

Construction Requirements

HDPE double-wall corrugated drainage pipes are used for buried pipelines. Construction must follow standards such as "Technical Specification for Buried Polyethylene Water Supply Pipelines" (CJJ 101) and "Technical Specification for Buried Polyethylene Double-Wall Corrugated Drainage Pipes" (CJ/T 250). The core requirements revolve around pre-construction preparation, pipe laying, connection, backfilling, hydrostatic testing, and manhole connection, as detailed below:

(I) Pre-construction Preparation

1. Pipe Material Acceptance: Inspect the pipe materials for cracks, dents, or deformation; ensure the corrugations are intact and the accompanying rubber rings are undamaged and not aged. Verify that the pipe's ring stiffness and specifications meet design requirements, and obtain product certificates and test reports;
2. Site Layout: Based on the design drawings, survey and mark the pipeline centerline and manhole locations, and indicate the backfill thickness and trench bottom elevation;
3. Trench Excavation: Excavate the trench according to the design slope and width, ensuring the trench bottom is level and avoiding over-excavation. If over-excavation occurs, backfill with graded sand and gravel to the design elevation; soft soil and silt are strictly prohibited for backfilling; the trench slope should be determined based on the soil type (for silty clay, the slope is 1:0.75~1:1.0). Deep trenches (>3m) require shoring to prevent collapse;
4. Trench Bottom Treatment: Remove sharp stones and debris from the trench bottom, and lay a 100-150mm thick layer of graded sand and gravel or plain soil as a cushion layer, compacting it to a compaction degree of $\geq 95\%$ to ensure uniform base bearing capacity and prevent pipe settlement.

(II) Pipe Laying

1. Pipe Handling: Handle pipes gently, avoiding dragging or dropping to prevent damage to the corrugated surface; use soft slings for long-distance transportation, and strictly prohibit using steel wire ropes to directly bundle the pipes;
2. Laying Method: Use manual laying (for small sizes) or soft sling lifting and laying (for large sizes). During lifting, ensure even force distribution on both ends of the pipe to prevent bending and deformation;
3. Pipeline Alignment: Straight pipe sections should be straight, and curved sections can utilize the natural flexibility of the pipe. The bending radius should not be less than 200 times the nominal outer diameter of the pipe. Forced bending is strictly prohibited;
4. Pipe Bottom Contact: After laying, the pipe should be in close contact with the bedding layer, without any gaps or warping, and the horizontal deviation of the pipe body should be $\leq 0.5\%$.

(III) Pipe Connection

Pipe connection is the core link for preventing leakage. The mainstream method is rubber ring socket sealing connection (most commonly used), and some large sizes use hot-melt butt welding. The requirements are as follows:

1. Rubber Ring Socket Connection:

- o Clean the inner side of the socket and the outer side of the spigot to ensure the sealing surface is clean;
- o Uniformly fit the rubber ring into the groove of the spigot, without twisting or turning inside out. A small amount of soapy water (lubricant) can be used to assist in installation. Grease lubricants are strictly prohibited (as they will corrode the rubber ring);
- o Slowly push the spigot into the socket using a crowbar or hand hoist until the marking line on the spigot aligns with the end face of the socket, ensuring the rubber ring is fully embedded in the sealing groove. After connection, check for tightness and ensure there is no looseness.

2. Hot-Melt Butt Welding Connection:

- o Cut the pipe ends to ensure the ends are flat, perpendicular to the pipe axis, and free of burrs;
 - o Heat the pipe ends using a hot-melt butt welding machine. The heating temperature should be controlled between 200~230 °C, and the heating time should be adjusted according to the pipe specifications;
 - o After heating, quickly butt weld the pipes, applying even pressure to ensure tight fusion of the welding surfaces. Wait until it cools to room temperature before proceeding with subsequent construction. Strictly prohibit shaking the pipe during the cooling process.
3. Connection Requirements: Joints in the same pipe section should be staggered to avoid being concentrated in the same cross-section; flexible connections should be used at the connection between the pipeline and the manhole, and waterproof sealing rings should be installed to prevent leakage between the manhole and the pipeline.

(IV) Trench Backfilling

Backfilling is crucial for ensuring the pipeline's resistance to external pressure. The principle of **"sides first, then the top; layered compaction, no forceful tamping"** must be followed. Backfilling should be done after the pipe connections are completed and the joints have cooled. Specific requirements:

1. Backfill Material: Within 500mm above the pipe invert, use graded sand and gravel, fine-grained soil, silty clay, or other backfill materials without sharp debris, with a particle size $\leq 20\text{mm}$; above 500mm from the pipe top, original soil can be used for backfilling, with a particle size $\leq 100\text{mm}$; construction waste, stones, and frozen soil are strictly prohibited for backfilling;

2. Backfilling Steps:

- o First, backfill the pipe haunches (the angle between the pipe bottom and the trench wall), using

a small compactor (rammer, plate compactor) for layered compaction. The thickness of each layer should be $\leq 200\text{mm}$, and the compaction degree should be $\geq 95\%$, ensuring uniform stress on both sides of the pipe and preventing pipe displacement;

o After the haunch backfilling is completed, backfill to 500mm above the pipe top, using layered compaction. The thickness of each layer should be $\leq 300\text{mm}$, and the compaction degree should be $\geq 93\%$ ($\geq 95\%$ under municipal main roads);

o For backfilling above 500mm from the pipe top, a large roller compactor can be used. The minimum distance between the roller compactor and the pipe top should be $\geq 500\text{mm}$. Heavy machinery is strictly prohibited from directly compacting the pipe top;

3. Covering Requirements: After backfilling to the design elevation, level the ground to avoid localized water accumulation; if the pipeline is laid under a road, the road surface should be paved only after the backfill soil has settled and stabilized. (V) Water Tightness Test

Before backfilling the HDPE double-wall corrugated drainage pipes, a water tightness test must be conducted to verify the overall sealing performance of the pipeline. The test requirements are as follows:

1. Test section: Select a continuous pipe section with a length not exceeding 1000m. Both ends should be sealed with sealing plates, and the sealing plates must be treated to prevent water leakage;

2. Test head: The test head should be 2m above the top of the pipe or the elevation of the manhole opening (whichever is higher). If the pipe section is buried shallowly and the water head is less than 2m, water can be added according to the actual manhole opening elevation;

3. Test time: After filling the pipe with water, soak for 24 hours to fully wet the pipe, and then observe the water level drop;

4. Acceptance criteria: The test time is 30 minutes. There should be no leakage in the pipe section, and the water level drop should be $\leq$ the allowable leakage rate (calculated according to the pipe diameter, e.g., for DN300mm pipe, the allowable leakage rate is $\leq 0.28 \text{ m}^3 / (24\text{h} \cdot \text{km})$).

(VI) Construction of Manholes and Ancillary Facilities

1. Manholes: Concrete or plastic manholes should be used. Flexible sealing treatment should be applied at the connection with the pipeline, and waterproof rings or sealing putty should be installed to ensure no leakage at the connection; a flow channel should be made at the bottom of the manhole, and the flow channel should be smoothly connected to the inner wall of the pipe to prevent water accumulation and siltation;

2. Supports and fixings: Concrete supports should be installed at pipe diameter changes, bends, tees, valves, and other locations to prevent pipe displacement due to water flow impact;

3. Marker installation: Pipe marker posts should be installed every 50m in straight pipe sections, at bends, and next to manholes, indicating the pipe specifications, direction, and burial depth.

(VII) Special Construction Requirements

1. Soft Soil Foundation: If the trench is located in soft soil, the foundation needs to be reinforced. Methods such as replacing the soil with graded sand and gravel or laying geotextiles should be used to improve the bearing capacity of the foundation and prevent pipe settlement;

2. Winter Construction: When the ambient temperature is below 0°C, the rubber rings should be placed in a normal temperature environment in advance to prevent them from becoming brittle; during hot-melt connection, the heating time should be appropriately extended, and the cooling time should also be increased accordingly, and windproof and insulation measures should be taken;

3. Rainy Season Construction: After trench excavation, the pipes should be laid promptly, and trench drainage should be ensured to prevent rainwater from soaking the trench bottom and causing foundation softening; for pipe sections that have not been backfilled, both ends should be sealed to prevent rainwater from entering the pipe.

(VIII) Safety Construction Requirements

1. After trench excavation, warning signs and barriers should be set up, and warning lights should be hung at night to prevent personnel from falling;

2. During deep trench construction, ventilation and support should be provided to prevent collapse and the accumulation of harmful gases;

3. During lifting operations, the distance between the lifting equipment and the edge of the trench should be $\geq 1.5\text{m}$, and illegal lifting above the trench is strictly prohibited;

4. After the construction is completed, the site should be cleaned up promptly, and the ground should be restored to its original condition to avoid affecting traffic and the surrounding environment.