

JIS

JAPANESE INDUSTRIAL STANDARD

Polyethylene lining lead pipes for water supply

Ⓔ JIS H 4312—1993

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.



1. Scope This Japanese Industrial Standard specifies polyethylene lining lead pipes (hereafter referred to as "lining lead pipes") used for water supply of 0.75 MPa{7.6 kgf/cm²} or under in service pressure.

Remarks 1. The cited standards in this Standard are as given in Attached Table 1.

2. The units and numerical values given in { } in this Standard are based on the traditional units and are appended for informative reference.

2. Definitions The definitions of principal terms used in this Standard are as follows.

(1) Basis pipe A bare pipe made of lead.

(2) Lining film A fusion-adhered layer wherein polyethylene is fusion-adhered to the inner surface of a basis pipe.

(3) Outer surface coating A coating of polyethylene applied onto the outer surface of basis pipe which has preliminarily been heated at a suitable temperature.

(4) Service pressure A highest service pressure of water (hydrostatic head) in an ordinary service condition.

3. Classes and symbols The classes and symbols of lining lead pipes shall be as given in Table 1 according to the chemical composition and the difference in wall thickness of a basis pipe.

Table 1. Classes and symbols of lining lead pipes

Class	Symbol	Informative reference
		Characteristics and examples of uses
Lining lead pipe special class	PbTWS-L	PbTWS-L is a pipe wherein a lining film and an outer surface coating are applied to a basis pipe special class, which is excellent in flexibility, fatigue resistance and corrosion resistance, and high in water hammer resistance. Tensile strength of the basis pipe is about $19.6 \text{ N/mm}^2 \{2.00 \text{ kgf/mm}^2\}$.
Lining lead pipe class 1	PbTW1-L	PbTW1-L is a pipe wherein a lining film and an outer surface coating are applied to a basis pipe class 1, which is excellent in flexibility and corrosion resistance, and high in water hammer resistance. Tensile strength of the basis pipe is about $13.2 \text{ N/mm}^2 \{1.35 \text{ kgf/mm}^2\}$.
Lining lead pipe class 2	PbTW2-L	PbTW2-L is a pipe wherein a lining film and an outer surface coating are applied to a basis pipe class 2, which is excellent in flexibility and corrosion resistance, and high in water hammer resistance. Tensile strength of the basis pipe is about $15.2 \text{ N/mm}^2 \{1.55 \text{ kgf/mm}^2\}$.

4. Quality

4.1 Appearance The appearance shall be as follows.

- (1) Lining lead pipes shall be practically near a perfect circle, free from defects harmful to use, rich in flexibility and easily bendable.
- (2) A lining film shall stick sufficiently to the inner surface of a basis pipe, and be free from harmful flaws, irregularities, mixing of foreign substances, etc.
- (3) An outer surface coating shall stick sufficiently to the outer surface of a basis pipe, and be free from harmful flaws, irregularities, mixing of foreign substances, etc.

4.2 Flexibility Lining lead pipes of 25 or under in a nominal diameter, when subjected to the test of 8.2, shall be free from water leakage.

Further, for a lining film and an outer surface coating, peeling-off, cracking, and breakage shall not be generated.

4.3 Pressure resistance When lining lead pipes are subjected to the test of 8.3, the lining lead pipe special class shall withstand 2.3 MPa{23.5 kgf/cm²}, and the lining lead pipe class 1 and class 2 shall withstand 1.75 MPa{17.8 kgf/cm²} in hydraulic pressure, and they shall be free from deformation and water leakage.

Further, for the lining film and the outer surface coating, peeling-off and breakage shall not be generated.

4.4 Performance of lining film and outer surface coating A lining film and an outer surface coating, when subjected to the tests of 8.4 to 8.7, shall conform to the requirements specified in Table 2.

Table 2. Performance of lining film and outer surface coating

Test	Quality	Test temperature	Applied test clause
Pinhole test	These shall be no defect to generate spark with a holiday detector.	Ordinary temperature ⁽¹⁾	8.4
Adhesion strength test	A load when the sample is peeled off shall be at least 15 N·cm{1.53 kgf/cm}.		8.5
Flattening test	A lining film and an outer surface coating shall be free from generation of peeling off, flaws, and breakage.		8.6
Elution test	Turbidity is 0.5 degree max.		8.7
	Chromaticity is 1 degree max.		
	Consumption of potassium permanganate is 2 mg/l max.		
	Elution quantity of lead is 0.008 mg/l max.		
	Loss of residual chlorine is 0.7 mg/l max. Odor shall not be abnormal.		
	Taste shall not be abnormal.		

Note (1) The ordinary temperature herein means 20 ± 15°C (temperature class 15 specified in JIS Z 8703).

5. Shape, dimensions, and tolerances thereon

5.1 Shape The shape of the lining film and outer surface coating of lining lead pipes shall be as same as those at the end face of the basis pipe over the whole length.

5.2 Thicknesses of lining film and outer surface coating and tolerances thereon The thicknesses of the lining film and outer surface coating of lining lead pipes and tolerances thereon shall be as given in Table 3.

Table 3. Thicknesses of lining film and outer surface coating and tolerances thereon

Unit: mm

Nominal diameter	Lining film		Outer surface coating		Informative reference		
	Thickness	Tolerance	Thickness	Tolerance	Approximate value of inner diameter of lining lead pipe	Approximate value of outer diameter of lining lead pipe	
						Special class and class 2	Class 1
13	0.3	+ not specified -0.05	0.4	+0.15 -0.05	12.4	20.6	23.2
20			0.5		19.4	29.4	32.6
25					24.4	35.4	38.6
30	0.35	+ not specified -0.05	0.6	+0.25 -0.1	29.3	41.8	44.8
40			0.7		39.3	54.2	57.6
50			0.8		49.3	66.6	70.4

6. Materials for lining lead pipes

6.1 Basis Pipes The basis pipes specified hereunder shall be used for lining lead pipes.

(1) **Chemical composition** The chemical composition of basis pipes shall be as given in Table 4.

Table 4. Chemical composition of basis pipes

Unit: %

Class	Chemical composition									
	Pb	Te	Sb	Sn	Cu	Ag*	As*	Zn*	Fe*	Bi*
Basis pipe special class	Re- mainder	0.015 to 0.025	Total 0.02 max.							
Basis pipe class 1			Total 0.10 max.							
Basis pipe class 2			0.10 to 0.30	Total 0.25 max.						

Note * Unless otherwise specified, these elements shall not be analyzed.

- (2) Dimensions, mass, and tolerances thereon The dimensions, mass and tolerances thereon shall be as given in Table 5 and Table 6.

Table 5. Dimensions and mass of basis pipes

Nominal diameter	Inner diameter mm	Basis pipe special class and class 2		Basis pipe class 1	
		Wall thickness mm	Mass per 1000 mm in length kg	Wall thickness mm	Mass per 1000 mm in length kg
13	13	3.4	2.0	4.7	3.0
20	20	4.2	3.6	5.8	5.3
25	25	4.7	5.0	6.3	7.0
30	30	5.3	6.7	6.8	8.9
40	40	6.4	10.6	8.1	13.9
50	50	7.5	15.4	9.4	19.9

Remarks: The mass of 1000 mm has been calculated on the basis of 11.34 g/cm³ in density by counting fractions of 1/2 and over as one and discarding the rest at two places of decimals.

Table 6. Tolerances on dimensions and mass of basis pipes
Unit: %

Tolerance on inner diameter	Tolerance on wall thickness	Tolerance on mass
±3	±8	±3

6.2 Film and coating materials Polyethylene powders used for a lining film and polyethylene used for an outer surface coating shall be as given in Annex 1.

7. Manufacturing methods

7.1 Basis pipes Basis pipes shall be manufactured with an extrusion tubing machine. However, the melting and casting temperature in case of basis pipe special class shall be about 500°C or higher.

7.2 Lining film The lining film shall be manufactured in accordance with either of the following methods.

- (1) For a lining film, just after the manufacture of a basis pipe or heat the basis pipe preliminarily, keep it at 180°C or higher, send polyethylene powders into its inner surface by a method such as pressure feed, suction, etc. and adhere by fusing to form the lining film.

Further, avoid rapid cooling after fusing.

- (2) Conform to fluidized bed coating method specified in 7.3.

7.3 Outer surface coating For an outer surface coating, heat the outer surface of a basis pipe preliminarily, and coat the outer surface with polyethylene by an extrusion method, a fluidized bed coating method, etc.

8. Test methods

8.1 Chemical analytical test The chemical analytical test of a basis pipe shall be in accordance with JIS H 1121 or JIS H 1123.

Further, the analytical method for tellurium shall be as given in Annex 2.

8.2 Bending test For a bending test of lining lead pipes, bend the sample gradually (during 10 s to 15 s) which have been used for the hydraulic test in 8.3 by 90° with the bending device as given in Attached Fig. 1 keeping a hydraulic pressure of 0.75 MPa{7.6 kgf/cm²} in the pipe, restore the sample to the original position at the same speed as bending (for 10 s to 15 s), and further bend it by 90° in the opposite direction then restore to the original position. The bending device shall be constructed as follows: a metallic roller having an outer diameter corresponding to three times the inner diameter of a basis pipe as given in Attached Fig. 1 is provided thereto; the pipe is brought into contact with the roller by use of a pipe like handle, and the lining lead pipe can be bent easily without generating any strain in its shape nor any flaw on the outer surface coating.

8.3 Hydraulic test For a hydraulic test of lining lead pipes, cut the sample into 1000 mm or more in length, apply pressure gradually (for 20 s to 40 s) thereto to the pressure specified in 4.3 with water at ordinary temperature, and leave as it is for 1 min.

8.4 Pinhole test For a pinhole test of lining lead pipes, use a holiday detector, and examine the existence of pinholes over the whole of inner and outer surfaces at about 2000 V (low frequency discharge system).

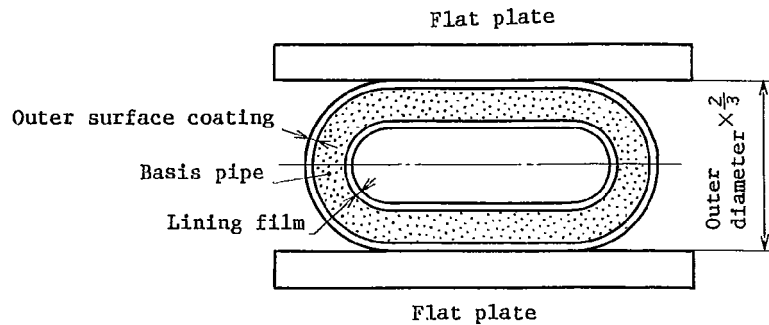
Further, voltage in using a high frequency discharge system shall be 10000 V to 15000 V.

8.5 Adhesion test For an adhesion test of lining lead pipes, cut a sample into 100 mm or more in length, cut it into two halves longitudinally, enter two notches of 60 mm or more in length at an interval of 10 mm on the lining film and the outer surface coating until reaching the basis pipe, raise its one end by peeling, and measure a load in peeling off at a speed of about 50 mm per min in a 90° to 180° direction at ordinary temperature by use of a spring balance or the like.

When the lining film or the outer surface coating is ruptured on the way to peeling off, sufficient adhesion is considered to exist.

8.6 Flattening test For a flattening test of lining lead pipes, cut a sample into 50 mm or more in length, put it between two flat plates as given in Fig. 1 at ordinary temperature, and compress gradually until the distance between two flat plates reaches an interval of $\frac{2}{3}$ the outer diameter of the lining lead pipe.

Fig. 1. Flattening test



8.7 Elution test The elution test method of lining lead pipes and the preparation method of test water shall be as given in Annex 3.

In this case, the preparation methods of sample water and blank test water shall be as follows.

- (1) Cut a test pipe in the length as given in Table 7, and wash the pipe using clean water at ordinary temperature (city water or the like) for 1 h at a flow rate of 5 m or under per min.

Table 7. Test pipe

Nominal diameter	Length	m
13	4	
20		
25	2	
30		
40	1	
50		

Remarks: Four or two test pipes of 1 m in the length may be used as the test pipe of 4 m or 2 m respectively.

- (2) Prepare sample water as follows; seal one end of a test pipe hermetically with a stopper wrapped with a water-washed polyethylene film, rinse that once with a suitable quantity of test water, then fill the pipe with test water; thereafter, seal the other end hermetically in the same way; and stand still for 24 h at ordinary temperature.
- (3) Prepare blank test water as follows; fill a 500 ml hard glass bottle with ground stopper⁽²⁾ with test water; seal hermetically, intercept light, and allow it to stand still for 24 h at the same place with sample water.

Note ⁽²⁾ Wash the bottle with ground stopper preliminarily with nitric acid (1+15), and further rinse it sufficiently with the water specified in Annex 3.

Remarks: The nitric acid (1+15) herein means that wherein nitric acid (of 60 % to 62 % in concentration) and water are mixed by a volume ratio of 1 to 15 by the expression method on concentration as specified in 7.2 of JIS K 0050.

8.8 Expression of numerical values of test results Obtain the test results of 8.1, 8.5 and 8.7 to digit, one place down the specified numerical value, and round off in accordance with JIS Z 8401.

9. Inspection The inspection shall be as given in JIS H 0321 and otherwise, shall be as follows.

- (1) Basis pipes Basis pipes, when subjected to the test specified in 8.1, shall conform to the requirements specified in 6.1 (1).

Further, the basis pipes shall be inspected on dimensions and mass, and the results shall conform to the requirements specified in 6.1 (2).

- (2) Lining lead pipes Lining lead pipes shall be inspected on appearance, and the shape and thickness of a lining film and an outer surface coating, and the results shall conform to the requirements specified in 4.1 and 5.

Further, they shall be subjected to the tests specified in 8.2 to 8.7, and the results shall conform to the requirements specified in 4.2 to 4.4.

Furthermore, the appearance shall be examined visually, and the dimensions shall be measured with the micrometer callipers for external measurement specified in JIS B 7502 and the vernier calliper specified in JIS B 7507, etc.

10. Designation Lining lead pipes shall be designated by the symbol of a class and the nominal diameter.

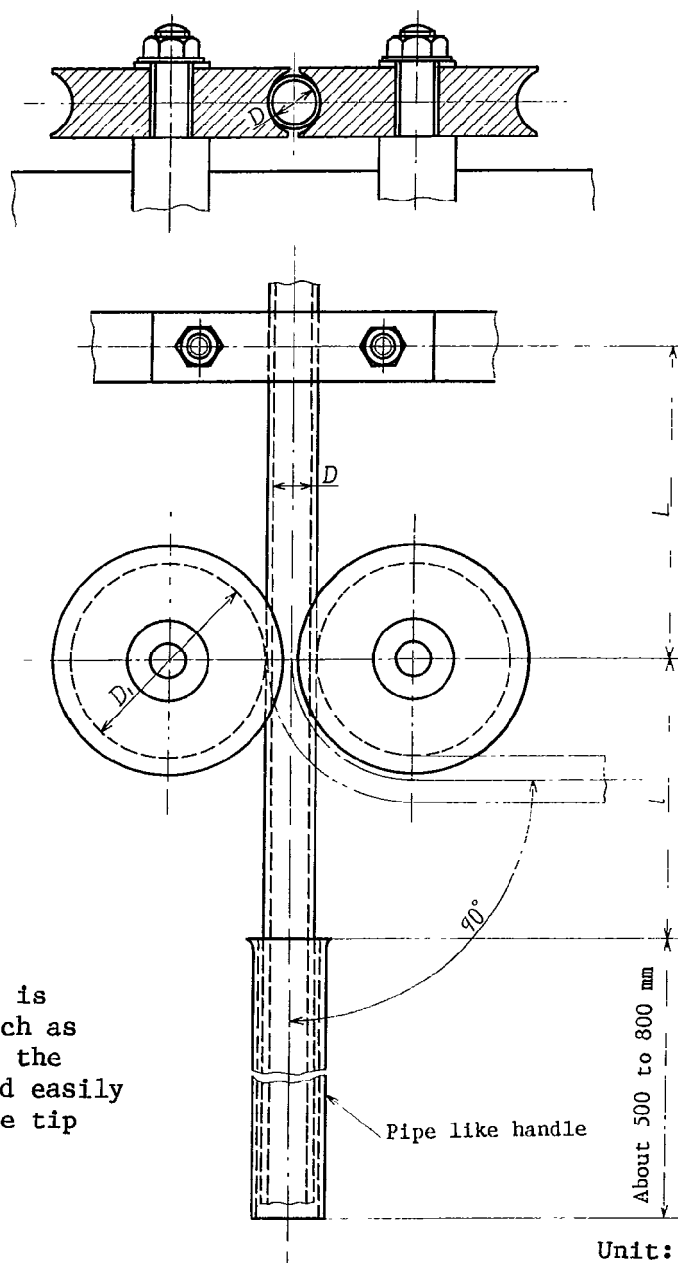
Example: In case of lining lead pipe special class and 13 in nominal diameter.

PbTWS-L-13

11. Marking Lining lead pipes shall be marked on each pipe or each bundle for a straight pipe and on each coil for a coiled pipe by a suitable method with the following items.

- (1) Class or its symbol
- (2) Dimensions (nominal diameter $\times$ thickness of basis pipe)
- (3) Manufacturing number
- (4) Manufacturer's name or abbreviation

Attached Fig. 1. Bending device



The pipe like handle is the metallic pipe such as carbon steel pipe or the like, can be inserted easily in the sample and the tip is rounded.

Unit: mm

Inner diameter of basis pipe D	Roller diameter D_1	L	l
13	39	130	120 max.
20	60	250	190 max.
25	75	250	260 max.