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National Standard of the People's Republic of China

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GB/T 50374-2018

Standard of construction and acceptance for communication conduit engineering

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Foreword

According to the requirements of Document Jian Biao [2024]NO. 41 issued by Ministry of Housing and Urban-Rural Development - “Notice on Printing the Development and Revision Plan of National Engineering Construction Standards in 2024”, China Information Technology Designing& Consulting Institute and the relevant units revised and completed this standard.

This standard is divided into 8 chapters and 7 appendices. The main technical content includes general provisions, equipment inspection, engineering surveying, earthwork engineering, formwork, reinforcement and concrete, mortar, manhole and handhole, service corridor, pipeline laying, and engineering acceptance.

During the revision process, the drafting team formulated this standard by referring to current domestic standards, collecting information on the use of engineering communication pipelines and materials, and soliciting opinions from various parties. The main revisions of this document include:

- Addition of commonly used cement No. 42.5;
- Update of physical and mechanical performance requirements for plastic pipes;
- Addition of specifications for plastic pipes;
- Addition of requirements for compaction of backfill soil in pipeline trenches;
- Update of requirements for formwork removal;
- Update of specifications for round steel and threaded steel;
- Update of cement mortar grade requirements;
- Addition of directional drilling construction requirements.

The standard printed in bold type are compulsory ones and must be enforced strictly.

This standard is managed and responsible for interpreting mandatory articles by the Ministry of Housing and Urban-Rural Development of the People's Republic of China, and is administrated on a daily basis by the Ministry of Industry and Information Technology of the People's Republic of China. The technical content is explained by China Information and Telecommunications Consultancy and Design Institute Co., Ltd.

All relevant organizations are kindly requested to sum up and accumulate your experiences in actual practices during the process of implementing this code. The relevant opinions and advice, whenever necessary, could be posted or passed on to China Information Technology Designing&Consulting Institute Co., Ltd. (Address: Building 3, Zhuyu Business Center, No. 9 Shouti South Road, Haidian District, Beijing, Postal Code: 100048) for future reference during revisions.

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1 General Provisions

1.0.1 This standard is formulated with a view to meet the needs of modern urban construction and information development, and to ensure that the material, construction, and completion acceptance indicators in the construction of communication pipelines meet the design requirements.

1.0.2 This standard is the technical basis for the construction, supervision, on-site inspection, preliminary acceptance, final acceptance, and preparation of completion documents for telecommunication duct projects.

1.0.3 This standard is applicable to the construction and acceptance of constructed, extend, and renovated telecommunication duct projects.

1.0.4 New processes and technologies that improve construction quality, reduce environmental pollution, and lower project costs shall be adopted in engineering construction.

1.0.5 For construction and final acceptance, if there is any work that does not meet the requirements, the relevant responsible unit shall be responsible for handling and repairing it until it meets the standards.

1.0.6 The construction and acceptance of communication pipelines and channels should not only comply with this standard, but also with the relevant national standards currently in effect.

2 Material Inspection

2.1 General Requirement

2.1.1 The specifications, procedures, and quality of equipment used in communication pipeline projects shall meet the requirements of the design documents and technical specifications. Before use, the construction unit shall organize on-site inspection in conjunction with the construction unit or (and) the supervision unit. Any problematic or unqualified equipment shall be dealt with promptly.

2.1.2 For equipment with factory certificates, if any problems are found during inspection, quality and technical appraisal shall be conducted before handling.

2.1.3 Equipment that has been inspected shall have inspection records.

2.1.4 After the pipeline equipment is delivered, storage, preservation, fire protection, safety, and other aspects shall meet relevant technical requirements.

2.2 Cement and Cement Products

2.2.1 The variety and grade of cement used in communication pipeline projects shall meet the design requirements. Pay attention to the production date or certificate of the cement before use. Expired or deteriorated cement shall not be used.

2.2.2 Cement of various grades shall meet the national product quality requirements. If the time from production to use of the cement exceeds three months or there are signs of deterioration, it shall be tested and appraised before use, and the use shall be determined based on the appraisal results.

2.2.3 Ordinary Portland cement with a grade of 42.5 shall be used in communication pipeline projects.

2.2.4 Cement should be protected from moisture during storage and purchased in batches, stacked separately according to the purchase date to avoid stacking.

2.2.5 The performance of cement shall meet the following requirements:

1. The initial setting time of cement shall not be earlier than 45 minutes, and the final setting time shall not be later than 600 minutes.

2. The bulk density of cement could be between 1100kg/m^3 and 1300kg/m^3 .

2.2.6 Before the production of cement prefabricated products, at least one set (three pieces) of concrete test blocks shall be made according to the type, grade, and concrete grade of cement. The specific number of sets shall be determined by the production unit according to the needs. The specifications of the concrete test blocks shall meet the requirements of Table 2.2.6.

Table 2.2.6 Specifications of Concrete Test Blocks (mm)

Maximum aggregate size for concrete	Specimen size (length x width x height)
Below 30	100 x 100 x 100
Above 30	150 x 150 x 150

2.2.7 The specifications of cement products shall be inspected one by one. Cement products of different specifications shall not be mixed and stacked.

2.2.8 The technical indicators of cement used in communication pipeline projects shall meet the relevant provisions of the national standard "General Portland Cement" GB 175.

2.3 Sand

2.3.1 Natural medium sand with an average particle size of 0.35mm to 0.5mm shall be used in communication pipeline projects.

2.3.2 The sand used in communication pipeline projects shall meet the following requirements:

1. The weight of lightweight material in the sand shall not exceed 1%.
2. The weight of sulfides and sulfates in the sand shall not exceed 0.5%.
3. The weight of clay content in the sand shall not exceed 5%.
4. The sand shall not contain debris such as leaves, grass roots, and wood chips.

2.3.3 The bulk density of the sand shall be 1300kg/m³ to 1500kg/m³ in a loose state and 1600kg/m³ to 1700kg/m³ in a compact state.

2.3.4 The technical indicators of sand used in communication pipeline projects shall meet the relevant provisions of the current national standard "Sand for construction" GB/T 14684.

2.4 Gravel

2.4.1 Artificial crushed stone or natural gravel shall be used in communication pipeline projects, and weathered stones shall not be used.

2.4.2 Continuous particle size stone with a particle size of 5mm to 32mm shall be used in communication pipeline projects. The size and particle size of stones should be matched.

2.4.3 The following requirements shall be met for the stone used in communication pipeline projects:

1. The weight of clay content in the stone shall not exceed 1.5%.
2. The weight of elongated or flaky particles shall not exceed 25%.
3. The weight of sulfides and sulfates in the stone shall not exceed 1%.
4. The stone shall not contain debris such as leaves, grass roots, and wood chips.

2.4.4 The bulk density of the stone shall be between 1350kg/m³ and 1600kg/m³.

2.4.5 The technical specifications for the stone used in communication pipeline projects shall comply with the relevant provisions of the current national standard "Pebble and crushed stone for construction" GB/T 14685.

2.5 Brick

2.5.1 For manholes in communication pipeline projects, first-class machine-made fired common bricks shall be used.

2.5.2 The following requirements shall be met for the bricks used in engineering:

1. The bricks shall have a complete shape and good water resistance. Slag bricks or silicate bricks with poor water resistance and reduced strength when exposed to water shall not be used.
2. The strength grade of the bricks used in communication pipeline projects shall comply with the provisions in Table 2.5.2.

Table 2.5.2 Strength Grades of Fired common bricks

Strength grade	Compressive strength average $\geq$ (MPa)	Coefficient of variation ≤ 0.21	Flexural strength Mpa > 0.21
		Strength standard value $\geq$ (MPa)	Minimum compressive strength value per block $\geq$ (MPa)
20	20.0	14.0	16.0
15	15.0	10.0	12.0

2.5.3 The technical specifications for the bricks used in communication pipeline projects shall comply with the relevant provisions of the current national standard "Fired common bricks" GB 5101.

2.6 Concrete Block

2.6.1 The variety and grade of concrete blocks used for bricklaying in communication pipeline projects shall meet the design requirements, and their shape shall be complete with good water resistance.

2.6.2 The specifications of the concrete blocks used shall comply with the relevant provisions of the current and industry standards "Drawing Gallery of Manhole and Handhole for Communication Conduit Engineering" YD/T 5178.

2.6.3 The technical specifications for the blocks used in communication pipelines shall comply with the relevant provisions of the current national standard "Code for design of masonry structures" GB 50003.

2.7 Water

2.7.1 Communication pipeline projects shall use tap water or clean natural water, and shall comply with the following regulations:

1. Industrial wastewater and spring water containing sulfides shall not be used.
2. The water shall not contain oil, acid, alkali, sugar, and other substances.
3. Seawater could not be used as water for reinforced concrete.

4. If the water quality is suspected during construction, samples shall be taken and sent to relevant departments for testing and confirmation before use.

2.7.2 The specific gravity of water shall be 1, and the bulk density shall be 1000kg/m^3 .

2.7.3 The technical specifications for water used in communication pipelines shall comply with the relevant provisions of the current industry standard "Standard of water for concrete" JGJ 63.

2.8 Concrete duct block

2.8.1 The quality of cement pipe blocks shall comply with the following regulations:

1. The maximum positive deviation of the nominal aperture of the pipe block shall not be greater than 0.5mm, and the negative deviation shall not be greater than 1.0mm. The pipe holes shall have no deformation.

2. The allowable deviation of the length of the pipe block is $\pm 2\text{mm}$, and the allowable deviation of the width and height is $\pm 5\text{mm}$. For multi-hole pipe blocks with three or more holes, the allowable deviation of the center position of each pipe hole is $\pm 0.5\text{mm}$.

3. The solid weight of dry-cast cement pipe blocks shall not be lower than the specified value in Table 2.8.1. The weight of concrete pipe blocks shall be greater than the specified value in Table 2.8.1 by 5%.

Table 2.8.1 Weight Table for Dry-Cast Cement Pipe Blocks

Number of holes (pcs) x aperture (mm)	Nominal	Dimensions (length x width x height) (mm)	Weight (kg/pc)
3 x 90	Three-hole pipe block	600×360×140	37
4×90	Four-hole pipe block	600×250×250	45
6×90	Six-hole pipe block	600×360×250	62

4. The unit strength of the finished surface of the pipe block shall not be less than 10.787MPa. When the pipe block is tested as a whole, the unit strength of the failure shall not be lower than 8% of the surface unit strength.

5. If there is suspicion of strength problems with cement pipe blocks, sampling tests shall be conducted. The number of samples shall be based on 3‰ of the total number of pipes used in the project (the number of distribution points), and 90% of the tested pipe blocks shall meet the standard to be qualified. If they do not meet the standard, another 3‰ could be tested, and 90% of the tested pipe blocks shall meet the standard to be qualified. If more than 10% of the tested samples do not meet the standard, the surface strength of all pipe blocks shall be treated as unqualified.

2.8.2 The surface strength of cement (including concrete) pipe blocks could be tested using a rebound instrument, and the test method shall comply with the provisions of Appendix A of this standard.

2.8.3 Cement products used in communication pipeline engineering shall be free of calcium hydroxide substances. Pipe blocks that have not undergone calcium hydroxide substance treatment shall not be used in the project.

2.8.4 The pipe body of the cement pipe block shall be intact, without missing edges or corners, and the mouth of the pipe hole shall be smooth. The inner wall of the pipe hole shall be smooth without defects such as unevenness, and its friction coefficient shall not be greater than 0.8. The length of longitudinal and transverse cracks on the surface of the pipe body shall be less than 50mm, and those greater than 50mm shall not be used as a whole. The missing edge of the pipe hole outer edge of the pipe block shall be less than 20mm. When the missing edge of the outer corner is less than 50mm, it shall be repaired as required before use.

2.9 Plastic pipes and accessories

2.9.1 Plastic pipes used in communication pipeline engineering include polyvinyl chloride (PVC-U) pipes and polyethylene (PE) pipes, and their models and sizes shall meet the design requirements.

2.9.2 The mechanical, physical, environmental, and sealing performance requirements of PVC-U pipes shall meet the following regulations:

1. The mechanical, physical, environmental, and sealing performance of PVC-U porous pipes shall meet the requirements in Table 2.9.2-1.

Table 2.9.2-1 Mechanical, physical, environmental, and sealing performance of PVC-U porous pipes

Category	Serial Number	Item Name		Technical Requirements
Mechanical Physical Properties	1	Tensile Yield Strength		$\geq 30\text{MPa}$
	2	Compressive Performance	Compressive Strength (for grid pipes)	$P = F/S; \quad P \geq 600\text{kPa}$
			Pipe Stiffness (for honeycomb pipes)	$P_s = F/(\Delta Y \cdot L); \quad P_s \geq 2000\text{kPa}$
			Flat Test (for grid pipes, honeycomb pipes)	Under vertical pressure to 75% of the section height, there shall be no rupture upon unloading.
	3	Drop hammer impact test		After testing 10 samples, at least 9 shall not break.
	4	Drop test		There shall be no damage or cracks after testing the sample.
Environmental Performance	5	Static friction coefficient		≤ 0.35
	6	Vicat softening temperature		$\geq 79^\circ\text{C}$
Sealing Performance	7	Longitudinal shrinkage rate		$\leq 5\%$
	8	Connection sealing		After pressurizing at room temperature to 50kPa for 24 hours, there shall be no leakage.

Note: P refers to compressive strength (kPa); P_s refers to pipe material stiffness (kPa); F refers to the load on the specimen (kN); s refers to the contact area of the force on the specimen (m^2); L refers to the length of the specimen (m); ΔY refers to the deformation of the specimen in the vertical direction of 5% of the cross-sectional height (m).

2. The physical and mechanical properties of PVC-U single-hole pipes shall meet the requirements in Table 2.9.2-2.

Table 2.9.2-2 Physical and mechanical properties of PVC-U single-hole pipes

Serial Number	Inspection Item	Unit	Performance Requirement
1	Drop hammer impact test	-	9/10 samples shall not break.
2	Flat test	-	When the vertical outer diameter deformation reaches 25%, immediately unload the sample, and there is no rupture.
3	Ring stiffness	KN/m^2	SN4 grade: ≥ 4 SN6.3 grade: ≥ 6.3 SN8 grade: ≥ 8 SN12.5 grade: ≥ 12.5 SN16 grade: ≥ 16
4	Recovery rate	-	$\geq 90\%$, and the sample does not rupture or delaminate.

5	Drop test	-	The sample shall have no damage or cracks.
6	Tensile yield strength	MPa	LDPE pipes: ≥ 8 HDPE pipes: ≥ 18
7	Longitudinal shrinkage rate	-	After being kept at $(150\pm 2)^{\circ}\text{C}$ for 60 minutes and cooled to room temperature, observe that the sample shall have no delamination, cracking, or foaming; the longitudinal shrinkage rate shall be $\leq 5\%$.
8	Joint sealing performance	-	No rupture or leakage in the sample
9	Vicat softening temperature	$^{\circ}\text{C}$	≥ 79
10	Static friction coefficient	-	≤ 0.35
11	Creep ratio ^a	-	≤ 4

Note: a indicates that this item shall be tested if necessary.

3. The physical and mechanical properties of PE plastic pipes shall meet the requirements in Table 2.9.2-3.

Table 2.9.2-3 Physical and mechanical properties of PE plastic pipes

No.	Inspection item	Unit	Performance requirement
1	Drop hammer impact test	-	9/10 of the samples shall not rupture
2	Flat test	-	When the outer diameter deformation in the vertical direction reaches 25%, immediately unload the load, and the sample shall not rupture
3	Ring stiffness	KN/m^2	SN6.3 grade: ≥ 6.3 SN8 grade: ≥ 8 SN12.5 grade: ≥ 12.5 SN16 grade: ≥ 16
4	Recovery rate	-	$\geq 90\%$, and the sample shall not rupture or delaminate
5	Tensile strength	MPa	≥ 30
6	Elongation at break	-	$\geq 150\%$
7	Longitudinal shrinkage rate	-	PE33/40 is tested at a temperature of $(100\pm 2)^{\circ}\text{C}$; PE50/63 and PE80/100 are tested at a temperature of $(110\pm 2)^{\circ}\text{C}$ for 60 minutes, and the longitudinal shrinkage rate shall be $\leq 3\%$.
8	Connection sealing	-	The sample shall have no cracks or leaks.
9	Static friction coefficient	-	≤ 0.35
10	Creep ratio ^a	-	≤ 4 means "less than or equal to 4" in English.

Note: a indicates that this item shall be tested if necessary.

2.9.3 Plastic pipes must not deform at the body or ends, and the inner and outer walls of the pipe holes shall be smooth and uniform in color, without bubbles, depressions, protrusions, or impurities. The cut ends shall be flat, without cracks or burrs, and perpendicular to the centerline. The bending radius of porous plastic pipes shall not be greater than 0.5%, and the bending radius of single-hole solid wall pipes in the same direction shall not be greater than 2%. The outer diameter of porous plastic pipes shall match the inner diameter of the joint sleeve and the inner diameter of the socket of the socket and spigot pipe.

2.9.4 The connecting fittings of communication plastic pipeline projects shall be complete and effective.

Depending on the different pipe types, inspections shall be carried out according to the following contents:

1. Quality and specifications of rubber rings for socket-type joints.
2. Quality and specifications of sleeves for sleeve-type joints.
3. Specifications, viscosity, and shelf life of neutral adhesive.
4. Supports and specialized straps for plastic pipe groups shall meet design requirements.

2.10 Steel, steel pipe and iron casting

2.10.1 The material, specification, and model of steel shall meet design requirements and shall not have rust peeling or severe rusting.

2.10.2 The material, specification, and model of steel pipes shall meet design requirements. The inner wall of the pipe hole shall be smooth, without scars, cracks, or burrs.

2.10.3 Various steel pipes must not deform at the body or ends, and the connecting fittings shall be complete and effective. The inner diameter of the socket of the sleeve shall match the outer diameter of the spigot.

2.10.4 The material, specifications, and anti-rust treatment of various iron components shall meet quality requirements and shall not be skewed, twisted, have flying burrs, fractures, or damage. The anti-rust treatment and galvanized layer of iron components shall be uniform, complete, with a smooth surface, and without defects such as peeling or bubbles.

2.10.5 The following regulations shall apply to manhole and handhole cover rings:

1. The specifications of manhole and handhole cover ring devices (including outer covers, inner covers, and rings) shall comply with the relevant provisions of the current industry standard "Drawing Gallery of Manhole and Handhole for Communication Conduit Engineering" YD/T 5178.

2. The manhole and handhole cover ring device shall be cast with gray iron, ductile iron, or nodular cast iron, and the tensile strength of the cast iron shall not be less than 117.68MPa. The cast iron shall be solid in texture, with a complete surface, and without defects such as flying burrs or sand holes. The anti-rust treatment of the casting shall be uniform and complete.

3. The well cover and ring shall match, and after being covered, they shall be smooth and not tilt.

4. The clearance between the outer edge of the well cover and the inner edge of the ring shall not be greater than 3mm. After the well cover and ring are covered, the edge of the well cover shall be 1mm to 3mm higher than the ring.

5. The cover shall be dense and uniform in thickness, without cracks, particle protrusions, or unevenness.
 6. The manhole and handhole cover shall have anti-theft, anti-slip, anti-fall, anti-displacement, and anti-noise facilities, and there shall be obvious usage and property rights signs on the cover.
 7. The material of the manhole and handhole cover ring device shall have a tensile strength of not less than 117.68MPa, and the surface shall be treated with anti-corrosion.
- 2.10.6 The brackets and optical (electric) cable support plates installed inside the manhole and handhole shall be made of cast steel (such as malleable iron or nodular cast iron), section steel, or other engineering materials, and shall not be made of cast iron.
- 2.10.7 The tension (cable pulling) rings and nails installed inside the manhole and handhole shall be made of $\Phi 16$ ordinary carbon steel (HRB300 grade), and all shall be treated with galvanization to prevent rust. The nails and tension (cable pulling) rings shall not have defects such as cracks, nodules, or welding.
- 2.10.8 The ponding tank should be made of cast iron and shall be treated with hot asphalt anti-corrosion treatment.
- 2.10.9 When non-standard drawings are used for manholes, the iron casting shall comply with the provisions of Article 2.10.5 to Article 2.10.8 of this standard.

3. Engineering Survey

3.0.1 The measurement of communication pipeline engineering shall be carried out according to the design documents, approved positions, coordinates, and elevations.

3.0.2 Before construction, the positions of communication pipelines and manholes shall be re-measured based on the design drawings and control stake points disclosed on site. Stake points shall be set according to construction needs, and the stake (plate) set during re-measurement shall comply with the following regulations:

1. For straight pipelines, a stake (plate) should be set every 20m~25m along the pipeline, starting from 3m~5m away from the center of the manhole. When using curved pipelines, the stakes (plates) shall be denser.
2. The stake points should be firmly set and the top shall be level with the ground. When there are permanent buildings or structures near the stake points, they could be used as reference points for positioning and shall be marked and recorded.
3. The allowable deviation for plane re-measurement shall comply with the following regulations:
 - 1) The allowable deviation for the pipeline centerline is $\pm 10\text{mm}$.
 - 2) The allowable deviation for the center position of a straight-through manhole and handhole is $\pm 100\text{mm}$.
 - 3) The allowable deviation for the center position of a manhole and handhole at a pipeline corner is $\pm 20\text{mm}$.

3.0.3 Temporary leveling points shall be set up at the construction site, and the leveling stake points for direct measurement of the pipeline and manholes shall be calibrated. The setting of temporary leveling points shall comply with the following regulations:

- 1 The temporary leveling points shall meet the accuracy requirements of construction measurement, with an allowable deviation of $\pm 5\text{mm}$.
2. The temporary leveling points shall be set up firmly and reliably, and the distance between two points shall not exceed 150m.
3. The top of the temporary leveling points and horizontal stakes (or leveling boards) shall be flat, stable, and clearly marked.
4. The temporary leveling points and horizontal stakes (or leveling boards) shall be numbered in order, and the corresponding elevations shall be measured. The depth of each point's corresponding ditch (or pit) bottom shall be calculated, marked on the leveling board, and recorded.

3.0.4 During construction, the calibration shall comply with the following regulations:

1. After completing the excavation of the ditch (or pit) and foundation treatment, the elevation of the pipeline ditch and manhole and handhole pit foundation shall be calibrated to ensure compliance with the design requirements.
2. If the horizontal stakes (or leveling boards) are found to be misplaced or lost during the construction process, they shall be calibrated and supplied in a timely manner.

3.0.5 After the excavation work is completed, for underground facilities such as pipes and lines that do not need to be moved or changed in the ditch (or pit), and for underground facilities that have been moved or changed, the elevation, width, relative position, vertical spacing, and horizontal spacing with adjacent manholes and communication pipes (channels) shall be measured and recorded, indicating their category and specifications.

3.0.6 The various elevations of communication pipes shall be based on the leveling point, with a permissible deviation of $\pm 10\text{mm}$.

4. Civil work

4.1 Trench and pit excavation

4.1.1 During the construction of communication pipes, civilized construction shall be carried out, and measures shall be taken to reduce the adverse effects of construction, such as disturbance and pollution, on the surrounding residents.

4.1.2 During the construction of communication pipes, if unstable soil or corrosive soil is encountered, the construction unit shall promptly propose it, and construction could only proceed after the relevant unit provides handling opinions.

4.1.3 When excavating for pipeline construction, if other pipelines already exist underground and are parallel or have a close vertical distance, the minimum net distance between them shall be checked according to the design requirements to ensure compliance with standards. If it is found that the standard is not met or other facilities are endangered, it shall be reported to the construction unit. Construction could not continue without the consent of the construction and property rights units.

4.1.4 If any buried objects, especially cultural relics or ancient tombs, are found during the excavation of trenches (pits), construction shall be immediately stopped, and the construction unit shall be responsible for protecting the site and contacting relevant departments. Construction could not continue in the area until the issue is properly resolved.

4.1.5 If the construction site conditions permit, the soil is solid, the groundwater level is below the bottom of the trench (pit), and the excavation depth does not exceed 3m, the slope method may be used for construction. The relationship between the slope and depth of the slope excavation shall be executed according to the requirements in Table 4.1.5 (Figure 4.1.5).

Table 4.1.5 Slope excavation table

Soil Types	H: D	
	$H \leq 2m$	$2m < H < 3m$
Clay	1:0.10	1:0.15
Sandy clay	1:0.15	1:0.25
Sandy soil	1:0.25	1:0.5
Debris, pebbles	1:0.50	1:0.75
Slag, backfill soil	1:0.75	1:1.00

Note: H is the depth; D is the width of the slope (on one side).

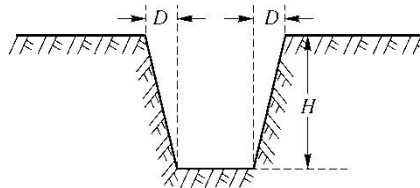


Figure 4.1.5 Slope excavation diagram

4.1.6 When the depth of pipeline trenches and manhole pits exceeds 3m, a 400mm wide soil dumping platform should be added or the slope coefficient should be increased (Figure 4.1.6).

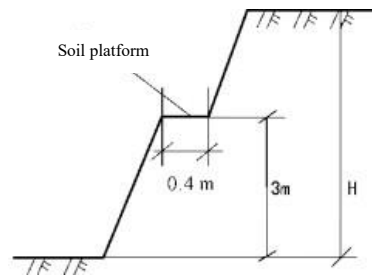


Figure 4.1.6 Backfill platform diagram

4.1.7 Excavate manhole pits that do not require support for soil protection boards, the plan shape of the pit could be basically the same as the shape of the manhole. The distance between the pit side wall and the outer wall of the manhole and handhole shall not be less than 0.4m. The slope shall be executed according to Table 4.1.5 and comply with the provisions of Article 4.1.6 of this standard.

4.1.8 It is advisable to dig rectangular pits when excavating manholes that require support for soil protection boards. The distance between the long side of the manhole and handhole pit and the outer side of the long side of the manhole and handhole wall shall not be less than 0.3m, and the width shall not be less than 0.4m.

4.1.9 After the excavation of the communication pipeline project trench is completed, if it is washed away by water, manual foundation treatment shall be carried out again before proceeding to the next construction process.

4.1.10 When the design drawings indicate the section where the soil protection board needs to be supported, construction should be carried out according to the requirements of the design documents. If there are no specific requirements in the design documents, protective soil boards shall be installed in the following sections:

1. Pipeline trenches that cross the roadway.
2. The soil in the trench includes loose backfill soil, rubble, sand, graded sand and stone layers, etc.
3. The soil in the trench is soft and its depth is lower than the groundwater level.
4. The sections that require support for soil protection boards, due to limited construction site conditions that prevent the use of slope cutting method, or the sections that are parallel to other pipelines and have a relatively small distance between them.

4.1.11 When excavating the trench to approach the designed bottom elevation, excessive excavation should be avoided to damage the soil structure. When the excavation depth exceeds the design elevation by 100mm, it shall be filled with gray soil or graded sand and stone and compacted.

4.1.12 The soil stacking on the construction site shall meet the following requirements:

1. The excavated road surface and stones shall be stacked separately from the soil.
2. The soil stacking shall not be placed directly against broken bricks or adobe walls, and pedestrian passages shall be left.
3. The height of soil stacking in urban areas should not exceed 1.5m.

4. The soil stacking shall not press down on facilities such as fire hydrants, gates, optical (electric) cable lines, inspection wells for heating, gas, rain (sewage) water pipelines, rainwater inlets, and measurement markers.

5. The foot of the soil pile shall be at least 400mm away from the edge of the trench.

6. The entire exposed surface of the soil pile shall be tightly covered.

7. The scope of soil stacking shall comply with municipal management requirements.

4.1.13 When excavating communication pipeline trenches, work shall not be carried out in the presence of stagnant water, and excavation work shall be carried out after the water has been discharged.

4.1.14 At the construction site of communication pipeline trenches, temporary lighting and red and white alternating temporary fences or conspicuous signs shall be set up for night work.

4.1.15 Effective anti-freezing measures shall be taken for the bottom of the trench when the outdoor minimum temperature is below -5°C.

4.2 Backfill soil

4.2.1 The backfill soil of communication pipeline projects shall be completed in the order of construction at the pipeline or manhole, and could only be carried out after 24 hours of maintenance and passing the concealed engineering inspection.

4.2.2 Before backfilling, debris such as leftover wood, grass curtains, and paper bags in the trench shall be removed. When there is stagnant water and sludge in the trench, it shall be removed before backfilling.

4.2.3 The backfill soil shall meet the design requirements and comply with the following regulations:

1. Fine sand or screened fine soil shall be used for backfill soil within a range of 300mm on both sides and the top of the pipeline, and no hard objects such as gravel and broken bricks with a diameter greater than 50mm shall be included.

2. Backfill soil on both sides of the pipeline shall be carried out simultaneously and compacted in layers, with a thickness of 150mm for each layer of backfill soil.

3. Backfill soil above 300mm on the top of the pipeline shall be compacted in layers, with a thickness of 300mm for each layer of backfill soil.

4. The degree of compaction of backfill soil in the pipeline trench shall comply with the relevant provisions of the current national standard "Code for construction and acceptance of water and sewerage pipeline works" GB 50268.

4.2.4 The backfill soil of the trench crossing the road shall comply with the following regulations:

1. The compacted backfill soil on the main roads in the city shall be level with the road surface.

2. The compacted backfill soil on general roads in the city shall be 50mm to 100mm higher than the road surface. For backfill soil on suburban land, it could be 150mm to 200mm higher than the ground surface.

4.2.5 The backfill soil of manhole and handhole pits shall comply with the following regulations:

1. The backfill soil of the pipeline at both ends of the manhole and handhole pit on the road shall comply with the provisions of Article 4.2.4 of this standard.

2. There shall be no hard objects such as gravel and broken bricks with a diameter greater than 100mm in the backfill soil around the manhole and handhole wall.

3. When backfilling the manhole and handhole pit by 300mm each time, it shall be compacted.

4. The backfill soil of the manhole and handhole pit shall not exceed the elevation of the manhole and handhole ring.

4.2.6 After backfilling is completed, the debris such as broken bricks and pipes on the site shall be cleaned up in a timely manner.

5. Formwork, steel bar and concrete, mortar

5.1 Assembly and disassembly formwork

5.1.1 The support formwork for concrete foundation, enclosure, lid, manhole wall, cover plate, etc. shall meet the design requirements.

5.1.2 The following regulations shall be complied with for pouring concrete formwork:

1. The strength, stiffness, and stability of all types of formwork shall meet the design requirements, without gaps and holes, and no deformation shall occur after pouring concrete.
2. The shape and specifications of the formwork shall meet the design requirements.
3. The contact surface between the formwork and concrete shall be flat, the edges shall be neat, the joints shall be tight and firm, the reserved hole positions shall be accurate, and the dimensions shall comply with the regulations.

4. The surface of the reusable formwork shall not have attached materials such as bonded concrete, cement mortar, and soil.

5.1.3 The following requirements shall be met for the removal period of the formwork:

1. Non-load-bearing side formwork could be removed only when the concrete strength could ensure that its surface and edges are not damaged by the removal of the formwork, and the removal time should be 12 hours later.
2. Load-bearing formwork could be removed only after the concrete strength meets the requirements in Table 5.1.3.

Table 5.1.3 Requirements for concrete strength during formwork removal

Component type	Component span (m)	Percentage of concrete cube compressive strength standard value achieved in design (%)
Slab	≤ 2	≥ 50
	$> 2, \leq 8$	≥ 75
	> 8	≥ 100

5.1.4 The dimensions of all parts of the formwork for pouring concrete, as well as the positions of reserved holes and embedded parts, shall be accurate, and there shall be no phenomenon of running or leaking slurry.

5.2 Reinforcement Processing

5.2.1 The variety, specifications, and models of reinforcement used in communication pipeline engineering shall meet the design requirements.

5.2.2 Reinforcement processing shall comply with the following regulations:

1. The surface of the reinforcement shall be clean, and floating skin, rust, oil stains, paint stains, etc. shall be removed from the reinforcement.

2. The reinforcement shall be cut to the specified size according to the design drawings and processed into the specified shape.

3. For round steel (HRB300) with end hooks, the length of the hook shall not be less than 5.5 times the diameter of the reinforcement, as shown in Figure 5.2.2-1.

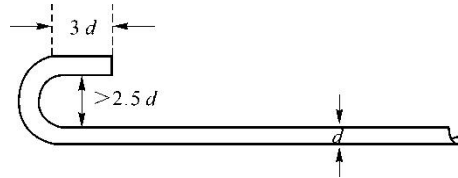
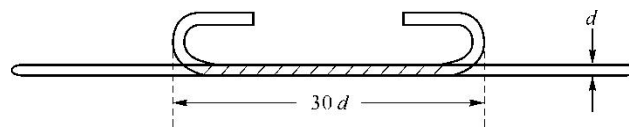


Figure 5.2.2-1 End hook diagram for reinforcement

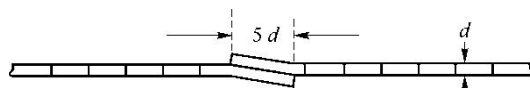
4. Ribbed steel bars shall be stretched before processing.

5. The quality of the reinforcement shall be checked during processing, and any remaining segments with cracks, defects, or other injuries shall not be used.

6. Short sections of reinforcement are allowed to be lengthened for use as distribution bars, and their connections are shown in Figure 5.2.2-2. There shall be no joints in the lid main reinforcement.



(a) Diagram of lap joint for round steel (HRB300)



(b) Welding diagram (double-sided welding) for bamboo joint (threaded) steel (HRB400)

Figure 5.2.2-2 Lap joint welding diagram for short sections of reinforcement

5.2.3 The shape and dimensions of each part of the reinforcement arrangement, as well as the positions of the main and distribution bars, shall comply with the design drawings and shall not be reversed. The error in spacing between main bars shall not exceed $\pm 5\text{mm}$, and the error in spacing between distribution bars shall not exceed $\pm 10\text{mm}$.

5.2.4 The intersection of longitudinal and transverse reinforcement shall be securely tied with iron wire of diameter 1.0mm or 1.2mm, without sliding or omission.

5.2.5 When using connected reinforcement, the connection points shall avoid the area of maximum stress and shall be staggered from each other, not concentrated on a single line. A single reinforcement shall not have more than one connection point.

5.2.6 The spacing between reinforcement and formwork should be 20mm. To maintain equal spacing between reinforcement and formwork, homemade concrete or mortar blocks could be placed under the reinforcement, but organic materials such as wood or plastic shall not be used as padding.

5.3 Concrete pouring

5.3.1 The cement, sand, aggregate, and water used in concrete preparation shall meet the relevant standards. Different types and grades of cement shall not be mixed. When the clay content in sand and aggregate exceeds the standard, they shall be washed with water and meet the requirements of sections 2.3.2 and 2.4.3 of this code.

5.3.2 The mix proportion and water-cement ratio of various grades of concrete shall be appropriate to ensure the required concrete grade. During construction, various mix proportions determined by experiments shall be used.

5.3.3 Concrete mixing shall be uniform, with consistent color as the standard. The uniformly mixed concrete shall be poured within about 45 minutes of initial setting.

5.3.4 Before pouring concrete, check whether the reinforcement padding in the formwork is secure and remove any debris inside the formwork. If segregation occurs before initial setting of the concrete, it could be remixed and poured again. When pouring concrete with a drop height of more than 3m, a funnel or inclined chute shall be used.

5.3.5 Concrete components shall be vibrated during pouring. Vibration shall be carried out layer by layer, and the compaction shall be dense, without any formwork shifting or mortar leakage.

5.3.6 After pouring concrete and initial setting, if the daily average temperature is below 5°C, watering is not allowed, and curing agent should be applied. When the daily average temperature is above 5°C, coverings such as straw curtains shall be used and water curing shall be carried out. Concrete components shall be protected from direct sunlight.

5.3.7 When pouring concrete under natural conditions with a daily average temperature of 5°C, heat storage methods shall be adopted for antifreeze, such as using hot water to mix concrete or covering exposed parts of components, or meeting design requirements.

5.3.8 After pouring concrete components that do not directly bear loads, under a daily average temperature of 15°C, curing for more than 24 hours is required before proceeding to the next process.

5.4 Cement Mortar

5.4.1 The proportion of cement mortar shall be strictly prepared according to regulations.

5.4.2 The cement mortar used for plastering joints, corners, surfaces, and pipe block joints should be sieved before use, and there should be no larger particle size crushed stones such as pebbles.

5.4.3 The curing of cement mortar could be carried out according to the provisions of Section 5.3 of this code.

6. Man (hand) hole and tunnel

6.1 General Requirement

6.1.1 Bricks and concrete blocks (hereinafter referred to as blocks) should be fully soaked before masonry construction, and the masonry surface should be flat and aesthetically pleasing, without vertical joint.

6.1.2 The filling degree of the mortar for brick masonry shall not be less than 80%, and the width of the brick joint shall be 8mm to 12mm, and the width of the same brick joint shall be consistent.

6.1.3 The horizontal joint of block masonry shall be 15mm to 20mm, and the vertical joint shall be 10mm to 15mm. The filling degree of the mortar for the horizontal joint shall not be less than 80%, and the vertical joint shall be filled tightly and firmly without any leakage.

6.1.4 The masonry shall be vertical, and the four corners of the top of the masonry shall be horizontally consistent. The shape and size of the masonry shall meet the requirements of the design drawings.

6.1.5 For the masonry that requires surface finishing according to the design requirements, the wall surface shall be cleaned. The surface shall be flat and compact, without hollowing, and the wall corners shall not be inclined. The thickness of the surface finishing and the mortar ratio shall meet the design requirements. For the jointed masonry, the joints shall be neat and uniform, without hollowing, falling off, or omission.

6.1.6 The construction specifications, dimensions, structural forms, and installation of iron casting in the passage shall all meet the design requirements.

6.2 subgrade and foundation

6.2.1 The foundation treatment of manholes and tunnels shall meet the design requirements. Natural foundations shall be compacted and leveled according to the design elevation requirements. Artificial foundation treatment shall meet the design requirements.

6.2.2 Before the foundation support formwork of manholes and tunnels, the shape, direction, and elevation of the foundation shall be checked.

6.2.3 The shape and size of the foundation of manholes and tunnels shall meet the design requirements. The deviation of its shape shall not be greater than $\pm 20\text{mm}$, and the thickness deviation shall not be greater than $\pm 10\text{mm}$.

6.2.4 The concrete grade and reinforcement of the foundation shall meet the design requirements. Before pouring concrete, debris inside the formwork shall be cleaned, and a ponding tank pit shall be excavated at the designated location according to the design requirements. The installation requirements of the foundation shall comply with the relevant provisions of the current standard "Drawing Gallery of Manhole and Handhole for Communication Conduit Engineering " YD/T 5178.

6.2.5 When the design documents have special requirements for manholes, tunnel foundations, and foundations such as increasing concrete grades, adding steel bars, waterproofing treatment, and installing grounding wires, they should be handled according to the design requirements.

6.3 Wall

6.3.1 The net height inside manholes and tunnels shall meet the design requirements. The vertical deviation of the wall shall not exceed $\pm 10\text{mm}$, and the elevation deviation of the top of the wall shall not exceed $\pm 20\text{mm}$.

6.3.2 The wall and foundation shall be tightly combined and shall not leak water. The inner and outer sides of the joint shall be coated with splay angle using a 1:2.5 cement mortar. The inner splay angle of the foundation could be omitted if the foundation has been coated. When coating the inner and outer splay angles of the wall and foundation, it shall be tight, solid, and without hollowing. The surface shall be smooth and free of defects such as missing edges, flying thorns, and fractures.

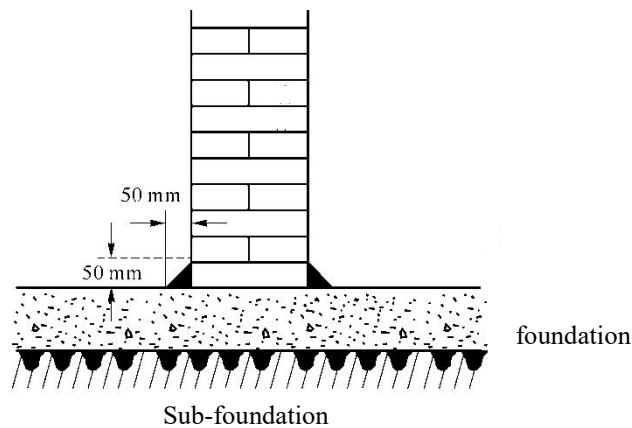


Figure 6.3.2 Coating splay angles between the foundation and the wall

6.3.3 The cement mortar grade for masonry walls shall meet the design requirements. When there are no specific requirements, cement mortar with a grade not lower than M10 shall be used for masonry, and mixed mortar containing white ash shall not be used.

6.3.4 The embedded parts in the walls of manholes and tunnels shall meet the following requirements:

1. The embedded cable support nails shall meet the following requirements:

1) The specifications and positions of the nails shall meet the design requirements, and the nails shall be perpendicular to the wall.

2) The upper and lower nails shall be on the same vertical line, and the vertical deviation shall not exceed $\pm 5\text{mm}$, and the spacing deviation shall not exceed $\pm 10\text{mm}$.

3) The spacing between adjacent nail groups shall meet the design requirements, and the deviation shall be less than $\pm 20\text{mm}$.

4) The length of the nail exposed from the wall shall be between 50mm and 70mm. The exposed part shall not have any mortar or other attachments, and the nail nuts shall be complete and effective.

5) The nails shall be firmly installed.

2. The embedded parts for tension (pulling) rings shall meet the following requirements:

1) The installation position of the tension (pulling) ring should meet the design requirements and shall be at least 200mm away from the bottom of the opposite pipeline.

2) The part of the tension (pulling) ring exposed from the wall shall be between 80mm and 100mm.

3) The tension (pulling) ring shall be firmly installed.

6.3.5 The window position for pipeline entering manholes (or handholes) and tunnels shall meet the design requirements, and the allowable deviation shall not exceed $\pm 10\text{mm}$. The end of the pipeline shall have a flared trumpet-shaped mouth towards the wall surface. The window inside the manhole and handhole (or handhole) and passage shall be tightly sealed and shall not be floating. The appearance shall be neat, and the surface shall be smooth and glossy. The outside of the pipeline window shall be filled tightly, without floating, and the surface shall be neat.

6.3.6 When the width of the pipeline window is greater than 600mm or when using pipe materials that are prone to deformation, a lintel or window frame shall be added outside the window according to the design requirements.

6.3.7 The waterproofing of the wall and pipeline window shall meet the design requirements.

6.4 Lid for manhole and handhole and tunnel cover plate

6.4.1 The steel bar model, processing, binding, and concrete grade of the covering and lid for manhole and handhole shall meet the design requirements.

6.4.2 The shape and elevation of the lid for manhole and handhole and trench cover shall meet the design requirements. The deviation of the shape shall not exceed $\pm 20\text{mm}$, and the maximum negative deviation of the thickness shall not exceed 5mm. The position and shape of the reserved holes shall meet the design requirements.

6.4.3 The gap between the prefabricated lid for manhole and handhole and trench cover shall be minimized, and the joint shall be tightly filled with 1:2.5 cement mortar, without hollowing, floating, and the surface shall be smooth without defects such as missing edges, burrs, and fractures. There shall be no mortar leakage on the top of the manhole and handhole or passage. Refer to Figure 6.4.3 for joint filling between the plates.

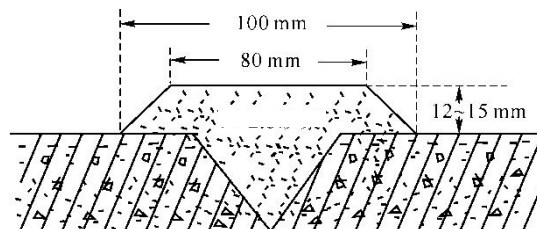


Figure 6.4.3 Section of joint filling between plates

6.4.4 The concrete of the lid for manhole and handhole and trench cover shall reach the design strength before it could bear the load or be lifted and transported.

6.4.5 The bottom surface of the lid for manhole and handhole and trench cover shall be flat, smooth, without exposed reinforcement, and without defects such as honeycombing.

6.4.6 The inner and outer sides of the lid for manhole and handhole and trench cover overlapped with the wall shall be filled with 1:2.5 cement mortar in a splayed fillet. However, if the covering and trench cover are directly poured on the wall, the corners do not need to be filled.

The splayed filling shall be tight and solid, without hollowing, and the surface shall be smooth without defects such as missing edges, burrs, and fractures. Refer to Figure 6.4.6 for the filling of the covering and trench cover corners with the wall.

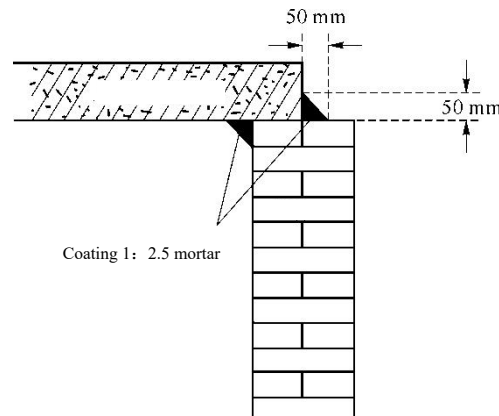


Figure 6.4.6 Lid and trench cover corners with the wall

6.5 Manhole orifice and cover

6.5.1 The elevation of the top of the manhole and handhole orifice shall meet the design requirements, and the deviation shall not be greater than $\pm 20\text{mm}$.

6.5.2 The concrete, curbstone and asphalt concrete that stabilize the manhole orifice shall meet the design requirements, and the surface outside the edge of the manhole orifice shall be designed to drain water.

6.5.3 A cavity of no less than 200mm should be built between the manhole orifice and the lid for manhole and handhole. The manhole cavity shall form a cylindrical shape with a concentric circle reserved for the opening of the covering. The inside and outside of the cavity shall be smoothed. The junction between the cavity and the covering shall be filled with a splayed angle. The splayed angle filling shall be tight and solid, without hollowing, and the surface shall be smooth without defects such as missing edges, burrs, and fractures.

6.5.4 Lid for manhole and handhole shall be intact and installed with corresponding rings according to different occasions such as roads and sidewalks. However, it is allowed to use the same ring for sidewalks and roads.

6.5.5 Before the formal acceptance of the communication pipeline project, all devices shall be installed and complete.

7 Laying pipeline

7.1 General Requirement

7.1.1 The specifications, procedures, and pipe section combinations of the communication pipeline shall meet the design requirements.

7.1.2 For pipeline renovation and expansion projects, the original manholes and optical (electric) cables shall be properly handled.

7.1.3 The burial depth from the top of the communication pipeline to the road surface shall not be less than the requirements in Table 7.1.3. When the requirements couldnot be met, concrete envelopment or steel pipe protection shall be used.

Table 7.1.3 Minimum depth from road surface to pipe top (m)

Category	Under sidewalks/green belts	Under motor vehicle lanes	Crossing with tram tracks (measured from the bottom of the track)	Crossing with railway tracks (measured from the bottom of the track)
Plastic pipes, cement pipes	0.7	0.8	1.0	1.5
Steel pipes	0.5	0.6	0.8	1.2

Note 1: When constructing pipelines under tracks or railways, relevant departments shall be consulted.

Note 2: When the minimum burial depth of steel pipes is within the frozen range, attention shall be paid to preventing the possibility of water inflow or accumulation inside the pipes during construction.

7.1.4 The protective measures for waterproofing, corrosion prevention, and protection against strong electrical interference of the communication pipeline shall be handled according to the design requirements.

7.1.5 The specifications, sections, and concrete grades of the encasement of the communication pipeline shall meet the design requirements.

7.1.6 The position where the pipeline enters the manhole and handhole or passage shall comply with the following regulations:

1. The distance between the top of the pipe and the bottom surface of the manhole, channel cover, and trench cover should not be less than 300mm. The distance between the bottom of the pipe and the foundation surface of the manhole and channel should not be less than 400mm.

2. The relative positions (elevation) of pipelines in different directions inside the manhole and handhole should be close to each other, and the relative height difference between the pipes and the manhole and handhole should not be greater than 500mm.

7.1.7 When the groundwater level is higher than the foundation, water shall be continuously pumped out at the lower end to keep the water flow below the foundation until the pipeline connection is completed and the mortar has solidified, then the pumping could be stopped.

7.1.8 During the hot summer and cold winter construction, straw bags shall be used to cover and protect the concrete from sun exposure and freezing.

7.1.9 If the pipeline could not be connected to the manhole, the pipe hole shall be temporarily sealed tightly.

7.2 Subgrade

7.2.1 The subgrade treatment of communication pipelines shall meet the design requirements. If natural foundation is used and there is no specific instruction on how to handle it in the design, when encountering a groundwater level higher than the lowest elevation of the pipeline and manhole and handhole or encountering loose soil, corrosive soil, or miscellaneous soil layers that belong to backfill, relevant units shall be informed in a timely manner and construction could only proceed after a treatment plan is proposed.

7.2.2 After the excavation of the natural subgrade pipeline trench, it shall be compacted and leveled, and the elevation of the foundation surface shall meet the design requirements. The allowable deviation shall not be greater than $\pm 10\text{mm}$.

7.2.3 The width of the subgrade at the bottom of the communication pipeline trench shall meet the following requirements:

1. When the subgrade width of the pipeline is below 630mm, the width of the trench bottom shall be increased by 150mm on each side of the pipeline group.
2. When the subgrade width of the pipeline is above 630mm, the width of the trench bottom shall be increased by 300mm on each side of the pipeline group.
3. When there is no pipeline subgrade, the width of the trench bottom shall be increased by 200mm on each side of the pipeline group.

7.3 Foundation

7.3.1 It is recommended to use plain concrete foundation for communication pipelines. The specifications, procedures, and concrete grades of the communication pipeline foundation shall meet the design requirements. If the design requires the use of prefabricated foundation plates or reinforced sections for the pipeline foundation, they shall be handled according to the design.

7.3.2 The centerline of the communication pipeline foundation shall meet the design requirements, and the deviation on the left and right sides shall not be greater than $\pm 10\text{mm}$, and the elevation error shall not be greater than $\pm 10\text{mm}$.

7.3.3 The width of the pipeline foundation shall be widened by 50mm on each side compared to the width of the pipeline group. When the pipeline is wrapped, the width of the pipeline foundation shall be increased by the thickness of the wrapping on each side of the pipeline group. The width and thickness of the foundation wrapping shall not have negative deviation.

7.3.4 In addition to meeting the design requirements, the foundation of communication pipelines shall comply with the following regulations when encountering geological conditions that do not conform to the design:

1. Cement pipelines shall comply with the following regulations:
 - 1) For sections with hard soil, the trench bottom shall be compacted and a concrete foundation shall be made after the trench is excavated.

2) For sections with loose and unstable soil, a reinforced concrete foundation shall be made after the trench is excavated.

3) For sections with rock soil, the pipeline trench bottom shall be kept flat.

2. Plastic pipelines shall comply with the following regulations:

1) For sections with hard soil, the trench bottom shall be compacted and backfilled with 50mm of fine sand or soil after the trench is excavated.

2) For sections with relatively loose and soft soil, a concrete foundation shall be made after the trench is excavated, and backfilled with 50mm of fine sand or soil on top of the foundation.

3) For sections with loose and unstable soil, a reinforced concrete foundation shall be made after the trench is excavated, and backfilled with 50mm of fine sand or soil on top of the foundation. If necessary, the pipeline shall be wrapped with concrete envelopment.

4) For sections with rock, gravel, and frozen soil, the trench shall be backfilled with 200mm of fine sand or soil after excavation.

5) The pipeline trench bottom shall be flat, without any protruding hard objects, and the pipeline shall be tightly attached to the trench bottom.

6) When the pipeline enters a manhole or building, a reinforced concrete foundation and wrapping of no less than 2 meters in length shall be made near the manhole or building side.

7.3.5 The foundation and wrapping shall meet the following requirements:

1 The main reinforcement should use HRB300 hot-rolled smooth steel bars with a diameter of $\Phi 10\text{mm}$, and the center-to-center spacing between the bars shall be 80mm or 100mm. The steel bar specifications and arrangement in special sections shall meet the design requirements.

2 The distribution reinforcement shall use HRB300 hot-rolled smooth steel bars with a diameter of $\Phi 6\text{mm}$, and the center-to-center spacing between the bars shall be 200mm. The steel bar specifications and arrangement in special sections shall meet the design requirements.

3 The intersection of the main reinforcement and distribution reinforcement shall be securely tied with iron wire with a diameter of $\Phi 1.0\text{mm}$, and a pad shall be used to position the reinforcement at the appropriate height.

4 The thickness of the concrete foundation should be between 80mm and 100mm, and the width shall be determined based on the grouping of the pipes. The thickness of the concrete envelopment shall be between 80mm and 100mm. The thickness of the reinforced concrete foundation and envelopment shall be 100mm. In special circumstances, it shall meet the design requirements.

5 Before pouring concrete into the foundation, the configuration, tying, and padding of the reinforcement shall be checked to ensure compliance with regulations, and debris inside the foundation formwork shall be removed. The poured concrete shall be compacted and consolidated, and after initial setting, it shall be covered with straw mats or other coverings and watered for maintenance. After the maintenance period is over and the formwork is removed, the foundation shall be inspected for defects such as honeycombing, chipping, cracking, undulation, peeling, powdering, and insufficient coverage.

6 When making the foundation, the installation and removal of formwork, processing of reinforcement, pouring of concrete, and cement mortar shall comply with relevant standards and regulations.

7.3.6 The reinforcement of pipeline foundations shall meet the design requirements. When there are no specific design requirements, the reinforcement of pipeline foundations of various specifications shall comply with the provisions in Table 7.3.6, and the reinforcement method shall comply with the provisions in Figure 7.3.6.

When the communication pipeline foundation enters a building or a manhole, the length of the reinforced concrete foundation and the reinforced concrete envelopment of the plastic pipeline near the building or manhole, which are placed on the window wall, shall not be less than 100mm.

Table 7.3.6: Reinforcement table for pipeline foundation entering manhole and handhole window

Pipeline foundation width (mm)	Reinforcement diameter (mm)	Quantity	Length (mm)	Total length (m)
350	Φ6	8	310	2.48
	Φ10	4	1565	6.26
460	Φ6	8	420	3.36
	Φ10	5	1565	7.83
615	Φ6	8	590	4.72
	Φ10	7	1565	11.00
735	Φ6	8	690	5.52
	Φ10	8	1565	12.52
835	Φ6	8	800	6.4
	Φ10	9	1565	14.09
880	Φ6	8	840	6.72
	Φ10	9	1565	14.09
1140	Φ6	8	990	7.92
	Φ10	11	1565	17.16

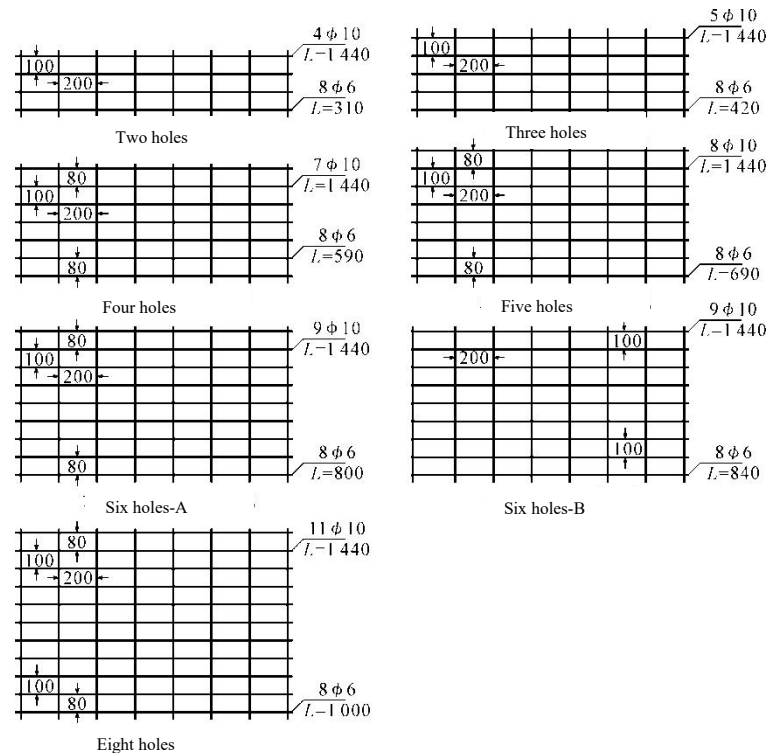


Figure 7.3.6: Reinforcement diagram for pipeline foundation entering manhole

7.3.7 Before pouring concrete into the foundation, the position of the added reinforcement sections shall be checked to ensure compliance with design requirements, and the tying and padding of the reinforcement shall comply with relevant standards. Any weeds or debris inside the foundation formwork shall be removed.

The poured concrete shall be compacted and consolidated, and covered with straw mats or other materials and watered for curing after initial setting. After removing the foundation formwork, there shall be no honeycomb, edge collapse, fracture, or insufficient trimming on the foundation side.

7.3.8. The concrete for communication pipeline foundation shall be compacted and consolidated, with a smooth surface and no fractures, waves, obvious joints, or insufficient trimming. The concrete surface shall not peel or powder.

7.4 Concret duct installation

7.4.1 Before laying the cement pipeline, the material, specifications, and process of the pipes and fittings shall be checked. The combination of the cross-section shall meet the design requirements.

7.4.2 For pipeline renovation and expansion projects, no expansion holes shall be added on both sides of the existing pipeline. In special cases where a hole needs to be expanded on one side of the existing pipeline, proper treatment shall be given to the existing manholes and existing optical (electric) cables.

7.4.3 The laying of cement pipes shall comply with the following regulations:

1. The combination of the cross-section of the pipe group shall meet the design requirements.

2. The longitudinal gap between cement pipe blocks shall not be greater than 5mm. The gap between the upper and lower layers of pipe blocks and between the pipe blocks and the foundation shall be 15mm, with a permissible deviation of no more than $\pm 5\text{mm}$.

3. The joints of the two layers of pipes and the two rows of pipes in the pipe group shall be staggered. The joints of the cement pipe blocks should be staggered by half of the pipe length, whether between rows or between layers, as shown in Figures 7.4.2-1 and 7.4.2-2.

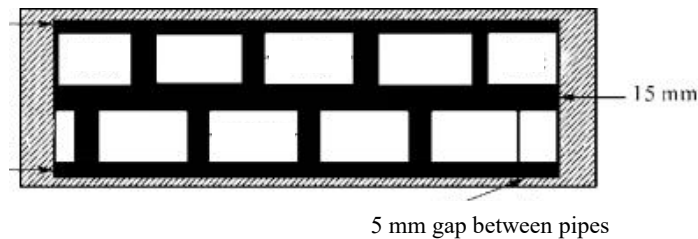


Figure 7.4.2-1: Staggered joints of two rows of pipe blocks

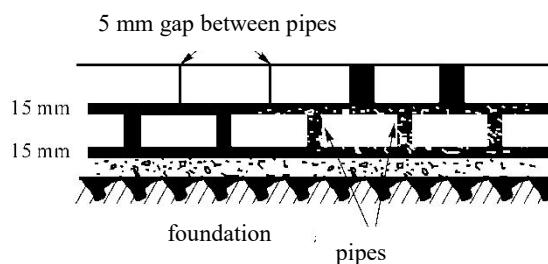


Figure 7.4.2-2: Staggered joints of two layers of pipe blocks

4. When the cement pipeline enters the manhole window, a complete cement pipe shall be used.

5. Cement pipes with bent pipes and pipes with special technical requirements in design shall have joint seams and cushion layers that meet the design requirements.

7.4.4 When laying cement pipes, two pull rods shall be used to test the diagonal pipe holes of each pipe block through the pipe holes. The outer diameter of the pull rod shall be 95% of the nominal aperture of the pipe hole. The length of the pull rod for straight pipes should be 1200mm~1500mm, and the length of the pull rod for bent pipes with a curvature radius greater than 36m should be 900mm~1200mm.

7.4.5 The grade of the mortar used for the bottom cushion layer of the cement pipeline shall meet the design requirements. The mortar shall be filled to no less than 95% of its capacity without any hollows, and stones or other materials shall not be used to pad the edges or corners of the pipe blocks. The cement pipe blocks shall be laid flat on the cement mortar cushion layer.

The vertical joints between two rows of pipe blocks shall be filled with cement mortar, and the grade of the mortar shall meet the design requirements. The filling shall be no less than 75% of its capacity.

The top joint, edge joint, and bottom eight-character joint of the pipe shall be coated with 1:2.5 cement mortar. The cement mortar used for laying or filling the joints between the pipes shall not be used for coating and

blocking. The bonding of the cement mortar shall be firm, flat, and smooth, without any hollows, missing edges, or fractures. The coating of the top joint, edge joint, and bottom eight-character joint is shown in Figure 7.4.5.

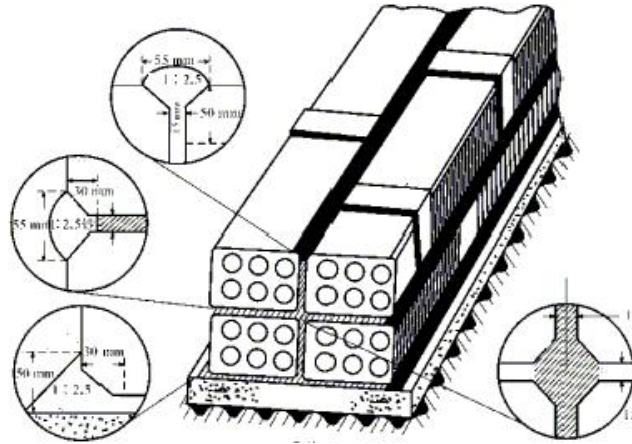


Figure 7.4.5: Diagram of the top joint, edge joint, and bottom eight-character joint

7.4.6 The cement pipe blocks should be joined using the grouting method. When using the grouting method to join the pipe blocks, the cloth lining shall not be exposed outside the mortar. The cement mortar shall be firmly bonded to the pipe body, with a solid texture and a smooth surface, and there shall be no hollows, protrusions, missing edges, fractures, or other phenomena. It shall also comply with the following regulations:

1. A cloth with a width of 80mm and a length of the circumference of the pipe block plus 80mm to 120mm shall be used at the joint of two pipe blocks. It shall be evenly wrapped around the joint of the pipe blocks, and the error shall not be greater than ± 10 mm.
2. After wrapping the joint with cloth, the cloth shall be brushed with water first until the pipe block is saturated, and then brushed with pure cement slurry.
3. After brushing the cement slurry on the joint cloth, immediately apply a 1:2.5 cement mortar.
4. The thickness of the 1:2.5 cement mortar applied on the cloth shall be 12mm to 15mm, with a width of 100mm at the bottom and 80mm at the top. The allowable deviation shall not exceed ± 5 mm (see Figure 7.4.6).

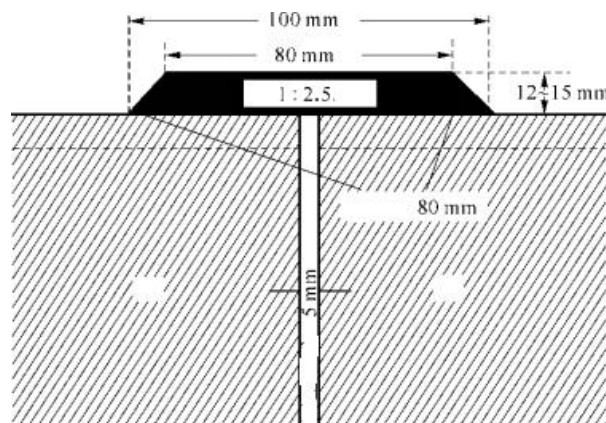


Figure 7.4.6: Diagram of jointing the pipe block

7.4.7 The position and size of various pipe inlets, manholes, and tunnels shall meet the design requirements. The distance from the top of the pipe to the cover of the lid for manhole and handhole or passage shall not be less than 300mm, and the distance from the bottom of the pipe to the top surface of the manhole and handhole or passage foundation shall not be less than 400mm.

7.4.8 When introducing pipes into manholes or passages, they shall be placed on the wall outside the pipe introduction window and should not overlap with the pipe. When the pipes enter the manhole and handhole or tunnel, they should be within a range of 200mm to 400mm below the lid for manhole and handhole or plate.

7.4.9 The curvature radius of the curved pipe shall meet the design requirements and shall not be less than 36m. The coordinates or elevations of each inflection point of the horizontal and vertical curved pipe shall meet the design requirements. The curved pipe shall be in an arc shape.

7.5 Plastic Pipe Installation

7.5.1 The installation of plastic pipes shall meet the design requirements. When there are no specific requirements in the design documents, relevant regulations in this section shall be followed.

7.5.2 The construction ambient temperature should not be lower than -5°C when laying and connecting plastic pipes.

7.5.3 The grouping of plastic pipes shall comply with the following regulations:

1. The pipe group should be arranged in a rectangular shape, with an even number of holes arranged horizontally, and shall be compatible with the cable support plate's cable capacity.
2. Pipes with larger inner diameters shall be placed at the bottom and outer sides of the pipe group, while pipes with smaller inner diameters shall be placed at the top and inner sides of the pipe group.
3. When multiple porous pipes are grouped together, it is advisable to use grid pipes, honeycomb pipes, or plum blossom pipes. The same type of porous pipe should be used in one pipe group, but it could be combined with larger aperture pipes such as corrugated single-hole pipes or cement pipes.
4. When multiple porous pipes enter a manhole, a gap of 20mm to 50mm should be left between the porous pipes, and a gap of 20mm shall be left between single-hole corrugated pipes and solid wall pipes. All gaps shall be filled in layers.
5. The pipe position between two adjacent manholes shall be consistent, and the cross-section of the pipe group shall meet the design requirements.
6. When grid pipes, corrugated pipes, and silicone core pipes are grouped together, a dedicated strap binding should be used to tie them at intervals of 3m. Honeycomb pipes or plum blossom pipes shall be arranged neatly in layers using brackets.
7. When the plastic pipe group is less than two layers, it shall be tied as a whole. When it is more than two layers, adjacent two layers shall be tied as a group before being tied as a whole.

7.5.4 The selection of pipe material shall comply with the following regulations:

1. The specifications and materials of the pipes shall comply with the current national standards and design requirements.

2. PVC-U pipes should be used in normal temperature environments, and HDPE pipes should be used in cold environments.

3. In areas with rodents and termites infestations, plastic pipes with corresponding protective capabilities should be selected.

4. HDPE pipes should be used when laying pipes using directional drilling methods.

5. Plastic pipes used in non-buried areas shall be protected against aging and mechanical damage.

7.5.5 The laying of pipelines shall comply with the following regulations:

1. The crossing angle between communication plastic pipelines and railways should not be less than 60 degrees. The distance from the crossing point to the turnout and the return line shall be greater than 3m.

Construction safety facilities shall be provided at the railway crossing.

2. The burial depth of communication plastic pipelines shall meet the requirements of 7.1.3.

3. The requirements for pipeline entry into manholes shall comply with the provisions of 7.4.7. The requirements for the entry of rising pipes into manholes shall comply with the provisions of 7.4.8.

4. In areas with permafrost, communication plastic pipelines shall be placed below the permafrost layer, and a 50mm cushion layer of fine sand or soil shall be applied on the foundation or above the foundation. In areas with permafrost and low water levels, communication plastic pipelines could be laid within the permafrost layer, and coarse sand shall be filled around the plastic pipe group, with a filling thickness of no less than 200mm.

5. The length of each section of communication plastic pipelines shall be determined by the distance between the center points of two adjacent manholes. The length of straight pipelines shall not exceed 200m, and the length of curved pipelines shall not exceed 150m.

6. The curvature radius R of curved pipelines shall not be less than 10m, and the turning angle θ of bent pipelines shall be as small as possible. There shall be no reverse bending (i.e. "S"-shaped bend) or bent pipelines with a turning angle $\theta > 90^\circ$ in the same section of pipeline. Refer to Figure 7.5.5-1 for curved pipelines.

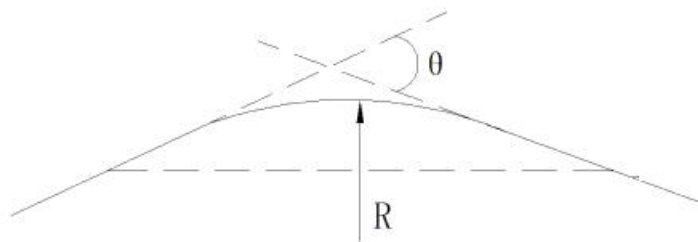


Figure 7.5.5-1: Schematic diagram of curved pipelines.

7. When straight pipelines need to avoid obstacles, local bending with a bending displacement H of no more than 500mm could be achieved using the method of wooden piles. Refer to Figure 7.5.5-2 for the wrapping and laying of curved pipelines ($H \leq 500\text{mm}$).

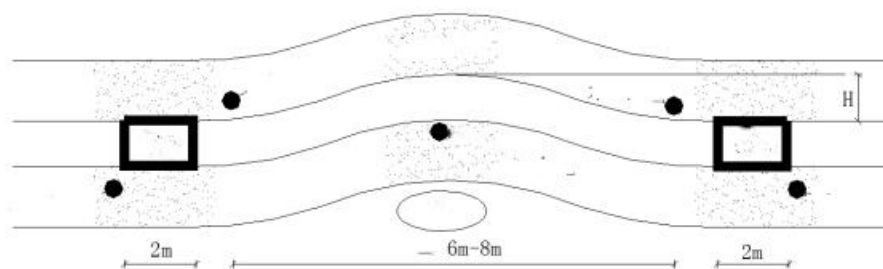


Figure 7.5.5-2: Schematic diagram of wrapping and laying of curved pipelines ($H \leq 500\text{mm}$)

The joints of curved pipelines shall be arranged as much as possible within the straight sections. If it could not be avoided, the joints of the curved section shall be locally wrapped, and the length of the wrapping should not be less than 500mm, with a thickness of 80mm to 100mm. Plastic pipes shall not be heated and bent.

8. When pipelines enter manholes (or handholes), the pipe opening shall not protrude into the inner wall of the manhole and handhole (or handhole). It shall terminate 100mm away from the inner wall and the pipe opening entering the manhole and handhole (or handhole) shall be tightly sealed and made into a trumpet shape. When the pipeline foundation enters the manhole and handhole (or handhole), the overlap length on the wall shall not be less than 140mm.

9. Plastic pipes shall be manually placed in the trench and shall not be rolled into the trench or suspended by ropes through holes.

10. Sections that are not suitable for excavation should be excavated using pipe jacking, horizontal directional drilling, or other non excavation methods.

7.5.6. The connections of plastic pipes shall comply with the following regulations:

1. Sleeve-type connection, socket-type connection, socket-type elastic sealing ring connection, and mechanical compression pipe fitting connection are recommended for connecting plastic pipes. The length of the socket-type pipe joint shall not be less than 200mm.

2. The marking surface of the plastic pipe shall face upwards.

3. The inner and outer walls of the socket of the porous plastic pipe should be uniformly coated with a specialized neutral adhesive with a minimum viscosity of $500\text{mPa}\cdot\text{s}$. The plastic pipe should be inserted to the bottom and secured by compression.

4. The interfaces of each plastic pipe should be arranged in a staggered manner, and the distance between the joints of adjacent pipes shall not be less than 300mm. Reinforcement measures shall be taken for the joints of the curved parts of the bent pipeline.

5. The cutting of plastic pipes shall use different specifications of cutting tools according to the size of the pipe diameter. The cut section of the pipe shall be perpendicular to the center of the pipe, and the cut section shall be straight and without burrs.

6. Socket-type elastic sealing ring connection is recommended for the joint of single-hole corrugated plastic pipes.

7.6. Steel Pipe Installation

7.6.1. The installation method and cross-sectional combination of the steel pipe communication pipeline shall comply with the design requirements. Sleeve welding shall be used for the connection of steel pipes, and the following regulations shall be followed:

1. The steel pipe joints shall be staggered.
2. The length of the steel pipe sleeve shall not be less than 300mm, and the sleeve shall be treated with anti-corrosion.
3. Two steel pipes shall be inserted into the sleeve for more than one-third of the length of the sleeve respectively. The pipe ends shall be filed into a slope.
4. When using a seamed pipe, the seam shall be placed on the top.
5. Before connecting the steel pipes, the pipe ends shall be rounded or filed into a slope, and the pipe ends shall be smooth, without edges or flying burrs.

7.6.2. When various steel pipes are introduced into manholes or channels, the pipe ends shall not protrude from the wall surface, but shall terminate 30mm to 50mm inside the wall and be tightly sealed with a flared opening.

8. Acceptance

8.1. Acceptance during construction

8.1.1. The on-site inspection of pipeline equipment shall include the following contents:

1. Cement pipes, plastic pipes, specifications, models, and other materials shall meet the regulations.
2. Plastic pipe joints shall fit tightly with the pipes.
3. The minimum viscosity of the adhesive for plastic pipe joints shall meet the regulations.
4. The bundling straps for porous plastic pipes and pipeline supports shall meet the quality requirements.
5. Concrete, lid for manhole and handhole, bricks, steel bars, manhole and handhole orifices, supports, pull rings, etc. shall all meet the standards.

8.1.2. The on-site inspection of pipeline foundations shall include the following contents:

1. The bottom of the trench shall be compacted and leveled.
2. The centerline of the pipeline trench and manholes shall meet the design requirements.
3. The elevation and slope of the foundation shall meet the design requirements.

8.1.3. The on-site inspection of pipeline foundations shall include the following contents:

1. The foundation position, elevation, and specifications shall meet the design requirements.
2. The concrete grade and quality of the foundation shall meet the design requirements.
3. The reinforcement treatment for sections with special design requirements and access holes shall meet the design requirements.
4. The handling of obstacles shall meet the design requirements.

8.1.4. The on-site inspection of pipeline laying shall include the following contents:

1. The pipeline position, cross-section combination, and elevation shall meet the design requirements.
2. The treatment of frozen layers and the coarse sand filled around plastic pipes shall meet the design requirements.
3. The protective measures taken for shallow buried plastic pipes shall meet the design requirements.
4. The backfill soil shall be of guaranteed quality and compacted in layers, and no debris shall be backfilled.
5. The quality of the filling between pipes and the bottom cushion layer shall meet the regulations.
6. The buried warning tape, concrete slab, ordinary sintered brick, steam-cured ash sand or steam-cured fly ash sand brick shall meet the standards.
7. The quality of the top seam, edge seam, and pipe bottom eight-character shall meet the regulations.
8. The minimum net distance between the pipeline and adjacent pipelines or obstacles shall meet the design requirements.
9. The crossing angle between the pipeline and railway, tramway, and the distance from the turnout and return line shall meet the regulations.
10. The pipeline shall be inspected for special sections such as bridges, ditches, couldals, rivers, slopes, roads, and rails to meet the design requirements.
11. The quality of cement coating shall meet the regulations.

8.1.5 The on-site inspection of pipeline joints shall include the following:

1. The pipe end shall be smooth and clean.
 2. The adhesive shall be evenly applied, and the pipe and joint shall be firmly connected.
 3. The quality of each pipeline joint shall be inspected one by one.
 4. The joint positions of the pipeline should be staggered.
 5. The grid pipe, corrugated pipe, or silicone core pipe in the pipeline group shall be spaced according to regulations and bundled with a special belt. The honeycomb pipe and plum blossom pipe shall be arranged neatly with brackets.
 6. The pipe positions between different manholes shall be consistent, and the cross-section of the pipeline group shall meet the design requirements.
- 8.1.6 The on-site inspection of the buried part of the manhole and handhole passage shall include the following:
1. The quality of the masonry and the wall treatment shall meet the regulations.
 2. The quality of concrete pouring for foundations, coverings, etc. shall meet the regulations.
 3. The filling inside and outside the pipeline entrance shall meet the regulations in terms of quality and quantity.
 4. The construction of manholes shall meet the design requirements.
 5. Corresponding foundation and base shall be made according to the soil conditions around the manhole.
 6. The marking surface of plastic pipes shall face upwards.
 7. The installation of warning tape shall meet the design requirements.
- 8.1.7 The on-site inspection of waterproofing and gas prevention shall include the following:
1. The measures for waterproofing and preventing harmful gases from entering the building through pipelines shall meet the design requirements.
 2. When pipelines enter buildings, the reinforced concrete foundation and concrete encapsulation shall meet the design requirements.
 3. When pipelines enter buildings or manholes in front of the station, pipe plugs shall be installed.
 4. The protective measures at the intersection of pipelines and gas pipes shall meet the design requirements.

8.2 Preliminary acceptance

8.2.1 The preliminary acceptance shall include the following:

1. The pipeline orientation, manhole and handhole position, elevation, cross-section and length of each section of pipeline, specific position and bending radius requirements of curved pipelines annotated on the completion drawings shall be checked.
2. The accepted concealed engineering acceptance items shall be inspected, and spot checks shall be carried out if abnormalities are found.
3. Pipe hole testing shall be conducted.
4. The sealing and gap of pipe holes shall meet the regulations.
5. All devices inside the manhole and handhole shall be complete and qualified.

8.2.3 Pipe hole testing shall meet the following regulations:

1. When testing straight pipeline pipe holes, the rod-pulling method shall be used. The length of the rod should be 900mm, and the diameter of the rod shall be 95% of the inner diameter of the pipe hole.

2. When testing curved pipeline pipe holes, the curvature radius of cement pipelines shall not be less than 36m, and the curvature radius of plastic pipelines shall not be less than 10m. The rod-pulling method should be used for pipe hole testing, and the length of the rod shall be 900mm, and the diameter of the rod shall be 60% to 65% of the inner diameter of the pipe hole.

3. Each porous pipe shall test two diagonally opposite holes, and each single-hole pipe shall be fully tested.

4. All sections of the pipeline shall be fully tested and qualified. The reasons for any unqualified parts shall be identified and properly resolved before the engineering acceptance.

8.2.4 Pipe hole sealing shall meet the following regulations:

1. The pipe holes entering the building shall be equipped with plugs.

2. The pipe holes of plastic pipelines entering the manhole and handhole shall be equipped with plugs.

3. The pull-out force of the pipe hole plug shall not be less than 8N.

8.2.5 The specifications and devices of manhole and handhole shall meet the following regulations:

1. The position, specifications, quantity, and quality of various devices such as the mouth ring, manhole and handhole orifice, ponding tank, bracket, and pull ring of the manhole and handhole shall meet the design requirements.

2. The specifications, shape, and size of the manhole and handhole shall meet the design requirements.

3. The waterproof treatment of the manhole and handhole shall meet the design requirements.

4. The arrangement of the section where the pipeline enters the manhole and handhole shall match the specifications and quantity of the bracket, and the number of pipe holes per layer shall be consistent with the number of optical (electric) cables accommodated.

8.3 Final acceptance

8.3.1 The final inspection of the project shall meet the following regulations:

1. Acceptance of completion documents: The construction unit shall submit the completion documents to the construction unit or the supervision unit before the final inspection of the project.

2. Acceptance of completion management documents: The completion management documents shall include the correspondence documents, memorandums, and review summaries and approval documents of construction drawings during the implementation of the project among the design, construction, supervision, material supply, relevant government departments, and cooperative units.

3. The completion documents shall include the following contents:

1) The completion documents shall include a detailed list of the quantity of construction and installation works.

2) The project description shall include the nature and overview of the project, design stage, construction dates, major changes, new technologies and processes, soil conditions, groundwater levels, frozen layers, environmental temperatures, and other related contents.

3) The revised construction drawings during construction shall indicate the plan, section, profile of the pipeline, as well as the relative positions with other pipelines and buildings, and the latitude and longitude of manhole and handhole.

4) The commencement report shall include the start and completion dates, construction site and environment, equipment quality, and necessary conditions for supply, etc.

5) The handover report shall include self-inspection of project quality, records of pipeline hole testing and flushing, completion date, etc. After the completion of the project, the construction unit shall organize timely acceptance within 7 days.

6) The completion documents shall include design changes, quality inspection records, major issues discovered during construction, negotiation records, and decision documents.

7) The engineering quality accident report shall clarify the cause of the accident, responsible person, and remedial measures taken.

8) The notice of suspension (resumption) of work shall explain the reason for the suspension and the approval for resumption.

9) The content of the on-site acceptance record shall comply with the provisions of Section 8.1.

10) The content of the initial inspection record shall comply with the provisions of Section 8.2.

11) The final accounts of the project shall be controlled within the budgeted value, and approval documents shall be provided for any exceeding of the budget.

12) The completion documents shall include the acceptance certificate and project quality comments.

4. The completion documents shall ensure quality, with a neat appearance, complete content, accurate data, and standardized binding.

8.3.2. If any unqualified items are found during acceptance, the acceptance team shall conduct a re-inspection according to the sampling rules, identify the reasons, clarify the responsibilities, propose rectification measures, and satisfactorily resolve them before the final inspection of the project.

8.3.3. During the final inspection of the project, the main inspection items shall be listed in the project final evaluation form as an attachment to the acceptance documents. The project final evaluation form shall comply with the provisions of Table 8.3.3.

Table 8.3.3 Project Final Evaluation Form

Serial number	Inspection item	Inspection requirement	Inspection result	
			Excellent	Qualified
1	Pipeline equipment	Appendix G, No. 1		
2	Pipeline location	Appendix G, No. 2		
3	Pipeline trench	Appendix G, No. 3		
4	Pipeline connection	Appendix G, No. 4		
5	Waterproofing and gas prevention	Appendix G, No. 5		
6	manhole and handhole construction	Appendix G, No. 6		
7	Completion acceptance content	Appendix G, No. 7		
8	Pipeline flushing test	Appendix G, No. 8		
9	Pipeline sealing	Appendix G, No. 9		
10	manhole and handhole specifications	Appendix G, No. 10		
11	Verification of completion drawings	Appendix G, No. 11		
12	Inspection of concealed works	Appendix G, No. 12		
13	Pipe selection for special cases	Appendix G, No. 13		

Appendix A: Measurement of concrete strength by rebound tester

A.0.1 The strength of concrete shall be tested using a rebound instrument. The schematic diagram of testing concrete strength with a rebound instrument is shown in Figure A.0.1.

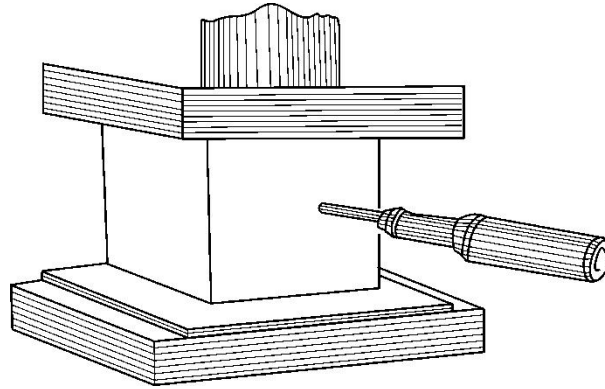


Figure A.0.1 Schematic diagram of testing concrete strength with a rebound hammer

A.0.2 The rebound instrument shall be operated according to the following regulations:

1. When in use, align the hammer head with the test object, and the instrument shall be perpendicular to the surface of the tested object. After lightly pressing and releasing the instrument, the button will bounce up and the spring rod will pop out. Then, evenly press the instrument onto the test block until the hammer inside the instrument moves rapidly, and the pointer is bounced up. The measurement personnel could read the rebound value after fixing the pointer by pressing the button.
2. Multiple non-overlapping test points shall be selected on the surface of the concrete for testing. The test value shall be the arithmetic mean of the values obtained from testing multiple points, excluding the maximum and minimum values.
3. The strength of the test block could be obtained by referring to Table A.0.2. The specific method could be found in the instrument manual.

Table A.0.2 Relationship between concrete strength and rebound value

Rebound value N	Concrete strength (Kg/cm ²)					
	Within 7 days	More than 7 days	30 days	60 days	90 days	120 days
24.0	169	152	-	-	-	-
24.5	176	159	-	-	-	-
25.0	183	166	-	-	-	-
25.5	189	173	-	-	-	-
26.0	196	180	-	-	-	-

26.5	203	187	-	-	-	-
27.0	210	195	-	-	-	-
27.5	217	202	-	-	-	-
28.0	225	210	100	-	-	-
28.5	232	218	106	-	-	-
29.0	239	225	112	-	-	-
29.5	246	233	120	-	-	-
30.0	254	241	127	104	-	-
30.5	261	249	134	110	-	-
31.0	269	257	144	116	-	-
31.5	277	265	152	124	102	-
32.0	285	274	160	130	110	-
32.5	292	282	170	138	116	-
33.0	300	291	178	146	122	102
33.5	307	299	189	154	130	108
34.0	315	307	198	164	136	114
34.5	323	315	206	172	145	121
35.0	331	324	217	182	153	128
35.5	342	333	230	192	162	136
36.0	348	342	240	202	170	144
36.5	356	350	252	210	180	152
37.0	365	360	264	221	188	160
37.5	373	368	276	232	198	170
38.0	381	377	290	244	207	179
38.5	389	386	302	254	216	186
39.0	398	395	316	267	226	196
39.5	407	404	329	278	238	204

40.0	416	413	336	290	250	216
40.5	425	422	351	294	260	226
41.0	434	432	361	318	272	236
41.5	442	441	371	332	284	246
42.0	451	450	380	346	296	258
42.5	460	459	-	360	310	270
43.0	470	469	-	-	322	282
43.5	478	478	-	-	336	294
44.0	488	488	-	-	-	308
44.5	497	497	-	-	-	320
45.0	507	507	-	-	-	-
45.5	516	516	-	-	-	-
46.0	526	526	-	-	-	-
46.5	536	536	-	-	-	-
47.0	546	546	-	-	-	-
47.5	555	555	-	-	-	-
48.0	565	565	-	-	-	-
48.5	575	575	-	-	-	-
49.0	584	584	-	-	-	-
49.5	594	594	-	-	-	-
50.0	604	604	-	-	-	-
50.5	613	613	-	-	-	-
51.0	623	623	-	-	-	-
51.5	633	633	-	-	-	-
52.0	643	643	-	-	-	-
52.5	653	653	-	-	-	-
53.0	663	663	-	-	-	-

53.5	673	673	-	-	-	-
54.0	683	683	-	-	-	-
54.5	693	693	-	-	-	-
55.0	707	703	-	-	-	-

A.0.3 The concrete component shall meet the following regulations:

1. The depth of carbonation on the surface of reinforced concrete should not exceed the depth of the reinforcement buried in the concrete. When testing the depth of carbonation on the surface of concrete, the corner part of the concrete specimen near the test surface shall be selected. A notch shall be made by tapping it with a small hammer, and then 1%-2% phenolphthalein solution shall be dropped onto the exposed concrete surface. The uncarbonated concrete immediately turns red, while the carbonated part remains unchanged. The depth of the uncolored part is the depth of carbonation of the concrete.

2. For each surface of the concrete component, 15-20 different test points shall be selected for rebound testing. The value of the rebound force R shall be the arithmetic mean of the values obtained from testing multiple points, excluding the maximum and minimum values (unit: N). The allowable error of the rebound force R value could be found in Table A.0.3:

Table A.0.3 Average rebound value

Rebound average value(N)	$15 \leq N < 25$	$25 \leq N < 35$: 25	$35 \leq N < 45$	$45 \leq N < 55$
Allowable error	± 2.5	± 3.0	± 3.5	± 4.0

3. To prevent shaking of the rebound instrument when it strikes the component and causing testing errors, the tested concrete component shall have sufficient stiffness, and the thickness of the concrete component shall be greater than 100mm.

A.0.4 The following regulations shall be followed during testing:

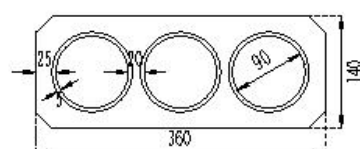
1. The instrument shall be perpendicular to the surface of the object being tested.
2. The surface being tested shall be cleared of debris such as mortar, oil, and wood chips. If necessary, it could be ground with a grinding wheel before testing.
3. The concrete surface shall be kept dry during testing.
4. Each test point shall only be tested once and not repeated. The distance between the test points and the edge of the specimen shall be at least 30mm.
5. The instrument shall be regularly calibrated to correct errors.

Appendix B: Specification for concret duct block and section of porous plastic pipe

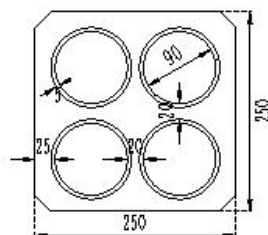
B.0.1 The specifications of cement pipe blocks shall comply with the regulations in Table B.0.1. Refer to the schematic diagram of specifications in Figure B.0.1.

Table B.0.1 Common specifications for cement pipe blocks

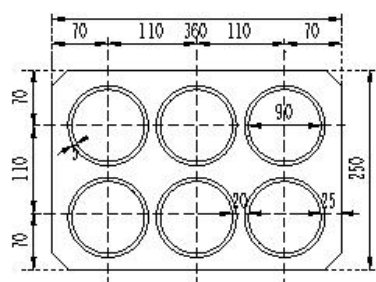
Number of holes X hole diameter (mm)	Standard name	Dimensions (Length x Width x Height, mm)
3×90	Triple-hole conduit block	600×360×140
4×90	Four-hole conduit block	600×250×250
6×90	Six-hole pipe block	600×360×250



three-hole cement pipe block



four-hole cement pipe block



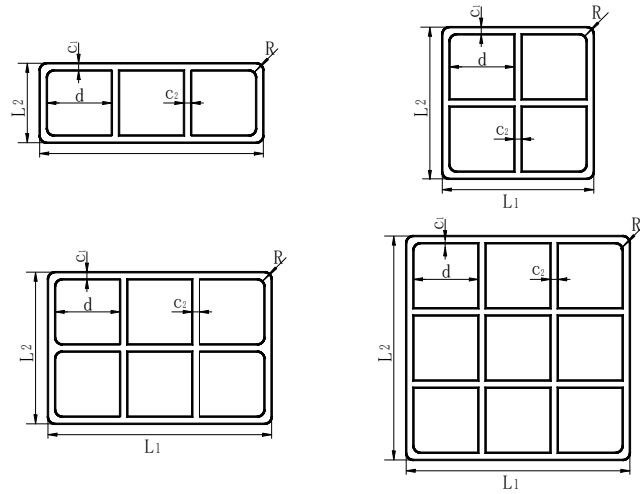
six-hole cement pipe block

Figure B.0.1 Schematic diagram of cement pipe block specifications

B.0.2 The commonly used end face specifications for porous plastic pipes shall meet the requirements in Table B.0.2. The end faces are shown in Figures B.0.2-1, B.0.2-2, and B.0.2-3.

Table B.0.2 Specifications for porous plastic pipe end faces

Serial number	Type	Material	End face specification
1	Grid pipe	PVC-U	3 holes
			4 holes
			6 holes
			9 holes
2	Honeycomb pipe	PVC-U	3 holes
			4 holes
			7 holes
3	Plum blossom pipe	PE	3 holes
			4 holes
			7 holes



R-Radius of curvature at corners

Figure B.0.2-1 Cross-section of grid pipe

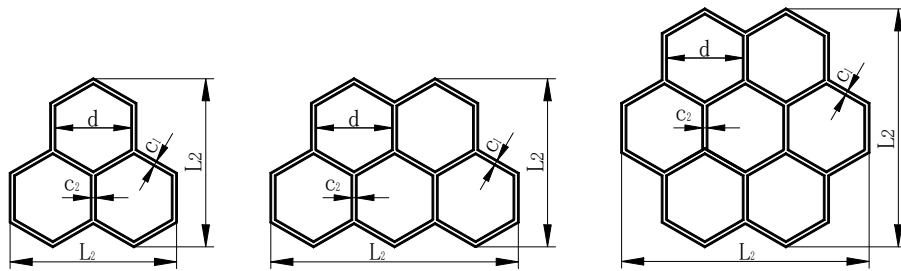


Figure B.0.2-2 Cross-section of honeycomb pipe

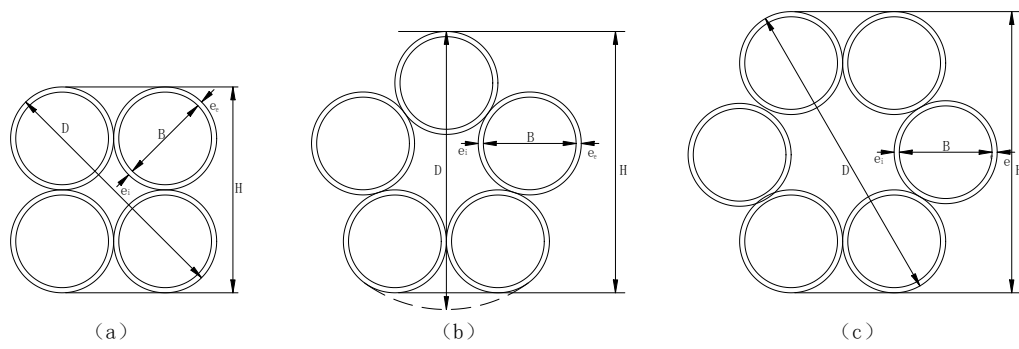


Figure B.0.2-3 Cross-section of plum blossom pipe

Appendix C: Plastic pipe specification

C.0.1 The specifications and dimensions of typical solid-wall pipes shall comply with the regulations in Table C.0.1-1 and Table C.0.1-2.

Table C.0.1-1 Structural dimensions and lengths (mm) of typical polyvinyl chloride (PVC-U) solid-wall pipes

Nominal outer diameter DN/OD	Average outer diameter d _{em}		Wall thickness e ₀			Length	
	Nominal value	Allowable deviation	Ring stiffness		Allowabl e deviation	Nominal value	Allowable deviation
			SN6.3	SN8			
			Nominal value				
90	90	+x ^{note a}	1.6	1.6	+y ^{note b}	The length of the rigid pipe is generally 6000mm, and could also be agreed upon by both supply and demand parties, with no breakage in the middle.	+0.4%
100	100		2.2	2.5			
110	110		2.6	3			

Note 1: PVC pipes are only available in rigid form.

Note 2: Products with specifications outside of this table could be produced upon request and after consultation with the manufacturer.

Note a: x shall be less than or equal to the larger of the following two values:

1. 0.3mm;
2. $0.003d_e$, with the calculation result accurate to 0.1mm and rounded up to the next digit if the second decimal place is greater than zero, where d_e is the outer diameter of the pipe.

Note b: y equals $0.1e_0 + 0.2$, with the calculation result accurate to 0.1mm and rounded up to the next digit if the second decimal place is greater than zero.

Table C.0.1-2 Structural dimensions and lengths (mm) of typical polyethylene (PE) solid-wall pipes

Nominal outer diameter DN/OD	The average outer diameter "d _{em}		Wall thickness e0.			Length L	
	Nominal value	Allowable error	Ring stiffness		Permissible error	Nominal value	Allowable error
			SN6.3	SN8			
			Nominal value				
90	90	+x ^{note a}	2.8	3.5	+y ^{note b}	The length of the rigid pipe is generally 6000mm, and could also be agreed upon by both supply and demand parties, with no breakage in the middle.	+0.4%
100	100		3.8	4.2			
110	110		4.2	4.8			

Note 1: Pipes with a nominal outer diameter of ≤ 63 could be made flexible.

Note 2: Products with specifications outside of this table could be produced upon request and after consultation with the manufacturer.

Note a: x shall be less than or equal to the larger of the following two values:

1. 0.3mm;
2. $0.009d_e$, with the calculation result accurate to 0.1mm and rounded up to the next digit if the second decimal place is greater than zero, where d_e is the outer diameter of the pipe.

Note b: y equals $0.1e_0+0.2$, with the calculation result accurate to 0.1mm and rounded up to the next digit if the second decimal place is greater than zero.

C.0.2 The specifications and dimensions of typical double-wall corrugated pipes shall comply with the provisions in Table C.0.2, and the minimum average inner diameter of the socket shall not be less than the maximum average outer diameter of the pipe. The specifications and dimensions of single-wall corrugated pipes are not specified for the time being.

Table C.0.2 Dimensions (mm) of typical double-wall corrugated pipes in the outer diameter series of pipes

Nominal outer diameter DN/OD	Average outer diameter d_{em}		Minimum average inner diameter $d_{i, min}$	Minimum laminated wall thickness e_{min}	Minimum inner layer wall thickness $e_{i, min}$	Minimum joining length A_{min}
	Nominal value	Allowable error				
100	100	+0.4 -0.6	86	1.0	0.8	30
110	110		90	1.0	0.8	32
125	125		105	1.1	1.0	35

Note: Products with specifications outside of this table could be produced upon request and after consultation with the manufacturer.

C.0.3 The specifications and dimensional tolerances of silicon-core pipes shall comply with the provisions in Table C.0.3.

Table C.0.3 Specifications and dimensional tolerances of typical silicon-core pipes

Specification (DN)	Mean outer diameter (d_{em})/mm		Wall thickness and allowable deviation/mm.		Out-of-roundness/%	
	Nominal value	Allowance	Nominal value	tolerance	Before winding the coil	After winding around the spool.
34/28	34	+0.3	3	+0.30	≤ 2	≤ 3
40/33	40	+0.4	3.5	+0.35	≤ 2.5	≤ 3.5
46/38	46	+0.4	4	+0.35	≤ 3	≤ 5

Note: The specifications and dimensional tolerances of ribbed pipes are to be agreed upon by both the supplier and the demander.

Silicon-core plastic pipes shall have a silicon-core layer on the inner wall to provide lubrication and reduce friction. The outer diameter of the silicon-core pipe shall be between 32mm and 60mm, and each pipe could be up to 2000m.

C.0.4 The specifications and dimensions of typical plum blossom pipes shall comply with the provisions in Table C.0.4.

Table C.0.4 Dimensions (mm) of typical plum blossom pipes

Number of Effective Holes	Internal Hole Size (B)	allowable deviation	Minimum inner wall thickness	Minimum outer wall thickness ($e_{e, min}$)	Length
---------------------------	------------------------	---------------------	------------------------------	---	--------

			($e_{i.min}$)		
Five holes	24 (26)	± 0.5	1.6	1.8	6000
Four-hole, five-hole.	28	± 0.5	1.8	2	6000
Four-hole, five-hole, seven-hole	32	± 0.5	2	2.2	6000

Note 1: The deviation of the thickness of the inner and outer walls should be within 0 to +0.4mm.

Note 2: The allowable length deviation is 0 to +0.3mm, and the delivery length could also be agreed upon by the manufacturer and the user.

Note 3: The size in brackets is optional, while the size outside the brackets is recommended for the inner hole size.

Note 4: When requested by the user and agreed upon with the manufacturer, products with specifications and dimensions outside the provisions in this table could be produced.

C.0.5 The models and dimensions of typical grid pipes (PVC-U) shall comply with the provisions in Table C.0.5.

Table C.0.5 Models and Dimensions (mm) of Grid Pipes (PVC-U)

Model number	Inner diameter size d	Inner wall thickness C_2	Outer wall thickness C_1	Width L_1	Height L_2
SVSY32×4	32	≥ 2.2	≥ 2.8	≤ 110	≤ 110
SVSY50(48)×4	50(48)	≥ 2.6	≥ 3.2		
SVSY28×6	28	≥ 1.6	≥ 2.2		
SVSY33(32) × 6	33 (32)	≥ 1.8	≥ 2.2		
SVSY28×9	28	≥ 1.6	≥ 2.2		
SVSY33(32)×9	33 (32)	≥ 1.8	≥ 2.2		

Note: The inner hole size of grid pipes refers to the diameter of the inscribed circle of the square.

C.0.6 The models and dimensions of typical honeycomb pipes (PVC-U) shall comply with the provisions in Table C.0.6.

Table C.0.6 Models and Dimensions (mm) of Honeycomb Pipes

Model number	Minimum inner diameter d	Inner wall thickness C_2	Outer wall thickness C_1	Width L_1	Height L_2
SVSY28×5	28	≥ 1.8	≥ 2.3	≤ 110	≤ 110
SVSY33(32)×5	33(32)				
SVSY28×7	27.5				
SVSY33(32)×7	33 (32)				

Note: The inner hole size of honeycomb pipes refers to the diameter of the inscribed circle of the regular hexagon.

Appendix D Ratio of various types of ordinary concrete and material usage per cubic meter

D.0.1 The use of this appendix shall comply with the following provisions:

1. Considering the different qualities of sand and stone materials in various regions across the country, construction units shall adhere to the principle of "testing first, then determining the proportion" in accordance with the requirements of this specification to determine the reasonable proportion of concrete used in the project, in order to improve the quality of the project, reduce costs, and have reliable inspection data.

2. The synthetic materials for ordinary concrete in this appendix are all standard materials that meet the requirements of the specification.

3. In engineering construction, cement types 52.5, 42.5, and 32.5 could be used, with 42.5 cement as the main type.

D.0.2 The proportion of ordinary concrete for prefabricated products shall comply with the provisions in Table D.0.2.

Table D.0.2 Concrete Proportions

Name or Title	Unit	Ordinary concrete mix proportion (m3)				
		C10	C15	C20	C25	C30
No.32.5 cement	kg	266	333	383	450	
Sand	kg	693	642	606	531	
5mm~32mm pebbles	kg	1231	1245	1231	1239	
Water	kg	170	180	180	180	
No.42.5 cement	kg		281	321	375	419
Sand	kg		717	646	627	576
5mm~40mm pebbles	kg		1222	1253	1218	1225
Water	kg		180	180	180	180

D.0.3 The proportion of cement mortar for general plastering shall comply with the provisions in Table D.0.3.

Table D.0.3 Cement Mortar Proportions

Serial number	Material	Mixing ratio (volume ratio)	Application scope
1	Lime: sand	1:2~1:3	Surface layer of brick and stone walls (well, passage walls)
2	Cement: lime: sand	1:0.3:3~1:1:6	Base coat for wall mixed mortar
3	Cement: lime: sand	1:0.5:2~1:1:4	Base coat for concrete ceiling with mixed mortar
4	Cement: lime: sand	1:0.3:4.5~1:1:6	Base coat for eaves, footings, and relatively humid wall surfaces with mixed mortar
5	Cement: sand	1:2.5~1:3	Base coat for relatively humid ground surfaces such as wells, passages, wall skirts, and footings with cement mortar
6	Cement: sand	1:2~1:2.5	For use as surface layer on ground, ceiling or wall.
7	Cement: Sand	1:0.5~1:1	For immediate troweling on concrete ground.

D.0.4 The proportion of commonly used cement mortar for masonry shall comply with the provisions in Table D.0.4.

Table D.0.4 Cement Mortar Proportions

No.	Cement Grade	Mortar Strength Grade		
		M10	M7.5	M5
1	32.5	1:4.8	1:5.7	1:7.1
2	42.5	1:5.5	1:6.7	1:8.6

Note: The table shows the ratio of cement to sand.

D.0.5 The weight ratio of masonry mortar and the amount of materials used per cubic meter of masonry shall comply with the provisions in Table D.0.5.

Table D.0.5 Weight Ratio and Reference Weight per Cubic Meter of Various Types of Mortar(kg)

Mortar Grade	32.5 Cement: Medium Sand: Water	Reference weight per cubic meter
M5 Cement Mortar	1:7.1:1.60	1720
M7.5 Cement Mortar	1:5.7:1.21	1820
M10 cement mortar	1:4.8:0.98	1840

D.0.6 The amount of materials used per cubic meter of masonry shall comply with the provisions in Table D.0.6.

Table D.0.6 Amount of Materials Used per Cubic Meter of Masonry

Masonry	Brick	Block (for masonry)	Mortar (m ³)
240×115×53mm	520		0.25
300×250×150mm		119	0.20
300×150×150mm		72	0.20

D.0.7 The conversion of commonly used cement quantities shall comply with the provisions in Table D.0.7.

Table D.0.7 Conversion Table for Commonly Used Cement Quantities

cement strength grade	32.5	42.5	52.5
32.5	1	0.86	0.76
42.5	1.16	1	0.89
52.5	1.31	1.13	1

Appendix E Standardized manhole and volume table

E.0.1 The volume of standardized manholes shall comply with the provisions in Table E.0.1.

Table E.0.1 Volume Table for Standardized Manholes

manhole program	Volume (cubic meters)	manhole program	Volume (cubic meters)
Small straight-through type	10.33	Medium-sized 45° diagonal tee	15.48
Small-sized three-way tee	16.31	Medium size 60° inclined pass type	19.16
Small size four-way type	17.17	Medium size 75° oblique through type.	18.92
Small size 15-degree inclined pass type	10.96	Large-size straight-through type	22.09
Small size 30-degree inclined pass type	11.21	Large size tee type fitting	34.74
Small size 45-degree inclined pass type	12.00	Large size four-way tee	38.08
Small size 60-degree inclined pass type	12.59	Large size 15° inclined pass type	22.16
Small size 60-degree inclined pass type.	13.18	Large size 30° inclined tee	23.78
Medium size straight pass type	11.59	Large size 45° inclined tee	24.86
Medium size three-way passtype	22.21	Large size 60° inclined tee	25.94
Medium size four-way pass type	23.27	Large size 75° inclined tee	27.03
Medium size 15-degree inclined pass type	13.55	90×120 hand hole	1.45
Medium size 30-degree inclined pass type	14.19	120×170 hand hole	3.26

E.0.2 The earthwork volume of standard manholes shall comply with the provisions in Table E.0.2.

Table E.0.2 Earthwork Volume Table for Standardized Manholes

manhole name		Concrete foundation without crushed stone foundation			Milling and excavation of road surface (m ²)
		Excavation volume (m ³)	Backfilling earthwork volume (m ³)	Transportation earthwork volume((m ³)	
Small size	Straight through type	27.82	13.40	14.42	16.32
	Tee type	41.00	18.53	22.47	20.84

	Four way type	42.87	18.90	23.97	21.65
	30-degree inclined pass type	32.01	14.74	17.27	18.41
	45-degree inclined pass type	30.38	14.23	16.15	17.62
	60-degree inclined pass type	32.76	14.98	17.78	18.81
Medium size	straight pass type	32.27	14.88	17.39	17.63
	Tee type	53.37	21.87	31.50	25.99
	Four-way type	55.57	22.26	33.31	26.91
	30-degree inclined pass type	38.78	17.13	21.65	20.99
	45-degree inclined pass type	36.77	16.29	20.48	20.53
	60-degree inclined pass type	43.40	17.92	25.48	23.72
Large size	Straight through type	50.16	21.38	28.78	24.01
	Tee type	70.51	28.54	41.97	30.05
	Four way type	73.28	28.98	44.30	31.10
	30-degree inclined pass type	57.12	23.41	33.71	27.05
	45-degree inclined pass type	58.65	23.86	34.79	27.72
	60-degree inclined pass type	58.93	23.94	34.99	27.84

E.0.3 The volume of each part of the standard manhole shall comply with the provisions in Table E.0.3.

Table E.0.3 Volume Table for Each Part of Standardized Manholes(m³)

project	Orifice concrete	Top cover section	Hole wall	Basic	metope
Small straight-through type	0.05	0.624	3.471	0.732	0.505
Small-sized three-way tee	0.05	1.121	5.00	1.058	0.726
Small size four-way type	0.05	1.110	4.572	0.950	0.68
Small size 15-degree inclined pass type	0.05	0.650	4.40	0.78	0.54
Small size 30-degree	0.05	0.66	4.11	0.75	0.58

inclined pass type					
Small size 45-degree inclined pass type	0.05	0.733	4.10	0.676	0.56
Small size 60-degree inclined pass type	0.05	0.812	4.209	0.899	0.691
Small size 60-degree inclined pass type.	0.05	0.838	4.547	1.105	0.607
Medium size straight pass type	0.05	0.767	4.213	1.027	0.573
Medium size three-way passtype	0.05	1.226	8.562	1.662	0.863
Medium size four-way pass type	0.05	1.305	8.944	1.619	0.866
Medium size 15-degree inclined pass type	0.05	1.122	4.458	1.026	0.607
Medium size 30-degree inclined pass type	0.05	1.228	4.662	1.157	0.622
Medium size 45-degree inclined pass type	0.05	1.070	4.834	1.237	0.654
Medium size 60-degree inclined pass type	0.05	1.427	7.575	1.529	0.919
Medium size 75-degree inclined pass type	0.05	1.368	7.900	1.383	0.708
Large size straight pass type	0.05	1.503	8.393	1.584	0.865
Large size three-way passtype	0.10	1.760	11.697	1.990	1.065
Large size four-way pass type	0.10	1.916	11.624	2.185	1.010
Large size 15-degree inclined pass type	0.05	1.480	8.544	1.628	0.762
Large size 30-degree inclined pass type	0.10	1.496	9.480	1.733	0.830
Large size 45-degree inclined pass type	0.10	1.816	9.555	1.665	0.822
Large size 60-degree inclined pass type	0.10	1.932	9.797	1.886	0.856
Large size 75-degree inclined pass type	0.10	2.070	9.807	1.925	0.880

Appendix F Type of soil and rock

According to relevant national regulations, soil can be classified into three types, and rock can be classified into two types.

Ordinary soil: general soil that could be excavated mainly with a shovel and could be easily shoveled off.

Hard soil: soil that requires part of it to be excavated with a shovel and part of it to be excavated with an iron hoe, such as hard soil, clay, urban rubble soil, and soil in rice fields with a depth of less than 0.5m of silt (including soil that can be excavated without iron, but cannot be removed from shovel by oneself).

Gravel soil: soil that is mainly excavated with a pickaxe and sometimes requires a crowbar to excavate, such as weathered stone, stiff stone, pebble, and soil in rice fields with a depth of 0.5m to 1m of silt.

Soft stone: stone soil that is partially excavated with a pickaxe and partially excavated with explosives, such as loose sandstone, pebble with particularly dense viscous bonding, softened stone, fractured limestone, hard clayey slate, shale, and hard gypsum.

Hard stone: stone soil that is excavated entirely by blasting or manually with a large hammer, such as hard rock, basalt, granite, and limestone viscous grave.

Appendix G Acceptance items and contents

G.0.1 The engineering acceptance items and contents shall comply with the provisions of Table G.0.1.

Table G Engineering Acceptance Items and Contents

Type	Item	Content	Acceptance method
1	Pipeline equipment	1. Selection of pipe block, pipe specifications, and materials 2. Pipe joints 3. Adhesive 4. Pipe support or tie 5. Concrete, bricks, steel bars, and various manhole and handhole equipment	In-process inspection
2	Pipeline location	1. Pipeline design coordinates and routing 2. Pipeline elevation slope 3. Minimum clearance between pipeline and adjacent pipelines or obstacles 4. Minimum crossing angle between pipeline and railway or tramway	In-process inspection
3	Pipeline trenching	1. Width and depth of trench 2. Treatment of soil, foundation and base 3. Treatment of frozen layer 4. Shallow burial protection 5. Backfilling and compaction 6. Warning tape, concrete slab, ordinary sintered brick, steam-cured fly ash brick or steam-cured sand-lime brick	In-process inspection Concealed works Inspection and approval
4	Pipeline jointing	1. Smooth and clean pipe opening 2. Even glue application and secure connection 3. Pipe markings facing upwards 4. Joints staggered 5. Quality of pipe connections (shall be checked one by one) 6. Bundling or support of pipes 7. Consistency of pipe end faces and positions	In-process inspection Concealed works Inspection and approval
5	Waterproofing and prevention of harmful gases	1. Pipes entering buildings shall be waterproof and prevent flammable gases 2. Pipes entering manholes shall have a 2m reinforced concrete foundation and be sealed 3. Pipes entering buildings or manholes shall have pipe plugs 4. Treatment of intersections between pipes and gas pipes	In-process inspection
6	manhole construction	1. In compliance with Chapter 4 of this specification. 2. Soil, foundation, and foundation treatment. 3. The specifications and quantity of the pipeline section shall match the manhole support and support plate. 4. Convenient for laying electrical (optical) cables.	In-process inspection Concealed works Inspection and approval
7	Contents of final acceptance	1. Pipeline hole testing 2. Pipeline hole sealing 3. manhole and handhole device complete and qualified 4. Check the completion drawing 5. Check the concealed projects that have been approved	Final acceptance
8	Pipeline flushing test	1. Straight pipe hole test 2. Bending pipe hole test 3. Sampling rules for pipe hole test	Final acceptance
9	Pipeline sealing	1. Quality of building borehole plugging 2. Quality of manhole and handhole plugging	Final acceptance

		3. Pull-off force of pipe plug head	
10	manhole and handhole specifications	1. manhole and handhole device complies with the standard 2. manhole and handhole specifications, shapes and sizes are in accordance with the standards.	Final acceptance
11	Verification of completion drawings	Verify that the drawings match the actual	Final acceptance
12	Inspection of concealed works	Check whether the hidden work visa formalities are complete	Final acceptance
13	Pipe selection for special cases	1. Selection of tubes in high cold environment 2. Special requirements for tubes in rodent and termite infested areas 3. Selection of pipes for special construction sites 4. Selection of pipes for non-buried applications	In-process inspection

Explanation of wording in this standard

1. Words used for different degrees of strictness are explained as follows in order to mark the differences in executing the requirements in this standard:

1) Words denoting a very strict and mandatory requirement:

“Must” is used for affirmation; “must not” for negation.

2) Words denoting a strict requirement under normal conditions:

“Shall” is used for affirmation; “shall not” for negation.

3) Words denoting a permission of a slight choice and an indication of the most suitable choice when conditions permit:

“shall” is used for affirmation; “shall not” for negation.

4) “May” is used to express the option available, sometimes with the conditional permit.

Words that indicate some choice and allow for certain conditions are expressed as “may”.

2. “Shall comply with...” and “Shall meet the requirements of...” are used in this standard to indicate that it is necessary to comply with the requirements stipulated in other relative standards.

List of quoted standards

1. "Drawing Gallery of Manhole and Handhole for Communication Conduit Engineering" YD/T 5178.
2. "General Portland Cement" GB 175
3. "Sand for construction" GB/T 14684
4. "Pebble and crushed stone for construction" GB/T 14685
5. "Fired common bricks" GB 5101
6. "Code for design of masonry structures" GB 50003
7. "Standard of water for concrete" JGJ 63
8. "Code for construction and acceptance of water and sewerage pipeline works" GB 50268

National Standard of the People's Republic of China

Standard of construction and acceptance for communication conduit engineering

GB/T 50374-2018

Explanation of provisions

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2 Material inspection

2.1 General requirement

2.1.4 PVC pipes shall be stored and kept flat in a warehouse or shed with a temperature not exceeding 40°C, and shall be protected from exposure to rain and sunlight. When stored indoors, they shall be kept at least 1m away from heat sources. If the pipes are stored in an environment below 0°C, they shall be placed at room temperature for one day before use.

2.2 Cement and concret products

2.2.3 According to GB 175 "General Portland Cement", the minimum strength of Portland cement and ordinary Portland cement is 42.5, while the strength grades of slag Portland cement, volcoudic ash Portland cement, fly ash Portland cement, and composite Portland cement are 32.5. This specification recommends the use of ordinary Portland cement with a grade of 42.5.

2.5 Brick

2.5.1 Sintered common bricks are classified by material into clay bricks (N), shale bricks (Y), coal gangue bricks (M), and fly ash bricks (F). In order to save land, clay bricks are avoided in construction projects.

2.10 Steel, steel pipe and iron casting

2.10.2 Steel pipes are prone to corrosion and have a short lifespan. They are generally used for crossing roads/bridges and when the depth of buried pipelines could not meet the requirements. They are also suitable for locations that require electromagnetic protection.

3 Engineering Survey

3.0.1 Before pipeline construction, the construction unit shall carefully re-measure the position of the pipeline and manholes based on the design drawings and on-site briefing, and set benchmark stake points as required. The re-measurement includes benchmark points, centerline measurement, and elevation benchmark point measurement. Wooden stakes could be used as benchmark stake points.

4. Civil work

4.1.5 There are different standards for soil classification. The corresponding relationship between soil classification in Appendix F is as follows:

Clay and sandy clay correspond to hard soil;

Gravel soil, slag, and backfill correspond to gravel soil;

Brick debris and pebbles correspond to soft stone.

4.1.7 When excavating pipeline trenches and manholes, different methods of soil support and protection shall be adopted according to the soil conditions, depth, and groundwater level to ensure safe and smooth construction. There are four methods of soil support and protection:

1. Sparse support: When the soil is relatively solid and the trench depth is not large, horizontal sparse support could be used. Every 4 meters along the trench, a 2000mm×50mm×150mm wooden board is placed horizontally at 1/4 of the trench depth from the trench edge, supported by two parallel 100mm round logs. If the soil is not solid enough and the trench is deeper, vertical sparse support could be used. Every 2 meters along the upper half of the trench, a 1000mm×50mm×150mm wooden board is erected, supported by two 100mm round logs above and below.

2. Cross bracing: When the soil is relatively solid but the trench section is close to the roadway or railway and subject to large vibrations, cross bracing could be used. Four 1500mm×50mm×150mm wooden boards are used to form a cross-shaped soil retaining plate support every 3m to 4m, and four 100mm round logs are used to support the four sides.

3. Close bracing: When the soil is soft, or the soil is solid but the trench section is close to the roadway or railway and subject to large vibrations, or when the trench is close to buildings, close bracing could be used. The soil retaining boards are horizontally arranged in a dense pattern, and a 50mm×150mm vertical wooden board is used to block the horizontal boards every 1m to 2m. A 100mm round log is used to support each end of the vertical board.

4. Sheet pile support: When digging trenches in sandy or sandy areas, sheet pile support could be used, and there are two methods for sheet pile support:

(1) Horizontal close-packed soil retaining boards, with 100mm round wood every 0.5m to 1m, the lower end is sharpened into a wooden pile and driven into the bottom of the trench at least 100mm, and then 100mm round wood is used to support the round wood pile up and down.

(2) Longitudinal close-packed wooden sheet piles, with the lower end sharpened and driven into the bottom of the trench at least 100mm, and the upper end supported by 100mm round wood at certain intervals using 50mm×150mm wooden boards.

5. Examples of several building support and protection methods:

(1) Housing: Before digging trenches (pits), investigate and register the road obstacles that may affect construction along the pipeline. When it is necessary to protect electric poles, houses, etc., support devices shall be installed (as shown in Figure 1 and Figure 2), and the construction unit shall be notified in a timely manner for handling.

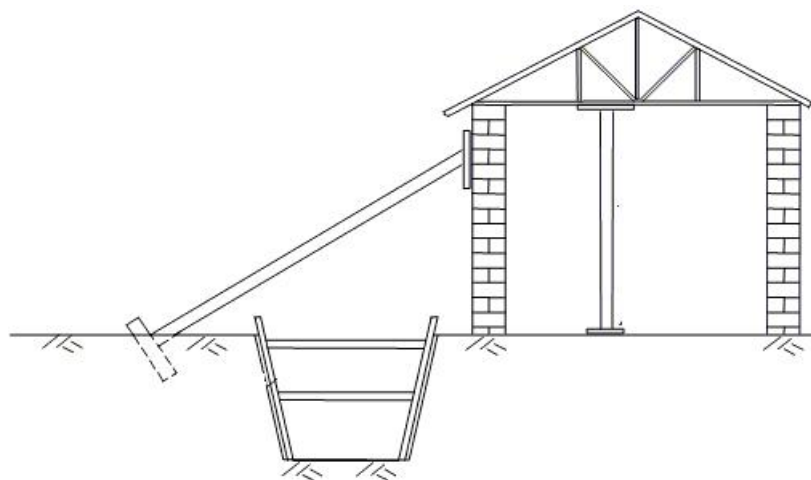


Figure 1: Schematic diagram of house support

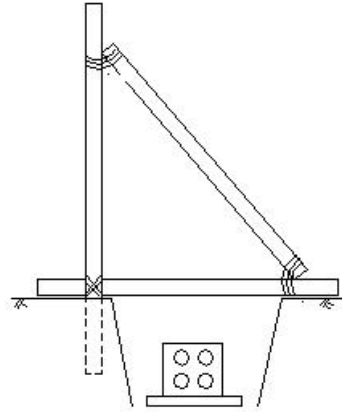


Figure 2: Schematic diagram of electric pole support

(2) If the trench (pit) intersects or runs parallel with other underground pipelines and poses certain risks, it shall be protected in a timely manner, as shown in Figure 3 and Figure 4.

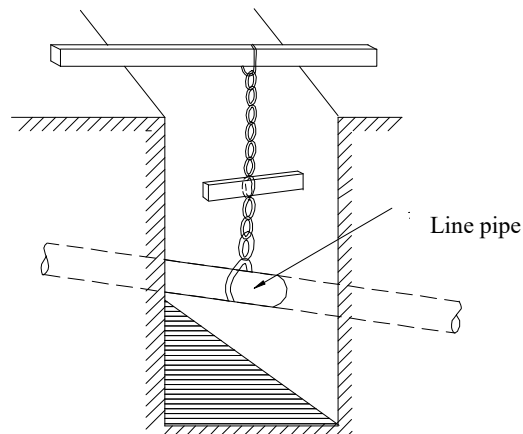


Figure 3: Protection of other pipelines intersecting with the pipeline trench

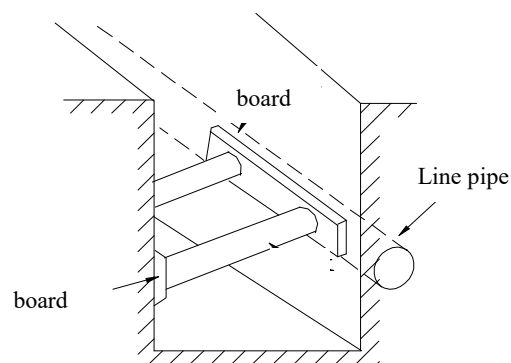


Figure 4: Protection of other pipelines running parallel with the pipeline trench

4.1.11 Generally, graded stones with a particle size of 5mm to 32mm are used for pipeline projects. Good matching of stones with different sizes could effectively save cement and improve the strength of concrete.

The stone could be graded continuously or intermittently, as shown in Figures 5 and 6. Continuous grading shall be used for communication pipeline projects.

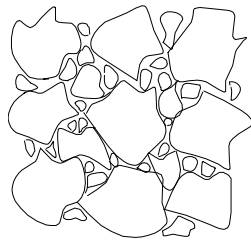


Figure 5 Continuous grading

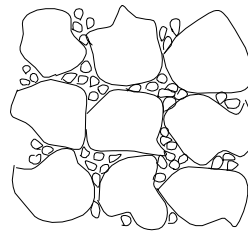


Figure 6 Intermittent grading

4.1.12 When stacking soil at the construction site, safety and environmental requirements shall be considered. The soil shall not be stacked against broken bricks or adobe walls, and pedestrian passages shall be left. The stacked soil shall avoid burying fire hydrants, gates, cable line markers, inspection wells, rainwater inlets, measurement markers, and other facilities for thermal, gas, rain (sewage) water pipelines. The entire exposed surface of the stacked soil shall be tightly covered to avoid environmental pollution caused by sand and dust.

4.1.14 For the construction site of excavating communication pipeline trenches (pits), safety requirements shall be considered, and temporary guardrails or conspicuous signs with red and white stripes shall be set up for night lighting.

5 Formwork, steel bar ,concrete and mortar

5.3.6 For the poured concrete, it shall be covered and watered, and meet the following requirements:

1. Cover and water the concrete within 12 hours after pouring.
2. The time for watering and curing the concrete shall not be less than 7 days for concrete mixed with Portland cement, ordinary Portland cement, or slag Portland cement, and not less than 14 days for concrete mixed with slow-setting admixtures or with requirements for impermeability.
3. The number of watering times shall be able to keep the concrete in a wet state.
4. The water used for curing concrete shall be the same as the water used for mixing.

Note:

- ① Avoid watering when the average daily temperature is below 5°C;
- ② When using other types of cement, the curing time of concrete shall be determined according to the technical performance of the cement used.

6. Man (hand) hole and tunnel

6.1 General requirement

6.1.6 The tunnel leading out of the main equipment room in the station shall avoid going beyond the station yard wall. For shallow-buried communication channels outside the station, the net height inside the channel shall be 1.8m.

6.2 Subgrade and foundation

6.2.4 The size of the installation pit for the ponding tank shall be 100mm larger than the surrounding area of the tank, and the pit depth shall be 160mm or 150mm deeper than the height of the water storage tank (the height of the water collection and irrigation part of the foundation of the hand hole and small manhole and handhole is 160mm, and other types of manholes are 150mm). The surface of the foundation should be flooded with 20mm water from all sides towards the water tank (Figure 7).

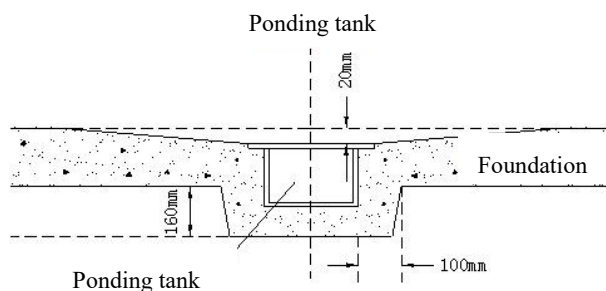


Figure 7 Cross-section of foundation for manhole and handhole and passage

6.3 Wall

6.3.4 Cable iron brackets: The specifications and dimensions of the brackets shall comply with the requirements of the "Drawing Gallery of Manhole and Handhole for Communication Conduit Engineering" YD/T 5178.

1. The brackets shall be made of cast steel (manganese steel or ductile iron) or other engineering materials, and cast iron shall not be used.
2. The internal dimensional error of the cable tray holes shall not exceed $\pm 1\text{mm}$.
3. All of them shall be treated with galvanization.
4. The cable support nails shall be made of ordinary carbon steel with a diameter of $\phi 16$ - $\phi 20$ and require galvanization treatment.
5. V-shaped pull ring: The pull ring shall be made of ordinary carbon steel with a diameter of $\phi 16$ and require galvanization treatment.
6. Ponding tank: The ponding tank shall be made of cast iron and require hot asphalt anti-corrosion treatment.
7. Cable tray: According to the size of the cable, the cable tray is divided into three types: single, double, and triple. It shall be made of cast iron and require galvanization treatment.

6.5. Manhole orifice and cover

6.5.5 Manhole and handhole cover: There are different types for pedestrian and vehicular use. Unless the construction unit has special requirements (such as special anti-theft covers), the cover is generally composed of an outer cover, an inner cover, and a cover seat, as shown in Figure 8. The cover shall meet the following requirements:

1. The specifications of the cover shall comply with the "Drawing Gallery of Manhole and Handhole for Communication Conduit Engineering " YD/T 5178"

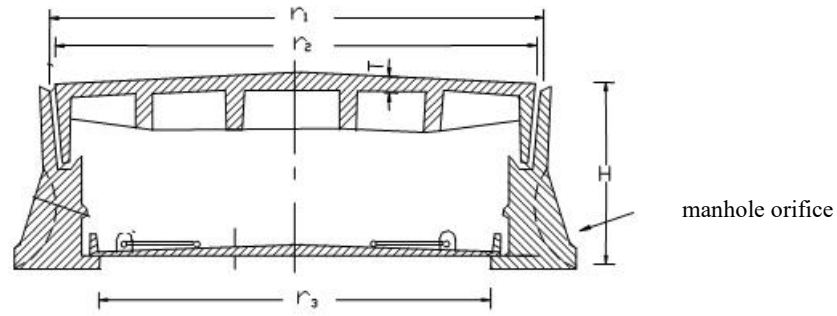


Figure 8: Schematic diagram of manhole and handhole cover device

Table 1: Comparison table of manhole and handhole cover specifications

Symbol	Atlas(mm)			
	footway	roadway	Heavy duty	Special type
H	100	100	123	205
T	20	25	35	30
r_1	758	758	758	776
r_2	754	754	754	764
r_3	670	670	670	610
tonnage	10	10	20	20

7. laying Pipeline

7.1 General requirement

7.1.3 In order to enhance the strength and waterproof performance of the pipeline, it is necessary to wrap the pipeline with a protective layer. The protective layer could be constructed by pouring concrete on site immediately after the pipeline is laid, so that the concrete protective layer could be closely combined with the pipeline foundation. The thickness of the envelopment shall be 80mm.

7.1.8 The specific extended time from the completion of pipeline laying and connection to the cessation of water pumping depends on the water flow: if the water flow is small and the rise is slow, pump for 4 hours; if the water flow is obvious and the rise is fast, pump for 8-12 hours; if the water flow is fast and the scouring is large, pump for 24 hours.

7.5 Plastic duct installation

7.5.2 According to the requirements of PVC pipe adhesive characteristics, the adhesive will lose its effectiveness at temperatures below -5°C , resulting in insufficient tightness of the pipe connection. Therefore, the construction environment temperature is required to be no lower than -5°C .

7.5.3 Due to the small spacing between the pipes and the dense distribution of the pipe holes in small-diameter porous pipes, although they occupy a smaller cross-sectional area, they will have adverse effects on cable threading. Therefore, a certain gap is left between the pipe blocks, mainly for the convenience of cable threading. The pipe blocks are fixed with special brackets before entering the manhole and handhole to make them stable and firm.

7.5.5

1. Due to the light weight of PVC-U pipes, they could generally be laid according to the following principles:

1) For good soil conditions (such as clay and sandy clay) without groundwater, a layer of fine soil 50mm thick could be laid on the compacted subsoil, and the pipes could be laid on top of it.

2) When the bottom of the trench is rock, a layer of sand 100mm thick shall be laid first, and then the pipes could be laid.

3) When the soil at the bottom of the trench is poor and there is water, especially in areas with flowing sand or silt, stones shall be thrown and compacted first, then an 80mm thick concrete foundation shall be laid, followed by a 50mm thick sand cushion layer, and then the pipes could be laid on top.

2. The following are commonly used adhesives for plastic pipe joints:

1) Chlorinated polyvinyl chloride resin pellets mixed with dichloroethane solvent in a ratio of 1:4.

2) Chlorinated polyvinyl chloride resin pellets mixed with acetone solvent in a ratio of 1:4.

3) Chlorinated polyvinyl chloride resin (5g), dibutyl phthalate (10ml), dioctyl phthalate (10ml).

3. A trajectory map shall be provided for horizontal directional drilling construction, and the requirements for the trajectory map are as follows:

1) The trajectory of the directional drilling guide hole is composed of oblique straight line segments, curved line segments, horizontal straight line segments, etc. Its design shall be based on the requirements of pipeline production technology, construction site conditions, construction machinery, etc., to comprehensively combine the trajectory.

2) The design of the trajectory of the directional drilling guide hole is determined by the method of drawing or calculation.

Drawing method: The determination of the entry and exit angles and the curved line segments could be carried out according to Figure 9.

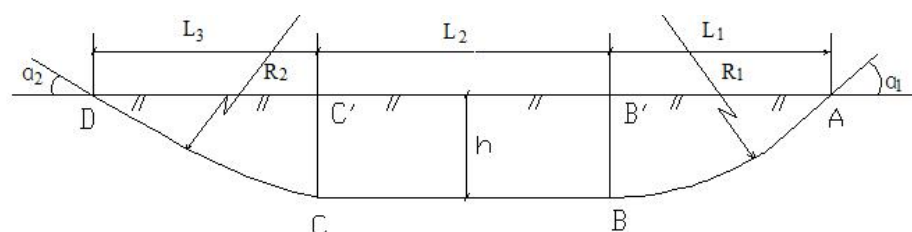


Figure 9: Design drawing of the trajectory of a general directional drilling guide hole

In the figure: α_1 - entry angle

α_2 - exit angle

A - entry point

D - exit point

B - point of trajectory change between the first curved section and the straight section

C - point of trajectory change between the straight section and the second curved section

R1 - radius of curvature of the entry section

R2 - radius of curvature of the exit section

h - depth of the trajectory (pipe laying)

L1 + L2 + L3 - horizontal length of the directional drilling pipe laying

Calculation method: the calculation of the entry and exit angles and the curved sections shall be calculated according to Figure 9 of this standard and the following formula.

$$L1 = \sqrt{h(2R_1 - h)} \quad (1)$$

$$\alpha_1 = 2 \arctg \sqrt{\frac{h}{2R_1 - h}} \quad (2)$$

$$L3 = \sqrt{h(2R_2 - h)} \quad (3)$$

$$\alpha_2 = 2 \arctg \sqrt{\frac{h}{2R_2 - h}} \quad (4)$$

4. The aperture of the terminal hole is 1.2-1.5 times the design laying production pipe diameter, and the aperture of the terminal hole is selected according to Table 2.

Table 2: Relationship between production pipe diameter and terminal hole aperture

Production pipe diameter (mm)	Drilling and reaming diameter (mm)	Note
< 200	D+100	empirical data
200~600	D×(1.2~1.5)	
> 600	D+(300~400)	

5. When the pipeline enters a manhole and handhole , the blown silicon core tube does not have a bell mouth in the manhole and the remaining length is 400mm.

7.5.6 The requirements for connecting plastic pipes are as follows:

1. The single-hole corrugated plastic pipe could be connected by socket-type elastic sealing ring, direct socket-type adhesive, or casing adhesive. According to current construction conditions, this specification recommends using socket-type elastic sealing ring for single-hole pipes.

2. The multi-hole pipe is connected by a fixed bracket, which is generally provided with the pipe material.

3. The main technical performance requirements for plastic pipe fittings are as follows:

1) Joint connection force: $\geq 4300\text{N}$.

2) Air tightness performance: $\geq 1.6\text{MPa}$.

3) The rubber sealing ring shall be wear-resistant, aging-resistant, corrosion-resistant, and resistant to environmental stress cracking.

4) Plastic pipe fittings shall be able to be repeatedly opened and used, and easy to disassemble.

4. The connection sealing performance between plastic pipes and fittings, as well as between plastic pipes and end plugs, shall meet the following requirements:

1) The connection sealing performance between plastic pipes and fittings: cut two sections of $300\text{mm} \pm 5\text{mm}$ long plastic pipes, connect them to the corresponding fittings according to the requirements, fill them with 50kPa water pressure at room temperature of 20°C , and keep them for 24 hours. The plastic pipes shall not leak to be qualified.

2) The connection sealing performance between the plastic pipe and the end expansion plug: Cut a plastic pipe with a length of about 1m and place it vertically. Install the end expansion plug at the bottom of the plastic pipe. Fill the plastic pipe from the open end above with tap water, and let it stand for 1 hour. The end expansion plug is qualified if there is no leakage at the bottom port of the plastic pipe.

3) The connection sealing performance between the plastic pipe and the end cable protection expansion plug: cut a plastic pipe with a length of about 1m and place it vertically. Install the end cable protection expansion plug at the bottom of the plastic pipe. Fill the plastic pipe from the open end above with tap water, and let it stand for 1 hour. The cable protection expansion plug is qualified if there is no leakage at the bottom port of the plastic pipe.

5. When performing connection operations, first check whether the sealing ring is intact, and clean the inner and outer mouths of the socket, without leaving any sludge or debris. Then place the sealing ring in the middle corrugated groove of the socket, and the direction shall not be reversed. Apply a small amount of soapy water inside the socket, align the socket end with the socket and insert it until it is firm. Refer to Figure 10 for the schematic diagram of inserting the socket of pipe B into the socket of pipe A.

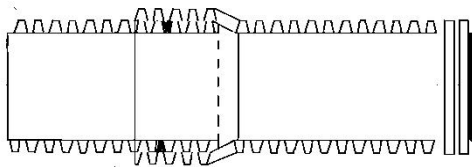


Figure 10. Schematic diagram of inserting the socket of pipe B into the socket of pipe A

8. Acceptance

8.1 Acceptance during construction

8.1.5 The cross-sectional area of the pipe gallery in the incoming room shall meet the design requirements.

8.1.7 When the pipeline enters the building, a special pipe plug shall be used to seal the pipe hole.