

JIS

JAPANESE INDUSTRIAL STANDARD

Coal-Tar Enamel Protective
Coatings for Steel Water Pipe

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Coal-Tar Enamel Protective Coatings
for Steel Water PipeG 3492-1977
(Reaffirmed: 1983)1. Scope

This Japanese Industrial Standard specifies the methods for coating or protective coating of steel water pipe, hereinafter referred to as the "pipe", by using coal-tar enamel, hereinafter referred to as the "enamel". However, the interior coating of field joint applies to pipes of not less than 800 A in nominal diameter.

2. Coating

The coating, which is used for coating and protective coating of pipes, is composed of coal-tar primer and coal-tar enamel. After drying, they shall be not detrimental to by give and shall not give bad influence on the quality of water.

2.1 Coal-Tar Primer The coal-tar primer, hereinafter referred to as the "primer", shall be used for improving close adhesion of the subsequent coating enamel to the pipe to be coated and shall conform to the following respective items.

Remark: Primer shall be sealed tightly and stored in a room.

2.1.1 Composition The primer shall be principally composed of coal-tar pitch, or swelling coal and refined tar-series solvents and free from benzole and other poisonous substances. However, to improve the properties of primer, other suitable substances may be added.

2.1.2 Workability The primer shall be able to be uniformly coated by brushing or spraying.

2.1.3 Heating Residue The heating residue of primer shall be 40 % min.

2.1.4 Drying Time The dry to touch time of primer shall be within 4 h.

2.1.5 Selection For the primer, the product from the same material manufacturer ⁽¹⁾ as that of enamel shall, as a rule, be used. However, when approved by the purchaser ⁽²⁾, primers from other material manufacturers may be used.

Notes ⁽¹⁾ The material manufacturer herein means the manufacturer of coating or protective coating material.

⁽²⁾ The purchaser herein means the purchaser of coating or protective coating steel pipe and the purchaser of engineering work for coating and protective coating of steel pipe.

Applicable Standards: See page 25.

2.2 Enamel Enamel is an important material for corrosion resistant coating of pipe and shall conform to the following items.

2.2.1 Composition Enamel, which is prepared by adding inert mineral particulates ⁽³⁾ to bituminous materials of coal-tar pitch series or swelling coal series, shall not contain petroleum asphalt or natural asphalt.

Note ⁽³⁾ The fineness of inert mineral particulates shall be 90 % min. in passing rate through 74 μm sieve of JIS Z 8801.

2.2.2 Quality of Material Enamel shall be tested concerning the items given in Table 1 and their results shall conform to the requirements specified in the Table.

Table 1. Quality of Enamel

Test subjects	Test items and test methods			Minimum	Maximum
Enamel	Softening point (JIS K 2531) °C			105	—
	Penetration (JIS K 2530)		25°C·100 g·5 s	10	20
			46°C·50 g· 5 s	15	45
	Specific gravity (JIS K 2249) (25/25°C)			1.40	1.60
	Ash content (JIS K2421) %			25	35
	Viscosity (230°C) P {Pa·s}			—	6.0
Test piece coated with primer and enamel	High temperature drooping test (70°C·24h) mm			—	2
	Low temperature crack test (presence of crack and peeling) (-30°C·6 h)			None	
	Bending test	The first class test	Deflection until crack is generated mm	20	—
			Peeled area when the test piece is deflected by 38 mm cm ²	—	20
		The second class test	Deflection until crack is generated mm	15	—
			Peeled area when the test piece is deflected by 38 mm cm ²	—	33
	Impact test (25°C·650g·2.4 m)		Peeled area by direct impact cm ²	—	65
			Peeled area by indirect impact cm ²	—	13
	Peel test (at respective temperatures of 30°C, 50°C and 70°C)		The first class test	No peeling	
			The second class test	No peeling	

- Remarks 1. The first and second class tests of bending test shall be as follows:
 The first class test: a test which is carried out by a coated test piece immediately after the temperature of molten enamel reaches 230°C.
 The second class test: a test in which after the temperature of molten enamel reached 230°C, the temperature is kept as it is and thereafter a coated test piece is tested.
2. The first and second class tests of peel test shall be as follows:
 The first class test: a test in which after enamel coating, the temperature of test piece is once lowered to ordinary temperature, then regulated at respective test temperatures and the test piece is tested.
 The second class test: a test in which after enamel coating, a test piece is heated at 70°C for 72 h and then the test piece is tested in the same way as that for the first class test.
3. The units and the numerical values given in () in this standard are in accordance with the international System of Units (SI), and appended for reference.

2.3 Marking Coatings shall be clearly marked on its package with company name, product name, year and month of manufacture, lot number, etc. However, when cannot be marked on the package, a portion thereof may be omitted by obtaining the approval of purchaser.

3. Protective Coating Materials

The protective coating materials shall protect enamel film, or otherwise shall reinforce the mechanical strength of film, and usually hessian cloth, glass cloth, or glass mat shall, as a rule, be used therefor.

3.1 Hessian Cloth The hessian cloth shall be numbers 7 and 9 of JIS L 3405.

3.2 Glass Cloth Glass cloth, which is prepared for the purpose of corrosion resistance, shall be uniform in thickness, abundant in flexibility and durability and free from textile irregularities, knots and folds, and shall have material qualities given in Table 2.

Table 2. Quality of Glass Cloth

Classification	Without alkali		With alkali	
Alkali content %	0.8 max.		15 max.	
Texture	Plain weave			
Thickness mm	0.13±0.02	0.22 ±0.03	0.15±0.02	0.27±0.03
Yarn number count of using yarn (both warp and weft)	68±7	136±14	70±6	140± 10
Diameter of single fiber μm	9±1.8 or 12±1.8			
Density (both warp and weft) yarns/cm	7 min.			
Tensile strength (both warp and weft) kgf{N}/15 mm in width	20 min. {196} min.	40 min. {392} min.	20 min. {196} min.	40 min. {392} min.

- Remarks 1. The yarn number count of using yarn is designated by the yarn number count by 7.2 of JIS R 3413 (gramme number of yarn of 1000 m in length).
2. The width is, as a rule, classified into 3 classes of 160 mm, 280 mm and 330 mm and its tolerance shall be $+15$ mm.
3. The length of one roll shall usually be 90 m or 420 m.

3.3 Glass Mat Glass mat, which is prepared by combining short glass fibers with thermosetting resin, is of uniform perforated state having flexibility. It is neither deformed when wound, nor foamed when molten enamel is contacted. It shall have material qualities given in Table 3.

Table 3. Quality of Glass Mat

Thickness mm		0.25 to 0.60
Organic materials adhesion rate %		17 ± 5
Tensile strength kgf{N}/15 mm in width	Length- wise	2.0 min. {19.6} min.
	Cross- wise	1.0 min. {9.81} min.
Reinforcing yarn density yarns/cm		About 1

Remarks 1. The width shall be classified into 3 classes of 135 mm, 160 mm and 245 mm and the tolerances shall be $+5_0$ mm.

2. The length of one roll shall usually be 250 m or 300 m.

4. Method for Coating and Protective Coating in Factory

4.1 Treatment Before Coating

4.1.1 Treatment Before Blasting

- (1) Projected parts detrimental to coating the bead part of interior weld shall be finished as smoothly as possible with a sander, a grinder, or the like before blasting.
- (2) Attached oil content shall be completely removed by using a cloth or the like with solvent naphtha or other suitable solvents. The solvent naphtha shall conform to 1.2 (1) of JIS K 2433.
- (3) When coating is given bad influence by hydrogen gas generated from deposited metal, hydrogen shall be removed by a suitable method. That method shall be agreed between the purchaser and the contractor.

4.1.2 Cleaning of Steel Surface Mill scale, rust, and other foreign matters attached to the steel surface shall be removed by blast method. Further, when approved by the purchaser, they may be removed by chemical treatment method. When pickling method applies, acid content remained on the steel surface shall be removed by washing with water and thereafter immediately dried. Further, when compressed air is used for blast, oil content, water content, or the like in compressed air shall be removed with an air cleaner.

4.1.3 Treatment After Cleaning the Steel Surface The pipe the steel surface of which is cleaned, shall be so treated as neither to be rusted, nor to be attached with foreign matters such as dust, oil content, etc. before coating primer. If rust generates and its degree is slight, the rust shall be removed with a sander on a wire brush and if remarkable, it shall be removed by using blast method or the like again.

Further, attached dust shall be removed by using a vacuum cleaner, or by other methods.

4.1.4 Heating of Pipe When the temperature of pipe at the time of coating primer is 10°C max. or otherwise when moisture exists on the steel surface, the pipe shall be heated at 30 to 40°C by a suitable method and coated with primer.

4.2 Coating of Primer

4.2.1 Coating After opening the can, the primer is sufficiently agitated, transferred into a small vessel and quickly coated.

For coating, either of brushing or spraying may be used. However, the coating shall be carried out immediately after the steel surface is cleaned and dried. At that time, a suitable amount thereof shall be uniformly coated and there shall not be overcoating, drips and bare spots.

4.2.2 Coating Amount The coating amount shall be 70 to 110 g/m².

4.2.3 Coating Interval The interval from coating primer to coating enamel is different according to the temperature of pipe and shall generally be as given in Table 4.

Table 4. Coating Interval

Temperature of pipe °C	Coating interval h
In the case of near 10	48 min.
In the case of near 20	24 min.
In the case of near 30	10 min.
In the case of near 40	2 min.

Further, when 5 days have elapsed after coating primer, the primer shall be coated again. The coating amount at that time shall be half the initial amount.

4.2.4 Protection of Coating Surface After coating primer, the coating surface shall be so protected as not to be in contact with rain, water drops, dust, and other foreign substances.

4.3 Melting of Enamel

4.3.1 Melting Apparatus The melting apparatus of enamel shall be so constructed that temperature is uniformly raised and it is easy to be cleaned, having a hinged lid and shall be equipped with a suitable mechanical stirrer and a self recording thermometer.

4.3.2 Introduction of Enamel

- (1) The enamel to be introduced into a melting vessel shall be crushed to lumps of about 20 cm in diameter. Further, cares shall be taken so that they are not attached with foreign matters such as earth and sand, dust, etc.
- (2) After completing the use of one introduction amount of enamel, the subsequent amount thereof shall be introduced. However, except where the melting apparatus is divided into a melting vessel and a temperature regulation vessel.

4.3.3 Melting

- (1) The melting enamel shall be carried out by covering the melting vessel with a lid to prevent change in quality and a coating temperature (210 to 250°C) shall be reached as quickly as possible.
- (2) During heating enamel, the temperature shall be accurately controlled. However, the heating permissible time at each temperature shall be generally as given in Table 5.

Further, the maximum permissible temperature in melting shall be 270°C.

Table 5. Heating Permissible Time of Enamel in Factory

Temperature of enamel °C	Heating permissible time h
210	10
230	8
250	6

- (3) During heating enamel, the enamel shall be agitated at least each 15 min.

4.3.4 Reuse of Enamel

- (1) The enamel remained after melting or the enamel which was once melted and stripped off, shall not be mixed by 10 % or more to the subsequent introduction amount. However, when approved by purchaser, they may be mixed to 30 %.
- (2) When enamel is reused, its viscosity shall not be regulated by adding oils.

4.3.5 Cleaning of Melting Vessel As required, the melting vessel shall be blanked and cleaned. All the contents at that time shall be discarded.

4.4 Heating of Tube Coated With Primer When the temperature of pipe at the time of coating enamel is 10°C max., or otherwise when there is moisture on the primer coating surface, the pipe shall be dried by uniformly heating by a method is not injurious to primer and immediately coated with enamel.

Though the temperature of pipe at that time is suitably 70°C max., it may reach 100°C for a short time.

4.5 Enamel Coating of Inside Surface of Pipe

4.5.1 Centrifugal Coating of Straight Pipe The inside surface of straight pipe shall be coated by centrifugal force as follows:

- (1) The coating temperature shall be, as a rule, 210 to 250°C. However, when the pipe is heated at 50°C min., the coating temperature may be lowered to 190°C.
- (2) Molten enamel is poured onto the inside surface of pipe with a trough method or a feed-line method rotating the pipe on a rubber-tired wheel or a steel wheel by a suitable method, and the rotation is continued until the enamel is solidified.
- (3) When the pouring method of (2) cannot be adopted, after preliminarily pouring molten enamel onto the inside surface of pipe, the pipe may be rotated. However, the coating temperature in that case shall suitably be 230 to 250°C.
- (4) The coating shall be sufficiently closely adhered to the pipe, particularly smooth, free of harmful blisterings, craterings, wrinklins, drips, projections, mixture of foreign matters, etc. There shall not be bare spots and pin holes.

4.5.2 Coating of Shape Pipe When centrifugal coating can be carried out, the coating shall conform to 4.5.1 and the coating of shape pipe for which centrifugal coating cannot be carried out, shall be carried out by manual coating as follows:

- (1) The coating temperature shall be, as a rule, 230 to 250°C.
- (2) Enamel shall be quickly coated onto the inside surface of pipe to form a uniform thickness. Thereafter, the surface shall be immediately carefully so finished as to be smooth with heating the surface.
- (3) For coating tools, brush, trowel, spatula, etc. shall be used. Further, the brush shall be Tampico brush or those equal or superior thereto.
- (4) Coating operation shall be carried out in a downward posture as far as possible and a small amount of enamel shall be flow-coated. It shall be spreadingly coated with a trowel or a spatula and so finished as smoothly as possible to a specific thickness.

When transverse or overhead coating operations are required, brushing shall be carried out at least 2 times and the films shall be overlapped at each coating.