

SECTION 02410 - COLD-APPLIED PLASTIC TAPE COATING

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes materials and application of cold-applied plastic tapes on steel pipe in accordance with AWWA C209 and C214 with a 1-inch thick reinforced cement mortar armor coat in accordance with AWWA C205, as modified herein.

1.2 REFERENCE SPECIFICATIONS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:
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|----|------|-------|---|
| 1. | AWWA | C205 | Cement Mortar Protective Lining and Coating for Steel Water Pipe |
| 2. | AWWA | C209 | Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines. |
| 3. | AWWA | C214 | Tape Coating Systems for the Exterior of Steel Water Pipelines |
| 4. | AWWA | C216 | Heat-Shrinkable Cross-Linked Polyolefin Coatings for Steel Water Pipe and Fittings |
| 5. | NACE | RP-02 | High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation |
| 6. | SSPC | SP-1 | Solvent Cleaning |
| 7. | SSPC | SP-6 | Commercial Blast Cleaning |

1.3 SUBMITTALS

- A. The following shall be submitted in compliance with Section 01300.
1. Shop Drawings
 - a. Manufacturer's product data.
 - b. Tape application method approved by tape manufacturer to minimize voids at weld seams; shipping and storage method approved by tape manufacturer to minimize disbondment of free ends of tape.
 - c. The names and qualifications of the workers and supervisors to be employed on the coating operation a minimum of 14 days prior to the start of taping operations.
 2. Certificates
 - a. Certification of test results of physical and performance characteristics of each batch of primer and each tape material specified herein.

- b. A certificate of compliance stating that tape materials and work furnished hereunder will comply or has complied with the requirements of these specifications and AWWA C209 and C214.
- c. Certification of primer and each tape material shall be substantiated by the tape manufacturer's production quality control test results. The tape manufacturer shall supply test data on each batch used.

1.4 QUALIFICATIONS OF MANUFACTURERS

- A. Manufacturer to demonstrate a minimum of five years successful application of tape coating system on large diameter steel water pipelines as specified herein.
- B. Supervisors of tape coating operations with at least two years continuous recent experience shall be assigned in the application of tape and coating systems for steel pipe.

1.5 INSPECTION

- A. All coating work shall be performed in the presence of the DISTRICT. Any coatings applied in the absence of the DISTRICT may be rejected.
- B. The DISTRICT shall be provided with reasonable facilities and space, at the CONTRACTOR'S expense, for the inspection, testing, and obtaining of any information required to determine the characteristics of the material to be used. The DISTRICT shall be furnished at least two electrical pipe coating flaw detectors at the plant and one electrical pipe coating flaw detector per pipe installation heading in the field to aid in the inspection of the tape coating.
- C. Free access shall be provided to the DISTRICT to plants of the manufacturer furnishing the materials and to the worksite.

PART 2 - PRODUCTS

2.1 COLD-APPLIED PLASTIC COATING

- A. Cold-applied plastic tape coating shall be applied in accordance with AWWA C209, AWWA C214, and as specified herein.
- B. Plant and field applied primer and plastic tape, and plant and field applied repair tape by a single manufacturer shall be furnished.
- C. Materials shall meet or exceed the physical properties of tape materials for plant and field application criteria listed when tested in accordance with the methods described in AWWA C209 and AWWA C214, Section 4.12, "Coating System Tests."
- D. Tape coating systems shall consist of an exterior cold-applied plastic tape on the bare metal surface of steel pipe with a cement mortar coating applied over the tape system. Tape coating systems are specified for:

1. Normal plant cold-applied tape.
2. Plant cold-applied tape for special sections, connections and fittings, and plant repairs of cold-applied tape.
3. Field joint, field coated fittings and repair of field cold-applied tape.

2.2 PRIMER

A. Primer shall be comprised of 100 percent butyl rubber with resins for adhesion, cathodic disbonding and stress corrosion cracking inhibitors. The primer shall be Polyken #1039 primer with the following properties:

1. Percent Solids: $\geq 18\%$
2. Flash Point: $> + 109^{\circ}\text{F}$
3. Viscosity: Thin syrup

2.3 STORAGE PRIMER

A. Storage primer on the exposed steel at the tape cutbacks shall be Polyken #1039 primer with the following properties:

1. Color: Black
2. Base: Synthetic natural rubber and resins
3. Solvent: Naphtha, toluene blend
4. Total Solids: 19 percent by weight
5. Viscosity: Thin syrup
6. Flash Point: $> + 10^{\circ}\text{F}$

2.4 PLANT COLD-APPLIED PLASTIC TAPE SYSTEM

A. Anti-corrosion inner layer tape shall be Polyken #989, with the following properties:

1. Tape Color: Black
2. Backing: Consist of a minimum 98 percent blend of high and low density polyethylene with the remaining portion a blend of colorants and stabilizers.
3. Adhesive: Consist of a 100 percent butyl based elastomer with resins for adhesion, cathodic disbonding, and long-term in-ground performance.

4. Thickness: Total thickness 20 mil: Backing, 9 mil; Adhesive, 11 mil. Tolerance: -5%, +10%.
5. Tensile Strength at Break: ≥ 30 lb/in width
6. Elongation at Break: ≥ 200 percent
7. Adhesion to Steel: ≥ 100 oz/in width
8. Adhesion to Primed Steel: ≥ 300 oz/in width
9. Adhesion to Backing: ≥ 40 oz/in width
10. Dielectric Strength: ≥ 20 kv
11. Insulation Resistance: 1×10^{12} ohms
12. Water Vapor Transmission: < 0.2 gm/100 in²/24 hr @ 70° F
13. Cathodic Disbonding at 68° F for 30 days: 0.2 in² (ASTM G8)
14. Shear Resistance at 68° F for 4 weeks: 0.2 mm/day
15. Hydrolytic Stability, 200 hrs at 98° CH₂O, Adhesion: > 150 oz/in
16. Thermal Stability, 2000 hrs at 100° C air, Adhesion: > 150 oz/in

B. First mechanical outer layer tape shall be Polyken #955, with the following properties:

1. Tape Color: Gray
2. Thickness: Total thickness 30 mil: Backing 25 mil; Adhesive, 5 mil. Tolerance: -5%, +10%.
3. Tensile Strength: ≥ 45 lb/in width
4. Elongation: ≥ 200 %
5. Adhesion to Backing: 40 oz/in width

6. Water Vapor Transmission: < 0.2 gm/100 in²/24 hr @ 70° F
7. Dielectric Strength: ≥ 25 kv

C. Second mechanical outer layer tape shall be Polyken #956 UV1 having UV protection properties as follows. Provide certification of UV protection.

1. Tape Color: White
2. Backing: Consist of a minimum 96 percent blend of high and low density polyethylene with the remaining portion a blend of colorants and stabilizers.
3. Adhesive: Consist of a 100 percent butyl based elastomer with resins for adhesion, and long term in-ground performance.
4. Thickness: Total thickness 30 mil; Backing 25 mil; Adhesive 5 mil. Tolerance: -5%, + 10%.
5. Tensile Strength: ≥ 55 lb/in width
6. Elongation: ≥ 200%
7. Adhesion to Backing: 60 oz/in width
8. Water Vapor Transmission: < 0.2 gm/100 in²/24 hr @ 70° F
9. Dielectric Strength: ≥ 25 kv

D. Total coating system shall be the Polyken YGIII system, with the following properties:

1. 100% Polyethylene based backings with colorants and stabilizers.
2. 100% Butyl based elastomers.
3. Adhesion to Steel: ≥ 100 oz/in
4. Adhesion to Backing: ≥ 60 oz/in width
5. Adhesion to Primed Steel: ≥ 300 oz/in
6. Tensile Strength: ≥ 85 lb/in width
7. Elongation: > 200%

- 8. Dielectric Strength: ≥ 20 kv
- 9. Insulation Resistance: 1×10^{12} ohms
- 10. Water Vapor Transmission: < 0.2 gm/100 in²/24 hr @ 70° F
- 11. Cathodic Disbonding @ 68° F for 30 days: 0.2 in² (ASTM G8)
- 12. Shear Resistance at 68° F for 4 weeks: 0.2 mm/day
- 13. Impact: 90 in-lbs.
- 14. Penetration: 11-15%

2.5 PLANT COLD-APPLIED TAPE PLASTIC COATINGS FOR SPECIAL SECTIONS, CONNECTIONS AND FITTINGS, AND PLANT REPAIR COLD-APPLIED PLASTIC TAPE MATERIAL

A. Anti-corrosion inner layer shall be Polyken #932-50, with the following properties:

- 1. Backing: Consist of a minimum 96 percent blend of high and low density polyethylene with the remaining portion a blend of colorants and stabilizers.
- 2. Adhesive: Consist of a 100 percent butyl based elastomer with resins for adhesion, cathodic disbonding, and long-term in-ground performance.
- 3. Thickness: Total thickness 50 mil: Backing 40 mil; Adhesive 40 mil. Tolerance -5%, +10%.
- 4. Tensile Strength: ≥ 25 lb/in width
- 5. Elongation: $\geq 150\%$
- 6. Adhesion to Steel: 225 oz/in width
- 7. Adhesion to Backing: 60 oz/in width
- 8. Water Vapor Transmission: < 0.2 gm/100 in²/24 hr @ 70° F
- 9. Dielectric Strength: ≥ 28 kv

B. Mechanical layer outer tape for plant fittings and plant repair cold-applied plastic tape shall be Polyken #955, with the following properties:

1. Backing: Consist of a minimum 96 percent blend of high and low density polyethylene with the remaining portion a blend of colorants and stabilizers.
2. Adhesive: Consist of a 100 percent butyl based elastomer with resins for adhesion, and long-term in-ground performance.
3. Thickness: Total thickness 30 mil: Backing 25 mil; Adhesive 5 mil. Tolerance -5%, +10%.
4. Tensile Strength: ≥ 45 lb/in width
5. Elongation: $\geq 200\%$
6. Adhesion to Backing: 40 oz/in width
7. Water Vapor Transmission: < 0.2 gm/100 in²/24 hr @ 70° F
8. Dielectric Strength: ≥ 25 kv

2.6 FIELD JOINT, FIELD COATED FITTINGS, AND FIELD REPAIR COLD-APPLIED PLASTIC TAPE

A. Joint filler tape to be Polyken #939, with the following properties:

1. Tape Color: Black
2. Thickness: 125 mil
3. Elongation: $> 600\%$
4. Solids Content: 98% minimum
5. Penetration Hardness: 85-105 DMM (300 GM moving load)
6. Low Temperature Flexibility: No cracking when bent around a 1 inch mandrel at -10° F
7. Chemical Resistance: No visible deterioration after 30 days immersion in the following solutions: 5% Caustic Potash; 5% HCL; 5% H₂SO₄; Saturated HS

B. Field joint, field fitting, and field repair outer layer tape shall be Polyken #932-50, as specified herein.

2.7 FIELD JOINT USING ALTERNATIVE HEAT-SHRINKABLE PIPE JOINT SLEEVES

- A. The sleeve shall consist of an irradiated and cross-linked polyethylene backing and a heat- activated adhesive layer that bonds to the pipe surface and common tape pipe coating such as polyethylene, polyurethane, and coal tar based coatings.
- B. Sleeves shall be provided in strip form pre-cut to length by the manufacturer specifically for the pipe diameter on which it is to be used. The width of the sleeve shall be such that it will overlap the tape pipe coating by 3 inches on each side of the joint.
- C. Packaging shall protect individual sleeves from damage and prevent adherence to other sleeves or the packaging material. Store the product away from extremes in temperature and out of the rain or other moisture sources.
- D. The product manufacturer shall demonstrate conformance with AWWA C216. The product manufacturer shall demonstrate that the sleeve will retain its corrosion protection properties when applied prior to internal joint welding. The manufacturer must demonstrate that the sleeve has been tested on large diameter pipe after three internal weld beads have been fully laid down. Use heat-shrinkable pipe joint sleeves manufactured by Canusa, Raychem, or District approved equal.

2.8 MORTAR OVERCOAT

- A. Cement shall be Type II, low alkali conforming to ASTM C-150. Mortar overcoat thickness shall be 1 inch.
- B. Sand shall conform to ASTM C 33 with 100 percent of the sand passing through a No. 4 sieve.
- C. Water shall be free of organic materials and shall have a pH of 7.0 to 9.0, a maximum chloride concentration of 500 mg/l, and a maximum sulfate concentration of 500 mg/l.
- D. Reinforcement shall be welded wire fabric 2-inch by 4-inch mesh, ungalvanized conforming to ASTM A 185 or spiral ribbon wire per AWWA C 205 Section 4.5.5. Wire with excessive rusting shall not be used.

PART 3 - EXECUTION

3.1 COLD-APPLIED PLASTIC TAPE COATING

- A. Apply plastic tape coating in accordance with AWWA C214, C209, and as modified herein.
- B. The tape manufacturer shall furnish a representative to provide assistance during the initial application of all tape materials to ensure proper installation.
- C. The tape manufacturer's representative shall be retained for a minimum of five (5) consecutive working days of tape coating for each project heading.

- D. At the completion of the five (5) day period, the tape material manufacturer's representative shall meet with the CONTRACTOR and DISTRICT to review and update the tape coating operation plan. If, in the opinion of the DISTRICT, significant modifications to the tape coating operations are identified in the initial five (5) day inspection period, the tape material manufacturer's representative shall be retained for an additional length of time, as necessary to correct all deficiencies in the application of the tape coating system.
- E. The tape manufacturer's representative shall be retained by the CONTRACTOR for the duration of the work and shall respond to periodic field problems and questions from the CONTRACTOR and DISTRICT within a sufficient time period so as not to cause delay in the installation and backfill of pipe. Costs incurred for retention of the tape manufacturer's representative shall be borne by the CONTRACTOR.
- F. Modifications to the pipe manufacturer's tape coating operation shall be properly documented and submitted within three (3) working days to the DISTRICT in accordance with shop drawing submittal procedures.
- G. Holiday Detection For Tape Coating
1. Prior to the application of the mechanical outer layer tapes, the inner layer tape shall be electrically tested for any flaws in the coating with a suitable holiday detector as approved by the DISTRICT.
 2. The total tape coating system shall be tested a second time immediately prior to installing cement mortar coating.
 3. The detector for both tests shall impress a voltage conforming to NACE Standard RP-02.
 4. The voltage to be used to electrically test the tape shall be included in the manufacturer's fabrication plan.
 5. All holidays shall be clearly marked electrically or otherwise detected, due to flaws, or mishaps, upon discovery, and immediately repaired.
 6. Discontinue wrapping of the first mechanical outer layer tape of any pipe section until the detected holiday has been repaired.
 7. Repairs shall be performed using methods specified herein. After the repair, retest the affected areas with the holiday detector prior to the application of the outer layer wrap. This process will be done until the coating has successfully passed the test.

3.2 STRAIGHT RUN PIPE APPLICATION

- A. For straight run pipe, plant applied conditions, the cold-applied plastic tapes shall be a four layer system consisting of: (1) primer; (2) corrosion prevention tape (inner layer); (3) mechanical protective tape (first outer layer); and (4) mechanical protective tape (second outer layer).

- B. Perform the entire coating operation as a one station operation where the pipe is supported at the ends in a manner which will permit the application of the primer, plastic tape, and cement mortar coating. Do not allow additional handling following the initial setup of the pipe section, from application of primer, tape coating, and cement mortar coating. No application involving rollers to support the pipe during the primer application, plastic tape, or cement mortar coating application will be permitted.
- C. Perform the entire coating operation by experienced workers skilled in the application of cold-applied plastic tapes and cement mortar coating under qualified supervisors. The DISTRICT is to be immediately informed of any personnel changes associated with the pipe coating operation.
- D. All equipment for blasting and application of the tape coating system shall be of such design and condition to comply with all the requirements of these specifications. Immediately repair or replace equipment which, in the opinion of the DISTRICT, does not produce the required result. Include equipment and a repair procedure for correction of defective tape application for use under this specification in the steel pipe fabrication plan. Make available for review a copy of this portion of the fabrication plan, and any updates, at the location of the coating operation, and a repair procedure for correcting defective tape application.
- E. Remove the exterior weld bead along the entire exterior surface of the pipe. The exterior weld bead shall be flush with the exterior surface of the pipe with a tolerance of plus 1/64-inch. Removal of the weld bead is to be conducted in such a manner that no gouging or nicking of the plate surface will occur. This operation is to result in a smooth exterior surface with no ridges or valleys which may result in bridging or disbonding of the tape from the surface of the pipe.
- F. Surface preparation shall conform to AWWA C214 and the following:
 - 1. Basic pipe shall be clean of all foreign matter such as mud, mill lacquer, wax, coal tar, asphalt, oil, grease, or any contaminants. Wash off any chemical solutions used in cutting or welding with hot water and allow the surface to dry. Remove welding slag or scale from all welds by wire-brushing, hammering, or other satisfactory means. Remove welding splash globules prior to priming.
 - 2. Prior to blast cleaning, inspect surfaces and, if required, preclean in accordance with the requirements of SSPC SP-1, Solvent Cleaning, to remove oil, grease, and all foreign deposits. Remove visible oil and grease spots by solvent wiping. Use only approved solvents that do not leave any residue. Include in the manufacturer's fabrication plan the cleaning solvent applications procedure and safety precautions. Preheating to remove oil, grease, and mill scale will be permitted; provided that the pipe is to be cement mortar lined in the field; and provided all pipe is preheated in a uniform manner to avoid distortion. Do not exceed preheat temperatures of 500 degrees Fahrenheit.
 - 3. Use on all affected steel-plate work, suitable and effective measures for eliminating the inclusion of gas forming elements, or other detrimental conditions, in any of the shop or field welds which results in any condition found to be detrimental to the successful application and bonding of primer, plastic tape, and cement mortar

coating. Said measures to include time-curing the pipe sufficiently, thoroughly neutralizing the gas forming elements, or other approved treatment.

G. Blast cleaning shall conform to AWWA C214 and the following:

1. Blast the pipe surface using a commercially available shot grit mixture to achieve a prepared surface equal to that which is specified in SSPC SP-6, Commercial Blast Cleaning.
2. For plant mortar-lined pipe, perform blast cleaning of said exterior surfaces after the initial curing of the spun mortar lining. Perform the exterior blast cleaning in such a manner as not to endanger the mortar lining in the pipe. Completely remove corrosion and foreign substances from the exterior of the pipe in the blast cleaning operation, and apply primer immediately after completion of blast cleaning.
3. The shot grit mixture shall not exceed 40 percent shot to 60 percent grit. The shot grit mixture is to be determined prior to the start of blast cleaning operations and this mixture ratio is not to be modified throughout the duration of the blast cleaning operations without the written approval of the DISTRICT.
4. Achieve from abrasive blasting an anchor pattern profile a minimum of 1.0 mil, but not exceeding 2.0 mils. Provide anchor pattern standards in the form of a 3-dimensional standard plate which depicts a commercial blast profile. Prepare a sample of the blasted surface on a representative steel plate measuring 6-inches by 1/4-inch or purchase standard industry plate samples of various blast finishes for comparisons. Purchase standard plates from NACE, meeting NACE TM-01-75, and conforming to NACE No. 3 standard using grit. Establish by agreement with the DISTRICT the visual standards that meet the specified anchor pattern and degree of cleanliness. Upon the establishment of the said standards, seal the steel plate using a clear acrylic coating, moisture proof plastic bag, or other approved means to protect the plate from surface contamination or corrosion. Use this plate as a visual comparator during the blast cleaning and coating operations. Measure the anchor pattern or profile of the blasted surface using comparator tape as specified herein.
5. Inspect the blast cleaned exterior pipe surface for adequate surface preparation prior to application of the primer. Surface comparator tapes are to be used by the manufacture in at least eight random areas, selected by the Engineer, along any given 40-foot length of pipe. The results of the surface comparator tapes are to be documented on the quality control sheet for each pipe section.
6. Coat each pipe section with primer and tape within the same day of being blast cleaned. Do not allow blasted and/or blasted and primed pipe to sit overnight. All blasted and primed pipe must be coated by the end of the day. No coating will be permitted on pipe sections showing evidence of rust.

H. Primer application shall conform to AWWA C214 and the following:

1. Prior to primer application, clean the pipe surface free of foreign matter such as sand, grease, oil, grit, rust particles, and dirt.

2. Apply the primer in a uniform thin film at the coverage rate recommended by the manufacturer for the state of dryness of the primer prior to the application of the inner layer of tape.
3. Make available at all times, primed surfaces for inspection prior to the application of the inner layer tape.
4. Maintain adequate safety precautions, as outlined in the manufacturer's fabrication plan, throughout the application of the primer.
5. Limit the application of primer to that length of pipe which can be taped within the same work day. Pipe coated with primer which was not taped within the same work day shall be rejected at the discretion of the Engineer. The primer shall be removed and the surface shall be reprimed.
6. Protect primer coated pipe sections from moisture, dirt, sand, and other potentially contaminating materials.
7. Protect priming operations from or suspend during times of high wind. Sections not adequately protected shall be rejected by the DISTRICT. If rejection occurs due to contamination of the primer, completely remove the primer from the exterior of the pipe section and reprime the surface.
8. Thoroughly mix the primer by agitation using an approved mixer powered by air or explosion proof electric motor. Continuously mix and agitate primer during application to prevent settling or lumping.
9. Apply primer only to a dry pipe surface. Whenever the ambient air temperatures are cold enough to cause gelling of the primer, the use of heaters will not be permitted to return the primer back to a fully liquid state. Use new primer at a minimum of 40° F.
10. Apply storage primer to the exposed steel pipe at tape cutbacks to prevent oxidation of the cleaned metal surface. Spray apply minimum of 1.5 mils and maximum of 2.5 mils of storage primer to exposed steel per the manufacturer's recommendations. Do not place storage primer on the edge of the steel plate.
11. The solvent of the primer and storage primer shall be certified by the manufacturer stating compliance with air pollution control rules and regulations and all requirements of agencies and other governmental bodies having jurisdiction. Include air pollution control rules and regulations regarding the application of the primer in the manufacturer's fabrication plan.

I. Inner Layer Tape Application

1. Apply the inner layer tape directly onto the primed surface using approved mechanical dispensing equipment to assure adequate, consistent tension on the tape as recommended by the tape manufacturer.
2. Rollers shall be used to apply pressure on the tape as it comes in contact with the pipe.

3. Necessary adjustments to mechanical application equipment to assure a uniform tight coating shall be made.
4. A tight, smooth, mechanically induced, wrinkle-free coating shall be maintained throughout the application process.
5. The application of tension shall be such that the width of tape will be reduced between 1-1/2 to 2 percent of tape width prior to the pull. A pressure readout gauge and chart recorder, suitable to the DISTRICT, with the tape let-off machine to document the tape tension during application shall be provided.
6. The inner layer tape shall be applied at a minimum roll temperature of 70° F. The temperature of the tape within 12 inches of the point of contact with the pipe surface shall be continuously monitored.
7. A chart recorder, suitable to the DISTRICT, shall be used to document the temperature of the tape during application. Sections where the tape application tension and temperature are not maintained within manufacturer's recommendations shall be rejected and the tape removed from the entire pipe section and reapplied.
8. The inner tape layer shall be continuously electronically tested at 6,000 volts immediately following application of the tape by a holiday tester permanently mounted to the tape application station and equipped with an indicator light and audio buzzer, suitable to the DISTRICT, to alert the workers of the presence of holidays in the coating system.
9. The inner layer tape shall be spirally wrapped for longitudinally welded pipe. For spiral welded pipe, the angle of the inner layer tape shall be wrapped as parallel as practicable to the spiral weld of the pipe or as approved by the DISTRICT. Provide a one (1) inch nominal tape overlap, minimum overlap 3/4 inch.
10. Splice each new roll by overlapping the new tape over the end of the preceding roll by at least 6 inches. Perform this end lap splice by hand or by a mechanical applicator such that the splice is wrinkle free and maintains the continuity of the inner wrap coating. Maintain the wrapping angle of the new roll parallel to that of the previous roll.
11. Provide cutbacks 10 inches from and parallel to the end of the pipe. Perform cutbacks using a cutting device that is guided from the end of the pipe to insure a uniform, straight cutback.

J. Mechanical Outer Layer Tape Application

1. The first mechanical outer layer of tape shall be applied over the inner layer tape using the same type of mechanical equipment used in the application of the inner layer tape.
2. No overlap splice of the other layer coinciding with the overlap splice of the inner layer will be permitted.

3. A minimum 6-inch separation between overlap of splices shall be provided.
4. Two mechanical outer layers of tape shall be provided as specified herein.
5. The inner layer tape shall be electrically tested, inspected, and approved prior to the application of the second mechanical outer layer tape. Both mechanical outer layer tapes shall be maintained smooth, tight, and wrinkle-free.
6. Mechanical outer layer tapes shall be applied in accordance with the requirements for the inner layer tape, except that the minimum tape roll application temperature shall be 90° F.
7. Monitoring for tension and temperature will be required for the mechanical outer layer tapes. The use of rollers to apply pressure on the tape is not required during application of the mechanical outer layer tapes.
8. The complete tape system shall be tested prior to coating as specified herein.

K. Storage Primer

1. Application of storage primer shall conform to AWWA C214 as modified herein.
2. Prior to storage primer application, clean the pipe surface free from foreign matter such as sand, grease, oil, grit, rust, particles, and dirt.
3. The primer shall be thoroughly mixed by agitation using an approved mixer powered by air or explosion proof electric motor. The primer shall be continuously mixed and agitated during application to prevent settling or lumping.
4. Primer shall be applied to a dry pipe surface. Whenever the ambient air temperatures are cold enough to cause gelling of the primer, the use of heaters will not be permitted to return the primer back to a fully liquid state. Use new primer at a minimum of 40o F.
5. Storage primer shall be applied to the exposed steel pipe at tape cutbacks to prevent oxidation of the cleaned metal surface. Spray apply minimum of 1.5 mils and maximum of 2.5 mils of storage primer to exposed steel per the manufacturer's recommendations. Storage primer shall not be applied on the edge of the steel plate.
6. The solvent of the primer and storage primer shall be certified by the manufacturer stating compliance with air pollution control rules and regulations and all requirements of agencies and other governmental bodies having jurisdiction. Include air pollution control rules and regulations regarding the application of the primer in the manufacturer's fabrication plan.

L. Mortar Overcoat

1. Apply cement mortar overcoating in accordance with Section 02400 and AWWA C205 immediately after the application of the tape coating layers. Allow 3-1/2 inch cut back beyond the edge of the tape coating.

2. Allow the mortar to cure properly before the pipe section is removed from the coating fixture and placed on rollers and timbers.

3.5 PLANT COATED FITTINGS

- A. Fittings which cannot be machine coated in accordance with AWWA C209 shall be coated using materials as specified herein.
- B. Weld bead preparation, surface preparation, blast cleaning, primer and tape application shall be as specified for straight run pipe.
- C. An inner layer tape with 1-inch nominal, 3/4-inch minimum, tape overlap on all plant coated fittings shall be applied.
- D. An outer layer of cold-applied plastic tape as specified herein with a 55 percent overlap on all plant coated fittings shall be applied.
- E. The total tape coat system for plant coated fittings shall have a minimum thickness of 110 mils.
- F. When more than 30 percent of the tape coating is removed from the circumference of the pipe for the installation of fittings, remove the tape coating system remaining on the pipe. Reprime and retape the fitting and pipe in accordance with these specifications.
- G. All completed tape coated fittings shall be tested in the presence of the DISTRICT with an electrical flaw detector prior to installation of cement mortar coating. Applied voltage shall be in the range of 11,000 to 15,000 volts. All holidays found shall be repaired.
- H. The procedure described herein for tape coating repair for fittings and field joints shall be followed. Cement mortar coating defects shall be repaired in accordance with these specifications.
- I. Cement mortar coating shall be applied in accordance with Section 02400 and AWWA C205 over the tape coated fittings immediately after completion of tape coating, testing, and inspections.

3.6 FIELD COATING JOINTS

- A. Field cold-applied plastic tape coating shall be in accordance with AWWA C209, as modified herein.
- B. Prior to welding any field joints, an 18-inch strip of heat resistant material shall be wrapped over the entire coated pipe sections on each side of the joint to be welded to avoid damage to the plant applied coating by the hot weld spatter. The coated portion of the pipe shall not be used for grounding.
- C. Immediately prior to exterior welding of the pipe for double welded lap joints, storage primer will be removed. Wire brush area to be welded per the manufacturer's recommendations.

- D. No tape coating will be permitted until the welding has been completed and the pipe section has cooled sufficiently so as not to damage the integrity of the tape coating system.
- E. Trapped air under the tape in the joint shall not be permitted.
- F. After joint welding, flash rusting shall be removed by mechanical means such as a wire brush. The weld, storage primed steel and all exposed steel shall be wire brushed. All burrs and weld slags shall be removed to achieve a smooth surface.
- G. The pipe surface shall be cleaned free of mud, mill lacquer, wax, tar, grease, or any foreign matter. Visible oil or grease shall be removed using an approved solvent that will not leave any residue on the pipe surface. The pipe surface shall be free of any moisture and all foreign matter prior to the application of primer.
- H. Prior to the application of the field applied tape coating, plant applied tape coating shall be tested in the presence of the DISTRICT with an electrical flaw detector. All holidays and physical damage to the plant applied tape coating shall be repaired prior to application of the field applied tape coating.
- I. Irregularities in joints shall be filled with elastameric joint filler.
- J. Primer shall be applied by brush or roller (4 mil wet, 1 mil dry).
- K. After primer has dried, tape shall be applied to the joint and extended a minimum of 3-inches onto the mill coat. End splices shall be a minimum of 6-inches and shall be staggered. The tape coating shall overlap at least 3-inches on the adjacent tape wrap. Maintain 55 percent overlap on all field joint tape to produce a minimum thickness of 100 mils.
- L. Tape with sufficient tension to conform with the surface irregularities shall be applied. The finished wrap shall produce a smooth, wrinkle-free surface.
- M. The final applied tape coating shall be tested in the presence of the DISTRICT with an electrical flaw detector. All holidays and physical damage to the final applied tape coating shall be repaired prior to application of the mortar coating.
- N. Mortar coating shall be applied in accordance with Section 02400 and AWWA C205, over the tape coated joint immediately upon completion of tape wrapping, testing, and inspections. Mortar at field joints shall overlap the shop-applied mortar overcoat a distance of not less than 5 inches. The thickness of the mortar across the joint shall be 1-inch minimum.

3.7 COATING OF FIELD JOINTS USING ALTERNATIVE HEAT-SHRINKABLE PIPE JOINT SLEEVES

- A. Field installed heat-shrinkable pipe joint sleeves shall be in accordance with AWWA C216, as modified herein.

- B. Protect the tape pipe coating from heat and weld splatter damage at welded joints by wrapping an 18-inch-wide strip of heat resistance material completely around the coated pipe sections covering the exposed tape pipe on each side of the joint prior to welding. Do not sue the coated portion of the pipe for grounding.
- C. Do not apply the joint sleeve until all welding has been completed and the pipe has cooled sufficiently so as to not damage the heat-shrinkable pipe joint sleeve.
- D. After joint welding, remove all weld slag, flash rusting and storage primer on the exposed steel by mechanical means, such as a wire brush. Remove all burrs and weld slag to achieve a smooth surface.
- E. Lightly abrade the tape pipe coating with course sandpaper to a distance of 2 inches beyond the end of the sleeve or up to the mortar overcoat.
- F. Clean the exposed steel pipe and adjacent tape pipe coatings free of dirt, mud, mill scale, wax, tar, grease, or any foreign matter. Remove visible oil or grease using an approved solvent that will not leave any residue on the pipe surfaces.
- G. Pack irregular surfaces in the joint with elastomeric joint filler. The edges of bell ends or butt-strapped joints shall be beveled to remove sharp edge. Apply a compatible elastomeric filler tape to provide a 2:1 slope such that there is a smooth transition across the step. More than one strip of filler tape may be required. The elastomeric tape shall be pressed into the joint to eliminate voids.
- H. Pre-heat the pipe surface using two workers with minimum 300,000 BTU propane torches with a flame spreader tip. The target pipe steel temperature is 140°F and 100°F for the coating. Apply sleeve quickly after heating to minimize heat loss. Apply the sleeve with the release liner attached.
- I. With the sleeve (in strip form) rolled up from both ends, center over top of pipe. Center the sleeve over the weld such that it overlaps the pipe tape coating by 3-inches on both sides. Allow material to drape over both sides of pipe.
- J. Adjust the sleeve so that the two ends meet (overlap per manufacturer's instructions) at the 4 o'clock position allowing a gap of no more than 1 inch between the sleeve and the pipe at the bottom. Pull the lower sections of material around the bottom quadrant of the pipe and bring up to the top of the pipe.
- K. Pull back the release liner 2-3 feet from the underlap end and apply heat gently to the adhesive from the top of the pipe to the underlap end and press down to pipe surface.
- L. Remove release liner from entire sleeve and ensure that sleeve is still properly positioned. Drape over pipe and insure that it is centered properly and that there is proper overlap at the closure. Gently heat the closure and press down firmly all corners.
- M. Continue heating the closure and press down with gloved hand or roller until a good bond is realized. Use a roller to firmly press down this area and ensure that no air is trapped.

- N. Once the closure is established use torches to anchor the sleeve by heat and pressure at the 5 and 7 o'clock positions. Begin shrinking the sleeve in the center from below first and gradually working to the top quadrant. Slowly spread to the ends of the sleeve until full recovery is achieved and the sleeve is taught.
- O. While shrinking press down the sleeve with gloved hand or roller to push out air and insure that the adhesive begins to ooze out from the edges. Do not permit trapped air under the sleeve. Finish off area of closure and underlap with a roller.
- P. Inspect the final applied joint sleeve in the presence of the District's Representative. A properly completed application will have no trapped air pockets and no scorched or overheated areas. Repair all damage to the final applied joint sleeve and tape pipe coatings prior to application of the mortar coating.
- Q. Apply mortar joint coating and reinforcement over heat-shrink joint sleeve and tape pipe coatings using fabric diapers to retain the mortar. Apply the mortar coating immediately upon completion of joint sleeve and inspection. Mortar at field joints shall overlap the shop-applied mortar overcoat a distance of not less than 5 inches. The thickness of the mortar across the joint shall be 1-inch minimum.

3.8 TAPE COATING REPAIRS

- A. Plant and field cold-applied plastic repair tapes shall be furnished and installed in accordance with AWWA C209 using plant and field tape materials as specified herein.
- B. Cold-applied plastic repair tapes from the same manufacturer as the plant applied plastic tape manufacturer shall be provided.
- C. Repair tapes and primer shall be completely compatible with the tape system used for straight run pipe.
- D. Damage in the form of holidays, flaws or mishaps found in the total coating system shall be repaired by removing the outer layer tapes and inner layer tape from the damaged area of the pipe. The damaged area shall be thoroughly cleaned using methods and materials approved by the DISTRICT. The methods and materials to be used in repairing the damaged areas will depend on the type and cause of damage.
- E. After cleaning, a suitable primer shall be applied, followed by a patch of repair tape over the affected area. The patch repair tape shall be overlapped over the undamaged coating a minimum of 4 inches in all directions. The repaired area shall be retested with a holiday detector.
- F. An outer layer tape shall be wrapped over the repaired area. At the discretion of the DISTRICT, depending on the extent of the repair area, the outer layer tape shall be wrapped around the entire circumference of the pipe.
- G. If the outer layer tapes are damaged and holidays or other flaws are not detected in the inner layer tape at the same area, the repair of the inner layer tape may not be necessary; however, if the damage is determined by the DISTRICT, to be severe enough to jeopardize the integrity of the inner layer tape, the DISTRICT will direct the CONTRACTOR to repair the inner layer tape. If such action is taken, the outer layer tapes shall be removed up to the boundaries of the damaged area, taking care not to

damage the inner layer tape any further. Before replacing the outer layer tapes, a holiday detector shall be applied to the inner layer tape to determine that no damage has been made to this primary tape coating during the outer layer removal process.

- H. Repair of the outer layer tapes shall be performed in accordance with the requirements as described above. The repair tape shall be overlapped over the undamaged coating a minimum of 4 inches in all directions.
- I. When the repair area tests show no holiday, a notation to the area indicating the test is satisfactory shall be applied.
- J. Cement mortar coating shall be applied over the cold-applied plastic tape coating.

3.9 COATED PIPE PROTECTION

- A. All coated surfaces shall be protected from damage prior to and during the pipe installation in accordance with these specifications. Coated pipe shall be handled using two, minimum 12-inch wide belt slings on spreader bars.
- B. The pipe shall be rested in saddles not less than 36 inches wide shaped to the outside diameter of the coated pipe during transportation.
- C. The saddles shall be in contact with the bottom of the pipe along an arc of at least 60 degrees.
- D. Saddles shall be completely lined with not less than 5/8-inch thick rubber belting. This belting shall overlap the edges of the saddles not less than 3-inches.
- E. No nails nor any other fasteners that may damage the coated pipe will be permitted in installing the rubber belting on saddles.
- F. Damaged pipe and coatings will be rejected. Rejected pipe may be repaired and retested when in the judgment of the DISTRICT an acceptable repair can be achieved.

END OF SECTION