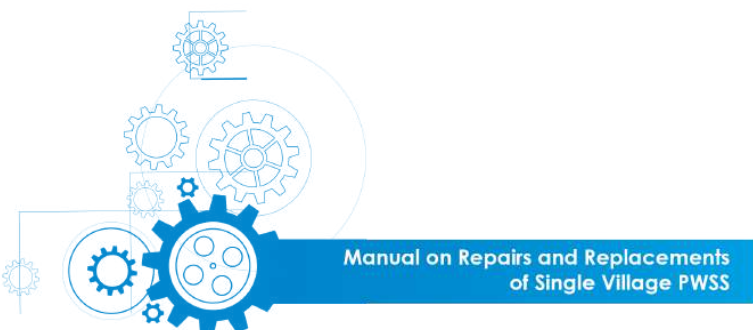
Signature: _____

Name: _____

Designation: _____

Block: _____

Date: _____



Annexure 4 : Repair and Maintenance framework of SBM-G assets

Asset	Routine Maintenance (Daily/Weekly)	Preventive Maintenance (Monthly/Quarterly)	Minor Repairs	Major Repla
Material Collection Facility (MCF) (Both Centralised and Mini)	Cleaning of shed, sorting platforms and bins; proper stacking of recyclables	Inspection of roofing, flooring, and drainage of the composting area	Repair of door, fencing, and sorting tools/accessories	Struct repair: replac replac doors/
Waste Collection Vehicles	Daily cleaning; tire pressure and brake checks; battery charging (for e-vehicles)	Scheduled servicing; rust prevention; battery health check	Tire puncture repair; brake cable, lights, and container repairs.	Engine overha; batter replac chassi
Community Compost Pits	Waste loading, turning, and moisture control; cleaning of the surrounding area and addition of earthworms for vermicomposting.	Structural inspection; leachate and drainage checks	Repair of pit walls and covers; replacement of tools and sieves	Struct repair: replac replac doors/
Plastic Waste Management Units (PWMUs)	Segregation, baling, and safe storage of plastics; cleaning of the work area	Inspection of baler, shredder, and electrical fittings	Repair of baler belts; shredder: replacement of storage cages.	Replac baler/s; machi struct repair: replac replac doors/
Community Sanitary Complex (CSC)	Daily cleaning and disinfection; water and electricity checks	Plumbing, flushing system, and soak pit inspection, working of twin pit	Repair of taps, flush valves, doors, and tiles; replacement of lights and fittings	Repair pits pl line replac struct repair:
End-of-Drainage Treatment (End of Drainage Treatment Systems/Soak Pits)	Removal of debris and floating waste; cleaning of screens and inlets; vegetation upkeep	Inspection of chambers, baffles, filters, and flow paths; pre-monsoon checks	Crack filling; replacement of screens, pipes, and filter media	Desilti tanks; recons of cha capaci enhan



11.1 Indent/Requisition slip

COST ESTIMATION: FORWARDING LETTER (Part A)

To _____ Date: _____
The GP Secretary
_____ GP
_____ Block
_____ District
Assam

Sir/Madam

We would like to inform you that the below-mentioned defect has been identified in _____ Scheme which is supplying drinking water to _____ households of _____ village of our _____ GP. The defect/damage needs to be immediately repaired so that the supply of drinking water is immediately restored.

The estimated cost of the repair is mentioned below for your kind reference.

We earnestly request you to provide us with a fund of Rs. _____ from the 15th/16th Finance Commission Fund.

Kindly refer to the joint directive no. _____, dated _____ for necessary actions from your end.

Yours Faithfully

WUC President

WUC Secretary

WUC Treasurer

Swajal Mitra

Scheme: _____
Village: _____
Gaon Panchayat: _____
District: _____

Defect identified in: Distribution pipes Valves Rapid Sand Filter
 Submersible Pump Centrifugal Pump
 Electrical Items Underground Reservoir
 Elevated Service Reservoir Civil Works

Nature of the defect/damage: _____

Date of identification of the defect/damage: _____

COST ESTIMATION

(Part B)

List, rates, and quantity of items required:

(A) Materials

Item. No.	Details of the Items	Rate	Quantity	Amount (in Rs.)
TOTAL				

(B) Labour

Item. No.	Details of labour required	Rate	Quantity	Amount (in Rs.)
TOTAL				

(C) Others (transportation cost, hiring of tools, equipment, machineries, etc.)

Item. No.	Details of other items	Rate	Quantity	Amount (in Rs.)
TOTAL				

1. Grand total amount required for repair/replacement: Rs. _____ (A)+(B)+(C)

2. Fund balance with WUC (as per WUC a/c passbook): Rs. _____

3. Net amount required for repair/replacement: Rs. _____ (1 – 2)

Section Officer (SO)-PHED

Encl: Copy of the WUC A/c Passbook



11.2 Labour payment receipt

I/we hereby confirm that I/we have received Rs. _____ towards the repair work done by us for _____ Scheme on _____ (mention date).

(Signature and name of the party)

11.3 Utilization Certificate by WUC

Utilization Certificate

This is to certify that a total sum of Rs. _____ was credited to the WUC Bank a/c _____ (mention the bank a/c number) on _____ (mention the date on which the fund was transferred to the WUC Bank a/c) by _____ Gaon Panchayat for repair works/replacement of parts (*strike out whichever is not applicable*) for _____ PWSS under Jal Jeevan Mission.

A sum of Rs. _____ was spent for the repair works/replacement of parts (*strike out whichever is not applicable*) on _____ (mention the date on which the payments were made) and Rs. _____ is remaining as unspent balance with the WUC of _____ PWSS.

(WUC Secretary)

(WUC Treasurer)

(Jal Mitra)

Date:



11.4 Utilization & Verification Certificate

Utilization & Verification Certificate

This is to certify that a total sum of ₹ _____ was credited to the Construction Committee of Gram Panchayat (GP)/Anchalik Panchayat (AP)/Zilla Parishad (ZP) having Bank a/c _____ (*mention the bank a/c number*) on _____ (*mention the date on which the fund was transferred to the Construction Committee of GP/AP/ZP Bank a/c*) by _____ GP/AP/ZP for repair works/replacement of _____ (*mention the repair work*) for _____ PWSS under Jal Jeevan Mission.

A sum of ₹ _____ was spent for the repair works/replacement of parts (*strike put whichever is not applicable*) on _____ (*mention the date on which the payments were made*) and ₹ _____ is remaining as unspent balance with the WUC of _____ PWSS.

Scheme Name: _____
Village: _____
Gram Panchayat: _____
Block: _____
PHE Division: _____
District: _____

- 1.The expenditure has been incurred exclusively for the sanctioned work, falling under eligible Finance Commission Tied Grant components.
- 2.The work has been physically verified at site and found to be completed / substantially completed / in progress as per approved scope.
- 3.The utilisation is fully aligned with the State-notified O&M Policy, including provisions related to sustainability, functionality, community participation, tariff/O&M arrangements, and asset management responsibilities.
- 4.The expenditure is supported by Measurement Books (MBs), vouchers, bills, work orders, and approvals, which are available for audit and inspection.
- 5.The asset created / repaired is functional / serviceable and has been entered in the relevant Asset Register, wherever applicable.
- 6.No part of the fund has been diverted, and utilisation adheres to prescribed financial rules, procurement norms, and audit requirements.

(Block Development Officer (BDO))

Name: _____
Block: _____
District: _____
Date: _____

Executive Engineer (EE), PHED

Name: _____
PHE Division: _____
District: _____

12. Item-wise Schedule of Rates

ADVISORY ON PROCUREMENT NORMS AND UTILIZATION OF BASE RATES

(FOR REPAIR AND REPLACEMENT WORKS UNDER SINGLE VILLAGE PWSS)

In view of the **State-notified Operation & Maintenance (O&M) Policy for Jal Jeevan Mission (JJM) assets** and the provisions of the **Assam Public Procurement Rules (APPR), 2020**, the following advisory is issued for guidance of the field regarding estimation and procurement of **repair and replacement works** under Single Village PWSS:

1. Repair and replacement works for ensuring functionality, service continuity, and sustainability of **Single Village Piped Water Supply Schemes (PWSS)** shall be undertaken strictly in accordance with the **State-notified O&M Policy for JJM assets**, as amended from time to time.
2. As envisaged in the said O&M Policy, execution of repair and replacement works shall be carried out through **duly constituted Construction Committees** at the appropriate PRI level, promoting decentralized implementation and community participation.
3. The **item-wise Schedule of Rates (SoR) / base rates** imparted by JJM Assam vide Letter No.JJMA-145/Tech/2025/10081 dated 06.09.2025 have been worked out after taking sufficient reference from prevailing market rates and applicable Schedule of Rates, and are considered reasonable and representative.
4. The item-wise base rates may be utilized **for estimating the indents for administrative and financial purposes**, including planning, approval of estimates, prioritization of works, and fund allocation, as provided in the **State-notified O&M Policy for JJM assets**.
5. Following the above, procurement of the repair works are to be undertaken by the duly constituted Construction Committees in compliance with **Clause 24(N) of the Assam Public Procurement Rules (APPR), 2020**, which governs procurement through Construction Committees.
6. As per the referred **Clause 24(N) read with Clause 24(G) of APPR, 2020**, Construction Committees shall undertake procurement of the estimated works through **Spot Purchase method** from the available market.
7. The **financial threshold / ceiling for such procurements** through Spot Purchase method shall be **as stipulated in the State-notified O&M Policy for JJM assets**, and shall be adhered to strictly.
8. Construction Committees shall ensure that:
 - Procurements are **reasonable, competitive, and aligned with prevailing market conditions**;
 - All required documentation pertinent to the contracting process such as quotations, comparative statements, approvals, and bills are maintained; and
 - Procurement decisions are transparent, justifiable, and capable of withstanding audit scrutiny.
9. All expenditures incurred shall be supported by proper records and shall be **open to audit and inspection** by competent authorities.
10. Field functionaries shall ensure that **no deviation** from the procedures prescribed in the **State-notified O&M Policy for JJM assets** and the **Assam Public Procurement Rules, 2020** is made while executing repair and replacement works.
11. This advisory is promulgated in conjunction with the **State-notified O&M Policy for JJM assets, APPR 2020**, and other applicable financial rules, manuals, and may evolve as per instructions issued by the Government from time to time.

SPARE PARTS OF PUMP AND STARTERS

SL NO	Item description	Unit	Recommended base rate (in Rs.)
	Component Cost of Submersible Pump and Motor (Spare Parts) as applicable for Kirloskar, Crompton, CRI,Lubi or equivalent brands		
	PUMP SIDE		
	Bowel		
1	Bowel upto 2 HP Single Phase Motor	Each	222.00
2	Bowel for 3–5 HP Three Phase Motor	Each	322.00
3	Bowel for 7.5–10 HP Three Phase Motor	Each	515.00
	Center Bowel		
4	Center Bowel upto 2 HP Single Phase Motor	Each	1384.00
5	Center Bowel for 3–5 HP Three Phase Motor	Each	1384.00
6	Center Bowel for 7.5–10 HP Three Phase Motor	Each	1691.00
	Upper Bowel Set		
7	Upper Bowel Set upto 2 HP Single Phase Motor	Per Set	1691.00
8	Upper Bowel Set for 3–5 HP Three Phase Motor	Per Set	1691.00
9	Upper Bowel Set for 7.5–10 HP Three Phase Motor	Per Set	1999.00
	Lower Bowel Set		
10	Lower Bowel Set upto 2 HP Single Phase Motor	Per Set	482.00
11	Lower Bowel Set for 3–5 HP Three Phase Motor	Per Set	774.00
12	Lower Bowel Set for 7.5–10 HP Three Phase Motor	Per Set	974.00
	Steel Bush		
13	Steel Bush upto 2 HP Single Phase Motor	Each	269.00
14	Steel Bush for 3–5 HP Three Phase Motor	Each	532.00
15	Steel Bush for 7.5–10 HP Three Phase Motor	Each	699.00
	Brass Bush		
16	Brass Bush upto 2 HP Single Phase Motor	Each	527.00
17	Brass Bush for 3–5 HP Three Phase Motor	Each	731.00
18	Brass Bush for 7.5–10 HP Three Phase Motor	Each	731.00
	Rubber Bush		
19	Rubber Bush upto 2 HP Single Phase Motor	Each	174.00
20	Rubber Bush for 3–5 HP Three Phase Motor	Each	185.00
21	Rubber Bush for 7.5–10 HP Three Phase Motor	Each	205.00
	Journal Bush For:		
22	Journal Bush upto 2 HP Single Phase Motor	Per Piece	704.00
23	Journal Bush for 3-5 HP Three Phase Motor	Per Piece	807.00
24	Journal Bush for 7.5-10 HP Three Phase Motor	Per Piece	986.00
	Carbon Bush		
25	Carbon Bush upto 2 HP Single Phase Motor	Per Piece	612.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
26	Carbon Bush for 3-5 HP Three Phase Motor	Per Piece	823.00
27	Carbon Bush for 7.5-10 HP Three Phase Motor	Per Piece	892.00
	Oil Seal Bush		
28	Oil Seal Bush upto 2 HP Single Phase Motor	Per Piece	72.00
29	Oil Seal Bush for 3-5 HP Three Phase Motor	Per Piece	123.00
30	Oil Seal Bush for 7.5-10 HP Three Phase Motor	Per Piece	144.00
	Bracket Top or Adapter with Non Return Valve(Pump Side)		
31	Bracket Top or Adapter with Non Return Valve(Pump Side) upto 2 HP Single Phase Motor	Each	1640.00
32	Bracket Top or Adapter with Non Return Valve(Pump Side) for 3-5 HP Three Phase Motor	Each	1896.00
33	Bracket Top or Adapter with Non Return Valve(Pump Side) for 7.5-10 HP Three Phase Motor	Each	2798.00
	Lower Bracket/Adapter (Pump Side with Strainer)		
34	Lower Bracket/Adapter (Pump Side with Strainer) upto 2 HP Single Phase Motor	Each	1333.00
35	Lower Bracket/Adapter (Pump Side with Strainer) for 3-5 HP Three Phase Motor	Each	2798.00
36	Lower Bracket/Adapter (Pump Side with Strainer) for 7.5-10 HP Three Phase Motor	Each	4415.00
	Lankey Bolts and Nuts		
37	Lankey Bolts and Nuts upto 2 HP Single Phase Motor	Each	118.00
38	Lankey Bolts and Nuts for 3-5 HP Three Phase Motor	Each	134.00
39	Lankey Bolts and Nuts for 7.5-10 HP Three Phase Motor	Each	175.00
	Pump Patti 4 nos Set		
40	Pump Patti 4 nos Set upto 2 HP Single Phase Motor	Per Set	683.00
41	Pump Patti 4 nos Set for 3-5 HP Three Phase Motor	Per Set	683.00
42	Pump Patti 4 nos Set for 7.5-10 HP Three Phase Motor	Per Set	683.00
	Pump Shaft		
43	Pump Shaft upto 2 HP Single Phase Motor	Job	1290.00
44	Pump Shaft for 3-5 HP Three Phase Motor	Job	3793.00
45	Pump Shaft for 7.5-10 HP Three Phase Motor	Job	4794.00
	Shafting Key		
46	Shafting Key upto 2 HP Single Phase Motor	Each	62.00
47	Shafting Key for 3-5 HP Three Phase Motor	Each	82.00
48	Shafting Key for 7.5-10 HP Three Phase Motor	Each	103.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
	CI Casing/ Pump Jacket for Submersible Pump		
49	CI Casing/ Pump Jacket for Submersible Pump upto 2 HP Single Phase Motor	Each	3287.00
50	CI Casing/ Pump Jacket for Submersible Pump for 3-5 HP Three Phase Motor	Each	4542.00
51	CI Casing/ Pump Jacket for Submersible Pump for 7.5-10 HP Three Phase Motor	Each	5081.00
	Impeller and Diffuser Set with Guide Vane :		
	G.M. Impeller and Diffuser Set with Guide Vane:		
52	G.M. Impeller and Diffuser Set with Guide Vane upto 2 HP Single Phase Motor	Per Set	1525.00
53	G.M. Impeller and Diffuser Set with Guide Vane for 3-5 HP Three Phase Motor	Per Set	1868.00
54	G.M. Impeller and Diffuser Set with Guide Vane for 7.5-10 HP Three Phase Motor	Per Set	3595.00
	Nylon/ Plastic Impeller and Diffuser Set with Guide Vane		
55	Nylon/ Plastic Impeller and Diffuser Set with Guide Vane upto 2 HP Single Phase Motor	Per Set	215.00
56	Nylon/ Plastic Impeller and Diffuser Set with Guide Vane for 3-5 HP Three Phase Motor	Per Set	320.00
57	Nylon/ Plastic Impeller and Diffuser Set with Guide Vane for 7.5-10 HP Three Phase Motor	Per Set	528.00
	SS Impeller and Diffuser Set with Guide Vane		
58	SS Impeller and Diffuser Set with Guide Vane upto 2 HP Single Phase Motor	Per Set	683.00
59	SS Impeller and Diffuser Set with Guide Vane for 3-5 HP Three Phase Motor	Per Set	788.00
60	SS Impeller and Diffuser Set with Guide Vane for 7.5-10 HP Three Phase Motor	Per Set	998.00
	CI Impeller and Diffuser Set with Guide Vane:		
61	CI Impeller and Diffuser Set with Guide Vane upto 2 HP Single Phase Motor	Per Set	788.00
62	CI Impeller and Diffuser Set with Guide Vane 3-5 for HP Three Phase Motor	Per Set	998.00
63	CI Impeller and Diffuser Set with Guide Vane 7.5-10 for HP Three Phase Motor	Per Set	1260.00
	MOTOR SIDE		
	Submersible Cable(3 CORE)		
64	Submersible Cable(3 CORE) 2.5 mm for single phase submersible motor	Per Metre	164.00
65	Submersible Cable(3 CORE) 4 mm for three phase submersible motor	Per Metre	261.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
66	Submersible Cable(3 CORE) 6 mm for three phase submersible motor	Per Metre	384.00
67	Submersible Cable(3 CORE) 10 mm for three phase submersible motor	Per Metre	487.00
	CABLE SEALS WITH WATER PROOF TAPE:		
68	Cable Seal with Water Proof Tape Upto 2 HP SINGLE PHASE MOTOR	Per Piece	105.00
69	Cable Seal with Water Proof Tape 3–5 HP Three Phase Motor	Per Piece	210.00
70	Cable Seal with Water Proof Tape 7.5–10 HP Three Phase Motor	Per Piece	315.00
	Gasket for:		
71	Gasket Upto 2 HP SINGLE PHASE MOTOR	Per Piece	210.00
72	Gasket 3–5 HP Three Phase Motor	Per Piece	210.00
73	Gasket 7.5–10 HP Three Phase Motor	Per Piece	210.00
	OIL SEAL:		
74	Oil Seal Upto 2 HP SINGLE PHASE MOTOR	Per Piece	308.00
75	Oil Seal 3–5 HP Three Phase Motor	Per Piece	769.00
76	Oil Seal 7.5–10 HP Three Phase Motor	Per Piece	871.00
	Cable Guard String or Rope for Holding Submersible Pumpset For:		
77	Cable Guard String or Rope for Holding Submersible Pumpset Upto 2 HP SINGLE PHASE MOTOR	Per Metre	1575.00
78	Cable Guard String or Rope for Holding Submersible Pumpset for 3–5 HP Three Phase Motor	Per Metre	1575.00
79	Cable Guard String or Rope for Holding Submersible Pumpset for 7.5–10 HP Three Phase Motor	Per Metre	1680.00
	Supporting Clamps and Cap(At the ground level) For:		
80	Supporting Clamps and Cap(At the ground level) Upto 2 HP SINGLE PHASE MOTOR	Per Piece	315.00
81	Supporting Clamps and Cap(At the ground level) for 3–5 HP Three Phase Motor	Per Piece	473.00
82	Supporting Clamps and Cap(At the ground level) for 7.5–10 HP Three Phase Motor	Per Piece	473.00
	Sand Guard For:		
83	Sand Guard Upto 2 HP SINGLE PHASE MOTOR	Per Piece	433.00
84	Sand Guard 3–5 HP Three Phase Motor	Per Piece	438.00
85	Sand Guard 7.5–10 HP Three Phase Motor	Per Piece	457.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
86	Coupler (Pinion Type Upto 2 HP SINGLE PHASE MOTOR	Per Piece	605.00
87	Coupler (Pinion Type 3–5 HP Three Phase Motor	Per Piece	707.00
88	Coupler (Pinion Type 7.5–10 HP Three Phase Motor	Per Piece	892.00
	Coupler (Key Type) for:		
89	Coupler (Key Type) Upto 2 HP SINGLE PHASE MOTOR	Per Piece	605.00
90	Coupler (Key Type) for 3–5 HP Three Phase Motor	Per Piece	707.00
91	Coupler (Key Type) for 7.5-10 HP Three Phase Motor	Per Piece	2045.00
	Shaft Sleeve for:		
92	Shaft Sleeve Upto 2 HP SINGLE PHASE MOTOR	Per Piece	909.00
93	Shaft Sleeve 3–5 HP Three Phase Motor	Per Piece	1014.00
94	Shaft Sleeve 7.5–10 HP Three Phase Motor	Per Piece	1280.00
	Thrust Carbon Bearing and Plate Set		
95	Thrust Carbon Bearing and Plate Set upto 2 HP Single Phase Motor	Per Set	2460.00
96	Thrust Carbon Bearing and Plate Set for 3–5 HP Three Phase Motor	Per Set	2563.00
97	Thrust Carbon Bearing and Plate Set for 7.5–10 HP Three Phase Motor	Per Set	3588.00
	Motor Bushing Housing (Upper)		
98	Motor Bushing Housing (Upper) upto 2 HP Single Phase Motor	Each	1230.00
99	Motor Bushing Housing (Upper) for 3–5 HP Three Phase Motor	Each	1640.00
100	Motor Bushing Housing (Upper) for 7.5–10 HP Three Phase Motor	Each	1948.00
	Motor Bushing Housing (Lower)		
101	Motor Bushing Housing (Lower) upto 2 HP Single Phase Motor	Each	769.00
102	Motor Bushing Housing (Lower) for 3–5 HP Three Phase Motor	Each	4613.00
103	Motor Bushing Housing (Lower) for 7.5–10 HP Three Phase Motor	Each	4613.00
	Replacement of Stator Housing:		
104	Head losses : 32 m, Single phase, 1 HP	Each	7353.00
105	Head losses : 43 m, Single phase, 1 HP	Each	7564.00
106	Head losses : 55 m, Single phase, 1 HP	Each	8606.00
107	Head losses : 32 m, Single phase, 2 HP	Each	12189.00
108	Head losses : 43 m, Single phase, 2 HP	Each	12189.00
109	Head losses : 55 m, Single phase, 2 HP	Each	10070.00
110	Head losses : 32 m, Three phase, 3 HP	Each	17146.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
111	Head losses : 43 m, Three phase, 3 HP	Each	15760.00
112	Head losses : 55 m, Three phase, 3 HP	Each	16680.00
113	Head losses : 32 m, Three phase, 5 HP	Each	22148.00
114	Head losses : 43 m, Three phase, 5 HP	Each	22148.00
115	Head losses : 55 m, Three phase, 5 HP	Each	22858.00
116	Head losses : 32 m, Three phase, 7.5 HP	Each	24921.00
117	Head losses : 43 m, Three phase, 7.5 HP	Each	24921.00
118	Head losses : 55 m, Three phase, 7.5 HP	Each	27882.00
119	Head losses : 32 m, Three phase, 10 HP	Each	25020.00
120	Head losses : 43 m, Three phase, 10 HP	Each	30632.00
121	Head losses : 55 m, Three phase, 10 HP	Each	30632.00
	Replacement of Rotor for:		
122	Head losses : 32 m, Single phase, 1 HP	Each	3960.00
123	Head losses : 43 m, Single phase, 1 HP	Each	4073.00
124	Head losses : 55 m, Single phase, 1 HP	Each	4634.00
125	Head losses : 32 m, Single phase, 2 HP	Each	6563.00
126	Head losses : 43 m, Single phase, 2 HP	Each	6563.00
127	Head losses : 55 m, Single phase, 2 HP	Each	5422.00
128	Head losses : 32 m, Three phase, 3 HP	Each	9233.00
129	Head losses : 43 m, Three phase, 3 HP	Each	8486.00
130	Head losses : 55 m, Three phase, 3 HP	Each	8982.00
131	Head losses : 32 m, Three phase, 5 HP	Each	11926.00
132	Head losses : 43 m, Three phase, 5 HP	Each	11926.00
133	Head losses : 55 m, Three phase, 5 HP	Each	12309.00
134	Head losses : 32 m, Three phase, 7.5 HP	Each	13419.00
135	Head losses : 43 m, Three phase, 7.5 HP	Each	13419.00
136	Head losses : 55 m, Three phase, 7.5 HP	Each	15013.00
137	Head losses : 32 m, Three phase, 10 HP	Each	13473.00
138	Head losses : 43 m, Three phase, 10 HP	Each	16494.00
139	Head losses : 55 m, Three phase, 10 HP	Each	16494.00
	Lock ,Nut,Bolt & Washer for:		
140	Lock Nut & Washer Upto 2 HP SINGLE PHASE MOTOR	Per Piece	161.00
141	Lock Nut & Washer 3–5 HP Three Phase Motor	Per Piece	161.00
142	Lock Nut & Washer 7.5–10 HP Three Phase Motor	Per Piece	161.00
	T-Bolt for:		
143	T-Bolt Upto 2 HP SINGLE PHASE MOTOR	Per Piece	269.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
144	T-Bolt 3–5 HP Three Phase Motor	Per Piece	296.00
145	T-Bolt 7.5–10 HP Three Phase Motor	Per Piece	323.00
	Circlip for:		
146	Circlip Upto 2 HP SINGLE PHASE MOTOR	Per Piece	103.00
147	Circlip 3–5 HP Three Phase Motor	Per Piece	154.00
148	Circlip 7.5–10 HP Three Phase Motor	Per Piece	205.00
	Head Screw for:		
149	Head Screw Upto 2 HP SINGLE PHASE MOTOR	Per Piece	54.00
150	Head Screw 3–5 HP Three Phase Motor	Per Piece	54.00
151	Head Screw 7.5–10 HP Three Phase Motor	Per Piece	54.00
	Component of Centrifugal/Monoblock Pump and Motor(Spare Parts) applicable for Kirloskar, Crompton, CRI, Lubi or equivalent brands		
	Pump Side :		
	CI Impeller		
152	CI Impeller upto 2 HP Single Phase Motor	Each	1200.00
153	CI Impeller for 3–5 HP Three Phase Motor	Each	1640.00
154	CI Impeller for 7.5–10 HP Three Phase Motor	Each	2563.00
	Brass Impeller		
155	Brass Impeller upto 2 HP Single Phase Motor	Each	6078.00
156	Brass Impeller for 3–5 HP Three Phase Motor	Each	10178.00
157	Brass Impeller for 7.5–10 HP Three Phase Motor	Each	10898.00
	Noryl or Plastic Impeller		
158	Noryl or Plastic Impeller upto 2 HP Single Phase Motor	Each	769.00
159	Noryl or Plastic Impeller for 3–5 HP Three Phase Motor	Each	974.00
160	Noryl or Plastic Impeller for 7.5–10 HP Three Phase Motor	Each	1281.00
	SS Impeller		
161	SS Impeller upto 2 HP Single Phase Motor	Each	2563.00
162	SS Impeller for 3–5 HP Three Phase Motor	Each	3588.00
163	SS Impeller for 7.5–10 HP Three Phase Motor	Each	4613.00
	Replacement of Pump Valuit Casing		
164	Replacement of Pump Valuit Casing upto 2 HP Single Phase Motor	Each	1640.00
165	Replacement of Pump Valuit Casing for 3–5 HP Three Phase Motor	Each	2255.00
166	Replacement of Pump Valuit Casing for 7.5–10 HP Three Phase Motor	Each	3116.00
	Glend Flange		
167	Glend Flange upto 2 HP Single Phase Motor	Each	368.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
168	Glend Flange for 3–5 HP Three Phase Motor	Each	461.00
169	Glend Flange for 7.5–10 HP Three Phase Motor	Each	743.00
	Glend Packing		
170	Glend Packing upto 2 HP Single Phase Motor	Per Kg	210.00
171	Glend Packing for 3–5 HP Three Phase Motor	Per Kg	179.00
172	Glend Packing for 7.5–10 HP Three Phase Motor	Per Kg	224.00
	Body Gasket		
173	Body Gasket upto 2 HP Single Phase Motor	Each	112.00
174	Body Gasket for 3–5 HP Three Phase Motor	Each	115.00
175	Body Gasket for 7.5–10 HP Three Phase Motor	Each	120.00
	Studs Bolt and Nuts		
176	Studs Bolt and Nuts upto 2 HP Single Phase Motor	Each	188.00
177	Studs Bolt and Nuts for 3–5 HP Three Phase Motor	Each	251.00
178	Studs Bolt and Nuts for 7.5–10 HP Three Phase Motor	Each	309.00
	Impeller Key		
179	Impeller Key upto 2 HP Single Phase Motor	Each	100.00
180	Impeller Key for 3–5 HP Three Phase Motor	Each	120.00
181	Impeller Key for 7.5–10 HP Three Phase Motor	Each	158.00
	Impeller Check Nuts		
182	Impeller Check Nuts upto 2 HP Single Phase Motor	Each	154.00
183	Impeller Check Nuts for 3–5 HP Three Phase Motor	Each	169.00
184	Impeller Check Nuts for 7.5–10 HP Three Phase Motor	Each	179.00
	Pump Shaft Sleeve (For the Glend Packing)		
185	Pump Shaft Sleeve upto 2 HP Single Phase Motor	Each	615.00
186	Pump Shaft Sleeve for 3–5 HP Three Phase Motor	Each	550.00
187	Pump Shaft Sleeve for 7.5–10 HP Three Phase Motor	Each	615.00
	Flange (Delivery Side)		
188	Flange (Delivery Side) upto 2 HP Single Phase Motor	Per Piece	390.00
189	Flange (Delivery Side) for 3–5 HP Three Phase Motor	Per Piece	490.00
190	Flange (Delivery Side) for 7.5–10 HP Three Phase Motor	Per Piece	590.00
	Flange (Suction Side)		
191	Flange (Suction Side) upto 2 HP Single Phase Motor	Per Piece	390.00
192	Flange (Suction Side) for 3–5 HP Three Phase Motor	Per Piece	490.00
193	Flange (Suction Side) for 7.5–10 HP Three Phase Motor	Per Piece	600.00
	Seals :		
	Oil Seal		
194	Oil Seal upto 2 HP Single Phase Motor	Per Piece	143.00
195	Oil Seal for 3–5 HP Three Phase Motor	Per Piece	148.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
196	Oil Seal for 7.5–10 HP Three Phase Motor	Per Piece	195.00
	Mechanical Seal		
197	Mechanical Seal upto 2 HP Single Phase Motor	Per Piece	390.00
198	Mechanical Seal for 3–5 HP Three Phase Motor	Per Piece	772.00
199	Mechanical Seal for 7.5–10 HP Three Phase Motor	Per Piece	893.00
	Motor Side:		
	Cable for Centrifugal Pump:		
200	2 core 2.5 mm copper cable for pumps upto 2 HP Single Phase motor	Per Metre	92.00
201	3 core 4 mm round type for 3 phase centrifugal pump	Per Metre	185.00
202	3 core 6 mm round type for 3 phase centrifugal pump	Per Metre	359.00
203	3 core 10 mm round type for 3 phase centrifugal pump	Per Metre	564.00
	CAPACITOR		
204	Capacitor for centrifugal pumps upto HP Single Phase Motor	Each	430.00
	Bearing Housing		
205	Bearing Housing upto 2 HP Single Phase Motor	Each	4330.00
206	Bearing Housing for 3–5 HP Three Phase Motor	Each	5720.00
207	Bearing Housing for 7.5–10 HP Three Phase Motor	Each	6805.00
	Bearing Cover		
208	Bearing Cover upto 2 HP Single Phase Motor	Each	980.00
209	Bearing Cover for 3–5 HP Three Phase Motor	Each	990.00
210	Bearing Cover for 7.5–10 HP Three Phase Motor	Each	1400.00
	Ball Bearing (6203 to 6310 or equivalent)		
211	Ball Bearing (6203 to 6310 or equivalent) upto 2 HP Single Phase Motor	Per Piece	769.00
212	Ball Bearing (6203 to 6310 or equivalent) for 3–5 HP Three Phase Motor	Per Piece	871.00
213	Ball Bearing (6203 to 6310 or equivalent) for 7.5–10 HP Three Phase Motor	Per Piece	974.00
	Bearing Cap		
214	Bearing Cap upto 2 HP Single Phase Motor	Per Piece	912.00
215	Bearing Cap for 3–5 HP Three Phase Motor	Per Piece	1015.00
216	Bearing Cap for 7.5–10 HP Three Phase Motor	Per Piece	1015.00
	Rotor Sleeve		
217	Rotor Sleeve upto 2 HP Single Phase Motor	Each	769.00
218	Rotor Sleeve for 3–5 HP Three Phase Motor	Each	820.00
219	Rotor Sleeve for 7.5–10 HP Three Phase Motor	Each	835.00
	Rotor Key		
220	Rotor Key upto 2 HP Single Phase Motor	Each	158.00
221	Rotor Key for 3–5 HP Three Phase Motor	Each	158.00
222	Rotor Key for 7.5–10 HP Three Phase Motor	Each	158.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
	Motor Connector Plate/Terminal Block		
223	Motor Connector Plate/Terminal Block upto 2 HP Single Phase Motor	Each	210.00
224	Motor Connector Plate/Terminal Block for 3–5 HP Three Phase Motor	Each	310.00
225	Motor Connector Plate/Terminal Block for 7.5–10 HP Three Phase Motor	Each	450.00
	Connector Cover/ Terminal Box		
226	Connector Cover/ Terminal Box upto 2 HP Single Phase Motor	Each	451.00
227	Connector Cover/ Terminal Box for 3–5 HP Three Phase Motor	Each	727.00
228	Connector Cover/ Terminal Box for 7.5–10 HP Three Phase Motor	Each	720.00
	SS Bush		
229	SS Bush upto 2 HP Single Phase Motor	Per Piece	485.00
230	SS Bush for 3–5 HP Three Phase Motor	Per Piece	485.00
231	SS Bush for 7.5–10 HP Three Phase Motor	Per Piece	368.00
	Foot Valve		
232	Foot Valve upto 2 HP Single Phase Motor	Per Piece	1680.00
233	Foot Valve for 3–5 HP Three Phase Motor	Per Piece	3675.00
234	Foot Valve for 7.5–10 HP Three Phase Motor	Per Piece	4725.00
	Back Plate		
235	Back Plate upto 2 HP Single Phase Motor	Per Piece	1005.00
236	Back Plate for 3–5 HP Three Phase Motor	Per Piece	1210.00
237	Back Plate for 7.5–10 HP Three Phase Motor	Per Piece	1415.00
	Cover Plate		
238	Cover Plate upto 2 HP Single Phase Motor	Per Piece	473.00
239	Cover Plate for 3–5 HP Three Phase Motor	Per Piece	473.00
240	Cover Plate for 7.5–10 HP Three Phase Motor	Per Piece	578.00
	Stud Bolt and Nuts		
241	Stud upto 2 HP Single Phase Motor	Per Piece	145.00
242	Stud for 3–5 HP Three Phase Motor	Per Piece	178.00
243	Stud for 7.5–10 HP Three Phase Motor	Per Piece	209.00
	Gland		
244	Gland upto 2 HP Single Phase Motor	Per Piece	185.00
245	Gland for 3–5 HP Three Phase Motor	Per Piece	204.00
246	Gland for 7.5–10 HP Three Phase Motor	Per Piece	285.00
	Replacement of Rotor Assembly		
247	2 HP Centrifugal Pumpset Single Phase 30 m Head	Each	5177.00
248	3 HP Centrifugal Pumpset Three Phase 30 m Head	Each	7928.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
249	5 HP Centrifugal Pumpset Three Phase 30 m Head	Each	8109.00
250	7.5 HP Centrifugal Pumpset Three Phase 30 m Head	Each	13840.00
251	10 HP Centrifugal Pumpset Three Phase 30 m Head	Each	16463.00
	Replacement of Stator Assembly		
252	2 HP Centrifugal Pumpset Single Phase 30 m Head	Each	16526.00
253	3 HP Centrifugal Pumpset Three Phase 30 m Head	Each	19557.00
254	5 HP Centrifugal Pumpset Three Phase 30 m Head	Each	33137.00
255	7.5 HP Centrifugal Pumpset Three Phase 30 m Head	Each	42089.00
256	10 HP Centrifugal Pumpset Three Phase 30 m Head	Each	48557.00
	Cooling Fan		
257	Cooling Fan upto 2 HP Single Phase Motor	Per Piece	205.00
258	Cooling Fan for 3–5 HP Three Phase Motor	Per Piece	359.00
259	Cooling Fan for 7.5–10 HP Three Phase Motor	Per Piece	666.00
	Key Way for Cooling Fan		
260	Key Way upto 2 HP Single Phase Motor	Per Piece	158.00
261	Key Way for 3–5 HP Three Phase Motor	Per Piece	158.00
262	Key Way for 7.5–10 HP Three Phase Motor	Per Piece	158.00
	Washers,Nuts and Bolts		
263	Washers,Nuts and Bolts upto 2 HP Single Phase Motor	Per Piece	105.00
264	Washers,Nuts and Bolts for 3–5 HP Three Phase Motor	Per Piece	105.00
265	Washers,Nuts and Bolts for 7.5–10 HP Three Phase Motor	Per Piece	210.00
	Gasket		
266	Gasket upto 2 HP Single Phase Motor	Per Piece	263.00
267	Gasket for 3–5 HP Three Phase Motor	Per Piece	263.00
268	Gasket for 7.5–10 HP Three Phase Motor	Per Piece	263.00
	Foundation Bolt		
269	Foundation Bolt upto 2 HP Single Phase Motor	Per Piece	53.00
270	Foundation Bolt for 3–5 HP Three Phase Motor	Per Piece	105.00
271	Foundation Bolt for 7.5–10 HP Three Phase Motor	Per Piece	158.00
	Components of Open Well Submersible/Centrifugal Pump and Motor(Spare Parts) applicable for Kirloskar, Crompton, CRI, Lubi or equivalent brands		
	CI Impeller		
272	CI Impeller upto 2 HP Single Phase Motor	Each	1200.00
273	CI Impeller for 3–5 HP Three Phase Motor	Each	1500.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
274	CI Impeller for 7.5–10 HP Three Phase Motor	Each	2563.00
	Brass Impeller		
275	Brass Impeller upto 2 HP Single Phase Motor	Each	8440.00
276	Brass Impeller for 3–5 HP Three Phase Motor	Each	9930.00
277	Brass Impeller for 7.5–10 HP Three Phase Motor	Each	9910.00
	Noryl or Plastic Impeller		
278	Noryl or Plastic Impeller upto 2 HP Single Phase Motor	Each	650.00
279	Noryl or Plastic Impeller for 3–5 HP Three Phase Motor	Each	1244.00
280	Noryl or Plastic Impeller for 7.5–10 HP Three Phase Motor	Each	1357.00
	SS Impeller		
281	SS Impeller upto 2 HP Single Phase Motor	Each	8440.00
282	SS Impeller for 3–5 HP Three Phase Motor	Each	9930.00
283	SS Impeller for 7.5–10 HP Three Phase Motor	Each	9910.00
	Repair of Pump Valuit Casing		
284	Repair of Pump Valuit Casing upto 2 HP Single Phase Motor	Each	692.00
285	Repair of Pump Valuit Casing for 3–5 HP Three Phase Motor	Each	941.00
286	Repair of Pump Valuit Casing for 7.5–10 HP Three Phase Motor	Each	1209.00
	Replacement of Pump Valuit Casing		
287	Replacement of Pump Valuit Casing upto 2 HP Single Phase Motor	Each	2360.00
288	Replacement of Pump Valuit Casing for 3–5 HP Three Phase Motor	Each	1230.00
289	Replacement of Pump Valuit Casing for 7.5–10 HP Three Phase Motor	Each	1845.00
	Flange (Delivery Side)		
290	Flange (Delivery Side) upto 2 HP Single Phase Motor	Per Piece	650.00
291	Flange (Delivery Side) for 3–5 HP Three Phase Motor	Per Piece	650.00
292	Flange (Delivery Side) for 7.5–10 HP Three Phase Motor	Per Piece	738.00
	STRAINER		
293	Strainer upto 2 HP Single Phase Motor	Per Piece	456.00
294	Strainer for 3–5 HP Three Phase Motor	Per Piece	578.00
295	Strainer for 7.5–10 HP Three Phase Motor	Per Piece	578.00
	Thrust Bearing		
296	Thrust Bearing upto 2 HP Single Phase Motor	Per Piece	2500.00
297	Thrust Bearing for 3–5 HP Three Phase Motor	Per Piece	2500.00
298	Thrust Bearing for 7.5–10 HP Three Phase Motor	Per Piece	2500.00
	Thrust Pad		
299	Thrust Pad upto 2 HP Single Phase Motor	Per Piece	1800.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
300	Thrust Pad for 3–5 HP Three Phase Motor	Per Piece	1800.00
301	Thrust Pad for 7.5–10 HP Three Phase Motor	Per Piece	1800.00
	Oil Seal		
302	Oil Seal upto 2 HP Single Phase Motor	Per Piece	80.00
303	Oil Seal for 3–5 HP Three Phase Motor	Per Piece	120.00
304	Oil Seal for 7.5–10 HP Three Phase Motor	Per Piece	200.00
	Lower Bush		
305	Lower Bush upto 2 HP Single Phase Motor	Per Piece	532.00
306	Lower Bush for 3–5 HP Three Phase Motor	Per Piece	747.00
307	Lower Bush for 7.5–10 HP Three Phase Motor	Per Piece	962.00
	Upper Bush		
308	Upper Bush upto 2 HP Single Phase Motor	Per Piece	630.00
309	Upper Bush for 3–5 HP Three Phase Motor	Per Piece	733.00
310	Upper Bush for 7.5–10 HP Three Phase Motor	Per Piece	826.00
	Leathe		
311	Leathe upto 2 HP Single Phase Motor	Per Piece	436.00
312	Leathe for 3–5 HP Three Phase Motor	Per Piece	513.00
313	Leathe for 7.5–10 HP Three Phase Motor	Per Piece	564.00
	Mechanical Seal		
314	Mechanical Seal upto 2 HP Single Phase Motor	Per Piece	366.00
315	Mechanical Seal for 3–5 HP Three Phase Motor	Per Piece	564.00
316	Mechanical Seal for 7.5–10 HP Three Phase Motor	Per Piece	794.00
	Replacement of Rotor Assembly		
317	2 HP OPEN WELL SUBMERSIBLE/CENTRIFUGAL PUMPSET Single Phase 30 m Head	Each	6745.00
318	3 HP OPEN WELL SUBMERSIBLE/CENTRIFUGAL PUMPSET Three Phase 30 m Head	Each	8488.00
319	5 HP OPEN WELL SUBMERSIBLE/CENTRIFUGAL PUMPSET Three Phase 30 m Head	Each	9403.00
320	7.5 HP OPEN WELL SUBMERSIBLE/CENTRIFUGAL PUMPSET Three Phase 30 m Head	Each	11420.00
321	10 HP OPEN WELL SUBMERSIBLE/CENTRIFUGAL PUMPSET Three Phase 30 m Head	Each	15944.00
	Replacement of Stator Assembly		
322	2 HP OPEN WELL SUBMERSIBLE/CENTRIFUGAL PUMPSET Single Phase 30 m Head	Each	15570.00
323	3 HP OPEN WELL SUBMERSIBLE/CENTRIFUGAL PUMPSET Three Phase 30 m Head	Each	19346.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
324	5 HP OPEN WELL SUBMERSIBLE/CENTRIFUGAL PUMPSET Three Phase 30 m Head	Each	22935.00
325	7.5 HP OPEN WELL SUBMERSIBLE/CENTRIFUGAL PUMPSET Three Phase 30 m Head	Each	33053.00
326	10 HP OPEN WELL SUBMERSIBLE/CENTRIFUGAL PUMPSET Three Phase 30 m Head	Each	34342.00
	Components of Electrical Starter		
	Contactors and Contactor Parts		
327	2 Pole Contactor for single phase upto 2 HP Motor	Each	1666.00
328	4 Pole Contactor for three phase 3 HP to 10 HP DOL Starter(20 Amp)	Each	3295.00
329	4 Pole Contactor for three phase 7.5 HP to 10 HP Star Delta Starter(20 Amp)	Each	3376.00
	Housing		
330	Housing 2Pole	Each	869.00
331	Housing 4Pole	Each	974.00
	Carrier Assembly		
332	Carrier Assembly 2P	Each	92.00
333	Carrier Assembly 4P	Each	113.00
	Contactors Coil		
334	2 Pole Contactor Coil	Each	759.00
335	4 Pole Contactor Coil	Each	764.00
	Single Fixed Contact		
336	2 Pole Single Fixed Contact(20 A)	Each	914.00
337	4 Pole Single Fixed Contact(20 A)	Each	2307.00
	Single Moving Contact		
338	2 Pole Single Moving Contact(20 A)	Each	179.00
339	4 Pole Single Moving Contact(20 A)	Each	179.00
	Contact Kit		
340	Contact Kit 2Pole Contactor(20 A)	Each	810.00
341	Contact Kit 4Pole Contactor(20 A)	Each	1037.00
	THERMAL OVERLOAD RELAY		
342	2 Pole Thermal Overload Relay for single phase upto 2 HP Starter for 20 A range	Each	1250.00
343	3 Pole Thermal Overload Relay for 4 Pole three phase from 3 HP to 10 HP Starter for 20 A range	Each	2090.00
344	NO Switch for single Phase upto 2 HP Starter	Each	174.00
345	ON/OFF Push Button Assembly for single Phase upto 2 HP Starter	Each	381.00
346	Start (Green)/ Stop(Red) Button Switch for single and three phase starter upto 10 HP	Each	718.00

SL NO	Item description	Unit	Recommended base rate (in Rs.)
347	Motor On (Green)/ Off (Yellow) Indicating Light for single and three phase starter upto 10 HP	Each	718.00
348	Single Phase Preventor for 3 phase starter	Each	3605.00
349	Combined Voltmeter and Ammeter for single and three phase starter upto 10 HP	Each	1540.00
350	Terminal Block 3 way for 3 phase starter	Each	256.00
351	Terminal Block 6 way for 3 phase starter	Each	494.00
352	Terminal Block 2 way SPSS for single phase starter upto 2 HP	Each	118.00
353	Terminal Block 5 way for single phase starter upto 2 HP	Each	244.00
354	RYB Voltage Selector Switch for 3 phase starter	Each	402.00
355	Timer Relay for 3 phase Star Delta starter upto 10 HP	Each	3195.00
356	Front Add On Auxillary Contact Block for single phase starter upto 2 HP	Each	1275.00
360	Front Add On Auxillary Contact Block for three phase starter upto 10 HP	Each	1585.00
361	Mini Rocker Switch - SPP By Pass for three phase starter upto 10 HP	Each	350.00
362	Copper Strip	Per Kg	103.00
363	Panel Screw	Each	103.00
364	Start Capacitor	Each	431.00

Abstract of Base Rate of 164 items

Sl. No.	Item Description	Quantity	Units	RECOMMENDED BASE RATE (In Rs.)
	Engagement of Highly Skilled Labourers :			
1	Head Carpenter	1	Per day	897.00
2	Head Mason	1	Per day	897.00
3	Head welder	1	Per day	897.00
	Engagement of Skilled Labourers :			
4	Carpenter	1	Per day	816.00
5	Mason	1	Per day	816.00
6	Plumber	1	Per day	973.00
7	Painter	1	Per day	816.00
8	Electrician	1	Per day	973.00
9	Technician	1	Per day	973.00
	Engagement of Un-skilled Labourers :			
10	Welder	1	Per day	239.20
11	Plumber	1	Per day	239.20
12	Polisher (Furniture)	1	Per day	239.20
13	Painter	1	Per day	239.20
	Engagement of Other Labourers :			
14	Skilled Labourers	1	Per day	450.00
15	Semi Skilled Labourer	1	Per day	280.00
16	Ordinary Labourer	1	Per day	240.00
	Supplying of ISI marked HDPE pipes (High Density Polyethylene Pipes-PE 100) confirming to IS 4984/2016 (with up to date amendment) :			
17	140 mm dia PN 6	1	Metre	524.64
18	125 mm dia PN 6	1	Metre	428.54
19	110 mm dia PN 6	1	Metre	334.81
20	90 mm dia PN 6	1	Metre	221.74
21	75 mm dia PN 6	1	Metre	155.48

Sl. No.	Item Description	Quantity	Units	RECOMMENDED BASE RATE (In Rs.)
22	63 mm dia PN 6	1	Metre	108.68
23	140 mm dia PN 10	1	Metre	798.85
24	125 mm dia PN 10	1	Metre	637.67
25	110 mm dia PN 10	1	Metre	494.41
26	90 mm dia PN 10	1	Metre	333.77
27	75 mm dia PN 10	1	Metre	233.66
28	63 mm dia PN 10	1	Metre	164.80
	DI Pipe (Class K-7) conforming to IS-8329 2004 (with up to date amendment) :			
29	80 mm dia	1	Metre	1150.00
30	100 mm dia	1	Metre	1216.00
31	125 mm dia	1	Metre	1386.00
32	150 mm dia	1	Metre	1600.00
33	200 mm dia	1	Metre	1996.00
34	250 mm dia	1	Metre	2700.00
35	300 mm dia	1	Metre	3412.00
36	350 mm dia	1	Metre	3800.00
37	400 mm dia	1	Metre	4565.00
38	450 mm dia	1	Metre	5295.00
39	500 mm dia	1	Metre	6130.00
40	600 mm dia	1	Metre	8097.00
41	700 mm dia	1	Metre	10500.00
42	750 mm dia	1	Metre	12497.00

Sl. No.	Item Description	Quantity	Units	RECOMMENDED BASE RATE (In Rs.)
43	800 mm dia	1	Metre	14170.00
44	900 mm dia	1	Metre	16700.00
45	1000 mm dia	1	Metre	19875.00
46	DI Pipe (Class K-9) conforming to IS-8329 2004 (with up to date amendment) : 80 mm dia	1	Metre	1190.00
47	125 mm dia	1	Metre	1541.00
48	DI Pipe (Medium Class) Fittings/Specials conforming to IS-9523 2000 (with up to date amendment) : Ductile Iron Socket/ Spigot Pipes Class-K7 As per IS:8329/2000 : 750 mm	1	Metre	11528.00
49	Ductile Iron Socket/ Spigot Pipes Class-K9 As per IS:8329/2000 : 100 mm	1	Metre	1373.10
50	150 mm	1	Metre	2026.30
51	200 mm	1	Metre	2749.65
52	250 mm	1	Metre	3684.60
53	300 mm	1	Metre	4658.65
54	350 mm	1	Metre	4429.00
55	400 mm	1	Metre	5213.00
56	450 mm	1	Metre	6200.00
57	500 mm	1	Metre	7173.00
58	600 mm	1	Metre	9400.00
59	700 mm	1	Metre	11773.00

Sl. No.	Item Description	Quantity	Units	RECOMMENDED BASE RATE (In Rs.)
60	750 mm	1	Metre	13642.00
61	800 mm	1	Metre	15100.00
62	900 mm	1	Metre	17838.00
63	1000 mm	1	Metre	21172.00
	Ductile Iron Sockets as per IS : 9523/2000 :			
64	100 mm - 200 mm	1	Per Kg	128.80
65	250 mm - 300 mm	1	Per Kg	190.00
66	350 mm - 450 mm	1	Per Kg	190.00
67	500 mm - 600 mm	1	Per Kg	197.00
68	700 mm - 750 mm	1	Per Kg	201.25
69	800 mm	1	Per Kg	201.25
70	900 mm	1	Per Kg	212.75
71	1000 mm	1	Per Kg	231.15
	Ductile Iron Flange as per IS : 9523/2000 :			
72	100 mm - 200 mm	1	Per Kg	134.55
73	250 mm - 300 mm	1	Per Kg	171.00
74	350 mm - 450 mm	1	Per Kg	178.00
75	500 mm - 600 mm	1	Per Kg	185.00
76	700 mm - 750 mm	1	Per Kg	205.00
77	800 mm	1	Per Kg	212.75
78	900 mm	1	Per Kg	231.15
79	1000 mm	1	Per Kg	231.15

Sl. No.	Item Description	Quantity	Units	RECOMMENDED BASE RATE (In Rs.)
	DI DOUBLE SOCKET BRANCH FLANGE TEE :			
80	Up to 500 x 500 mm	1	Per Kg	200.00
81	Above 500 x 500 mm	1	Per Kg	165.69
	DI ALL SOCKET TEE :			
82	Up to 500 mm	1	Per Kg	197.50
83	Above 500 mm	1	Per Kg	165.69
	DI DOUBLE SOCKET TAPER (REDUCER) :			
84	Up to 500 x 450 mm	1	Per Kg	200.00
85	Above 500 x 450 mm	1	Per Kg	165.69
	DI FLANGED SPIGOT :			
86	Up to 500 mm	1	Per Kg	193.00
87	Above 500 mm	1	Per Kg	165.69
	DI DOUBLE SOCKET DUCK FOOT BEND :			
88	Up to 300 mm	1	Per Kg	206.50
89	Above 300 mm	1	Per Kg	206.50
	DI DOUBLE FLANGE DUCK FOOT BEND :			
90	Up to 300 mm	1	Per Kg	203.50
91	Above 300 mm	1	Per Kg	207.00
	DI ALL SOCKET CROSS :			
92	Up to 300 x 300 mm	1	Per Kg	196.50
93	Above 300 x 300 mm	1	Per Kg	165.69
	DI ALL FLANGE CROSS :			
94	Up to 300 x 300 mm	1	Per Kg	193.00
95	Above 300 x 300 mm	1	Per Kg	165.69

Sl. No.	Item Description	Quantity	Units	RECOMMENDED BASE RATE (In Rs.)
	DI DOUBLE FLANGE REDUCER :			
96	Up to 500 x 450 mm	1	Per Kg	193.00
97	Above 500 x 450 mm	1	Per Kg	165.69
	DI BLANK FLANGE :			
98	Up to 500 mm	1	Per Kg	193.00
99	Above 500 mm	1	Per Kg	208.00
	DI MECHANICAL JOINT :			
100	Up to 300 mm	1	Per Kg	203.50
101	Above 300 mm	1	Per Kg	207.00
	DI DOUBLE SOCKET BEND :			
102	Up to 500 mm	1	Per Kg	198.50
103	Above 500 mm	1	Per Kg	216.50
	DI DOUBLE FLANGE BEND :			
104	Up to 500 mm	1	Per Kg	193.00
105	Above 500 mm	1	Per Kg	208.00
106	Gunmetal Bib Cock (15 mm)	1	Each	215.05
107	Gunmetal Bib Cock (20 mm)	1	Each	240.35
	PVC Rubber Lubricant :			
108	100 gm Container	1	Each	73.60
109	250 gm Container	1	Each	152.95
110	500 gm Container	1	Each	246.10
	Rubber Insertion Sheet :			
111	3 mm thick	1	Kg	118.45
112	6 mm thick	1	Kg	118.45
113	M-Seal	1	Kg	446.20
114	Pig Lead : Pig Lead 99.99% pure	1	Kg	401.35

Sl. No.	Item Description	Quantity	Units	RECOMMENDED BASE RATE (In Rs.)
115	Lead Wool : Lead Wool Best Quality	1	Kg	211.60
116	Spun Yarn : Spun Yarn Best Quality	1	Kg	161.00
117	Jute Yarn	1	Kg	74.75
118	Teflon Tape : Teflon Tape (12m long, 12mm width)	1	Each	46.00
119	Steel Wire Rope : 16 mm dia	1	Metre	342.70
120	Steel Wire Rope Grip Clip : For 16mm Dia	1	Each	23.00
121	Steel Wire Rope Lube (IS:2266) : Wire Rope Lube	1	Kg	155.25
122	Repairing of doser pump (inlet, suction line and dosing line), Injector, Foot Valve, Dosing Line, Controller.	1	Job	2500.00
123	Tools & Machinery : HEAVY DUTY PIPE WRENCH IS : 4003 PART-II 1986 : 200 mm long suitable for 25 mm pipe	1	Each	366.85
124	250 mm long suitable for 40 mm pipe	1	Each	476.10
125	300 mm long suitable for 50 mm pipe	1	Each	641.70
126	350 mm long suitable for 50 mm pipe	1	Each	954.50
127	450 mm long suitable for 65 mm pipe	1	Each	1661.75
128	600 mm long suitable for 75 mm pipe	1	Each	2710.00
129	900 mm long suitable for 125 mm pipe	1	Each	4427.50
130	1200 mm long suitable for 175 mm pipe	1	Each	7578.50
131	CHAIN PIPE WRENCH IS : 4123 1986 : 900 mm long suitable for 100 mm pipe	1	Each	4059.50
132	1000 mm long suitable for 150 mm pipe	1	Each	5479.75
133	1200 mm long suitable for 200 mm pipe	1	Each	7515.25
134	1300 mm long suitable for 250 mm pipe	1	Each	9257.50

Sl. No.	Item Description	Quantity	Units	RECOMMENDED BASE RATE (In Rs.)
135	1400 mm long suitable for 300 mm pipe	1	Each	11793.25
136	1585 mm long suitable for 324 mm pipe	1	Each	14605.00
137	ADJUSTABLE SPANNERS IS: 6149-1984 : 110 mm long	1	Each	195.50
138	155 mm long	1	Each	230.50
139	205 mm long	1	Each	241.50
140	255 mm long	1	Each	322.00
141	305 mm long	1	Each	442.75
142	380 mm long	1	Each	902.75
143	445 mm long	1	Each	2317.25
144	606 mm long	1	Each	3772.00
145	780 mm long	1	Each	14566.50
146	Hiring of Machineries : Electro Fusion PipeMachine for HDPE	1	Per Day	1000.00
147	Butt Fusion Welding Machine	1	Per Day	1000.00
148	Gas Welding Machine	1	Per Day	2500.00

Sl. No.	Item Description	Quantity	Units	RECOMMENDED BASE RATE (In Rs.)
149	Electric Welding Machine	1	Per Day	1000.00
150	Civil Works & Materials : Jati Bamboo	1	Each	80.50
151	Bhaluka Bamboo	1	Each	126.50
152	Cotton waste	1	kg	70.00
153	Coconut Rope	1	kg	125.00
154	Plastic rope	1	kg	172.50
155	Jute Rope	1	kg	200.00
156	Spun yarn	1	kg	80.50
157	Cotton rope	1	kg	586.50
158	Coarse sand	1	m3	1475.00
159	Fine sand	1	m3	1265.00
160	Coarse Aggregate	1	m3	1725.00
161	Pea gravel	1	m3	2300.00
162	Broken bricks	1	m3	2760.00
163	Pine / 2nd class wood (25mm thick)	1	m3	18752.00
164	Wire, nails	1	kg	86.25

Abstract of Base Rate of 484 items

SL NO	Item description	Unit	RECOMMENDED BASE RATES (In Rs.)
1.0	CARRIAGE CHARGE		
	Item Name: Carriage of different materials UPTO 10 KG (including loading,unloading,stacking and applicable GST and cess)		
1.1	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 0-10 km lead	0-10 kg	900
1.2	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 11-20 km lead	0-10 kg	1200
1.3	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 21-50 km lead	0-10 kg	2500
1.4	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 51-100 km lead	0-10 kg	4000
	CARRIAGE OF DIFFERENT MATERIALS UPTO 11- 50 KG (including loading,unloading ,stacking and applicable GST,cess, etc)		
1.5	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 0-10 km lead	11-50 kg	1200
1.6	Carriage (including loading,unloading and stacking and applicable GST,cess, etc) for 11-20 km lead	11-50 kg	1800
1.7	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 21-50 km lead	11-50 kg	2900
1.8	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 51-100 km lead	11-50 kg	4500
	CARRIAGE OF DIFFERENT MATERIALS UPTO 51- 100 KG (including loading,unloading ,stacking and applicable GST,cess, etc)		
1.9	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 0-10 km lead	51-100 kg	2500
1.10	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 11-20 km lead	51-100 kg	3000
1.11	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 21-50 km lead	51-100 kg	3800
1.12	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 51-100 km lead	51-100 kg	5500
	CARRIAGE OF DIFFERENT MATERIALS UPTO 101- 300 KG (including loading,unloading ,stacking and applicable GST,cess, etc)		
1.13	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 0-10 km lead	101-300 kg	3000



SL NO	Item description	Unit	RECOMMENDED BASE RATES (In Rs.)
1.14	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 11-20 km lead	101-300 kg	3400
1.15	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 21-50 km lead	101-300 kg	4500
1.16	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 51-100 km lead	101-300 kg	6000
	CARRIAGE OF DIFFERENT MATERIALS UPTO 301- 500 KG (including loading,unloading ,stacking and applicable GST,cess, etc)		
1.17	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 0-10 km lead	301-500 kg	3000
1.18	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 11-20 km lead	301-500 kg	3500
1.19	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 21-50 km lead	301-500 kg	4500
1.20	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 51-100 km lead	301-500 kg	6500
	CARRIAGE OF DIFFERENT MATERIALS UPTO 501- 1000 KG (including loading,unloading ,stacking and applicable GST,cess, etc)		
1.21	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 0-10 km lead	501-1000 kg	4000
1.22	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 11-20 km lead	501-1000 kg	4500
1.23	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 21-50 km lead	501-1000 kg	5000
1.24	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 51-100 km lead	501-1000 kg	6800
	CARRIAGE OF DIFFERENT MATERIALS UPTO 1001- 2000 KG (including loading,unloading ,stacking and applicable GST,cess, etc)		
1.25	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 0-10 km lead	1001-2000 kg	4500
1.26	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 11-20 km lead	1001-2000 kg	5400
1.27	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 21-50 km lead	1001-2000 kg	7000
1.28	Carriage (including loading,unloading ,stacking and applicable GST,cess, etc) for 51-100 km lead	1001-2000 kg	9500
2.0	CAST IRON PIPE AND FITTING'S COST (EXCLUDING TRANSPORTATION BUT INCLUDING APPLICABLE GST)		

SL NO	Item description	Unit	RECOMMENDED BASE RATES (In Rs.)
	Cast Iron (CI) Pressure Pipe, conforming to IS:1536/2001 or IS:7181 or equivalent, centrifugally cast (spun) in metal moulds for water supply schemes		
2.1	CI Pipe 100 mm dia	Rm	3128
2.2	CI Pipe 150 mm dia	Rm	5060
	Cast Iron (CI) Flange for joining cast iron pipes, conforming to IS:1536/2001 or IS:7181, drilled with standard bolt holes for flanged connections		
2.3	CI Flange 100 mm dia	Each	386
2.4	CI Flange 150 mm dia	Each	617
	Cast Iron (CI) Bend (Flanged Type) suitable for use in water supply schemes		
2.5	CI Bend (Flanged Type) 100 mm dia	Each	1564
2.6	CI Bend (Flanged Type) 150 mm dia	Each	2852
	Cast Iron (CI) Tee (Flanged Type) conforming to IS:1538 (latest revision), suitable for use in water supply schemes		
2.7	CI Tee (Flanged Type) 100 mm dia	Each	2392
2.8	CI Tee (Flanged Type) 150 mm dia	Each	4324
2.9	Cast Iron (CI) Reducer 150 mm x 100 mm dia (Flanged Type) conforming to IS:1538 (latest revision), suitable for use in water supply schemes	Each	2300
2.10	Cast Iron (CI) Welding Electrodes, of 2 mm dia and 350 mm in length suitable for arc welding of cast iron materials including CI pipes, flanges, and specials, having high strength and crack resistance, conforming to IS: 4332 (Part 1 & 2) or equivalent standard	kg	2200
3.0	GI PIPES AND ACCESSORIES's COST (EXCLUDING TRANSPORTATION BUT INCLUDING APPLICABLE GST)		
	Galvanized Iron (GI) Socket, ISI marked, medium class, conforming to IS:1239 (Part II) – 2004 with up-to-date amendments		
3.1	GI Socket (50 mm dia)	Each	108
3.2	GI Socket (65 mm dia)	Each	174
3.3	GI Socket (80 mm dia)	Each	261

SL NO	Item description	Unit	RECOMMENDED BASE RATES (In Rs.)
3.4	GI Socket (100 mm dia)	Each	423
3.5	GI Socket (125 mm dia)	Each	1860
3.6	GI Socket (150 mm dia)	Each	2190
	Galvanized Iron (GI) Union Socket, medium class, screwed type, conforming to IS:1239 (Part-I) – 2004 with up-to-date amendments, for use in water supply schemes		0
3.7	GI Union Socket (50 mm dia)	Each	345
3.8	GI Union Socket (65 mm dia)	Each	541
3.9	GI Union Socket (80 mm dia)	Each	727
3.10	GI Union Socket (100 mm dia)	Each	1789
	GI Union Socket (125 mm dia)	Each	3566
3.11	GI Union Socket (150 mm dia)	Each	5583
	Galvanized Iron (GI) Threaded Flange, medium class, with threaded bore suitable for GI pipe connections as per IS:1239 (Part-I) – 2004		0
3.12	GI Threaded Flange (50 mm dia)	Each	270
3.13	GI Threaded Flange (65 mm dia)	Each	370
3.14	GI Threaded Flange (80 mm dia)	Each	391
3.15	GI Threaded Flange (100 mm dia)	Each	499
3.16	GI Threaded Flange (125 mm dia)	Each	675
3.17	GI Threaded Flange (150 mm dia)	Each	714
	Galvanized Iron (GI) Bend, medium class, 90-degree angle, screwed type, conforming to IS:1239 (Part-II) – 2004 with up-to-date amendments, suitable for GI pipes of specified diameter		0
3.18	GI Bend (50 mm dia)	Each	230

SL NO	Item description	Unit	RECOMMENDED BASE RATES (In Rs.)
3.19	GI Bend (65 mm dia)	Each	352
3.20	GI Bend (80 mm dia)	Each	525
3.21	GI Bend (100 mm dia)	Each	1095
3.22	GI Bend (125 mm dia)	Each	3100
3.23	GI Bend (150 mm dia)	Each	3275
	Galvanized Iron (GI) Elbow, 90-degree angle, medium class, screwed type, conforming to IS:1239 (Part-II) – 2004 with latest amendments, suitable for GI pipe connections of specified diameter		0
3.24	GI Elbow (50 mm dia)	Each	145
3.25	GI Elbow (65 mm dia)	Each	277
3.26	GI Elbow (80 mm dia)	Each	394
3.27	GI Elbow (100 mm dia)	Each	670
3.28	GI Elbow (125 mm dia)	Each	2231
3.29	GI Elbow (150 mm dia)	Each	2722
	Galvanized Iron (GI) Reducing Socket, medium class, screwed type, conforming to IS:1239 (Part-II) – 2004 with latest amendments, for connecting GI pipes of different diameters		0
3.30	GI Reducing Socket (65 x 50 mm dia)	Each	191
3.31	GI Reducing Socket (80 x 65 mm dia)	Each	287
3.32	GI Reducing Socket (100 x 80 mm dia)	Each	465
3.33	GI Reducing Socket (125 x 100 mm dia)	Each	2045
3.34	GI Reducing Socket (150 x 100 mm dia)	Each	2392
3.35	GI Reducing Socket (150 x 125 mm dia)	Each	2272

SL NO	Item description	Unit	RECOMMENDED BASE RATES (In Rs.)
	Galvanized Iron (GI) Reducing Tee, medium class, screwed type, conforming to IS:1239 (Part-II) – 2004 with up-to-date amendments, for branching GI pipelines of different diameters		0
3.36	GI Reducing Tee (65 x 50 mm)	Each	387
3.37	GI Reducing Tee (80 x 65 mm)	Each	566
3.38	GI Reducing Tee (100 x 80 mm)	Each	945
3.39	GI Reducing Tee (125 x 100 mm)	Each	3270
3.40	GI Reducing Tee (150 x 100 mm)	Each	3785
3.41	GI Reducing Tee (150 x 125 mm)	Each	3785
	Galvanized Iron (GI) Plug, medium class, screwed male-threaded end, conforming to IS:1239 (Part-II) – 2004 with latest amendments, used for closing pipe ends or openings in GI pipe fittings		0
3.42	GI Plug (50 mm dia)	Each	138
3.43	GI Plug (65 mm dia)	Each	177
3.44	GI Plug (80 mm dia)	Each	222
3.45	GI Plug (100 mm dia)	Each	396
3.46	GI Plug (125 mm dia)	Each	990
3.47	GI Plug (150 mm dia)	Each	966
	Galvanized Iron (GI) 3-Way Tee, ISI marked, medium class, conforming to IS:1239 (Part II) – 2004 with up-to-date amendments, suitable for branch connections in GI pipe		0
3.48	50 mm dia	Each	194
3.49	65 mm dia	Each	352
3.50	80 mm dia	Each	515