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TELECOM INDUSTRY STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

M 42

YD/T 841-1996

**Underground communication pipe
with plastic pipe**

地下通信管道用塑料管

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Issued on: April 4, 1996

Implemented on: September 1, 1996

**Issued by: Ministry of Posts and Telecommunications of the People's
Republic of China**

Table of Contents

Foreword.....	3
1 Scope	4
2 Normative References.....	4
3 Product Classification, Model and Label	5
4 Shape and Structure Size of Pipes.....	6
5 Technical Requirements	12
6 Test Methods	14
7 Inspection Rules.....	18
8 Label, Transportation, and Storage	19
Appendix A.....	20

Foreword

This Standard was proposed on the premise of widely promoting the new structure plastic pipe in the developed countries; it is aimed to reform the backwardness of domestic use of cement pipe block, and achieve modernization.

When this Standard was proposed, some developed countries had prepared the formal standards on the stress-free delivery plastic pipe including plastic pipe for underground communication pipe, such as German DIN 16961, American ASTM F949-89; however, there is no unique standard prepared for the communication plastic pipe. European Organization for Standardization published a draft on stress-free pipe; International Organization for Standardization (ISO) published several individual provisions concerning this aspect, thereof including the most important aperture series, which plays an important role for preparing this Standard.

“Rigid PVC (PVC-U) Double-wall Corrugated Pipe” issued by Chinese Ministry of Light Industry, and several performance standards approved to be issued by State Bureau of Technical Supervision also play a guiding role for preparing this Standard.

Appendix A of this Standard is informative.

This Standard was proposed and shall be under the jurisdiction of China Academy of Telecom Research and Planning of Ministry of Post and Telegraph.

Drafting organizations of this Standard: China Association of Senior Scientists and Technicians Post and Telecommunications Branch, and Beijing Design Institute of Ministry of Post and Telegraph.

Chief drafting staffs of this Standard: Liu Huai, Kong Guanghai, and Yang Zhenzhong..

The Standard was firstly published on April 4, 1996.

Underground communication pipe with plastic pipe

1 Scope

This Standard specifies the classification and type, shape and structure size, technical requirements, test methods, inspection rules, labels, package, transportation and storage of underground communication pipe used rigid PVC, and high and low density polyethylene plastic pipe (hereinafter referred to as pipe) products.

This Standard is applicable to the outdoor communication cable and fiber optic cable pipe systems within the local network range, which include trunk pipeline, feeder pipeline, wiring pipeline, and private network pipeline. In addition to the specifically provided long-distance communication pipeline, others can also refer to this Standard. .

2 Normative References

The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. At the time of publication, the editions indicated are valid. All standards are subject to revision. The parties who are using this Standard shall explore the possibility of using the latest version of the following standards.

GB 2828-81 Sampling Procedures and Tables for Lot-by-Lot Inspection by Attributes (Apply to Inspection of Successive Lots or Batches)

GB 2918-82 Plastics - Standard Atmospheres for Conditioning and Testing

GB 6671.2-86 Polyethylene (PE) Pipes - Determination of Longitudinal Reversion

GB 8804.2-88 Test Methods of Tensile Properties for Thermoplastic Pipes - Polyethylene (PE) Pipes

GB 8805-88 Determination of Deflection for Rigid Plastic Pipes

GB 8806-88 Method for Dimension Measuring of Plastic Pipes

GB 96467-88 Test Method for External Loading Resistance for Plastic Pipe

GB/T 13849-93 Local Telecommunication Cables with Polyolefin Insulation and

Polyolefin Sheath

GB/T 14152-93 Thermoplastic Pipes – Determination of Resistance to External Impact – True Impact Rate Method

YD/T 630-93 Test Method of Copper-Core, Polyolefin Insulated, Composite Aluminum-Plastic Sheathed Cables for Urban Local Communications

ZB G 33008-89 PVC Corrugated Pipe

3 Product Classification, Model and Label

3.1 Product classification

Communication plastic cable pipe can be classified into the following ones as per the materials:

- High density polyethylene (HDPE) pipe taking high density polyethylene as the main material;
- Rigid PVC (PVC-U) pipe taking rigid PVC as the main material.

It can be classified into the following pipes as per the structure:

- Double-wall corrugated pipe with smooth internal wall and corrugated external wall (“double-wall corrugated pipe” for short);
- Composite foam pipe with smooth internal and external wall, and intermediate containing foam layer (“composite foam pipe” for short);
- Solid wall plastic pipe with smooth internal and external wall (“solid wall pipe” for short);
- Single-wall corrugated pipe with uneven internal and external wall.

It can be classified into the following pipes as per the molding appearance:

- Hard straight pipe;
- Hard bent pipe;
- Rotatable pipe.

3.2 Product model and label

Product model and label consists of prefix, material, structure, molding appearance, outside/inside diameter and plant name.

4.5 Refer to Table 1 for the pipe structure and size; the diameter of pipe used in the same city shall be consistent as much as possible; refer to Appendix A for the application range of various pipe diameters.

Table 1

mm

Nominal Diameter	Allowable Deviation of Outside Diameter		Minimum Inside Diameter $d_{i \min}$	Pipe Length	Application Range
	Composite foam, solid wall pipe	Double-wall corrugated pipe			
110/100	+0.4 0	+0.4 -0.7	97	6000	Beyond the penetrate and put standard series Little use of extra-large cable
100/90	+0.3 0	+0.3 -0.6	88		Feeder pipe
75/65	+0.3 0	+0.3 -0.5	65		From feeder pipe to the connection cabinet, special network
63/54	+0.3 0	+0.3 -0.4	54	±30	Wiring pipe
50/41	+0.3 0	+0.3 -0.3	41		Fiber optic cable

Note:

- Allowable deviation between composite foam pipe and solid wall pipe shall be positive value, which is expressed by $+x$, thereof, x shall be equal or more than the larger value of the following two ones:
 - 0.3mm;
 - $0.003d_e$, the value less than 0.1mm shall be calculated as 0.1mm.
- The maximum outside diameter and minimum inside diameter among composite foam pipe, solid wall pipe and double-wall corrugated pipe equal.
- The ratio between maximum outside diameter and minimum inside diameter of double-wall corrugated pipe shall be 1.009:1.

The color and luster of pipe shall be uniform; it shall be black or gray, which is determined by the buyer and seller, however, it must be different from other similar underground plastic pipes. The color of sub-pipes penetrating into the same large diameter of plastic pipe shall be different.

5.2 Appearance

- a) Pipe wall is not allowed to have air bubbles, cracks, discoloration decomposition line, and obvious impurities. The waveform of corrugated pipe shall be even, having no shortened wave.
- b) The internal walls of composite foam pipe and solid wall pipe are required to be smooth; and the medial incision is also required to be smooth.
- c) The internal walls of double-wall corrugated pipe are required to be smooth; slight fluctuation of the internal wall is allowed during the wave forming.
- d) The internal and external walls of the double-wall corrugated pipe shall be closely frit; and no opening phenomenon shall occur.

5.3 Size and deviation

5.3.1 Pipe length deviation shall conform to the provisions in Table 1.

5.3.2 Pipe average outsider diameter, minimum inside diameter, and its deviation shall conform to the provisions of Table 1.

5.3.3 The same cross-sectional thickness deviation between composite foam pipe and solid wall pipe shall be no more than 14%.

5.3.4 Pipe minimum socket's average inside diameter and depth shall conform to the provisions in Table 2.

5.3.5 Pipe bent in the same direction shall be less than 2%.

5.4 Physical and mechanical properties

5.4.1 Pipe's physical and mechanical properties shall conform to the requirements in Table 5.

Table 5

Items	Technical Indicators	Test Methods
Drop hammer impact (0°C)	9/10 no breaking	See Clause 6.5.1
Ring stiffness (kN/m ²)	≥6.3	See Clause 6.5.2
Flattering test	No breaking	See Clause 6.5.3
Coefficient of friction	Dry putting ≤0.363 Applying swell soil ≤0.155	

Connection sealing test	No leakage	See Clause 6.5.4
Note: coefficient of friction refers to the one when the internal wall of pipe penetrates the low density sheath cables. Test methods is to be determined.		

5.4.2 Cold-bending radius of curvature. Refer to Table 6 for the minimum bend radius of the pipe; when the co-bender is adopted to bend as per the minimum bend radius, the pipe wall shall not be broken. See Clause 6.5.5 for the test methods.

Table 6

Nominal Diameter / mm	110/100	100/90	75/65	63/54	50/41
Minimum bend radius / m	5.0	4.5	3.5	3.0	2.5

5.4.3 Physical and mechanical properties of low-density polyethylene smooth-wall sub-pipe shall conform to the requirements in Table 7.

Table 7

Items	Technical Indicators	Test Methods
Tensile strength	≥8 MPa	See Clause 6.5.6
Elongation at break	≥350%	See Clause 6.5.6
Longitudinal reversion	≥3.0%	See Clause 6.5.7

5.4.4 The technical requirements of single-wall corrugated pipe shall conform to the provisions in ZB G33 008-89.

6 Test Methods

6.1 Standard environment for conditioning and testing

Unless otherwise specified, specimen shall be carried out conditioning at 23°C as per the provision in GB 2918; the time shall be no less than 24h. And test shall be carried out under such condition.

6.2 Appearance inspection

Inspect with naked eyes; while the internal wall can be observed through the light source.

6.3 Size measurement

6.3.1 Length

It shall be measured by the scale with accuracy of 5mm.

6.3.2 Average outside diameter

Corrugated pipe shall be measured by vernier caliper with accuracy of 0.02mm; take

three specimens; measure the two mutually perpendicular outside diameters on the same cross-section for each specimen; then take arithmetic average value of the two outside diameters as the average outside diameter of the pipe. Use the measurement results to calculate the deviation of outside diameter. Take the one of the three specimen measurement values with maximum deviation to be the measurement result.

The average outside diameter and deviation of composite foam pipe and solid wall pipe shall be carried out as per the provisions in GB 8806.

6.3.3 Minimum inside diameter

Take three specimens; measure the various inside diameters on the same cross-section for each specimen by the vernier caliper with accuracy of 0.02mm; then find the minimum value, which shall be the minimum inside diameter. Use the measurement results to calculate the deviation. Take the one of the three specimen measurement values with maximum deviation to be the measurement result.

6.3.4 Wall thickness deviation on the same cross-section

Take three specimens; measure the maximum and minimum wall thickness of composite foam pipe and solid wall pipe on the same section as per the provision in GB 8806; use the maximum wall thickness minus the minimum wall thickness and then divided by the maximum thickness; the calculated results of the above shall be wall thickness deviation on the same section. Take the one of the three specimen measurement values with maximum deviation to be the measurement result.

6.3.5 Inside diameter and depth of socket

Take three specimens; use the inside diameter measuring scale with accuracy of 0.001mm to measure the two mutually perpendicular inside diameters in the middle of the bonding socket; then calculate the arithmetic mean of them; take the one of the three specimen measurement values with maximum deviation to be the measurement result of inside diameter of socket.

Use the vernier caliper with accuracy of 0.02mm to measure the three specimens; take the minimum depth value of each specimen; the minimum depth among three measurement results shall be regarded as the measurement result.

6.4 Degree of curvature

It shall be measured as per the provisions in GB 8805.

6.5 Physical and mechanical properties

6.5.1 Drop hammer test

Figure 11 Cold-Bending Test**6.5.7 Longitudinal reversion**

It shall be measured as per GB 6671.2.

7 Inspection Rules

7.1 Product can only leave the factory after it is inspected-qualified by the manufacturer's quality inspection department and attached with the certificate of quality.

7.2 Group-batch

Pipes shall be regarded as one batch with the same materials, the same formulation and process; the amount of each batch shall not exceed 30t. If the production is little, less than 30t is produced within 6 days, then the 6-day production shall be regarded as one batch.

7.3 Exit-factory inspection

7.3.1 Exit-factory inspection items include the ones specified in Clause 5.1~5.3; drop hammer impact test and flatter test specified in Clause 5.4.1. Exit-factory inspection items of low-density polyethylene smooth-wall sub-pipe include the tensile strength and elongation at break specified in Clause 5.1~5.3, and Clause 5.4.3.

7.3.2 Clause 5.1~5.3 shall be carried out as per GB 2828; adopt one normal sampling plan; take general inspection level 1; the qualified level is 6.5, see Table 10.

Table 9**Piece**

Batch Range / <i>N</i>	Specimen Size / <i>n</i>	Qualified Qty. / <i>A_e</i>	Disqualified Qty. / <i>R_e</i>	Batch Range / <i>N</i>	Specimen Size / <i>n</i>	Qualified Qty. / <i>A_e</i>	Disqualified Qty. / <i>R_e</i>
≤150	8	1	2	501~1200	32	5	6
151~280	13	2	3	1201~3200	50	7	8
281~500	20	3	4	3201~10000	80	10	11

7.3.3 Randomly take sufficient samples from the ones that are qualified during the counting sampling; then conduct the impact test and flatter test specified in Clause 5.4.1; the low-density polyethylene smooth-wall sub-pipe shall conduct tensile strength and elongation at break tests specified in Clause 5.4.3.

7.4 Type inspection

Type inspection items shall be all of the technical requirements items.

According to the technical requirements of this Standard and the provisions of Clause 7.3.2, conduct test for Clause 5.1~5.3; randomly take sufficient samples from the ones that are inspected qualified; then conduct the various performance tests as per Clause 5.4. Generally, test once each year. Type inspection shall be implemented in case of the following situations:

- a) Trial production and type appraisal against the transfer-the-factory-production of old and new products;
- b) When there are significant changes for the structure, material, and process which may influence the product performance;
- c) After the long-term shutdown, the production is restored;
- d) When there is significant difference between exit-factory inspection and the previous type inspection;
- e) When State Administration of Quality Supervision proposes to conduct type inspection.

7.5 Determination rules

If any item in Clause 5.1~5.3 doesn't conform to the provisions in Table 9, then such batch of product shall be judged as disqualified. If one property in physical and mechanical properties doesn't reach the relevant indicator, then randomly take double quantity of samples for the re-inspection. If it is disqualified in the re-inspection, then such batch of product shall be judged as disqualified.

8 Label, Transportation, and Storage

8.1 Label

The following obvious labels shall be attached to the product: produce name, product label, this Standard number, manufacturer name (or trademark), and production date.

8.2 Transportation

During the loading, unloading and transporting of the product, it shall not suffer severe impact, tossing or heavy pressure.

8.3 Storage

Pipe storage site shall be smooth; and pipe shall be stacked neatly; the stacking height shall not exceed 2m; keep away from the heat source for no less than 1m; PE pipe shall be no less than 5m, and shall not expose to the air. Storage period shall not exceed two years since the production date.

Appendix A

(Informative)

Adaption Relationship between Pipe Diameter and Cable, Cable Network

A1 Inside diameter of pipe shall be determined by the adaption relationship between the inside diameter of pipe and the outside diameter of specified type of cables.

A2 Major cable types that determine the pore diameter

Different types of cables require different outside diameter. The type of cables that determine the pore diameter shall be commonly used, which is conducive to reduce the pore diameter and improve the line-containing rate of pipe and pore, and conform to the requirements of twisted, hollow-core, high capacitor, integrated aluminum sheath, 0.4mm line diameter, foam (foam-containing/ solid skin) polyolefin insulated cables that are stipulated in China cable product standards. 2400 pairs of the above types of cables are the conventionally maximum outside diameter or maximum pairs cables that determine the inside diameter of pipe pore. The plastic pipe equipped for the extra-large outside diameter shall be extra-large pore diameter of plastic pipe.

A3 Cable outside diameter standards that determine the pore diameter

The outside diameter of the same type of cable may be different in different countries and different standards. High-standard requires small outside diameter, while low standard requires large outside diameter. The inside diameter of plastic pipe for underground communication pipe shall be determined by the outside diameter of cables stipulated in GB/T 13849.1-93 and YD/T 630-93; these two standards have the close provisions as many countries' BPO standards in the fields of outside diameter of cables.

A4 Empirical formula of adaption relationship between the inside diameter of pipe pore and outside diameter of cables is as follows:

There are several kinds of empirical formulas to express the adaption relationship between the outside diameter of cable and pore diameter; this Standard adopts the following two formulas:

CCITT suggested formula:

$$\Phi \geq d/0.8 \quad \dots\dots\dots (A1)$$

James S. Tyler formula:

$$\Phi \geq 1.05 d + 8.38 \quad \dots\dots\dots (A2)$$

Where:

d – Outside diameter of cable, mm;

φ – Inside diameter of pipe pore, mm.

The meaning of Formula (A1) is that the cross-section of cable shall not exceed 80% inner cross-section of pipe pore; it is applicable to the medium above pair cables.

Formula (A2) has contained 5% outside diameter deviation of cable in item “1.05 d ”; while the ring thickness has been contained in item “8.38”. The margin between inside diameter of pipe pore and outside diameter of cable is 6.38mm. In order to meet such requirement, when the plastic pipe with inside diameter 65mm or below, the outside diameter of cable shall be calculated as per Formula (A2). Refer to Table A1 for the adaption relationship between the inside diameter of pipe pore and outside diameter of cable.

Table A1 Adaption Relationship between Inside Diameter of Pipe Pore and Outside Diameter of Cable

Nominal Diameter / mm	Minimum Inside Diameter of Pipe Pore / mm	Adapted Maximum Outside Diameter of Cable / mm	Adapted Cable types
110/100	97	86.7	0.32/6000 HYFA, 86.16 0.4/3600 HYFA, 85.28
100/90	88	78.7	0.4/3000 HYFA, 77.87
75/65	65	53.9	0.4/1200 HYFA, 52.5
63/54	54	43.4	0.4/600 HYFA, 39.0
50/41	41	31.1	0.4/300 HYFA, 30.0

A5 Pore diameter series

There are big and small cables; it is economic and conducive for adopting several pore diameters. The pore diameter grades and series are adapted with the pipe network structure in Figure 1.

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