NAPCA Bulletin 14-83-94

EXTERNAL APPLICATION PROCEDURES
FOR POLYOLEFIN PIPE COATING
APPLIED BY THE CROSS HEAD EXTRUSION METHOD
OR THE SIDE EXTRUSION METHOD
TO STEEL PIPE.

1. **General**
   a. These specifications may be used in whole or in part by anyone without prejudice, if recognition of the source is included. The National Association of Pipe Coating Applicators (NAPCA) assumes no responsibility for the interpretation or use of these specifications.
   b. The intended use of these coatings is to provide corrosion protection for buried pipelines. Above ground storage of coated pipe in excess of 6 months without additional Ultraviolet protection is not recommended.
   c. The following definitions apply:
      i. Applicator - The contractor who applies the coating to the pipe.
      ii. Company - The purchaser of the coated pipe or the entity for whom the Applicator coats the pipe.
      iii. SSPC - The Steel Structures Painting Council.
      iv. NACE - NACE International.
      v. Manufacturer - The company that makes the coating materials which are applied to the pipe.
      vi. AWWA - American Water Works Association.

2. **Scope**
   a. The Applicator shall furnish all labor, equipment and material required, shall prepare all surfaces to be coated and shall apply the coating to all surfaces to be coated.
   b. Corrosion protection, as provided under this specification, is furnished by the application of extruded polyolefins to the exterior of pipe to be placed underground.
   c. As an variation of the Side Extrusion method described in this specification, the procedure for Tape and Side Extrusion Polyolefin Sheath coatings described in AWWA C215 is available.

3. **Pipe Conditions**
   a. Pipe delivered to the Applicator for coating shall be free of protective oils, lacquers, mill primer, dirt or any other deleterious surface contamination which may affect the application of the coating. The pipe surface shall be as free as possible from scabs, slivers and laminations.
   b. Any paint markings or stenciling of the pipe surface shall be of the type and thickness that can be removed easily during normal surface preparation.

4. **Handling of Bare Pipe**

a. Proper equipment for unloading, handling, and temporary storage of bare pipe shall be used to avoid any damage to the pipe or pipe ends.
b. If internally coated pipe is received at the Applicator's plant, care shall be taken to avoid damage to the internal coating or the obliteration of the internal pipe markings during any phases of work covered by this specification. Internal coatings must be capable of withstanding the processing conditions necessary for the application of the external coating.
c. The Applicator shall visibly inspect the pipe upon receipt for damage such as dents, flat ends, and bevel damage. Any damage observed at this point shall be noted on the inbound tally, and the Company shall be informed within 24 hours of receipt of the pipe. Any non-visible defects such as slivers, scabs, laminations, burrs, dents, etc. will be observed after the pipe is blast cleaned and at the Company's request, removed as an extra work item.

5. **Material and Workmanship**

All material furnished by the Applicator shall be of the specified quality. All work shall be done in a thorough workmanlike manner. The entire operation of pipe receiving, stockpiling, surface preparation, coating application, storage and loadout shall be performed under the supervision of and by experienced personnel skilled in the application of protective coating.

6. **Equipment**

The Applicator's equipment shall be in such condition as to permit the Applicator to follow the procedure and obtain results prescribed in these specifications.

7. **Coating Material**

a. All coating materials, including repair or patch materials, purchased or used under these specifications, shall be packaged in suitable and approved containers. The containers shall be plainly marked with the name of the Manufacturer, type of material and batch or lot number where applicable. Bulk shipments shall be allowed provided the above information is included in the bill of lading.
b. The coating material shall be packaged in containers suitable to keep the contents clean and dry during handling, shipping and storage. Storage and handling conditions shall be in accordance with the Manufacturer's recommendations.
c. Precautions shall be taken during the handling, shipping and storage of all materials to prevent damage to the containers that would result in contamination of the coating materials. All contaminated, or otherwise damaged materials shall be discarded.

8. **Surface Preparation**

a. Before blasting, all oil, grease, mill lacquer and other deleterious material on the surfaces of the metal to be coated shall be removed by suitable means.
b. In cold weather or any time when moisture tends to collect on the steel, the pipe shall be uniformly warmed for sufficient time to dry the pipe prior to cleaning. The pipe temperatures shall be maintained at least 5 degrees F above the dew point during the cleaning and coating operations. Pipe temperature shall not

exceed 160 degrees F as a result of preheat.

c. Pipe surfaces shall be blast cleaned to a Commercial metal finish in accordance with SSPC-SP-6 or NACE #3 requirements.

d. NACE, Swedish Pictorial, SSPC or other mutually agreed upon standards shall be used to judge the degree of cleaning.

e. A consistent abrasive working mix shall be maintained by frequent additions of small quantities of new abrasive commensurate with consumption. Infrequent large quantity additions of abrasive shall be avoided.

f. Following cleaning and prior to coating the pipe, abrasive remaining on the outside and loose contamination on the inside of the pipe shall be removed by air blast, vacuum or other suitable methods. If air is used, the air should be dry and free of contaminants, and all particles removed from the surface shall be collected in such a manner as not to contaminate clean pipe.

g. Following cleaning and prior to coating, the pipe surface shall be inspected for adequate cleaning and surface condition. Pipe not properly cleaned shall be rejected and recleaned.

h. Blast cleaned pipe surfaces shall be protected from conditions that would allow the pipe to flash rust before coating. If flash rusting occurs, affected pipe shall be recleaned.

9. **Coating Application**

a. Cross Head Extrusion Method

i. The adhesive undercoating shall be applied to the clean pipe surface. It shall consist of a blend of rubber, asphalt and high molecular weight resins and shall conform to the physical properties specified in Table I, under the heading "Cross Head Extrusion Data". The adhesive shall be applied to the pipe by flood-coating, at a temperature of 265 to 325 degrees F., to a minimum thickness of 8 mils.

ii. Immediately following the application of the adhesive, the polyolefin sheath shall be extruded over the undercoating. The seamless sheath must be smooth, free of pinholes, bubbles, blisters, wrinkles, cracks or mechanical voids, and must conform to the physical properties specified in Tables II, III and IV, under the heading "Cross Head Extrusion Data".

iii. Immediately following the extrusion, the polyolefin sheath shall be water-quenched so that it will shrink tightly around the pipe and adhesive under-coating.

iv. Unless otherwise specified by the Company, the polyolefin sheath shall extend to approximately 4 to 6 inches from each end of plain end pipe and approximately 2 to 3 inches from the last thread on threaded pipe.

v. Unless otherwise specified by the Company, the polyolefin sheath shall be applied to the thickness specified in Table V, under the heading "Cross Head Extrusion Data".

b. Side Extrusion Method

i. The adhesive material shall be a butyl rubber compound and shall be made from isobutylene and 1.5 percent to 2.0 percent by weight of isoprene. The butyl rubber compound shall contain no asphaltic, coal tar, or other

property-degrading extenders. The butyl rubber compound shall conform to the physical properties specified in Table I, under the heading "Side Extrusion Data".

ii. The adhesive shall be applied by side extrusion at approximately 300 degrees F. in single or multiple layers to specified thickness.

iii. Immediately following the extrusion of the adhesive, a high molecular weight polyolefin shall be applied by side extrusion at approximately 500 degrees F. in single or multiple layers to specified thickness to produce a tightly bonded, seamless coating between 30 and 250 mils thick, as specified by the Company (minimum coating thickness allows 90% of specified thickness). The polyolefin material shall conform to the physical properties specified in Table II under the heading "Side Extrusion Data".

10. **Inspection and Testing**

a. The entire procedure of applying the protective coating material as herein specified will be rigidly inspected from the time the bare pipe is received until the coated pipe is loaded on the carrier for shipment.

b. If the Company designates an Inspector, the Inspector shall be provided free access to the Applicator's plant at any time during any operation involving the pipe, with the right to inspect and to accept or reject work performed.

c. The Applicator's Quality Control Inspector shall be responsible for stopping operations when conditions develop which could adversely affect the quality of the completed work.

d. Although the principal purpose of the coating inspection by the Company and Applicator is to insure compliance of the coating with these specifications, such inspection shall also include examination for previously undetected defects in the pipe, pipe surface or on the pipe ends. Pipe having such defects shall be set aside for subsequent repair or replacement by the pipe supplier and for any necessary coating repair. Recoating or coating repair that may be necessary by reason of these defects in the pipe which do not involve fault on the part of the Applicator shall be done at the Company's expense.

e. When Company's Representative exercises Company's right of approval at the Applicator's plant, the Company's Representative shall conduct final inspection on the Applicator's out-bound rack. Accepted pipe shall be presumed to be produced as specified unless test results indicate a discrepancy.

f. Coating Thickness Measurements

i. An appropriate film thickness gauge, calibrated to the National Bureau of Standards' Certified Coating Thickness Calibration Standards shall be used to perform coating thickness measurement.

ii. The coating thickness shall meet or exceed the agreed upon minimum coating thickness. All joints which fail to meet the minimum coating thickness test shall be recoated or repaired.

g. Electrical Inspection

i. Holiday inspection of the entire coated surface shall be performed with an approved high voltage Holiday Detector to indicate any flaws, holes, breaks or conductive particles in the protective coating.

ii. The Holiday Detector shall have sufficient A.C. voltage and be equipped with a positive signaling device. The search electrode shall be made of conductive rubber, or other applicable material. The Holiday Detector shall be operated in such a way as to audibly and/or visually detect the presence of all holidays.

iii. The minimum testing voltage for a particular coating thickness shall be within 20 percent of the value determined from the following formula:

1250 x (square root of coating thickness (mils))

11. **Repair Procedures**

a. All defects disclosed by the Holiday Detector and other obvious defects shall be repaired by the Applicator.

b. Holidays which are the result of slivers, scabs, laminations, or other steel conditions beyond the control of the Applicator shall be repaired at the Company's expense.

c. Areas of repair to the coating shall be holiday inspected by the Applicator on a 100 percent basis.

d. Repairs shall be made by using heat shrinkable sleeves, pressure sensitive polyolefin/butyl rubber tapes and other materials approved by the Company for this purpose.

12. **Coated Pipe Handling, Storage and Loading Requirements**

a. Pipe shall be stored, handled and transported in a manner to prevent damage to the pipe walls, beveled ends and the coating.

b. Storage racks shall be so designed as to protect the coated pipe from standing water, direct soil contact, and sharp or hard objects that might damage the coating.

c. The coated pipe shall be shipped using sufficient and proper dunnage to adequately protect the pipe and coating.

d. All pipe shipped by rail shall be loaded in accordance with API Specifications RP 5L1, Latest Edition.

13. **Supplementary Details Supplied by the Company**

When possible, the Company shall supply the following supplemental information:

a. Length and diameter of pipe.

b. Grade, wall thickness and/or weight per foot of pipe.

c. Source and approximate shipping date from the pipe mill.

d. Method of shipment from the mill.

e. Approximate shipping date to the destination.

f. If pipe is to be stored, the approximate length of time it is to be stored.

g. Length, style and post preparation of cutback.

h. Minimum weight per car or truck required to protect lowest outbound rate.

i. Name and type of carrier.

j. Stacking and/or loading instructions.

Cross Head Extrusion Data

Table I
Physical Properties of
Adhesive Undercoating

Properties	**Test Method**	**Requirement**
Softening Point, F	ASTM E 28	140 to 190
Penetration, mm, 77F	ASTM D 5	3 to 12
Stormer Viscosity, sec for 100 revs at 270F at 300F	ASTM D 562	 120 to 180 60 to 80
Specific Gravity, 77F	ASTM D 71	1.0 to 1.2

Table II
Properties of Polyethylene

Properties	**Test Method**	**Requirement**
Density, g/cm(3rd)	ASTM D 1505	Min. 0.941
Flow Rate, g/10 min	ASTM D 1238, Condition E	Max. 0.75
Pigment Content, % by wt.		Min 2.0
Environmental Stress Crack Resistance F(50) hrs.	Condition B, 100% Igepal	Min. 100

Table III
Properties of Polypropylene Resin

Properties	**Test Method**	**Requirement**
Density, g/cm(3)	ASTM D 1505	Min. 0.897
Flow Rate, g/10 min	ASTM d 1238, Condition E	Max. 1.0
Pigment Content, % by wt.		Min. 0.95
Environment Stress Crack		

Resistance	ASTM D 1693	Not Applicable

Table IV
Thickness of Plastic Sheath of Pipe Coating
*Sheath Thickness

Pipe Size	**Standard (mils)**		**60 mil Sheath**	
	Nom.	*Min.*	*Nom.*	*Min.*
1/2" through 1-1/2" Nom.	25	22.5	60	54
2-3/8" through 2-7/8" OD	30	27.0	60	54
3-1/2" through 4-1/2" OD	35	31.5	60	54
5-9/16" through 24" OD	40	36.0	60	54

Side Extrusion Data

Table I
Physical Properties of Butyl Rubber

Property	**Test Method**	**Requirement**
Density, g/cc	ASTM D 1505	1.0 to 1.1
Flow Rate, g/10 min	ASTM D 1283	1.8 to 8.0

Table II
Physical Properties of
White or Black Polyethylene

Property	**Test Method**	**Requirement**
Tensile Elongation	ASTM D 638	Min. 500%
Tensile Strength	ASTM D 638	Min. 2,700 lb/in(2)
Dielectric Strength	ASTM D 149	700-800 volts/mil
Water Penetration	ASTM G 9	0.0046 in dissipation factor-water

		penetration remained constant.
Environmental Stress Crack Resistance F(50) hrs.	ASTM D 1693; Condition B 100% Igepal	Min. 1000 hrs.
Density (pigmented) g/cm(3)	ASTM D 1505	Min. 0.941
Flow Rate, g/10 min	ASTM S 1238; Conditon E	0.2 to 1.0

Table III
Table of Recommended Nominal Coating Thickness (Mils)

Pipe Size	**Adhesive**	**Polyolefin**	**Total**
up to 16"	10	40	50
up to 42"	10	50	60
Up to 120"	10	60	70

NOTE: The above are the nominal thicknesses to be specified. Tolerance would be less 10%. Additional thickness of adhesive and/or polyolefin may be specified for specific requirements.