

**MATERIAL STANDARD**

**FOR**

**COLD-APPLIED LAMINATED PLASTIC TAPE**

**AS**

**INNER-LAYER TAPE**

**FOR TAPE COATING SYSTEM OF BURIED STEEL PIPES**

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**1. SCOPE**

This Standard Specification covers the minimum requirements for cold-applied laminated plastic tape to be used as inner-layer tape (innerwrap) in tape coating system to the exterior of all diameters of buried steel pipes through mechanical methods.

The main function of the inner-layer tape is to serve as the corrosion protective coating.

**2. REFERENCES**

Throughout this Standard the following standards and codes are referred to. The editions 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.

**ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)**

ANSI-AWWA C214 "Tape Coating Systems for the Exterior of Steel Water Pipelines"

**ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)**

- D 257 "Standard Test Method for D-C Resistance or Conductance of Insulating Materials"
- D 570 "Standard Test Method for Water Absorption of Plastics"
- D 618 "Standard Methods of Conditioning Plastics and Electrical Insulating Materials for Testing"
- D 1000 "Standard Test Method for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications"
- E 96 "Standard Test Method for Water Vapor Transmission of Materials"
- G 8 "Standard Test Method for Cathodic Disbonding of Pipeline Coatings"
- G 14 "Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)"

**IPS (IRANIAN PETROLEUM STANDARDS)**

- E-TP-270 "Coatings"
- M-TP-321 "Ditch and Yard Primers for Use with Cold-Applied Laminated Plastic Tape for Tape Coating System of Buried Steel Pipes"
- M-TP-311 "Cold-Applied Laminated Plastic Tape as Outer-Layer Tape for Tape Coating System of Buried Steel Pipes"

**3. DEFINITIONS AND TERMINOLOGY**

In this standard, the following definitions shall apply:

**Adhesion Strength**

The force necessary to remove the tape from a prescribed surface when measured in accordance with specific conditions of test.

**Cathodic Disbonding**

The failure of adhesion between a coating and a metallic surface that is directly attributable to cathodic protection conditions and that is often initiated by a defect in the Coating system, such as accidental damage, imperfect application or excessive permeability of the coating.

**Coating**

A coating is an electrical insulating covering applied to a metal surface as passive protection against external corrosion.

**Dielectric Strength**

The voltage at which a single layer of tape will show electrical failure under specific conditions of test.

**Elongation**

The increase in length at break when the tape is tested under specific conditions of test.

Elongation of tape is important as a measurement of its uniformity and quality.

**Impact Resistance**

The ability of a pipe Coating to resist impact from a falling weight under specific conditions of test.

**Insulation Resistance**

The insulation resistance between two electrodes that are in contact with, or embedded in, a specimen, is the ratio of the direct voltage applied to the electrodes to the total current between them.

**Lot or Batch**

The lot or batch shall consist of an indefinite number or rolls, offered for acceptance, of materials 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.

**Primer**

A solution applied as an under coat directly to the metal surface, in order to assist the bonding of a subsequent coating.

**Tensile Strength**

The force required, per unit width, to break the tape when tested under specific conditions of test.

## Water Vapor Transmission Rate

The steady water vapor flow in unit time through unit area of a body, normal to specific parallel surfaces, under specific conditions of temperature and humidity at each surface.

## 4. UNITS

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

## 5. DESCRIPTION

The inner-layer tape shall be a prefabricated tape consisting of a plastic backing of a polyethylene film and an adhesive layer of homogeneous elastomeric-sealant component laminated to the polyethylene film.

The finished material shall provide high electrical resistivity, pliability and conformability, resistance to corrosive environments, low moisture absorption and permeability, ability to remain in place on the pipe during its normal service life, and shall provide an effective bond to the primed steel surface. It shall be such a nature as to resist fungi, bacteria, plant root, and also excessive mechanical damage during normal application operations. The inner-layer tape may be made by any process that produces a product meeting the properties described in the following sections.

### Note:

**The inner-layer tape and primer(s) shall be from the same manufacturer. (For specification of primers see IPS-M-TP-321).**

## 6. PROPERTIES

The inner-layer tape shall comply with the requirements of Table 2, when applied with primer(s) of IPS-M-TP-321, and Clauses 6.1 to 6.8 inclusive.

### 6.1 Plastic Backing

The plastic backing shall be made of high-molecular-weight film-grade polyethylene resins with densities in the range of 900-960 kg/m<sup>3</sup>, as determined by ASTM D 1505 and nominal melt flow rate (melt index) range of 0.5-2.5 g/10 min., as determined by ASTM D 1238 (condition E) plus suitable additives and carbon black. The minimum thickness shall be 0.3 mm, as determined by ASTM D 1000.

### 6.2 Adhesive Layer

The adhesive layer shall consist of an elastomer compound based on a stable synthetic rubber and suitable additives. The elastomer content typically shall not be less than 20 percent by weight. The minimum thickness shall be 0.2 mm, as determined by ASTM D 1000.

### 6.3 Application Properties

The inner-layer tape shall be sufficiently pliable for normal application operations and shall withstand, without tearing, the tensile force necessary to obtain a tightly wrapped inner coating free of voids.

The inner-layer tape shall be suitable for line-travel application and also shop coating with wrapping machine, and no significant wrinkles or blisters shall be developed during application even under sunshine.

**6.4 Appearance**

The backing shall be smooth and uniform, freedom from visible faults such as slits, folds, breaks, uneven or frayed edges.

The adhesive layer shall be smooth and uniform and as free from lumps and bare spots as the best commercial practice will permit. There shall be no adhesive transfer when the tape is unwound from the roll.

**6.5 Color**

The color of plastic backing shall be black.

**6.6 Form**

The inner-layer tape shall be supplied in roll form, wound on hollow cores with a nominal inside diameter of 80 mm.

**6.7 Heat Aging**

After test samples from inside of the roll have been aged for 30 days in an air-circulating oven at a constant temperature of 60°C, the tensile strength and the elongation shall be determined at 22°C by ASTM D 1000. An average value for tensile strength and elongation shall be not less than 80 percent of the original unaged value.

**6.8 Dimensions (Roll Sizes)**

The inner-layer tape shall be furnished in standard widths and lengths consistent with the pipe diameter as will be specified by the purchaser (see Table 1)

**TABLE 1 - STANDARD DIMENSIONS FOR INNER-LAYER TAPE (NOMINAL)**

PIPE DIAMETER	TAPE WIDTHS	TAPE LENGTHS
100 mm. AND UNDER	100 mm.	61 m., 122 m.
150-300 mm.	230 mm.	61 m., 122 m.
355-610 mm.	300 mm.	61 m., 122 m. , 244 m.
660 mm. AND OVER	300 mm. OR 460 mm.	61 m., 122 m. , 244 m.

**TABLE 2 - PHYSICAL PROPERTIES OF INNER-LAYER TAPE**

PROPERTY -----	UNIT	REQUIREMENT	TEST METHOD ----- ASTM
THICKNESS: TOTAL BACKING (min.) ADHESIVE (min.)	mm.	0.550 ± 10% 0.300 0.200	D 1000
TENSILE STRENGTH (min.)	Kg/cm width	5	D 1000
ELONGATION AT BREAK (min.)	%	100	D 1000
ADHESION TO PRIMED STEEL (min.)	Kg/cm width	2.2	D 1000 (METHOD A)
ADHESION TO SELF (AT OVERLAPS) (min.)	Kg/cm width	0.5	D 1000
DIELECTRIC STRENGTH (min.)	V/ μm (KV/mm)	40	D 1000
INSULATION RESISTANCE (min.)	MEGOHMS	10 <sup>6</sup>	D 257
WATER VAPOR TRANSMISSION RATE (max.)	g/m <sup>2</sup> / 24 hrs	3	E 96 (METHOD B)
WATER ABSORPTION (max.)	%Wt	0.1	D 570
CATHODIC DISBONDING (max.)	mm. DIAMETER	50	G8 (METHOD A)
HEAT AGING IN 30 DAYS AT 60°C: REDUCTION OF ELONGATION & TENSILE STRENGTH (max.)	%	20	SEE 6.7
TEMPERATURE RANGE: APPLICATION OPERATION	°C	-20 TO +60 -20 TO +60	—

**7. STORAGE LIFE AND PACKAGING**

**7.1 Storage Life**

The product shall meet the requirements of clause 6 after storage for 24 months from date of delivery, in a full tightly covered container at temperatures between -20 to +60°C.

**7.2 Packaging**

The inner-layer tapes purchased according to this standard specification shall be packaged in suitable containers to ensure acceptance and safe delivery to their destination. Rolls of inner-layer tape shall be packaged in quantities not to exceed the weight limitation of the container specification. Each roll of inner layer tape shall be protected from adhering to other rolls, the container, or to the packaging material itself by the use of separators.

Each container of inner-layer tape shall contains application instructions.

## **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 shall be responsible for the performance and costs for all laboratory test requirements as specified in this Standard.

The supplier 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 sample rolls (see 8.8) 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 materials that have been previously accepted are found not to conform to this standard, all such materials will be rejected.

**8.8** Unless otherwise specified, 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 rolls. The results of the tests on four specimens cut from each sample roll shall be averaged for each test specified in Table 2 to determine conformance with the specified requirements.

## **9. LABELING**

### **9.1 Marking of Rolls**

Each roll shall be legibly marked with the following:

- a) Name or trade mark of the supplier;
- b) Type and trade name of tape;
- c) Length of the roll (m);
- d) Width of the roll (mm).

**9.2 Marking of Containers**

Each container shall be plainly marked with the following information:

**Name:** Cold applied laminated plastic tape as inner-layer tape for tape coating system of buried steel pipes.

**Specification :** IPS-M-TP-310

**Order No. :** .....

**Mesc No. :** .....

**Type and Trade Name of Tape :** .....

**Roll sizes : Length ..... m, width.....mm.**

**Type or Trade Name of Primer(s) (ditch and/or yard) to be Used With the Tape :** .....

**Batch No. :** .....

**Stock No. :** .....

**Date of manufacture :** .....

**Quantity (number of rolls) :** .....

**Manufacturer's name and address :**

**Design guide :** For guidance on the usage of this material reference shall be made to IPS-E-TP-270