

MATERIAL STANDARD

FOR

BITUMEN ENAMEL (HOT APPLIED)

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1. SCOPE

This Standard Specification covers the minimum requirements for the composition, properties, storage life, packaging, sampling, inspection and testing; and labeling of bitumen (Asphalt) enamels grades a, b, and c (Hot- Applied) suitable mainly for protecting the external surfaces of steel pipes and fittings, used in buried and submerged pipelines. The enamel is to be selected according to the maximum service temperature as set out in table 1 and/or local conditions (particularly of climates, storage, handling and exposure). Asphalt enamels are not intended for use on pipelines carrying crude oil, petroleum products and liquid hydrocarbon which may dissolve the enamel.

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The edition of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this standard shall be mutually agreed upon by the Company and the Vendor.

ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

ISO 5256 "Steel Pipes and Fittings for Buried or Submerged Pipelines-External and Internal Coating by Bitumen or Coal-tar Derived Materials"

BSI (BRITISH STANDARD INSTITUTION)

BS 4147 "Bitumen Based Hot-Applied Coating Materials for Protecting Iron and Steel, Including Suitable Primers Where Required"

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-TP-270 "Coatings"

3. DEFINITIONS AND TERMINOLOGY

ADDITIVE

A suitable substance which, when added to a petroleum product, confers on it special properties or enhances its natural properties.

COATING (PROCESS)

The Process of applying a thin layer of a material in the form of a fluid or powder upon a substance.

COATING (PRODUCT)

A thin layer of a material applied by a coating process.

FILLER

An inert powder which can be incorporated in a bitumen enamel in order to improve one or more of its useful properties without changing its quality.

HOT-APPLIED

Of such a consistency at ambient temperature that heating is require before application.

LOT OR BATCH

The lot or batch shall consist of an indefinite number of containers, offered for acceptance, of materials (see 7.3) manufactured by a single plant run through the same processing equipment, with no change in ingredient materials.

NOMINAL PARAMETERS

The nominal parameters are the parameters(e.g., weight, thickness, density, etc.) specified on product labels, invoices, sales literature, and the like. The actual parameters shall not be less than 95% of nominal parameters.

PENETRATION

The depth, expressed in units of 0,1 mm, to which a standard needle placed vertically on the surface of the sample of bitumen enamel, and loaded with a 100 g weight under the specified conditions of temperature (25°C) and time (5s) will enter.

PETROLEUM BITUMEN

A mixture of high molecular mass hydrocarbons derived from petroleum by oxidation of suitable selected bases to a varying extent, possibly by adding fillers, in order to produce a material conforming to one of the grades a, b or c of Table 1.

PRIMER

A liquid material applied as an undercoat directly to the metal, in order to assist the bonding of a subsequent coating of bitumen enamel. There are two types of primer: bitumen and synthetic primer.

SOFTENING POINT (RING AND BALL)

The temperature at which a disc of the material, contained in a ring, undergoes a standard deformation caused by the weight of a ball under standardized test conditions.

SYNTHETIC PRIMER

A primer containing solvent and whose base consists of resins and synthetic plasticizers (see IPS-M-TP-275).

4. UNITS

This Standard is based on International System of Units (SI), except where otherwise is specified.

5. COMPOSITION

5.1 Ingredients and Proportions

The bitumen enamel of either grades (see Table 1), as specified by the purchaser, shall consist of a uniform mixture of petroleum bitumen and inert non-fibrous filler, plus suitable additives. The filler shall be non-hygroscopic and unreactive with the other constituents of the protection, and resistant to attack by the medium to which it will normally be exposed. It shall be stable at the maximum application temperature of the coating material.

The particle size of the filler shall meet the following requirements when tested by the method N of ISO 5256.

- a) > 500 μm : 0 %
- b) > 90 μm : < 10 %

It shall be black in color and possesses waterproofing and adhesive properties. Suitable additives shall be utilized in the enamel formulation in order to resist fungi and to pass the test described in Appendix A regarding root penetration.

5.2 Percentage

The enamel shall contain 100% by weight of non-volatile film forming solids (bitumen and filler).

6. PROPERTIES

6.1 Requirements to be Met by Bitumen Enamel

The enamel shall comply with the requirements for the appropriate grade, as specified by the purchaser, given in table 1 when tested by the methods specified and also with requirements of subclauses 6.1.1 through 6.1.3.

6.1.1 Compatibility

There shall be no evidence of incompatibility of any of the ingredients of enamel when two parts of the enamel are melted together.

6.1.2 Application temperature

The application temperature of the enamel shall be within 220 to 240°C.

6.1.3 Pot life

The Pot life of the enamel in molten state shall be 4 hours minimum (without agitation).

6.2 Requirements to be Met by Bitumen Enamel and Primer

6.2.1 The Bitumen enamel in conjunction with an appropriate primer, IPS-M-TP-285 (Bitumen Primer for cold application) or IPS-M-TP-275 (Synthetic Primer for coal-tar and bitumen enamel) as specified by the purchaser, shall comply with the requirements for the appropriate grade given in Table 2 when tested by the methods specified.

6.2.2 Unless otherwise specified, the bitumen enamel and primer shall be supplied by the same manufacturer.

6.2.3 When bitumen enamel and primer are from different suppliers, the coating materials shall also pass the test C-J of ISO 5256 (adhesion and compatibility) in addition to requirements of 6.2.1.

TABLE 1 - PROPERTIES OF BITUMEN (ASPHALT) ENAMEL

CHARACTERISTICS	UNIT	REQUIREMENTS			TEST METHOD
		Grade a	Grade b	Grade c	ISO 5256
Ash and filler content (mass)	%	≤ 40	≤ 40	≤ 55	Method M
Softening point (ring & ball)	°C	≥ 95	≥ 110	≥ 120	Method D
Penetration (25°C; 100 g; 5s.)	10 ⁻¹ mm	< 25	< 20	< 20	Method E
Indentation* (25°C; 25 N; 24h)	mm	≤ 17	≤ 10	≤ 8	Method G
Water absorption (40°C; 5h)	g/m ²	≤ 1.5	≤ 15	≤ 1.5	Method L
Change on heating - difference in softening point - difference in penetration	°C %	≤ 10 ≤ 40	≤ 10 ≤ 40	≤ 10 ≤ 40	Method K
Maximum service temperature	°C	35	60	60	—

* The penetration, expressed in millimeters, of a standard rod, placed vertically on the surface of a bitumen and loaded under specified conditions of temperature, load and time.

TABLE 2 - PROPERTIES OF ENAMEL ON PRIMED STEEL

Test	Unit	Grade a	Grade b	Grade c	Method	
					ISO 5256	BS 4147
Cold bending ¹	mm	≥ 20	≥ 15	≥ 10	Method F	—
Flow ² (70°C; 45°; 20h)	mm	≤ 6	≤ 2	≤ 2	Method H	—
Peel, initial and delayed (Max.) 38°C 40°C 50°C 60°C	mm	3.0 3.0 3.0 3.0	3.0 3.0 3.0 3.0	— 3.0 3.0 3.0	—	} Appendix H }
Impact, Disbanded area (max.) 0°C ³ 25°C	mm ²	15000 —	— 6500	— 6500	—	} Appendix G { (Revision A) }

1) The test consists of verifying the flexibility at low temperature of bitumen used as a coating on steel pipes and under conditions simulating the bending of coated pipe.

2) The test consists of measuring the displacement of the surface of a coating of a bitumen by its own weight under specified conditions of temperature and time.

3) If the test specimen fails the impact test at 0°C, two further test specimens shall be prepared from the same sample as the failed test specimen and both shall be tested at 0°C. The material shall be deemed to comply with the requirements of the impact test provided both of the test specimens pass the test.

7. STORAGE LIFE, PACKAGING, SAMPLING

7.1 Storage Life

The product shall meet the requirements of clause 6 after storage of at least 24 months from date of delivery, in a full tightly covered container.

7.2 Packaging

The bitumen enamel shall be supplied in one of the following forms:

1. In non-contaminated steel drums containing not more than 200 litres.
2. In craft paper bags, with easily strippable lining containing approximately 50 kg. (only in case of local purchase).

7.3 Sampling

Unless otherwise specified by purchaser, the number of samples for testing shall consist of 10 percent of the lot, but in no case shall be less than one or more than ten containers of material (see 7.2). The results of the tests on four specimens made from each sample shall be averaged for each test specified in Tables 1 & 2 to determine conformance with the specified requirements.

In coating materials, the filler will settle during storage. In order to ensure that test samples of these materials are representative, they shall be made up of equal increments taken from the top, middle and bottom of the package.

Preparation of samples for testing shall be in accordance with method C of ISO 5256.

8. INSPECTION AND TESTING

8.1 All materials supplied under this Standard Specification shall be subject to timely inspection by the purchaser or his authorized representative. The purchaser shall have the right to reject any material(s) supplied which is (are) found to be defective under this Standard Specification. In case of dispute, the arbitration or settlement procedure, established in the procurement documents shall be followed.

8.2 The supplier and/or manufacturer shall be responsible for the performance and costs for all laboratory test requirements as specified in this Standard.

The manufacturer shall set up and maintain such quality assurance and inspection systems as are necessary to ensure that the materials comply in all respects with the requirements of this Standard Specification.

8.3 Samples of any or all ingredients used in the manufacture of this material may be requested by the purchaser and shall be supplied upon request, along with the supplier's name and identification for the sample.

8.4 Purchaser's inspector(s) shall have free access to the supplier's work to follow up the progress of the materials covered by this Standard and to check the quality of materials.

The supplier shall place free of charge at the disposal of the purchaser's inspector(s) all means necessary for carrying out their inspection:

Results of tests, checking of conformity of materials with this Standard requirements, checking of marking and packing and temporary acceptance of materials.

8.5 Samples submitted to the purchaser and/or collected by the purchaser will be tested in the purchaser’s laboratory or in a responsible commercial laboratory including manufacturer’s laboratory designated by the purchaser.

8.6 The supplier shall furnish the purchaser with a certified copy of results of tests made by the manufacturer covering physical and performance characteristics of each batch of product to be supplied under this Standard Specification. The supplier shall furnish, or allow the purchaser to collect samples of the material representative of each batch of product. Certified test reports and samples furnished by the supplier shall be properly identified with each batch of product.

8.7 Prior to acceptance of the supplier’s and/or manufacturer’s materials, samples of material submitted by the supplier, or collected by the purchaser, will be tested by the purchaser. If any of the samples (see 7.3) is found not to conform to this Standard, materials represented by such sample will be rejected. If samples of the supplier’s and/or manufacturer’s material that have been previously accepted are found not to conform to this Standard, all such material will be rejected.

8.8 After the supplier has obtained approval from the purchaser for the bitumen enamel proposed to be furnished, the supplier shall submit the coating manufacturer’s detailed specifications for the bitumen enamel supplied, with instructions for the handling and application of the material. This information shall include: application temperature of enamel, maximum allowable temperature to which enamel may be heated, and maximum time enamel may be held in heating kettles at application temperature.

8.9 Unless otherwise specified in this standard specification the methods of sampling and testing shall be in accordance with applicable methods of the American Society for Testing and Materials or BS 4147.

9. LABELING

9.1 Marking of Containers

Each container shall be legibly and permanently marked with the following information:

- Name: Bitumen (Asphalt) enamel (Hot Applied)**
- Specification: IPS-M-TP-295**
- Grade number of the enamel :**
- M.E.S.C. No. :**
- Order No. :**
- Maximum temperature resistance:**
- Application temperature:**
- Pot life (hours) :**
- Color : Black**
- Batch No. :**
- Stock No. :**
- Date of manufacture :**
- Quantity of enamel in container :**
- Information and warning, if required:**
- Manufacturer’s Name and Address :**
- Design guide : For the guidance on the usage of this enamel for various applications/environments reference shall be made to IPS-E-TP-270.**

9.2 Directions for Use

In addition to the manufacturer's instructions for use, the following directions shall also be supplied with each container of bitumen enamel:

These materials are heavy-duty products for application at a minimum thickness of 2.4 mm to provide long term protection underground and in submarine installations. They are applied to iron and steel.

The enamel shall be maintained moisture and dirt-free at all times prior to, and at the time of, heating and application.

Agitation of enamel in the molten state is necessary to prevent settling of the filler.

The hot enamel shall be thoroughly and continuously stirred for a minimum of 5 min., and intervals between stirring shall not exceed 15 min., regardless of whether the enamel is being dispensed from kettles or is being held ready for use. Iron paddles shall be used for stirring. Wooden paddles will not be permitted.

Enamel that has been heated in excess of the maximum allowable temperature or that has been held at application temperature for a period in excess of that specified, shall be condemned and rejected. Fluxing the enamel will not be permitted.

All materials shall be applied in compliance with the manufacturers instructions. Care shall be exercised to ensure there is no mixing of material from different sources or of different types unless experience has shown that the final product has satisfactory properties. In particular it shall be recognized that the chemical and physical characteristics of coal-tar-based coatings differ from those of bitumen-based coatings and that the two kinds of coating shall not be blended in protective coatings. It is also essential to clean out plant thoroughly when the use of bitumen coating materials follows that of coal-tar coating materials or vice versa.

APPENDICES

APPENDIX A

TESTING FOR RESISTANCE TO ROOT PENETRATION

Procedure: Three dry flowerpots (unglazed earthenware) approx. 22 cm high are required for testing root penetration. A circular strip approx. 4 cm wide is applied to the inside of each pot about 10 cm from the bottom, using the coating material supplied by the manufacturer. When the strip is completely dry the pot is filled with soil (containing very little calcium and no compost) of pH 5-6, into which some peat has been mixed. The soil shall just cover the bottom edge of the strip.

Three plates, each 2 cm thick, are cast from the material to be tested. Their diameter shall be approximately that of the internal diameter halfway up the flowerpots. Once cool, the cast plates are put on top of the soil layer and the gap between the plate and the pot is carefully sealed with more of the test material.* 35-40 lupine seeds (*Lupines albus*) are planted in the soil and covered with about 1 cm of soil.

During winter the seeds should be grown in a heated greenhouse under artificial light. At other times of the year they can be grown outside. The soil above the plate should be watered with rain water led through a pipe into the pot so that the surface of the test material is kept damp. The soil beneath the plate is kept moist by standing the pots in rain-filled troughs. After 6 weeks (or 8 weeks in winter) the pots are cracked open and the plates are examined for root growth. The bottom side is inspected to see whether any roots have grown through the plate, and the upper side is examined to assess the number of roots penetrating the material and the depth of penetration.

As a control for this test, another pot must be prepared as described above using an 85/40 bitumen plate. At the end of the test period, a large number of lupine-roots must have grown through the plate.

The material cannot be described as root proof if any roots, even thin root-hairs, have grown through the plate, between the plate and the pot, or have penetrated the plate to a depth greater than 5 mm.

The material can be described as root proof if no roots penetrated further than 5 mm into the plates in two out of the three pots. No roots must have grown through the plate in any of the three pots.

The test is only valid if the roots have reached the upper surface of the plates.

The test shall be checked by carrying out a long-term test as well in order to confirm the depth of penetration and to ascertain whether or not the prescribed test period is adequate.

* **Approximately 9 cm soil is put on top of the plate.**