



**American Water Works
Association**

The Authoritative Resource for Safe Drinking WaterSM

ANSI/AWWA C217-04
(Revision of ANSI/AWWA C217-01)

AWWA Standard

Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines



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6666 West Quincy Avenue
Denver, CO 80235-3098
T 1.800.926.7337
www.awwa.org

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AWWA Standard

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Committee Personnel

The Steel Water Pipe-Manufacturer's Technical Advisory Committee (SWPMTAC) Task Group on updating AWWA C217 had the following personnel at the time:

Frank C. Rampton, *Chair*

R.W. Geary, Tek-Rap Inc., Houston, Texas	(AWWA)
Jack O'Brien, Tapecoat Company, Deerfield, Ill.	(AWWA)
F.C. Rampton, Trenton Corporation, Ann Arbor, Mich.	(AWWA)
Tom Weber, Trenton Corporation, Houston, Texas	(AWWA)
J.A. Wise, Canus International Sales Inc., Langley, B.C.	(AWWA)

The AWWA Standards Committee on Steel Pipe, which reviewed and approved this standard, had the following personnel at the time of approval:

George J. Tupac, *Chair*
John H. Bambei Jr., *Vice-Chair*
Dennis Dechant, *Secretary*

Consumer Members

G.A. Andersen, New York City Bureau of Water Supply, Little Neck, N.Y.	(AWWA)
J.H. Bambei Jr., Denver Water Department, Denver, Colo.	(AWWA)
D.W. Coppes, Massachusetts Water Resources Authority, Southborough, Mass.	(NEWWA)
R.V. Frisz, US Bureau of Reclamation, Denver, Colo.	(USBR)
T.R. Jervis, Greater Vancouver Regional District, Burnaby, B.C.	(AWWA)
T.J. Jordan, Metropolitan Water District of Southern California, La Verne, Calif.	(AWWA)
T.A. Larson, Tacoma Public Utilities, Tacoma, Wash.	(AWWA)
G.P. Stine, San Diego County Water Authority, Escondido, Calif.	(AWWA)

Milad Taghavi, Los Angeles Department of Water and Power, Los Angeles, Calif.	(AWWA)
J.V. Young, City of Richmond, Richmond, B.C.	(AWWA)

General Interest Members

W.R. Brunzell, Brunzell Associates Ltd., Skokie, Ill.	(AWWA)
R.L. Coffey, Kirkham Michael Consulting Engineers, Omaha, Neb.	(AWWA)
H.E. Dunham, MWH, Bellevue, Wash.	(AWWA)
K.G. Ferguson,* MWH, Las Vegas, Nev.	(AWWA)
S.N. Foellmi, Black & Veatch Corporation, Irvine, Calif.	(AWWA)
J.W. Green, Alvord Burdick & Howson, Lisle, Ill.	(AWWA)
K.D. Henrichsen, HDR Engineering Inc., St. Cloud, Minn.	(AWWA)
M.B. Horsley,* Black & Veatch Corporation, Overland Park, Kan.	(AWWA)
J.K. Jeyapalan, Pipeline Consultant, New Milford, Conn.	(AWWA)
Rafael Ortega, Lockwood Andrews & Newnam Inc., Houston, Texas	(AWWA)
A.E. Romer, Boyle Engineering Corporation, Newport Beach, Calif.	(AWWA)
H.R. Stoner, Consultant, North Plainfield, N.J.	(AWWA)
C.C. Sundberg, CH2M Hill Inc., Bellevue, Wash.	(AWWA)
G.J. Tupac, G.J. Tupac & Associates Inc., Pittsburgh, Pa.	(AWWA)
J.S. Wailes,† Standards Engineer Liaison, AWWA, Denver, Colo.	(AWWA)
L.W. Warren, Consultant, Seattle, Wash.	(AWWA)
W.R. Whidden, Post Buckley Schuh & Jernigan, Orlando, Fla.	(AWWA)
M.C. Young,† Bucher Willis & Ratliff Corporation, Kansas City, Mo.	(AWWA)

Producer Members

H.H. Bardakjian, Ameron International, Rancho Cucamonga, Calif.	(AWWA)
Mike Bauer, Tnemec Company Inc., North Kansas City, Mo.	(AWWA)

*Alternate

† Liaison, nonvoting

R.J. Card, Victaulic Depend-O-Lok Inc., Atlanta, Ga.	(AWWA)
R.R. Carpenter, American Cast Iron Pipe Company, Birmingham, Ala.	(MSS)
Dennis Dechant, Northwest Pipe Company, Denver, Colo.	(AWWA)
B.D. Keil, Continental Pipe Manufacturing Company, Pleasant Grove, Utah	(SPFA)
J.L. Luka [*] , American SpiralWeld Pipe Company, Columbia, S.C.	(AWWA)
Bruce Vanderploeg, [*] Northwest Pipe Company, Portland, Ore.	(AWWA)
J.A. Wise, Canus International Sales Inc., Langley, B.C.	(AWWA)

^{*} Alternate

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Contents

All AWWA standards follow the general format indicated subsequently. Some variations from this format may be found in a particular standard.

SEC.	PAGE	SEC.	PAGE
Foreword		4	Requirements
I Introduction.....	ix	4.1 Coating System.....	4
I.A Background.....	ix	4.2 Material Requirements.....	4
I.B History.....	ix	4.3 Field- and Shop-Coating Applications	5
II Special Issues.....	ix	4.4 Field Procedures.....	6
II.A Advisory Information on Product Application.....	ix	5	Verification
III Use of This Standard.....	ix	5.1 Inspection	8
III.A Purchaser Options and Alternatives	ix	5.2 Testing.....	8
III.B Modification to Standard.....	x	5.3 Rejection.....	10
IV Major Revisions	x	5.4 Visual Inspection of Tape Coating System for Continuity	10
V Comments.....	x	5.5 Electrical Inspection for Continuity	10
Standard		6	Delivery
1 General		6.1 Marking.....	11
1.1 Scope	1	6.2 Packaging, Handling, and Storage ...	11
1.2 Purpose	2	6.3 Affidavit of Compliance.....	11
1.3 Application	2		
2 References.....	2	Table	
3 Definitions	3	1 Physical Properties of Coating and Primer.....	5

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Foreword

This foreword is for information only and is not a part of AWWA C217.

I. Introduction.

I.A. *Background.* This standard was developed to provide information on cold-applied petrolatum tape coatings and petroleum wax tape coatings for external use on special sections, connections, and fittings for buried or submerged steel water pipelines.

I.B. *History.* Development of this standard was authorized by the American Water Works Association (AWWA) Standards Council on Nov. 3, 1986. The first edition was approved on June 21, 1990. The second edition was approved on June 17, 1995, with an effective date of Nov. 1, 1996. The third edition was approved on Jan. 24, 1999. This edition was approved on Jan. 18, 2004.

II. Special Issues.

II.A. *Advisory Information on Product Application.* This standard defines the performance of cold-applied petrolatum tape and petroleum wax tape coatings establishing the quality desired for long-term protection and prevention of corrosion. It applies to the exterior coating of steel water pipelines for underground and underwater installation under normal conditions. It is based on previous experience but is not designed for unqualified use under all conditions. The advisability of its use for any installation must be reviewed by the purchaser. If an extended period of aboveground storage of coated pipe is anticipated, the material's ability to resist degradation by ultraviolet light and other atmospheric and environmental conditions should be considered.

III. *Use of This Standard.* It is the responsibility of the user of an AWWA standard to determine that the products described in that standard are suitable for use in the particular application being considered.

III.A. *Purchaser Options and Alternatives.* The following items should be covered in the purchaser's specification

1. Standard used—that is, ANSI/AWWA C217, Standard for Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings Steel Water Pipelines, of latest revision.
2. Any exceptions to the standard that may be required.

3. Description and dimensions of each type of special section for each type of exterior protection.
 - a. Normal or average conditions.
 - b. Unusual conditions (Sec. 1.1.1).
4. Expected aboveground exposure time (foreword, Sec. II.A).
5. Physical properties of coating and primer (Table 1).
6. Coating-system thickness (Sec. 4.2.2.4).
7. Surface preparation (Sec. 4.3.1).
8. Tape coating repair (Sec. 4.3.4).
9. Inspection requirements (Sec. 5.1).
10. Sample test requirements (Sec. 5.2).
11. Packaging (Sec. 6.2).
12. Affidavit of compliance, if required (Sec. 6.3).

III.B. *Modification to Standard.* Any modification to the provisions, definitions, or terminology in this standard must be provided in the purchaser's specifications.

IV. **Major Revisions.** Major revisions made to the standard in this edition include the following:

1. Title was changed for simplification.
2. The word "visual" was added in Sec. 4.3.4.
3. Sec. 5.3.2 requirements were changed to reference rejected coating materials.

V. **Comments.** If you have any comments or questions about this standard, please call the AWWA Volunteer and Technical Support Group 303.794.7711, FAX 303.795.7603, or write to the group at 6666 West Quincy Avenue, Denver, CO 80235-3098, or by e-mail at standards@awwa.org.



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SECTION 1: GENERAL

Sec. 1.1 Scope

This standard establishes minimum requirements for cold-applied petrolatum tape and petroleum wax tape coatings used on the exterior of steel water pipelines.

This standard describes exterior coatings that consist of cold-applied petrolatum or petroleum wax primer, petrolatum or petroleum wax saturated tape coatings and their applications to special sections, connections, and fittings to be used with buried or submerged steel water pipelines. The primers and tapes are not intended for use with steel joints or sections of steel pipe where coatings of cement mortar or concrete are applied directly onto the bare steel pipe. These coatings may be field- or shop-applied according to the provisions of this standard.

1.1.1 *Conditions not described in this standard.* This standard does not describe the additional materials and procedures that may be required for difficult

conditions, such as those encountered in building some submarine lines, casing pipe, river crossings, and lines that are in rocky areas or in severe soil stress. Consult the manufacturer for the additional materials and procedures that may be required for these conditions. These materials may not be described in this standard.

1.1.2 *Maximum temperatures.* The tape coatings described in this standard are intended for use at the service temperature of potable water but have performed properly at higher than normal service temperatures. When higher than normal temperatures are anticipated, the manufacturer should be consulted for recommendations suitable to the purchaser's needs.

Sec. 1.2 Purpose

The purpose of this standard is to provide purchasers, manufacturers, and constructors with the minimum performance requirements for cold-applied petrolatum tape and petroleum wax tape coatings, including material, application, inspection, testing, marking, and packaging requirements.

Sec. 1.3 Application

This standard or sections of this standard may be referenced in specifications for purchasing cold-applied petrolatum tape and petroleum wax tape coatings for the exterior of special sections, connections, and fittings for steel water pipelines. This standard can be used as a guide for applying, inspecting, and testing cold-applied petrolatum tape and petroleum wax tape coatings conforming to ANSI/AWWA C217. The stipulations of this standard apply when this document has been referenced and then only to cold-applied petrolatum tape and petroleum wax tape coatings.

SECTION 2: REFERENCES

This standard references the following documents. In their latest editions, they form a part of this standard to the extent specified within the standard. In any case of conflict, the requirements of this standard shall prevail.

ASTM D70*—Standard Test Method for Density of Semi-Solid Bituminous Materials.

*American Society for Testing and Materials, 100 Barr Harbor Dr., West Conshohocken, PA 19428.

ASTM D92—Standard Test Method for Flash and Fire Points by Cleveland Open Cup.

ASTM D127—Standard Test Method for Drop Melting Point of Petroleum Wax, Including Petrolatum.

ASTM D149—Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.

ASTM D937—Standard Test Method for Cone Penetration of Petrolatum.

ASTM D1000—Standard Test Method for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications.

ASTM E96—Standard Test Methods for Water Vapor Transmission of Materials.

SSPC-SP* 1—Solvent Cleaning.

SSPC-SP 2—Hand Tool Cleaning.

SSPC-SP 6/NACE† No. 3—Commercial Blast Cleaning.

SECTION 3: DEFINITIONS

The following definitions shall apply in this standard:

1. *Constructor*: The party that provides the work and materials for placement or installation.
2. *Manufacturer*: The party that manufactures, fabricates, or produces materials or products.
3. *Petrolatum*: A purified mixture of semisolid hydrocarbons obtained from petroleum jelly.
4. *Petroleum wax*: A refined mixture of solid hydrocarbons, paraffinic in nature, obtained from petroleum. It may be prepared as refined paraffin wax or as microcrystalline wax.
5. *Purchaser*: The person, company, or organization that purchases any materials or work to be performed.

*SSPC: The Society for Protective Coatings, 40 24th St., Sixth Floor, Pittsburgh, PA 15222.

†NACE International, 1440 South Creek Dr., Houston, TX 77084.

SECTION 4: REQUIREMENTS

Sec. 4.1 Coating System

The tape coating system consists of a petrolatum primer and a cold-applied petrolatum tape or a petroleum wax primer and a cold-applied petroleum wax tape applied to the exterior surface of buried or submerged steel water pipe. When construction or soil conditions exist where mechanical damage may occur, the use of an overwrap of an extra thickness of tape, a suitable outer wrap, reinforcements, or special backfill provisions may be required (Sec. 4.4). If these conditions exist, consult the manufacturer. Where voids or other surface irregularities are encountered, a filler material may be required to provide a smooth surface.

4.1.1 *Materials and workmanship.* Materials provided shall meet the provisions of this standard. Materials or work that fail to comply shall be rejected.

Sec. 4.2 Material Requirements

4.2.1 *Primer.* The primer shall be a compound of petrolatum or petroleum wax and may contain suitable inhibitors. The primer used shall be supplied by the tape manufacturer and shall conform to the requirements given in Table 1. The primer shall protect the metal surface before application of the tape and promote adhesion of the tape to the surface.

4.2.2 *Tape coating.* The tape coating shall conform to the following requirements.

4.2.2.1 *Materials.* The tape coating shall be a cold-applied, saturant tape made from either petrolatum or petroleum wax and a noncellulosic synthetic fiber fabric. The fabric shall be encapsulated and coated on both sides with the petrolatum or petroleum wax. Inert materials may be added to improve applications; and thermal extenders may be added for temperature resistance.

The tape coating shall be applied after the primer has been applied. The main function of the tape coating is to serve as the corrosion barrier. The tape coating shall conform to the appropriate values in Table 1.

4.2.2.2 *Form.* The petrolatum or petroleum wax tape coating shall be supplied in sheets, pads, or rolls.

4.2.2.3 *Dimensions.* Typical petrolatum or petroleum wax tape roll widths are 2, 3, 4, 6, 8, 9, and 12 in. (50, 75, 100, 150, 200, 225, and 300 mm). Typical standard lengths are 9, 18, and 33 ft (2.75, 5.5, and 10 m). Pads and sheets shall be sized to fit the area that is to be covered, allowing for overlap as specified in Sec. 4.3.3.

Table 1 Physical properties of coating and primer

Property	Requirements	Test Method
Primer		
Flash point, minimum; °F (°C)	150 (65)	ASTM D92
Specific gravity at 77°F (25°C)	0.90–1.25	ASTM D70
Drop melting point, minimum; °F (°C)	133 (56)	ASTM D127
Petrolatum or petroleum wax content, minimum; percent, by weight	70	Sec. 5.2.2.4
Cone penetration at 77°F (25°C), 100 g wt, 5 sec.; in. (mm)	0.29–0.88 (7.4–22.4)	ASTM D937
Thickness, minimum; mil (µm)	3 (76)	—
Tape		
Dielectric strength, minimum; volts/mil	170	ASTM D149
Thickness, minimum; mil (µm)	40 (1,016)	Sec. 5.2.2.2
Breaking strength, minimum; lbf/in. (N/m) width	22.5 (3,940)	ASTM D1000
Elongation at break, minimum; percent	6	ASTM D1000
Flash point, minimum, °F (°C)	300 (150)	ASTM D92
Water vapor transmission rate, maximum; perms (ng/Pa s m ²)	0.25 (1.44)	ASTM E96, procedure A
Petrolatum or petroleum wax components applied to fabric carrier, minimum; percent, by weight	50	Sec. 5.2.2.4
Drop melting point of saturant, minimum; °F (°C)	140 (60)	ASTM D127
Cone penetration of saturant at 77°F (25°C) 100 g wt, 5 sec.; in. (mm)	0.24–0.50 (6.1–12.7)	ASTM D937
Width deviation, maximum; in. (mm)	±5% of width or ¼ in. (6.4 mm), whichever is smaller	Sec. 5.2.2.1

4.2.2.4 Thickness. The total applied thickness specified will depend on both soil and service conditions; however, at no time shall the thickness of the tape be less than 40 mil (1,016 µm).

Sec. 4.3 Field- and Shop-Coating Applications

4.3.1 Surface preparation.

4.3.1.1 Bare surface. Bare surfaces shall be free from dirt, loose rust, loose mill scale, loose coating, and other detrimental foreign matter. Preheating to remove

ice may be used, provided all surfaces are preheated in a uniform manner to avoid distortion. If moisture is present, wipe the surface free from moisture. Welds shall be cleaned of all welding slag, spatter, and scale and shall be allowed to cool before the coating is applied. Sharp edges or burrs that could puncture or cut the tape shall be removed by grinding or filing.

4.3.1.2 *Surface cleaning.* Unless otherwise specified by the purchaser, all metal surfaces shall be blast-cleaned to achieve a surface preparation equivalent to SSPC-SP 6/NACE No. 3. Surfaces that have been blast-cleaned in a shop or that have been shop-coated or that are in good condition before shipment to a field location may be field-cleaned by wire brushing or other means approved by the purchaser to achieve an SSPC-SP 2 surface preparation immediately before applying the primer and tape. If oil or grease is present, a solvent wash conforming to SSPC-SP 1 shall be used before wire brushing.

4.3.2 *Priming.* Primer shall be applied by brush, hand, glove, or roller. A uniform and continuous coat shall be firmly pressed onto the surface. The film thickness of the primer shall be at least 3 mil (76 μm). Drying or curing of the primer is not required. Application of tape shall begin immediately after the primer is applied.

4.3.3 *Coating and wrapping.* The tape coating system shall be applied as recommended by the manufacturer and shall not exhibit defects, such as folds and bridging. The total thickness applied shall conform to the purchaser's specifications but shall not be less than 40 mil (1,016 μm) using a minimum overlap of 1 in. (25.4 mm).

4.3.4 *Tape coating repair.* All damage, visual holidays, or unsatisfactory laps shall be repaired by removing any frayed or damaged tape and any contaminants at the affected area. Primer shall be applied to the area, followed by the application of additional tape coating, to completely cover the area. Each repair shall begin and end on sound, undamaged tape coating.

Sec. 4.4 Field Procedures

Precautions to prevent damage to the tape coating shall be used at all times during construction. No metal tools or heavy objects shall come into contact with the finished tape coating. Walking on the coated pipe shall be avoided to prevent damage to the tape coating. Any damage to the special sections, connections, and fittings or tape coating from any cause during installation shall be repaired.

When construction or soil conditions exist where mechanical damage may occur, a suitable overwrap may be required. This will depend on the conditions encountered, but, in general, an extra thickness of tape or other mechanical protection shall be used. It should be spiral-wrapped, if possible, and bonded or mechanically held in place. Under these conditions, the manufacturer should be consulted for specific recommendations.

4.4.1 *Protection during welding.* An 18-in. (450-mm) wide strip of heat-resistant material shall be draped over the coated pipe on each side of the weld area during welding to avoid damage to the coating by hot weld spatter. No welding ground shall be made on the coated part of the pipe.

4.4.2 *Hoisting.* Coated pipes shall be hoisted from the trench side into the trench using wide belt slings. Chains, cables, tongs, or other equipment likely to cause damage to the tape coating shall not be used; nor shall dragging be permitted. The tape coating shall be inspected on the underside of the coated pipe while the pipes are suspended from the slings. Any tape coating damage shall be repaired according to Sec. 4.3.4.

4.4.3 *Bedding and trench backfill.* Trenches shall be backfilled in a way that prevents abrasion or other damage to the tape coating.

Unless otherwise specified, the following requirements shall be met. Where the trench traverses rocky ground containing hard objects that could penetrate the protective coating, the pipe shall be bedded on a 6-in. (150-mm) thick (minimum) layer of screened earth or sand. Other acceptable bedding material may be used in place of the earth or sand.

Backfill shall be placed around the exterior of the coated pipe only after the final inspection has been made and the exterior coating has been approved. If rocks or other hard objects occur in the backfill material along any section of the pipeline, screened backfill material shall be placed around the coated pipe to a minimum depth of 6 in. (150 mm) above the pipe before backfilling the remainder of the trench. Bedding and backfill shall be compacted in the trench according to the purchaser's specification. Rodding with metal rods or other metal tools that could come into contact with and damage the tape coating shall not be permitted.

SECTION 5: VERIFICATION

Sec. 5.1 Inspection

5.1.1 *Optional inspection.* If specified, the entire application procedure from the surface preparation to the completion of tape coating may be inspected.

5.1.2 *Surface inspection.* Surfaces shall be inspected for adequate surface preparation as described in Sec. 4.3.1.

5.1.3 *Access for inspection.* The purchaser shall have access to the construction site and to those areas of all plants used to perform the work according to the provisions of this standard.

5.1.4 *Facilities for purchaser.* In accordance with conditions agreed to by the purchaser and the constructor, the purchaser shall be provided with facilities and space for inspection, testing, and information-gathering purposes.

Sec. 5.2 Testing

5.2.1 *Coating-materials tests.* Before the coating materials are accepted and applied, the purchaser may request samples for testing by the purchaser in the purchaser's laboratory or in an independent commercial laboratory designated by the purchaser.

5.2.2 *Tape and coating-system tests.*

5.2.2.1 *Tape width.* Remove a specimen of tape at least 3 ft (0.9 m) long from each of three randomly selected rolls, or select three sheets or pads of tape specimens at random from each lot and place on a smooth, flat surface. The width of the specimen shall be measured at several points along the length of the sample to the nearest $\frac{1}{16}$ in. (1 mm). Any width deviation from the limits shown in Table 1 shall constitute failure of the width test.

5.2.2.2 *Tape thickness.* The thickness of the tape shall be measured at not less than 10 locations on each of the three sheets, pads, or roll specimens used in Sec. 5.2.2.1. The measurement shall be made with a micrometer calibrated to read in thousandths of an inch (millimetres) and having contact feet of not less than $\frac{1}{4}$ in. (6 mm) in diameter. Any thickness measurement below the limits stated in Table 1 shall constitute failure of the thickness test.

5.2.2.3 *Water vapor transmission.* The tape coating shall be tested for water vapor transmission according to ASTM E96, procedure A. A value in excess of the

limits shown in Table 1 shall constitute failure of the tape to meet the water vapor transmission requirements.

5.2.2.4 Determining solvent-extractable material in petrolatum and petroleum wax. In this test procedure, a known weight of material shall be supplied with a continuous flow of hot solvent until the solvent no longer becomes discolored. The solvent-extractable material is calculated after weighing the dried residue.

1. Apparatus.

- a. Soxhlet extraction apparatus with reflux condenser.
- b. 250-mL flask containing approximately 150 mL of solvent (use 1,1,1 trichloroethane or other suitable solvent).
- c. Electric heating mantle.
- d. Cellulose extraction thimbles (22 mm inside diameter [ID] $\times$ 88 mm).
- e. Filter paper (700 mm slow or medium).

2. Procedure. The test shall be performed in triplicate. A thimble and filter paper shall be dried in an oven at 105°C for at least 30 min. The thimble and filter paper shall then be cooled in a desiccator for 30 min and weighed together with the filter paper, with the weight recorded as *A*, in grams, carried to two decimal places. The weighing must be done as quickly as possible to avoid moisture absorption. Thereafter, approximately 5 g of a representative sample of the petrolatum or petroleum wax shall be introduced into the thimble. The filter paper, folded into a thimble shape, shall be placed on top of the sample compound. (The purpose of the filter paper is to ensure that no insoluble matter is washed out with the solvent.)

The thimble with sample and filter paper shall then be reweighed, with the total weight recorded as *B*, in grams, carried to two decimal places.

The thimble shall be placed in a Soxhlet apparatus. The rate of heating the solvent and the cooling in a condenser shall be adjusted to ensure that there is a regular flow of solvent through the Soxhlet and thimble. The solvent shall then flow continuously until it is no longer discolored. The heat source shall be removed and the thimble allowed to cool slightly before it is removed from the apparatus. The thimble shall be dried for 1 hr in a current of air. The thimble shall be placed in an oven at 105°C for 30 min, and then cooled in the desiccator for 30 min. The thimble shall then be reweighed, with the total weight recorded as *C*, in grams, to the nearest 0.2 mg.

3. The percent of solvent-extractable material is calculated as the following:

$$\% \text{ solvent-extractable material} = 100 \times (B - C)/(B - A) \quad (\text{Eq 1})$$

The test results shall be recorded as the percentage of extractable material and must meet the minimum percentages cited in Table 1.

Sec. 5.3 Rejection

5.3.1 *Coating rejection.* When inspection is specified, all coating work not done in the presence of the purchaser may be subject to rejection. If it is found at any time that the coating materials were not applied according to this standard, the coating work may be rejected.

5.3.2 *Surface preparation and tape coating application.* Coated pipe may be rejected if the surface preparation or tape coating application does not comply with the requirements of Sec. 4.3.1, 4.3.2, and 4.3.3. Pipe with rejected coating materials shall be recleaned, recoated, and reinspected.

Sec. 5.4 Visual Inspection of Tape Coating System for Continuity

After wrapping operations have been completed, a visual inspection of the tape coating system shall be conducted to verify the integrity of the application as stated in Sec. 4.3.3.

Sec. 5.5 Electrical Inspection for Continuity

Conforming to industry practice, electrical inspection of the petrolatum tape and petroleum wax tape coatings described in this standard is impractical and is not recommended. These tapes are saturated with a semisolid, pastelike compound that, when the inspection electrode contacts with the tape coating, deposits a residue of the dielectric saturant on the electrode. This eventually leads to its insulation and thereby blocking the electrical signal, making the detector inoperative. Consequently, visual inspections as defined in Sec. 4.3.3 and tests (Sec. 5.2) are the practical and preferred methods of inspection.

SECTION 6: DELIVERY

Sec. 6.1 Marking

6.1.1 *Marking.* Containers shall be plainly marked with the name of the manufacturer, type of material, batch or lot number, date of manufacture, and information as required by federal, state, or provincial laws.

Sec. 6.2 Packaging, Handling, and Storage

6.2.1 *Packaging.* All primers and tape coatings purchased or used according to this standard shall be packaged in containers that ensure acceptance, safe delivery to their destination, and protection while in storage. Preference for individual or multiple packaging of tape coating and size of primer container may be specified. All primers and tapes shall be stored in the original packaging until the time of use.

6.2.1.1 Individual items. Each sheet, pad, or roll of tape shall be packaged to prevent it from adhering to the packaging material or the container.

6.2.1.2 Multiple items. Multiple sheets, pads, or rolls shall be packaged in quantities not to exceed the weight limitations of the container specification. Each sheet, pad, or roll of tape shall be protected from adhering to other sheets, pads, or rolls of tape coating, the container, or to the packaging material itself using separators. See Sec. 4.2.2.3 for tape roll width dimensions.

6.2.1.3 Primer. Primer shall be packaged in pails or other containers that comply with the applicable federal, state, provincial, or local regulations.

6.2.2 *Handling and Storage.* Tape-coated pipe shall be handled, stored, and shipped to prevent damage to the tape coating. If an extended period of aboveground storage of the pipe is anticipated, the materials ability to resist degradation by ultraviolet light and other atmospheric and environmental conditions shall be considered. Tape coating damaged in handling or other operations shall be repaired according to Sec. 4.3.4.

Sec. 6.3 Affidavit of Compliance

An affidavit may be required affirming that all materials provided and work performed comply with the applicable requirements of this standard.

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