Designation: D 3486 – 85

Standard Practice for Installation of Vulcanizable Rubber Tank Linings and Pipe Linings[1]

This standard is issued under the fixed designation D 3486; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice as outlined in Parts A to G, covers the techniques used to install rubber linings in metal tanks and pipes. Installation requirements, procedures, inspection instructions, and storage conditions for the lined tanks or equipment are outlined.

1.2 The parts appear in the following sections:

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Part A—Requirements for Field Installation of Rubber Sheet Linings	4
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1.3 The values stated in SI units are to be regarded as the standard.

1.4 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements, see Section 4.

2. Referenced Documents

2.1 *NACE Standard:*

TM-01-70 Visual Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive[2]

2.2 *Steel Structures Painting Council Standard:*

SSPC No. 5 Blast Cleaning to "White" Metal[3]

3. Significance and Use

3.1 The storage of corrosive or abrasive, or both, solutions or suspensions requires that the metal surface of storage tanks, large pipes, or holding vessels be lined with a material that resists such action. Vulcanized rubber that is securely adhered to the tank or other metal surface imparts such resistance. An integral part of the installation of such linings is the vulcanization operation that produces proper mechanical strength, chemical resistance, and good rubber-to-metal adhesion.

4. PART A—REQUIREMENTS FOR FIELD INSTALLATION OF RUBBER SHEET LININGS

4.1 *General*—Tanks or other equipment too large to ship, or those that have to be erected prior to lining in critical plant areas, can be lined at the purchaser's plant by the applicator in a manner that will be satisfactory in every way for the intended service.

4.2 *Services and Facilities*—The following services and facilities are required to install a rubber sheet lining in the field. Their availability and cost should be agreed upon between the applicator and the purchaser.

4.2.1 *Metal Fabrication*—Metal fabrication and welding shall be in accordance with specified codes. Welds shall have a round and smooth surface suitable for applying rubber lining.

4.2.2 *Protection of Tank*—If the equipment to be lined is located out of doors it will be necessary, in certain latitudes and seasons, to protect the equipment from the weather and to provide the heat necessary to maintain a temperature above 15°C (59°F). In any event, the equipment must be properly protected against rain and in warm weather from direct exposure to the sun. A satisfactory installation cannot be made if conditions are such as to induce condensation on surfaces prior to cementing and lining. Nor can lining be properly cured unless equipment is protected against excessive heat loss during cure.

4.2.3 *Blasting*—Just prior to the application of the first coat of adhesive primer, all metal surfaces to be lined shall be abrasive-blasted to a gray-white (uniform metallic) color, surface finish in accordance with NACE Standard No. 1 TM-01-70 or Steel Structures Painting Council SSPC No. 5. The minimum surface profile shall be 0.051 mm (0.002 in.).

4.2.4 *Scaffolding and Ladders*—On large tanks, scaffolding and ladders must be provided and removed after the lining operation and the initial spark tests are completed.

4.2.5 *Workroom and Cutting Table Storage of Materials*—The workroom and materials storage should be located as close to the equipment being lined as possible. Both areas should be reasonably clean, and the temperature should be maintained above 15°C (59°F). A cutting table with a smooth top shall be provided.

4.2.6 *Ventilation and Safety Precautions:*

4.2.6.1 Solvent fumes from adhesives may be explosive under certain conditions; therefore, no flame, welding, or smoking shall be permitted during the lining application. Precautions shall be taken to ensure that all electrical

[1] This practice is under the jurisdiction of ASTM Committee D-11 on Rubber and is the direct responsibility of Subcommittee D11.38 on Vulcanized Rubber Tank Linings.

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[2] Available from the National Association of Corrosion Engineers (NACE), 2400 West Loop South, Houston, TX 77027.

[3] Available from the Steel Structures Painting Council (SSPC), 4400 Fifth Ave., Pittsburgh, PA 15213.

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switches or materials that could cause sparks are a safe distance from solvent fumes.

4.2.6.2 Tanks, tables, and air-moving blowers shall have ground wires to eliminate the possibility of static sparks during cementing and solvent-washing operations.

4.2.6.3 Operators shall be provided with suitable masks and breathing equipment during the cementing and solvent washing operation as protection against toxic solvent vapors when required.

4.2.6.4 Adequate provisions for removal of solvent fumes by a suction blower and recirculation of fresh air shall also be provided.

4.2.6.5 When possible, two 610-mm (24-in.) diameter manholes, free of obstructions, should be provided for access to closed tanks. Other openings required for safety or to facilitate lining operations will be indicated by the applicator.

4.2.6.6 All safety requirements shall conform to state and federal laws.

4.2.7 *Vulcanization:*

4.2.7.1 Steam is required to vulcanize most rubber sheet linings to produce the required physical and chemical properties and adhesion to the metal. The steam pressure required will depend on the size of the vessel and will be specified by the applicator. Other methods of vulcanization, such as hot water, hot air, or chemical cure, are acceptable when vulcanized in accordance with rubber-lining manufacturers' recommendations and the approval of the end user.

4.2.7.2 Adequate piping and headers to circulate the steam during vulcanization and a drainage system to remove condensate shall be provided.

4.2.8 *Air Lines and Electrical Connections*—Compressed air lines and electrical connections shall be provided for as specified by the applicator.

5. PART B—GENERAL PROCEDURE FOR APPLICATION OF ELASTOMERIC SHEET LINING

5.1 *Procedure:*

5.1.1 Prepare all metal surfaces to be lined in accordance with 4.2.3.

5.1.2 Apply one coat of adhesive primer immediately after blasting to prevent rusting. Apply additional coats of adhesive primer, if necessary, as specified by the lining manufacturer.

5.1.3 Apply required number of coats of intermediate or tie adhesives, or both, as specified by the lining manufacturer. Allow sufficient drying time between adhesive coats so the coat being applied does not lift up the preceding coat.

5.1.4 Apply the type and thickness of lining specified using a minimum number of sheets and splices consistent with good lining practice. Overlap the edges of the sheets approximately 50 mm (2 in.), unless restricted by dimensional tolerances. The rubber lining sheets may be washed with recommended solvent and allowed to dry before application. During the application, roll the sheets and carefully stitch all the seams and corners to eliminate all trapped air between the lining and adhesive-coated surfaces so there is full contact with all coated areas.

5.1.5 Skive the edges of all the sheets at a 45° angle (minimum) from the top surface to the bottom of the sheet. Use a closed-skive construction, commonly known as a down skive, wherever possible. This is required where the lining is a combination of hard-face stock and soft cushion. Open-skived splices may be used when specified by the lining manufacturer.

6. PART C—RUBBER SHEET LINING INSPECTION AND REPAIRS BEFORE AND AFTER VULCANIZATION

6.1 *Procedure:*

6.1.1 Prior to vulcanization, inspect all lined surfaces for blisters (trapped air), pulls, or lifted edges at seams and surface defects. After lining, also check any special dimensional tolerances required.

6.1.2 The scope of this procedure covers the calibration of the equipment and the use of the equipment to determine if there are leaks and their location on sheet linings. Spark test all areas for "pinhole" leaks using a high voltage spark tester adjusted and used as follows:

6.1.2.1 *Equipment*—The required equipment consists of a high frequency spark tester capable of producing sufficient voltages to ensure the proper calibration, a probe, with an "L" shaped 3/32 in. diameter wire with up to a 12 in. bottom leg (end bent to a ½ in. radius), or a brush type (similar to a snare drum brush). For confined areas other shape probes may be used, and a steel rubber-covered plate referred to as a calibration coupon, 12 by 12 in., with a known leak. The coupon shall be covered with the same material and thickness as that to be tested. The coupon shall be cured as the material to be tested.

6.1.2.2 *Calibration Procedures*—The material on the coupon shall have a leak to the metal substrate made by puncturing the material with a 22-gage hypodermic needle or comparable piercing equipment or tool. The probe to be used on the work shall be passed over the surface of the test coupon in a constant, uninterrupted manner until the pin hole (leak) is found. The pinhole (leak) is detected with the spark tester as a white spark. A purple or dark blue spark denotes sound rubber. Also, there might occur a snap noise or crack when the white spark detects the pin hole (leak). This is contrasted with the normal blue discharge over a pin hole-free (leak free) lining. The voltage shall be adjusted to the lowest setting that will yield a minimum ½ in. spark. (The ½ in. is measured from the top surface of the bonded rubber to the probe). The spark tester shall be re-calibrated periodically using the calibration coupon to ensure that the settings on the tester have not changed. The spark tester shall be calibrated using the same power source, cable lengths from power source to tester, and probe to be used for testing the work piece.

6.1.2.3 *Test Procedure*—After calibration, the probe is then used to test the work piece by passing the probe over the lining in an uninterrupted constant stroke. The pattern used shall be designed such that no surface is missed and the strokes shall overlap. Pinholes (leaks) that are found shall be marked for repair using chalk. The probe shall not be allowed to remain stationary at any time, as this will cause pinholes in the lining.

NOTE 1—Butyl, graphite-reinforced, and some neoprene linings should be tested at 10 000 V. The minimum required voltage for testing should be used since the purpose of testing is to find pinholes and leaks and not to test the electrical strength of the compound. Repairs should be made before vulcanization, using the lining originally specified.

NOTE 2—Suppliers who manufacture linings that are too conductive to be tested in accordance with 6.1.2 or Note 1 should advise applicators of this limitation.

NOTE 3—The Holitector Model 530/166[4], Spark Tester WEG21/200 Mk III[5], and other spark test equipment[6] are available and suggested for conducting these tests.

6.1.3 The vulcanization of the lining is a time and temperature function, and is needed to produce the required chemical and physical properties as well as proper adhesion to the metal being lined. The time and temperature of vulcanization are to be in accordance with lining manufacturers' specifications. Vulcanization with steam under pressure is recommended; however, many linings have been developed that will cure in steam at atmospheric pressure and can be used in most services with good life expectancy. Chemical-cure linings (those linings that are cured by application of a liquid surface curing agent) and chemical cure repairs are also acceptable with the lining manufacturer's recommendations.

6.1.4 After vulcanization, inspect all lined surfaces again for blisters, open seams, lifted edges, and surface defects.

6.1.5 Spark test all areas again, in accordance with 6.1.2, for "pinholes," and check that the durometer hardness meets the lining manufacturer's specifications.

6.1.6 Repair all "pinholes" and other lining defects in accordance with the lining manufacturer's specifications.

7. PART D—STANDARD FOR SURFACE APPEARANCE OF RUBBER SHEET LINING MATERIALS

7.1 *Scope*—This practice covers surface imperfections and defects of rubber sheet lining materials, and how these conditions affect serviceability.

7.2 *Definitions:*

7.2.1 *blister*—a cavity or sac that deforms the surface of a material.

7.2.2 *bond failure*—the separation of two adjoining surfaces due to service conditions.

7.2.3 *defect*—a condition that prevents the lining from serving its function. It should be removed and the lining repaired to ensure proper serviceability of the lining system.

7.2.4 *overlay*—the application of a layer of uncured stock to uncured sheet stock to achieve at least the minimum thickness specified. After vulcanization, the area so treated is homogeneous and should be considered identical to a lap joint or seam, not a patch or repair.

7.2.5 *patch or repair*—the remedies to defects that are done after vulcanization, necessitating application of uncured sheet stock to fully cured or vulcanized stock.

7.2.6 *surface imperfection*—a condition on the surface of sheet stock that, although presenting an appearance other than smooth, is not really detrimental to the serviceability of the lining.

7.3 *Wrinkles and Overlays:*

7.3.1 *Wrinkle*—A wrinkle is a surface imperfection if it has no effect on the serviceability of the lining, due to the fact that the full thickness and integrity of the material under the surface imperfection is unaffected. A wrinkle that does violate the thickness tolerance specified or integrity of the sheet is a defect, and should have an overlay applied over it. Such an overlay might apear to be a patch or repair.

7.3.2 *Overlay*—An overlay on unvulcanized sheet rubber or other uncured material is not a patch or repair. If properly performed, no non-rubber adhesives need be utilized. Thus, after vulcanization, what appears to be a repair is in reality an extra thickness of lining and should be considered identical to the lapped seams in construction and integrity. Repairs made after vulcanization are in fact what the term implies, since the integrity of the repair is dependent on the adhesive bond between the patching material and the fully vulcanized lining.

7.4 *Acceptability of Repairs in Original Equipment:*

7.4.1 In spite of all possible precautions, defects may be found on some units of rubber-lined equipment when the prescribed cure is completed. The most common defects will be blisters between rubber and metal, blow holes where the rubber lining is actually ruptured, small cracks in a hard rubber lining, or physical damage that may result in a scuffed or broken lining.

7.4.2 In general, if such a defect occurs, the defective rubber should be removed (that is, peeled from the metal, to a point where firm adhesion to the metal is found) and a suitable repair made with the same or equivalent lining material.

7.4.3 It is improper to indiscriminately specify the number of true repairs (made after vulcanization) that will be considered acceptable without consideration being given to the total area involved. A specific number of repairs considered acceptable in a simple, small vessel would be entirely too restrictive if applied to a much larger and particularly more complex vessel as a means of determining whether or not the applied lining is commercially acceptable.

7.5 *Recommendations:*

7.5.1 The preferred way of determining what action should be taken with any particular surface imperfection is to examine it closely and, using reason and sound judgment based on 7.4, decide whether it should be overlaid or left alone.

7.5.2 If, after vulcanization, a difference of opinion exists between the applicator and the purchaser as to whether or not a particular condition is a "surface imperfection" or a "defect" in the stock, a repair procedure shall be conducted as follows:

7.5.2.1 Buff the surface imperfection of the vulcanized lining to a relatively smooth condition. Apply a layer of appropriate unvulcanized lining over the area involved; follow this by vulcanization. This repair should be considered equally acceptable to the procedure of removing the material to bare steel and inlaying the new material. This latter operation should be done if the "defect" is suspected of being more severe than merely violating the thickness tolerance.

8. PART E—STORAGE OF PROTECTIVE LINED VESSELS

8.1 *Procedure:*

8.1.1 Between delivery and use, store lined vessels away from direct sunlight, heat, or outdoor seasonal weathering

[4] Available from Zormco Corp., 8520 Garfield Blvd., Cleveland, OH 44125.

[5] Available from Edlon Plastics, 6 Pheasant Run, Newtown, PA 18940.

[6] Other spark test equipment is available from KTA-TATOR, Inc., 115 Technology Drive, Pittsburgh, PA 15275.

ible-type lining may be stored outdoors, provided the ls are covered with protective tarpaulins and are not cted to extreme temperature conditions, such as below (32°F) or above 49°C (120°F). Avoid sudden changes in erature. Tanks stored or used in the outdoors may be ted a light color on the outside to reflect heat.

1.2 To ensure protection, store semi-hard and especially -hard type lined equipment in a way that does not allow be subjected to extremely cold climatic conditions. If occurs, thermal stress and expansion may introduce king.

1.3 Rubber-lined equipment may also be protected for nded periods of time by storing the tank partially filled a diluted solution. When recommended by the rubber g manufacturer, a 5 % sulfuric acid, 5 % sodium carate solution, or a weak salt solution make ideal storage lia to help keep the lining flexible, to minimize expansion contraction, and to keep the air (ozone) from premaly deteriorating the lining surface. Do not permit the id contained within to freeze.

1.4 Shelter large rubber-lined equipment that cannot be d with a solution under a suitable structure to protect it n the direct rays and heat of the sun. Provide sufficient space between the tank and covering to allow for ulation.

1.5 For small tanks that can be stored inside, cover any n tops and outlets with plywood, or other suitable erial, and store them away from steam coils or other -temperature sources.

1.6 Inspect any stored vessel prior to being put into rice.

1.7 Do not carry on any welding nor any other activity uiring intense heat in the vicinity of a lined tank.

1.8 When tanks might be stored outside, take care to ure good weatherability of the paint. Primer paints are designed to withstand prolonged atmospheric weather ditions.

PART F—CHEMICAL RESISTANCE OF RUBBER SHEET LININGS

1 Rubber sheet linings have been used for many years to tect chemical process and storage tanks, pipe and fittings, k cars and truck tanks, metal pickling and plating tanks, s and ducts, and other industrial equipment against the naging effects of corrosion, abrasion, or contamination of product being handled.

2 The types of rubber sheet linings can be listed in four egories:

2.1 *Soft Rubber (NR or IR)*—One homogeneous layer.

2.2 *Two-Layer Construction*—Semi-hard, hard, or xible hard rubber face with a soft cushion layer of rubber.

2.3 *Three-Layer Construction*—Soft face, semi-hard bber, and soft cushion.

2.4 *Synthetic Rubbers*—Including but not limited to oprene (chloroprene) (CR), butyl (isobutene-isoprene) R), chlorobutyl (chloro-isobutene-isoprene) (CIIR), ylene propylene diene (EPDM), chloro-sulfonyl polyeth-ne (CSM), etc.

NOTE 4—Each layer usually consists of 0.5 to 0.8-mm (0.02 to 03-in.) plies calendered together to produce the specified thickness.

9.3 Rubber sheet linings resist many chemicals and are considered suitable for the following, subject to temperature and concentration limitations:

9.3.1 Most inorganic acids including, but not limited to, hydrochloric, phosphoric, sulfuric, hydrofluoric, and hydrofluosilicic.

9.3.2 Many organic acids including, but not limited to, acetic, tannic, and gallic.

9.3.3 Inorganic salt solutions including, but not limited to, ferric chloride, zinc chloride, tin chloride, sodium cyanide, and ferrous sulfate.

9.3.4 Inorganic bases including, but not limited to, sodium hydroxide, calcium hydroxide, and potassium hydroxide.

9.3.5 Plating solutions including, but not limited to, nickel, brass, tin, zinc, silver, and cadmium.

9.3.6 Bleach solutions including, but not limited to, sodium hypochlorite, calcium hypochlorite, and chlorine.

9.4 The type of rubber sheet lining to be used for a specified chemical service should be recommended by the protective linings applicator and the lining manufacturer based on their laboratory tests and individual past experience. Past experience is very important and in many cases cannot be confirmed by short term laboratory tests.

9.5 A complete specification of service conditions is very important in the selection of a rubber sheet lining. The following information should be included:

9.5.1 Size, shape, and dimensions of tank or equipment to be lined (drawings if possible).

9.5.2 Dimensions, wall thickness, and type of flanges or couplings for the pipe systems.

9.5.3 Chemical concentrations of all ingredients, including defoamers, additives, or impurities in the solution to be handled.

NOTE 5—It is important that these ingredients be listed no matter how small their concentration, as certain materials may not remain totally in solution. They may concentrate on the bottom, on the top (liquid vapor interface), or volatilize in the vapor phase above the liquid level.

9.5.4 Maximum, minimum, and operating temperatures and time cycle for temperature fluctuations.

9.5.5 Percent abrasive solids, type of solid, particle size, and velocity.

9.5.6 Indoor or outdoor installation.

9.5.7 Operating pressure or vacuum.

9.5.8 Special requirements or conditions not covered in above factors.

9.6 Where concentrations are low, from 0 to 5 %, it is often preferable to use hard or semi-hard rubber linings, especially at higher temperatures 65 to 85°C (149 to 185°F), because of their superior water resistance when compared with soft rubber.

9.7 Soft rubber linings are normally considered suitable up to 55°C (131°F) and semi-hard, hard, or synthetic rubber linings up to 85°C (185°F). At elevated temperatures, the chemical effect on the lining is accelerated and the effects of oxidation and diffusion are more rapid, so that the overall life of the lining will be shorter than it would be at room temperature.

9.8 There have been many economical applications of linings for chemical service in the range of temperatures

from 85 to 150°C (185 to 302°F). No potential application should be rejected because of service temperature but should be referred to the protective linings applicator and the lining manufacturer.

9.9 In many cases of high-temperature service, protective brick sheathings are used to reduce the actual temperature at the rubber lining and extend the expected service life by a long enough time to justify the added expense.

9.10 Alternating from one chemical service to another is not generally recommended. In such cases, objectionable surface effects often develop which can take the form of crusting, flaking, and pitting, which can cause contamination of the chemical solution. Alternate chemical service can also shorten the service life of the lining.

9.11 The fact that discoloration is not specifically mentioned on all service conditions should not be interpreted to mean that linings may not cause some discoloration or contamination of chemically pure solutions.

9.12 Certain linings are swollen and deteriorated in various degrees by certain liquid fatty acids, drying oils, cyclic aliphatic liquids, aromatic solvents, carbon tetrachloride, ethylene dichloride, and carbon disulfide. Sometimes this effect can prove quite pronounced even with small quantities present as the result of a cumulative absorption into the lining.

9.13 For the majority of installations, 4.76 or 6.35 mm (0.187 or 0.250 in.) nominal gage linings are considered standard. However, there are many installations where a 9.52 to 12.7-mm (0.375 to 0.500-in.) nominal gage has been used. Where either the temperature or concentration of the chemical solution approaches a maximum operating condition, the 6.35-mm (0.250-in.) nominal gage or heavier is recommended. The heavier gage lining is also used with soft rubber to handle a severe abrasion problem. If small amounts of petroleum additive are present in an abrasion service or temperatures exceed 76.6°C (150°F), neoprene could be the proper selection.

10. PART G—GENERAL PROCEDURE FOR APPLYING RUBBER SHEET LININGS IN PIPE

10.1 *Metal Specification*—Pipe shall be fabricated and welded in accordance with specified codes. Welds shall have a round and smooth surface suitable for applying rubber lining. Any special requirements specified by engineering company or end user shall be agreed upon by all parties prior to pipe fabrication.

10.2 *Metal Preparation*—All surfaces to be lined shall be in accordance with 4.2.3. Surfaces shall be free of all oil, grease, dirt, mill, scale, rust, corrosion products, and other foreign material.

10.3 *Cementing:*

10.3.1 Apply one coat of primer as soon as possible after blasting to prevent oxidation. Apply additional coats of primer, intermediate, or tie adhesives as specified by the manufacturer.

10.3.2 Allow sufficient drying time between coats so the coat being applied does not lift up the preceding coat.

10.4 *Lining Application:*

10.4.1 *Flat Sheet*—Whenever calendered or extruded flat sheet lining is supplied, the tube should be formed by using longitudinal skived butt splice(s). The spliced tube's outside circumference should be slightly smaller than the inside circumference of the pipe to be lined.

10.4.2 *Extruded Tube*—Whenever unvulcanized extruded seamless elastomer tubes are supplied, the tubes should have a slightly smaller outside circumference than the inside circumference of the pipe to be lined.

10.4.3 *Bleeder Strings*—Apply twisted multifilament string or yarn lengthwise in two to four locations, to allow for proper gas venting between lining and pipe.

NOTE 6—Use of bleeder strings is optional with applicator.

10.4.4 Enclose the tube in a fabric liner and attach a tow rope. Pull tube into pipe with a slow constant pull.

NOTE 7—The fabric liner facilitates the positioning of the tube in the pipe and prevents premature bonding.

10.4.5 *Tube Inflation:*

10.4.5.1 *Small and Medium Diameter Pipe*—Remove fabric liner and expand elastomer tube against the pipe wall by using pressurized air. A mechanical extension and flange arrangement may be used for the pipe ends so that a minimum of 10 psig internal pressure can be maintained in the expanded tube for at least 5 min.

10.4.5.2 *Large Diameter Pipe*—Pipe too large to feasibly line by inflating a tube and large enough to allow personnel to enter should be rubber lined in the same manner as tanks or duct work. "Bleeder strings" may be used, at applicator's option, to facilitate the escape of gases during cure.

10.4.6 Remove extension and flare excess stock over flange face and trim flush.

10.4.7 Apply a covering to full face of flange. Skive inside diameter of flange stock to slightly less than the inside diameter of lining and stitch firmly to tube stock. On larger sized pipe, the flange stock may be lapped into the pipe lining instead of the skive used on smaller pipe. Rubber shall be removed from bolt holes after cure by means of a knife, reamer, or other suitable tool.

10.5 *Curing*—Cure rubber lined pipe as specified by rubber lining manufacturer.

10.6 *Inspection and Testing*—Lining inspection and spark test in accordance with Section 6. Special equipment is usually required so spark tester can reach all areas inside long lengths of pipe.

10.7 *Identification and Protection:*

10.7.1 Identify each piece by stamping on a ground area so numbers will remain visible as follows: "Rubber Lined—Do Not Cut or Weld."

10.7.2 Protect lining on flange faces during shipment or storage by covering with plywood or other suitable material.

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