

## JIS G3469 Polyethylene coated Steel Pipes

### 1. Scope

This Japanese Industrial Standard specifies the external polyethylene coated steel pipes, hereinafter referred to as the "coated steel pipes", mainly used for underground (1) services transporting gas, oil, water, etc.

Note (1) The underground referred to herein includes the bottoms of river, sea, etc.

#### Remarks

The standards cited in this Standard are as follows.

JIS B 2311-Steel Butt-Welding Pipe Fittings for Ordinary Use

JIS B 2312-Steel Butt-Welding Pipe Fittings

JIS B 2313-Steel Plate Butt-Welding Pipe Fittings

JIS C 2110-Testing Methods for Electric Strength of solid Insulating Materials

JIS G 0303-General Rules for Inspection of Steel

JIS G 3451-Fittings of Coated Steel Pipes for Water Service

JIS G 3452-Carbon Steel Pipes for Ordinary Piping

JIS G 3454-Carbon Steel Pipes for Pressure Service

JIS B 3457-Arc Welded Carbon Steel Pipes

JIS K 2207-Petroleum Asphalts

JIS K 2235-Petroluim Waxes

JIS K 6760-Testing Method for Polyethylene

JIS K 7206-Testing Method for Vicat Softening Temperature of Thermoplastics

JIS K 7209-Testing Method for Water and Boiling Water Absorption of Plastics

JIS K 7215-Testing Method for Durometer Hardness of Plastics

### 2. Classification

The coated steel pipes shall be classified into 3 classes, and their symbols shall be as given in Table 1.

Table 1 Classification

Symbol of class	Polyethylene	Undercoat	Application
P1H	First layer	Adhesive	Straight pipe
P2S	Second layer	Gluing agent	Straight pipe

P1F	First layer	-	Deformed pipe
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Remarks

1. Subject to the agreement between parties concerned with delivery, gluing agent on the first layer and adhesive on the second layer can be applied respectively. The symbols of class thereof shall be P1S and P2H respectively.
2. The outer layer of polyethylene used for P2S shall be for the purpose of packaging.

World Standard Conferens Table

KS					JIS	
Grade number	Polyethylene	Undercoat	Application	GRADE	Grade number	GRADE
D 3589	First layer	Adhesive	Straight pipe	P1H	G-3469	P1H
	Second layer	Gluing agent	Straight pipe	P2S		P2S
	First layer	-	Deformed pipe	P1F		P1F

3. Quality

3.1 Appearance

The coating shall stick wall to the steel surface and be free from harmful flaws, unevenness, mingling of foreign substances, etc.


3.2 Shape and dimension

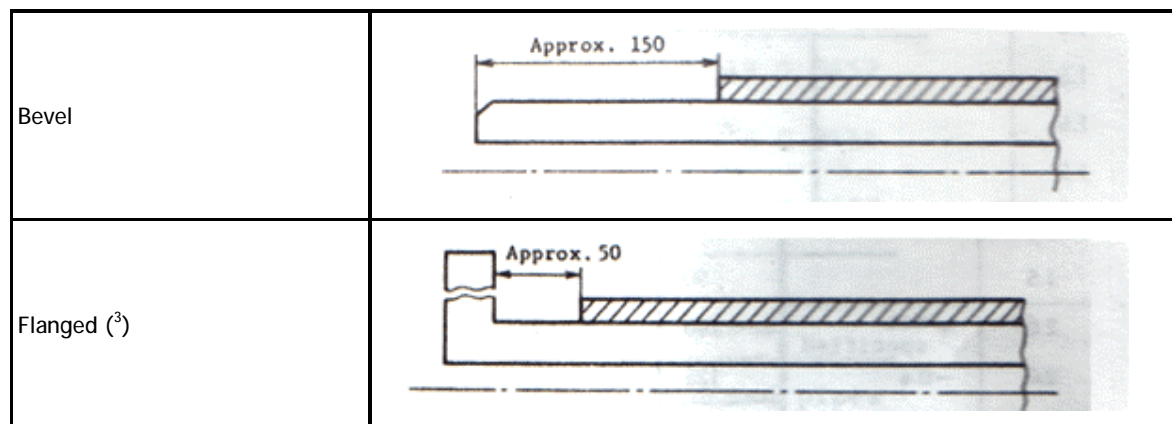
The shape and dimensions shall be as follows

- (1) The nominal diameters shall be expressed by the nominal diameters of the original pipes(²).
- (2) The position and shape of coating at both pipe ends, shall be, unless otherwise specified, as shown in Table 2. In case of plain ends, however, it shall be agreed between the parties concerned with delivery.
- (3) The maximum outside diameter of coated steel pipes using mechanical couplings may be specified by the purchaser upon agreement with the manufacturer.

Note (2) The original pipes signify both straight and deformed pipes before coating.

Table 2 Position and shape of coating at pipe end Unit:mm

Shape of pipe end	Position and shape of coating at pipe end
Threaded	



Note (3) In the case of mounting flanges to the pipes after coating, it shall be agreed upon between the parties concerned with delivery.

### 3.3 Thickness of coating

The coating thickness and its tolerances for each nominal diameter of the coated steel pipes shall be subjected to the test specified in 6.1 and shall conform to Table 3. The thickness of coating of P1H to be used with threaded couplings, however, may be specified upon agreement between the parties concerned with delivery.

### 3.4 Pinholes

The coated steel pipe shall be free from defects which generate sparks, when pinhole-tested as specified in 6.2.

### 3.5 Peeling strength

The coated steel pipes P1H and P1F shall be subjected to the test specified in 6.3 and shall show the strength of 35 N/10 mm width and over.

Table 3 Thickness of polyethylene coating and its tolerance Unit: mm

Nominal diameter A	P1H(4) and P1F		Nominal diameter A	P2S			
	Coating			Coating		Packing jacket (Informative reference)	
	Thickness	Tolerance		Thickness	Tolerance	Thickness	Tolerance
15	1.5	+Not specified	15	0.6	+Not specified	1.0	+Not specified
20	1.5	-0.3	20	0.6	-0.2	1.0	-0.3
25	1.5		25	0.6		1.0	
32	1.5		32	0.6		1.0	
40	1.5		40	0.6		1.0	
50	1.5		50	0.6		1.0	

65	1.5		65	0.6		1.0	
80	1.5		80	0.6		1.0	
90	1.5		90	0.6		1.0	
100	2.0		100	0.8		1.1	
125	2.0	+Not specified	125	0.8		1.1	
150	2.0	-0.4	150	0.9		1.2	
200	2.5	+Not specified	200	1.1		1.5	
250	2.5	-0.5	250	1.2	+Not specified	1.6	+Not specified
300	2.5		300	1.2	-0.3	1.7	-0.4
350	2.5		350	1.2		2.0	
400	2.5		400	1.2		2.0	
450	2.5		450	1.3		2.0	
500	2.5		500	1.3		2.0	
550	2.5		550	1.3		2.0	+Not specified
600	2.5		600	1.3	+Not specified	2.0	-0.5
650	2.5		650	1.3	-0.4	2.0	
700	2.5		700	1.3		2.0	
750	2.5		750	1.3		2.0	
800	2.5		800	1.3		2.0	
850	2.5						
900	2.5						
1000	2.5						
1100	3.0						
1200	3.0						
1350	3.0						

1500	3.0						
1600	3.0						
1800	3.0						
2000	3.0						

Note (4) The coating thickness of P1H includes that of adhesive layer.

#### 4. Materials

##### 4.1 original pipes

4.1.1 The original pipes to be used for the coated steel pipes shall be in accordance with either Table 4 or 5. If original pipes other than those given in Tables 4 and 5 are required, it shall be as agreed upon between the parties concerned with delivery.

Table 4 Straight pipes

Nominal diameter A	Straight pipes
15~2000	JIS G 3452
	JIS G 3454
	JIS G 3457

Table 5 Deformed pipes

Nominal diameter A	Deformed pipes
15~2000	JIS B 2311
	JIS B 2312
	JIS B 2313
	JIS B 3451

##### 4.1.2 Shape of both ends of original pipes

The shape of both ends of original pipes shall conform to either of the shapes given in Table 6. If pipe-end shape other than those given in Table 6 is required, it shall be as agreed upon between the parties concerned with delivery.

Table 6 Pipe-end shapes

Nominal diameter	Pipe-end shapes
150 and under	Plain, bevel, threaded or flanged end
Over 150	Plain, bevel or flanged end

4.2 Coating materials Polyethylene shall be as specified in Appendix 1. Adhesives and gluing agents used as undercoat shall be as specified in Appendix 2 and Appendix 3.

## 5. Method of manufacture

5.1 Pretreatments Harmful oils, rust, and other foreign substances adhering to the original pipes shall be removed by mechanical or chemical treatment.

### 5.2 Coating of straight pipes

5.2.1 P1H For P1H, the outer surface of pretreated original pipes shall be preheated and, after being applied with adhesive 0.05 to 0.3mm thick by an appropriate method, shall be coated with polyethylene by extrusion method.

#### Remarks

In case of P1S, the outer surface of pretreated original pipes shall be applied with glueing agent 0.1 to 0.5mm thick by an appropriate method and shall be coated with polyethylene by extrusion method.

5.2.2 P2S For P2S, the outer surface of pretreated original pipes shall be applied with glueing agent 0.1 to 0.5mm thick by an appropriate method and, after being coated with polyethylene by extrusion method, shall be coated with packaging polyethylene layer by the same way. In this case, coating polyethylene and packaging polyethylene layer shall never come to sticking to each other. When so designated by the purchaser, packaging polyethylene later shall be omitted.

#### Remarks

In case of P2H, the outer surface of pretreated original pipes shall be preheated and applied with adhesive 0.05 to 0.3mm thick by an appropriate method and, after being coated with polyethylene by extrusion method, shall be coated with packaging polyethylene layer by the same way. In this case, coating polyethylene and packaging polyethylene layer shall never come to sticking to each other.

5.3 Coating of deformed pipes For P I F, the outer surface or pretreated original pipes shall be heated to the temperature suitable for adhesion by heat of polyethylene and shall be coated by the methods such as fluidizing immersion, spraying or spreading of polyethylene powder.

## 6. Tests

### 6.1 Coating thickness test

The thickness of coating of the coated steel pipe shall be measured at four arbitrary points which lie diametrically at right angles at one end of the pipe.

### 6.2 Pinholes test

The holiday detector shall be used in the pinhole testing of coated steel pipe. Existence of pinholes shall be examined applying 10000 to 12000 V for contact type detector and 20000 to 40000 V for noncontact type detector, respectively.

### 6.3 Peeling strength test

In the peeling strength test, the coating shall be given 2 parallel cut lines reaching the original pipe surface, 10mm apart and not less than 60mm long, and after one end of the coating between the cut lines has been raised by peeling a little, it shall be peeled at a rate of about 50mm/min in the direction of about 90° or about 180° at ordinary temperature, and the load during peeling shall be determined.

## 7. Inspection

### 7.1 Inspection in general

The general requirements of the inspection for the coated steel pipes shall be in accordance with 2. in JIS G 0303.

### 7.2 Appearance inspection

The appearance inspection of coated steel pipes shall be carried out by visual test on each length of the coated steel pipe.

### 7.3 Coating thickness inspection

The thickness inspection on the polyethylene film for coated steel pipes shall be carried out by measuring one end of each pipe, taking two lengths from a lot of pipes of the same dimension and manufacturing.

### 7.4 Pinhole inspection

The pinhole inspection for the coated steel pipe shall be carried out on over-all coated face for each length.

### 7.5 Inspection of peeling strength

The inspection of peeling strength shall be conducted at one end of 2 lengths of coated steel pipes taken from a lot of the same dimension and manufacturing.

## 8. Marking

The coated steel pipes which have passed inspection shall be clearly marked on each length of the pipe with the following information. However, a part of the following items may be omitted by the approval of the purchaser.

- (1) Symbol of class
- (2) Manufacturer's name or its abbreviation
- (3) Symbol of original pipe
- (4) dimensions of original pipe
- (5) Year and month of manufacture

## 9. Packaging

Deformed coated steel pipes shall have their outer surfaces protected by an appropriate method if necessary.

## 10. Report

Upon request of the purchaser, the manufacturer shall submit the test results report of the specified items.

## Appendix 1. Polyethylene

### 1. Scope

This Appendix specifies the polyethylene for coatings to be used for the polyethylene coated steel pipes.

## 2. Quality

The polyethylene shall be subjected to the tests specified in 4.3 through 4.10, and shall comply with the requirements specified in Appendix 1 Table 1.

Appendix 1 Table 1. Basic properties of polyethylene (1)

Item	Unit	Specified value
Density	g/cm <sup>3</sup>	0.915 min.
Tensile strength	kN/cm <sup>2</sup>	1.18 min.
Elongation	%	300 min.
Hardness	H <sub>D</sub> D	40 min.
Softening point	°C	85 min.
Stress cracking resistance	h	96 min.
Impact resistance		No pinhole shall be produced.
Moisture absorbency	%	0.01 min.
Dielectric breakdown voltage	kV	30 min.

## 3. Materials

The materials shall be as follows:

- (1) The polyethylene is a polymer composed of ethylene as a principal component, including also that which has a very small amount of lubricant, antioxidant, etc.
- (2) In order to improve the weathering resistant property, the polyethylene shall be blended with carbon black or other pigments dispersed homogeneously.
- (3) The form of polyethylene shall be granular for straight pipes and powdery for deformed pipes respectively.

## 4. Tests

### 4.1 Preparation of test pieces

The preparation of test pieces shall comply with requirements of 3. in JIS K 6760.

### 4.2 Test in general

The test of polyethylene on density, tensile strength, elongation, hardness, softening point, stress cracking resistance, impact resistance, moisture absorbency and dielectric breakdown voltage shall be carried out on each manufacturing lot of polyethylene.

### 4.3 Density test

The density shall be measured by 4.2 in JIS K 6760.

### 4.4 Tensile strength and elongation test

The tensile strength and elongation shall be measured by 4.3 in JIS K6760.



#### 4.5 Hardness test

The hardness shall be measured by the test specified in JIS K 7215.

#### 4.6 Softening point

The softening point shall be measured by JIS K7206.

#### 4.7 Stress cracking resistance

The stress cracking resistance shall be determined by the test specified in 4.7 of JIS K 6760. The test solution, however, shall be nonylphenoxypoly (ethyleneoxy) ethanol (concentration 10 %).

#### 4.8 Impact resistance test

##### 4.8.1 Preparation of test pieces

A sheet of steel plate, 3.2 mm in thickness, 200 mm in width and 200 mm in length, one side surface of which has been removed of oils, rust, etc. and a piece of polyethylene sheet, 1.0 ± 0.10mm, in thickness, 200mm, in width and 100mm or over in length, are dipped into thermostatic water bath at 23 ± 0.5 °C for not less than one hour.

These are removed of adhering with clean cloth immediately after taken out of the water bath, and there are used as test pieces.

##### 4.8.2 Method of test

The method of test shall be as follows:

- (1) Carry out the test immediately after preparation of test pieces.
- (2) Lap the polyethylene sheet on the treated surface of the steel plate and place those on a flat wooden plate (2) with polyethylene sheet upside. Drop a steel ball and dropping height shall conform to either of those given in Appendix 1 Table 2.

Appendix 1 Table 2. Steel ball and dropping height

Steel ball	Dropping height mm
Steel ball for ball bearing 2 1 /4 common grade (mass 770g)	2050
Steel ball for ball bearing 2 1 /8 common grade (mass 650g)	2400

Note (2) Dimensions of the wooden plate are 300 ± 300mm, by 50mm in thickness of pine, Japanese cypress, of lauan.

- (3) Examine existence of pinholes using a holiday detector, at voltage specified in 6.2 in this text, after application of impact.

#### 4.9 Moisture absorbency test

The moisture absorbency shall be measured in accordance with 7.2.1 in JIS K 7209. Provided that the size of test piece is a square plate of 100 mm in one side or a circular plate of 100 mm in diameter, thickness being 3 ± 0.2mm.

#### 4.10 Dielectric breakdown voltage test

The dielectric breakdown voltage shall be measured in accordance with 8.1 in JIS C 2110. Provided that the test temperature shall be kept at a temperature of 23 ±2 C and the thickness of test piece shall be 1 ±0.1mm.

## Appendix 2. Adhesives

### 1. Scope

This Appendix specifies the adhesives to be used for polyethylene coated steel pipes.

### 2. Quality

The adhesives shall well both to steel surface and polyethylene coating, shall be subjected to the test specified in 4. and its physical and mechanical properties shall conform to Appendix 2 Table 1.

Appendix 2 Table 1. Physical and mechanical properties of adhesives (1)

Item	Unit	Specified value
Density	g/cm <sup>3</sup>	0.915 min.
Tensile strength	kN/cm <sup>2</sup>	1.18 min.
Elongation	%	300 min.
Hardness	H <sub>D</sub> D	40 min.
Softening point	°C	85 min.

### 3. Materials

Main constituent of the adhesives shall be denaturalized polyethylene which is given with adhesive property.

### 4. Test

#### 4.1 Preparation of test piece

The preparation of test piece shall be as specified in 3. of JIS K6760.

#### 4.2 Test in general

The test for density, tensile strength, elongation, hardness and softening point of the adhesives shall be carried out on each manufacturing lot of the adhesives.

#### 4.3 Density test

The density test shall be carried out in accordance with 4.2 in JIS K 6760.

#### 4.4 Tensile strength and elongation test

The tensile strength and elongation test shall be carried out in accordance with 4.3 in JIS K 6760.

#### 4.5 Hardness test

The hardness test shall be carried out in accordance with JIS K 7215.

#### 4.6 Softening point test

The softening point test shall be carried out in accordance with JIS K 7206.

### Appendix 3. Gluing agent

#### 1. Scope

This Appendix specifies the gluing agent to be used for the polyethylene coated steel pipes.

#### 2. Quality

The gluing agent shall stick well to steel face and polyethylene coating, and by the test of 4. shall be confirmed to have properties as given in Appendix 3 Table 1.

Appendix 3 Table1. Properties of gluing agent

Item	Unit	Specified value
Softening point		60 min.
Cone penetration		70 max.
Volatile loss	%	2 max.

#### 3. Materials

The gluing agent shall consist of rubber, asphalt and resin or these as principal ingredients.

#### 4. Tests

##### 4.1 Softening point test

The softening point test shall be carried out in accordance with 6.4 in JIS K 2207 on each manufacturing lot.

##### 4.2 Cone penetration test

The cone penetration test shall be carried out in accordance with 5.10 in JIS K 2235 on each manufacturing lot. However, sample temperature shall be 23 【0.5°C.

##### 4.3 Volatile loss test

The volatile loss test shall be carried out in accordance with 6.9 in JIS K 2207 on each manufacturing lot. However, an electric hot wind drier may be used.