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SPECIFICATION: **G-8209-6b**

TITLE: **FIELD COATING OF STEEL PIPE AND FITTINGS INSTALLED UNDERGROUND AND IN SUBSURFACE STRUCTURES**

VOLUMES: **2 (Section 1.0), 10, Yellow Book, Electric Construction Standards Volume 3 (Section 21)**

COURSE ID: **GAS0351**

CORE GROUPS: **Gas Construction, Corrosion Control, Emergency Response Force Lead Mechanic**

★ **TARGET AUDIENCE:** **Gas Construction, Corrosion Control, Pressure Control, Tunnels, LNG, Major Projects, EH&S Operations, Per Diem Contractors, Other Gas Contractors, Transmission Operations, Energy Services, Emergency Response Force Lead Mechanic**

REV 6b (2/8/2021)
Contents: Added Attachment section and Attachment A.

REV 6a (11/11/19)
Cover Page: Edit Table of Contents Revision summary.
Contents: Corrected Revision marker locations throughout specification.

REVISIONS: (See ★)

Cover Page	-	Removed Gas Quality Assurance from “Target Audience”.
Table of Contents	-	Added new Sections 11, 12, and 15 and relocated “Protection, Precautions, Quality Control” from §11 to §13; “Records Retention” from §12 to §14.
Section 1.1	-	Added System D, 2-Part Epoxies.
Section 2.0	-	Clarified references to regulatory code(s) and added operator qualified statement.

Section 3.0	-	Updated and clarified environmental and safety references in subsections 3.1, 3.3, and 3.6.
Section 4.0	-	Added reference to manufacturers' recommendations for material handling and storage. Revised table to: update manufacturer and material information, add "Applied Thickness" information, add "System D" for "2-Part Epoxies". Added note regarding spot buy.
Section 5.0 – Table 1	-	Updated "Preferred" and "Alternate" coatings. Added coating selections for: submerged pipe, elevated temperatures and subsurface structures exposed to atmosphere. Added references to specification
Section 6.0	-	Updated surface preparation for "Existing Coated Pipe" and "Bare Steel Pipe". Updated and clarified "Surface Washing" process. Updated "Ambient Temperature: considerations. Added information concerning Nominal Pipe Surface Temperatures.
Section 7.0	-	Clarification on use of primers.
Section 8.0	-	Updated and clarified coating application process with diagrams and backfill procedures
Section 9.0	-	Updated and clarified coating repair process
Section 10.0	-	Updated and clarified inspection process, specific testing. Added Table 2 for ease of guidance.
Section 11.0	-	Added section on coating compatibility. Added figures and Table 3 for ease of selection and guidance. Added Figure 5 for guidance. Added Figures 6 and 7 for guidance.
Section 12.0	-	Added section on coating at thermite weld. Added Table 4 for available pads, process and figures for use of cut pieces of Cold Applied Tape.
Section 13.0	-	Updated and clarified coating during rain, snow, fog.
Section 15.0	-	Added section for reference documents and specifications.

Gas Operations Standards

TITLE: FIELD COATING OF STEEL PIPE AND FITTINGS INSTALLED UNDERGROUND AND IN SUBSURFACE STRUCTURES

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	EFFECTIVE DATE: 11/12/19				
	EH&S REVIEW BY:		**OPERATIONS REVIEW BY: R. McGrath (Const.), K. Kelly (GDS)**		
	AUTHORS:	**APPROVED BY:**	**DATE APPROVED:**	**VOLUMES: 2 (Section 1.0), 10 and Yellow Book, Electric Vol 3 (Section 21)**	**PAGE 1 OF**
	R. Dereck & G. Bonasia	**Angel Cardoza General Manager Technical Operations**	**10/3/19**	**Construction Standards, O&M Manual, Yellow Book, Electric Construction Standards**	**31 PAGES**

1.0. SCOPE

1.1 This specification covers the field coating of all steel gas, electric feeder and related equipment, cooling water, gasoline, and diesel pipe and fittings installed underground and in subsurface structures:

A) System A: Mastic
B) System B: Cold Applied Tape
C) System C: Hot Coal Tar Enamel (See Section 1.2)
★ D) System D: 2-Part Epoxies

1.2 Hot Coal Tar Enamel may only be used with approval from Corrosion Control.

2.0. LEGAL REQUIREMENTS

★ 2.1 Title 49 CFR Part 192, Subpart I; Section 192.451 through 491 and Subpart N; Section 192.805

★ 2.2 Title 16 NYCRR Part 255 Section 255.451 through 491 and 255.604

★ 2.3 NYC Administration Code Title 24, Subchapter 6 Emissions Standards Subpart 24-141.

★ 2.4 The procedures and process outlined in this document shall be performed by operator qualified individuals specific for the coating application task and surface preparation task (refer to G-8195). For operator qualified individuals while overseeing non-qualified individual(s), span of control shall follow the task requirements in accordance with Appendix D of the Con Edison's OQ Written Plan. No other work and/or tasks shall be assigned to the operator qualified individual while overseeing non-qualified individual(s).

3.0. ENVIRONMENTAL AND SAFETY IMPACT

★ 3.1 The use and application of a cathodic protection coating is an important part of effective corrosion control on buried pipe, pipe substructures and facilities, aboveground pipe and associated appurtenances.

3.0. ENVIRONMENTAL AND SAFETY IMPACT (Continued)

Properly applied, maintained and approved coating used in conjunction with effective passive or active cathodic protection methods both minimize external corrosion and prevent leaks on buried pipe and associated appurtenances.

Properly applied, maintained and approved coatings on subsurface pipe and facilities will minimize atmospheric corrosion.

3.2 All operations that are performed (i.e. coal tar removal, disposal, installation, etc.) must be in compliance with all applicable specifications, Corporate Environmental Health and Safety Procedures (CEHSPs), General Environmental Health and Safety Instructions (GEHSIs) and Asbestos Management Manual (AMM).

★ 3.3 Applicators of coatings, such as but not limited to hot coal tar enamel, shall follow all federal, state, city and local municipality regulatory requirements that apply to their coating and/or coating removal operations. Therefore, applicators are responsible for having engineering controls in place to meet applicable air quality regulations. This means that applicators working within the five boroughs of New York City shall comply with NYC Administrative Code Title 24, Subchapter 6 Emissions Standards, Subpart 24-141, and applicators working in Westchester County shall comply with all state, county, and local air regulations. It is each applicator's responsibility to obtain any and all required permits.

3.4 All employees should be given updated, product specific Hazardous Communication Training for the products/materials used in this specification.

3.5 Where employees are required to work around hot liquids, adequate ventilation and PPE must be used, including respiratory protection if necessary.

★ 3.6 If employees enter an enclosed space (manhole), proper enclosed space (manhole) entry procedures, including atmosphere testing, must be followed in accordance with GEHSI S17.02.01, "Gas Enclosed Space Entry" and/or GEHSI S17.01, "Electrical Enclosed Space".

4.0. MATERIAL

★ All materials shall be handled and stored as recommended and specified by the material manufacturer. Storage shall be in a clean, dry environment and temperature controlled environment as to not adversely affect the material properties.

System	Material	Unit	Stock No.	Product	Manufacturer	Applied Thickness
A	Mastic	Gallon	631-0004	Roskote R-28 CE Mastic	Chase Corporation	Per Section 8.2: 3 Layers, min 30mil each layer. Min. 90 mil Total. ***Exceptions:*** *8.2(f) & repairs*
			----------**or**----------			
			631-1211	Thick 'n Quick	Chase Corporation	
	Felt	Roll	Spot Buy			
B	Cold Applied Tape	2" Width Roll	631-3324	Tape Coat H35 Gray or T/R Green	Chase Corporation	Per Section 8.3 1 or 2 layer wrapping.
		------or------		----------or----------		
		4" Width Roll	631-3316	T/R Green	Chase Corporation	
				----------or----------		
				Gator Butyl 601-HP	Pipe Gator Corporation	
C	Primer	Gallon	Spot Buy	Omniprime	Chase Corporation	*Refer to manufacturer specification*
	Enamel	100# Kits	Spot Buy	Cold Tar Enamel	Lone Star Specialties	Per Section 8.4 2-Layers min. 94 mil 1st layer & min. 32 mil 2nd layer. Min. 126 mil plus thickness of felt.
	Primer	Gallon	Spot Buy	Reilly #122-M Black Synthetic Primer	Lone Star Specialties	
	Felt	Roll	Spot Buy	Durapax	Durapax LLC	
D	2-Part Epoxy	A & B Kits	Spot Buy	Belzona 5831 - Epoxy Belzona 9111 - Cleaner	Belzona	Apply 2-Layers, Min 12 mil each layer. Min of 24 mil in Total
		----------**or**----------				
		A & B Kits	Spot Buy	Protal 7200	Denso	Apply 1-Layer, Min 35mil to Max 50mil
		----------**or**----------				
		Other epoxies not specifically listed, manufacturer datasheets, SDS sheets, ASTM test results, etc… shall be submitted, approved by EH&S and Corrosion Control Engineer prior to use.				Corrosion Control Engineer to specify.
All Systems	Rock Shield	Roll	686-0134	Rock-Stop	Stuart or Johns-Mansville	N/A
	Cleaner / Degreaser	Quart	634-1853	Envirosolv 655	Fine Organics Corp.	
		Aerosol Can	634-1960	PTF Cleaner (Part # PTF14-AC)	Patomac Technologies	
	Wipes		689-3135 025-3724	Alcohol Wipes Canister		

Note: Item(s) and/or material(s) identified as "Spot Buy" have no class and stock number available being that these item(s) and/or material(s) are not being stocked and/or procured by Con Edison. These item(s) and/or material(s) are to be purchased on an as needed basis per job and/or layout requirements.

5.0. COATING SELECTION

★ Table 1 shall be used in selecting the proper coating system unless the Corrosion Control engineer identifies and selects a specific coating, other than the preferred or alternate shown in Table 1, based on environmental and/or field conditions.

TABLE 1: COATING SELECTION

	Preferred	Alternate
Welded joints, elbows, offsets, sleeves, damaged coating on pipe (refer to Section 6.1D), pipe in manholes, straight pipe, etc.	System B (Cold Applied Tape) Or System D (Epoxy)	System C (Hot Coal Tar)
Irregular surface fittings, all bolted fittings, Valves & valve appurtenances less than 12 inches, weldolets, non-bolted compression couplings, posi-hold type couplings, irregular pipe surfaces in manholes, etc	System A (Mastic) Or System D (Epoxy)	System C (Hot Coal Tar)
IJs, Valves & valve appurtenances 12 inches and larger	System D (Epoxy)	System C (Hot Coal Tar)
Pipeline and/or appurtenances continuously submerged in water (i.e. Marine applications)	Belzona 5831	Consult Corrosion Control
Pipeline and/or appurtenances itself or surroundings nominally at elevated temperatures, 140ºF (60ºC) or above.	Consult Corrosion Control	
Pipeline, fittings, irregular surfaces and/or appurtenances within subsurface structures exposed to the atmosphere.	Wax Tape - Refer to Spec G-8213	

6.0. SURFACE PREPARATION – ALL SYSTEMS

6.1 Existing Coated Pipe

A) Surface(s) coated with Hot Coal Tar wrap or other known/unknown coatings may contain asbestos and/or PCBs. If a painted surface is encountered, lead, cadmium, and chromium may be present. Refer to CEHSP S10.00, "Lead Management Program." All handling and/or removal of existing mill/field coatings shall comply with procedures specified in applicable GEHSIs and CEHSPs or Personal Protective Equipment (PPE), handling, training, and disposal requirements.

★ B) All loose/disbonded existing field coating shall be removed from the surface(s) to be coated in accordance with AMM 6.04. For coal tar coated pipe, any remaining edges shall be cut on a taper. Upon removal of all loose/disbonded existing field coating, the bare steel surface(s) shall be prepared per Section 6.2.

★ C) All mill applied coatings for shipping and handling purposes (not an approved cathodic protection coating) shall be removed from the pipe surface(s) to be coated.

- In the event these mill applied coatings are difficult to remove using a power tool, the applied coating does not need to be removed. The surface of the mill applied coating shall be scuffed by hand tool and/or power tool to achieve an anchor profile. The scuffed surface(s) shall be wiped clean and degreased as per Section 6.3 prior to applying an approved coating. Scoring or gouging a coated surface is not acceptable.

★ D) Where a new coating is to be applied over existing coated pipe, the new coating selected shall be compatible with the existing coating as per Section 11. The surface of the existing coating shall be wiped free of debris, dirt, dust, residues, etc… and then scuffed by hand tool and/or power tool to achieve an anchor profile. The scuffed surface(s) shall be wiped clean and degreased as per Section 6.3 prior to applying the new coating.

6.0. SURFACE PREPARATION – ALL SYSTEMS (Continued)

6.2 Bare Steel Pipe

★ A) For coating system A, B and C; use a power tool to clean the bare pipe surface to be coated in accordance with SSPC SP-3, SP-11 to a metal surface to achieve an anchor profile free of any rust, dirt, dust, grease, oil, mill scale, burrs, weld splatter and/or sharp edges. When approved by Con Edison's Field Representative, hand tool cleaning in accordance with SSPC SP-2 to achieve an anchor profile is acceptable in areas not accessible to power tool cleaning.

★ B) For coating system D; grit/sand blasting in accordance with SSPC SP-6/NACE No. 3 or use of a power tool, for example Montipower "Bristle Blaster", in accordance with SSPC SP-3, SP-11 of the pipe surface to a near-white finish in accordance with SSPC SP-10/NACE No. 2 achieving an anchor profile requirement of 2 mil minimum and not to exceed 5 mil. An appropriate anchor profile gauge shall be used to confirm an adequate profile has been achieved.

When approved by Con Edison's Field Representative, the use of a power tool in accordance with SSPC SP-3, SP-11 is acceptable in areas not easily accessible or when approved by Corrosion Control Engineer, the use of a hand tool in accordance with SSPC SP-2 to achieve an anchor profile is acceptable in areas not easily accessible to power tool cleaning.

★ C) Where coatings are applied to bare steel and are adjacent to existing coating, coating compatibility shall be considered before overlapping existing coating as per Section 11.

6.3 Surface Washing

★ A) Wash the surface(s) to be coated removing oil, grease, dirt, etc. accordance with SSPC SP-1 using the degreaser listed in Section 4.0. This washing shall be done by wiping the surface(s) to be coated with clean rags soaked with the degreaser. A final wipe with either alcohol wipes or a white, clean lint free rag shall be done. The white lint free rag shall be free of dust, dirt, etc. Chemical resistant gloves, such as, neoprene or nitrile and coveralls such as, Tyvek shall be worn. The coating shall not be applied until all of the degreaser has evaporated from the surface(s) being coated.

6.0. SURFACE PREPARATION – ALL SYSTEMS (Continued)

6.2 Surface Washing (Continued)

B) Care shall be taken as to have no debris fall onto the cleaned surface. If debris fall onto a cleaned surface(s) or a dirty rag is used, the surface(s) shall be re-washed per Section 6.3 (A).

For example, when entering and/or exiting an open excavation, dirt/debris can be accidentally kicked onto the prepared and clean surface requiring the surface to be re-washed.

C) Certain epoxies may have specific and additional cleaner/degreasers that are specified by the epoxy manufacturer. Application of this specific cleaner/degreasers shall follow manufacturer recommendations and applied after Section 6.3 (A) and (B) are performed.

6.4 Ambient Temperatures

★ A) When ambient temperature is at or below 45°F (7°C), moisture in the air or on the pipe may "freeze" on the pipe surface(s). To enhance the immediate bond and/or remove the frozen moisture and ice on the pipe surface(s) in colder temperatures, the prepared pipe surface(s) shall be heated with an appropriate heat source. After heating the pipe surface(s), the pipe surface(s) shall be wiped using either an alcohol wipe or a new clean white lint free rag soaked with the approved degreaser. Prepared pipe surface(s) shall be free of debris, dirt, dust, residues, etc. The coating shall not be applied until pipe surface(s) is clean and dry.

★ B) When the ambient temperature falls below the coating manufacturer's stated minimum application temperature, the pipe surface shall be heated with an appropriate heat source (Section 6.4 A) and a primer may be required (Section 7.0). The coating material and primer shall be stored in a heated area prior and while pipe surface is being prepared and prior to coating application. System D – 2-Part Epoxies may require additional temperature controls during application process and curing time, consult manufacturer recommendations and datasheets.

6.0. SURFACE PREPARATION – ALL SYSTEMS (Continued)

★ 6.5 Nominal Pipe Surface Temperature(s) above 140ºF (60ºC)

Corrosion Control shall be contacted for a proper coating and primer selection if the nominal pipe surface temperature is expected to be above 140ºF (60ºC).

7.0. APPLICATION OF PRIMER

★ 7.1 Use and application of a primer shall follow the manufacture's application recommendation for the coating systems identified within this section, unless the Corrosion Control engineer identifies and selects a primer based on manufacturer's consultation, environmental and/or field condition(s).

For all coating systems that require primers; coatings shall be applied immediately after the primer has dried.

7.2 System A – **Mastic** no primer is required.

★ 7.3 System B – **Cold Applied Tape** requires primer when ambient and/or pipe surface temperatures are at or below 40°F (4.5°C), apply a primer with a minimum Wet Film Thickness (WFT) of 4 mil to the properly prepared surface.

★ 7.4 System C – **Hot Coal Tar Enamel** requires primer, EH&S shall be consulted for specific PPE and engineering controls requirements. Primer shall be stirred thoroughly and should appear uniform prior to use. Apply the primer to the properly prepared surface. The primer shall be applied by brushing, leaving a uniform coating completely covering the surface of the pipe or fitting and overlapping the mill coating on each side by at least four inches. Allow the primer to dry. The hot coal tar enamel shall be applied immediately after the primer has dried.

★ 7.5 System D – **2-Part Epoxies** no primer is required unless specified by coating manufacturer.

8.0. COATING APPLICATION

★ 8.1 Coating application shall follow the manufacturer's application recommendation for the coating systems identified within this section, unless the Corrosion Control engineer identifies and selects a coating on manufacturer's consultation, environmental and/or field condition(s). Applied thickness shall be adequate for holiday testing per G-8201.

A NACE certification coating applicator (CCA) is recommended and/or required where specified for a coating system.

8.2 System A – Mastic

★ A) Mastic is furnished properly formulated for application. Normal appearance is thicker than most coatings, but it can be brushed evenly. Stir mastic thoroughly. Mastic should appear uniform prior to use.

★ B) Apply mastic by brush, a minimum of three coats that each have a Wet Film Thickness (WFT) of 30 mils. Allow each coat to dry to the touch before application of the next coat, about 30 minutes. Never apply more than 40 mils in a single coat to prevent cracking. Each coat of mastic shall overlap any adjacent coating. Use only clean brushes that are not caked or hard due to prolonged use.

★ C) With the final coat applied, allow mastic to fully dry prior to light handling and/or backfilling, about after 1-1/2 hours.

The drying times are variable and dependent upon ambient temperature and relative humidity. Drying times longer than those indicated are possible. When such conditions arise, a good indication to fully dried mastic is to depress with a thumb. If the thumb depression remains, Mastic needs more time to dry.

D) Do not backfill until the mastic is completely dry. If emergency backfilling is required, as authorized by Corrosion Control, RockShield shall be wrapped loosely around the coating to protect it against abrasion.

8.0. COATING APPLICATION (Continued)

8.2 System A – Mastic (Continued)

★ E) Once mastic is completely dry, inspection shall be initiated in accordance with Section 10.0. Any repairs shall be initiated in accordance with Section 9.0 and re-inspected.

★ F) All bolt threads, heads, and nuts shall be given two coats of mastic regardless of the condition of the factory coating. Follow same WFT thickness and dry times as identified above.

8.3 System B – Cold Applied Tape

A) Cold Applied Tape is furnished in 2” or 4” wide rolls. The use of 2" wide tape for pipe 8" diameter and/or smaller, and 4" wide tape for larger diameters is recommended.

B) Field coating of welded joints, elbows, offsets, etc. using cold applied tape shall be done as follows:

★ 1) Tape shall be applied evenly with tension and minimizing wrinkles, starting at either the 3 or 9 o’clock positions. The wrapped end shall terminate in the downward direction.

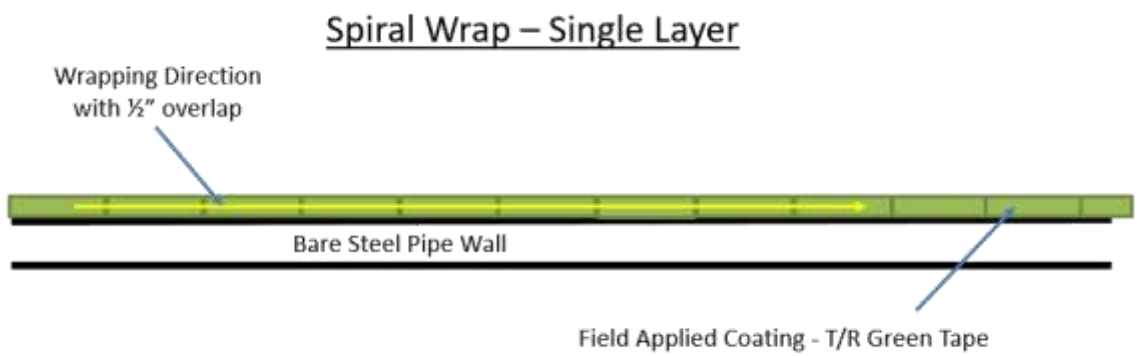
★ 2) Remove paper separator from side of tape which will be in contact with pipe. Apply slight pressure on to the back of the tape and work out any wrinkles.

★ 3) The tape shall be applied by the "spiral wrap" method. Overlap each adjacent tape layer 1/2". Wrap first and last turn of tape a minimum of 1-1/4 times around pipe, overlapping mill coating by 4". (See Figure 1 - Below)

8.0. COATING APPLICATION (Continued)

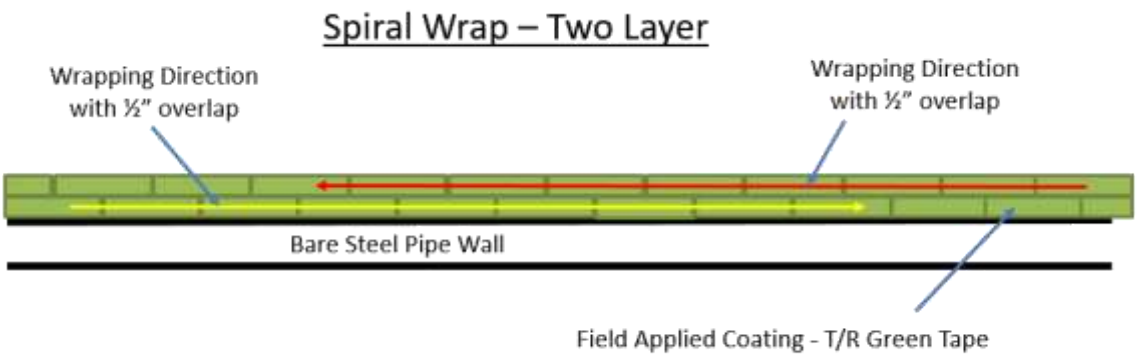
8.3 System B – Cold Applied Tape (Continued)

Figure 1



★ 4) For pipe, sleeves, barrels, couplings, etc., 16" in diameter and larger, a second layer of tape shall be applied following steps "1" through "3". This second layer of tape shall be started at the opposite end, and the application angle reversed. (See Figure 2 – Below)

Figure 2

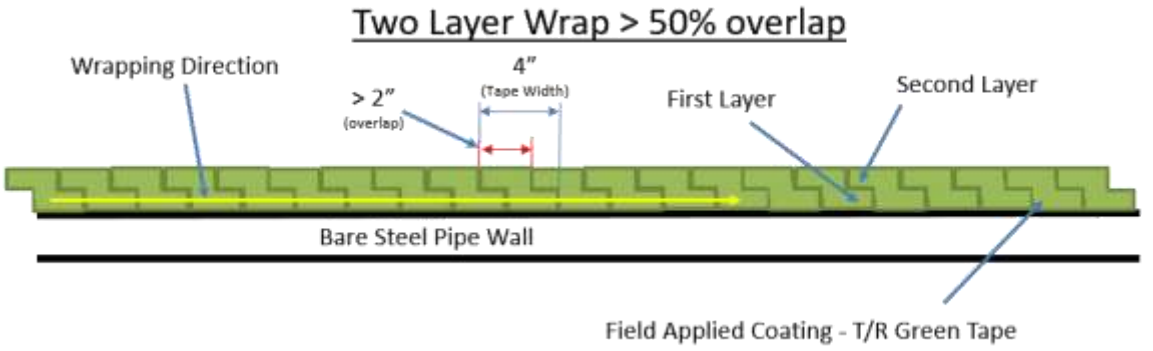


8.0. COATING APPLICATION (Continued)

8.3 System B – Cold Applied Tape (Continued)

★ 4) (Continued) As an alternate to 2 layer spiral wrap in opposite directions, the application of tape with greater than 50% overlap (55% preferred) is equivalent to <u>two</u> layers of tape. (See Figure 3 – Below)

<u>Figure 3</u>

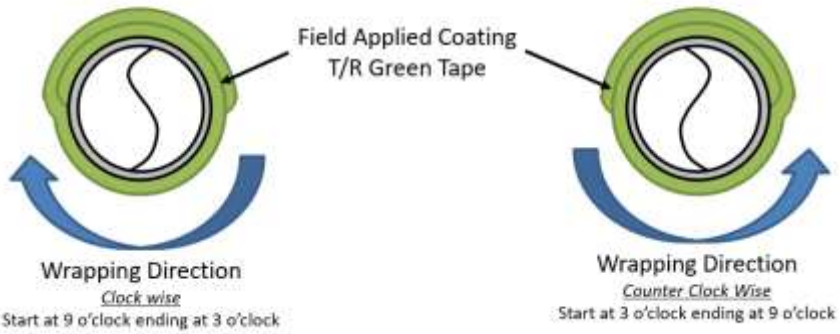


★ 5) For pipe, sleeves, barrels, couplings, etc., 16" diameter and larger, a "cigarette wrap" application is acceptable using wider tape as long as there are no wrinkles, bubbles, or voids in the tape. Wrapping shall start at either the 3 or 9 o'clock positions and end in the downward direction. Wrap shall be a minimum of 1-1/4 turns with 1/2" overlap between adjacent tape wraps and 4" on the mill coating. Two layers of tape shall be applied. (See Figure 4 – Below).

8.0. COATING APPLICATION (Continued)

8.3 System B – Cold Applied Tape (Continued)

Figure 4



8.4 System C – Hot Coal Tar Enamel (See Section 1.2)

A) An alternate for System A or B is System C – Hot Coal Tar Enamel. Pipe and fittings shall be coated with the coal tar enamel specified herein. The enamel shall be heated in kettles equipped with accurate and easily read thermometers. Upon removal from its container, the enamel shall be broken into small pieces before it is placed in the heating kettle. Overheating the enamel results in green-yellow acrid smoke and will carbonize the enamel rendering it useless.

★ Continued stirring is essential to obtain uniform heating. The heating and pouring temperatures are:
Maximum Kettle Temp., 525°F (274°C)
Minimum Pouring Temp. 485°F (252°C)

The enamel shall be kept free flowing and above the minimum pouring temperature both in the kettle and in the pouring buckets.

★ Kettle shall be placed within close proximity of pipe being coated in keeping above the minimum pouring temperature as bucket with hot coal tar is transported for coating.

8.0. COATING APPLICATION (Continued)

8.4 System C – Hot Coal Tar Enamel (See Section 1.2) (Continued)

B) Field coating of welded joints, elbows, offsets, etc., using Hot Coal Tar Enamel, shall be done as follows:

★ 1) Strips of felt shall be cut long enough to go around the pipe, a minimum of 1-1/4 times the circumference of pipe being coated.

a. Hot coal tar enamel shall be poured and spread using a brush onto the surface of the pipe and ensure coverage to the underside of the pipe.

b. Using the felt strips as slings, pour hot coal tar on to the felt strip sling and spread using a brush.

c. Bring felt sling to the underside of pipe, with a back and forth action while applying tension, allow the felt sling and hot coal tar to adhere together to the underside of pipe. Do not fold over the ends of the sling on the top side of pipe.

d. Inspect underside of pipe, removing wrinkles, voids and/or excess drippings.

e. Apply a coat of hot coal tar to the top of the pipe, fold over the ends of the sling. Apply hand pressure over the felt strip and strip ends to smooth out wrinkles, voids and excess coal tar at edges to seal and keep out moisture. There shall be at least 3/32 inch thickness over the entire coated area.

★ 2) The felt strip shall be inspected over the entire circumference for voids, thin spots, sags, wrinkles, tears and/or other defects. Defects shall be corrected before the application of any adjacent felt strip(s).

8.0. COATING APPLICATION (Continued)

8.4 System C – Hot Coal Tar Enamel (See Section 1.2) (Continued)

★ 3) Continue applying felt strips in a similar manner as described in (1) and (2) above, overlap each applied felt strip by a minimum of 1/2", until the entire area to be coated is complete.

4) Excess enamel shall be evident along all felt edges to get good sealing properties.

5) Using a brush, apply a second coat of enamel, at least 1/32 inch thick, over the first coat having the felt and the entire area coated.

★ 6) Where hot enamel overlaps mill coatings other than coal tar, coating compatibility shall be considered before overlapping existing coating as per Section 11.

★ C) Field coating of irregular fittings, where a felt strips and sling method is impractical, apply Hot Coal Tar Enamel shall be done using two separate coats. The first coat of enamel shall be at least 3/32-inch thick. The first coat shall be inspected for voids, thin spots, wrinkles, sags, blisters and other defects which shall be repaired prior to the application of the second coat. The second coat of enamel shall be at least 1/32 inch thick.

The working parts of valves shall be coated in accordance with Sections 6.0 and 8.1 of this Specification using System A – Mastic.

★ D) Once Hot Coal Tar Enamel has cooled, about 30 minutes, inspection shall be initiated in accordance with Section 10.0. Any repairs shall be initiated in accordance with Section 9.0 and re-inspected.

8.0 COATING APPLICATION (Continued)

★ 8.5 System D – 2-Part Epoxy

A) Each type of 2-Part Epoxies are typically furnished in two separate and properly sized containers such that the mixing ratio is kept consistent with manufacturer specification. If not, the mixing ratios shall follow the manufacturer specification.

B) Only one container from each of the two parts shall be mixed together and applied as one batch before another batch is mixed and applied. Do not mix more than one batch at a time.

C) Mixing of the epoxy shall be done in a suitably sized container (Part A or Part B) or a separate clean and suitably sized container. Use a clean spatula to wipe any remaining Part A and/or Part B from their respective containers and into the mixing container.

D) Use a mixing paddle on a power tool and mix the 2-Part Epoxy for about 2 minutes or until the mixture appears uniform in color. A new, clean and suitable container and new mixing paddle, if not wiped clean, is recommended for each batch being mixed.

E) Each type of 2-Part Epoxy have specific pot life and cure times, and each are different between Manufacturer and product. These times are also very dependent upon ambient temperatures & humidity. Manufacturer specification for the specific product on pot life and cure times shall be reviewed and adhered to prior to using 2-part Epoxies.

1) Pot life is the length of time in which the mixed 2-parts of epoxy can be applied before the mixture becomes no longer usable for application and must be discarded.

2) Cure time is the length of time when all layers of epoxy have been applied and has “fully” cured before any inspection, handling and backfilling can be initiated. Even though the coating is no longer “tacky”, the coating may still not be “fully” cured.

8.0 **COATING APPLICATION** (Continued)

8.5 System D – 2-Part Epoxy (Continued)

F) When ambient and pipe surface temperatures are at or below the manufacturer's specified minimum application temperature, a heat source(s) shall be required, see Section 6.4 for heating pipe surface.

G) Application of epoxy shall follow manufacturer recommended application process and adhering to allowed maximum thickness application for each layer being applied. The use of a Wet Film Thickness (WFT) gauge to ensure each layer is applied at the correct thickness.

H) The epoxy manufacturer and/or manufacturer representative shall be consulted as to the best method for application. A NACE certified coating inspector (CIP Level 1 minimum) is recommended.

I) Visually inspect for any voids, excess runs, no gaps between adjacent epoxy layers, etc... Repair by spreading coating with roller or brush before allowed pot life has expired. Coating shall appear uniform, both longitudinally and circumferentially, completely covering the entire surface of the pipe. Repeat the above steps for each layer to be applied.

J) One layer shall be applied along the entire length of pipe being coated and allowed to cure to a "tacky" cure before additional layers are applied. All layers being applied shall be done within one continuous process.

For Example: if the requirements to meet a minimum thickness is to apply two layers of epoxy, the application process shall not be allowed to stop after the first layer and then continued the next day for the second layer.

K) With all layers applied, coating shall be allowed to cure "fully" before initiating backfill procedures. Additionally and during the "fully" curing time, additional temperature controls shall be put in place, such as a heated enclosure around the coated pipe.

8.0 COATING APPLICATION (Continued)

8.5 System D – 2-Part Epoxy (Continued)

L) Once the coating is allowed to be "fully" cured, refer to manufacturer's specified cure times, inspection shall be initiated in accordance with Section 10.0. Any repairs shall be initiated in accordance with Section 9.0 and re-inspected.

★ 8.6 Backfilling procedures after coating application

A) In order to minimize any potential damages to the newly coated pipe, backfill procedures shall commence immediately and/or within 24hrs once the coating is:

1. Applied per specification
2. Allowed to "fully" dry and/or cure
3. All defects are repaired
4. All inspections are completed.

B) If backfill procedures are to be delayed beyond 24hrs, a detailed inspection shall be performed per Section 10.1 and all defects repaired.

9.0. REPAIRS OF DAMAGED COATING

★ 9.1 Selection of the repair coating, where the repair coating is to be applied over prior coated pipe, the two coating systems shall be compatible, see Section 6.1 (D) and Table 3.

★ 9.2 Follow all applicable surface preparation steps in Section 6.0, application of primer in Section 7.0 and coating application steps in Section 8.0 for the selected repair coating.

★ 9.3 Repairs of damaged coating using System A - Mastic:

A) Only one coat of mastic shall be applied for touch-ups, no larger than 2 square inches.

9.0 REPAIRS OF DAMAGED COATING (Continued)

★ 9.3 Repairs of damaged coating using System A - Mastic: (Continued)

B) Two coats of mastic shall be applied for all other repair sizes.

9.4 Repair of damaged coating using System B - Cold Applied Tape:

A) Cut a piece of tape (patch) large enough to cover damaged area, overlapping mill coating by at least 2

B) Cut a second piece of tape long enough to wrap around the pipe 1-1/4 times.

C) Remove the paper separator from side of tape which will be in contact with pipe.

D) Apply the patch.

E) Wrap the second piece of tape around the pipe 1-1/4 times, covering the patch. Avoid too much handling and stretching of tape, which will result in wrinkles and bubbles in the tape.

★ 9.5 Repair of damaged coating using System C - Hot Coal Tar Enamel:

★ A) Repairs made with hot coal tar coating shall be used only to repair hot coal tar enamel coatings.

B) The loose or disbonded coating shall be removed in accordance with procedures specified in applicable GEHSIs, CEHSPs, and variances. The edges of the coating shall be cut on a taper.

★ C) If bare metal is exposed when preparing the coated surface, apply the primer and allow primer to dry.

★ D) Hot coal tar enamel shall be poured on the primed metal and brushed over existing coal tar coating or primed surface, and a first piece of felt shall be carefully applied over the opening/area.

9.0. REPAIRS OF DAMAGED COATING (Continued)

9.5 Repair of damaged coating using System C - Hot Coal Tar Enamel: (Continued)

E) After a second application of hot enamel, a second piece of felt, larger than the first by not less than 4" in any direction, shall be immediately placed over the patched area.

★ F) Apply hand pressure over the repaired patch to smooth out wrinkles, voids and excess coal tar at edges to seal and keep out moisture.

★ 9.6 Repair of damaged coating using System D – 2-Part Epoxy:

★ A) Certain epoxy manufacturers provide repair kits consisting of the same epoxy for small repairs, the use of these repair kits on epoxy coating shall follow manufacturer recommendation(s).

★ B) When these repair kits are unavailable, select an appropriate compatible coating other than System D to apply over the repair, see Section 6.1 (D) and Table 3.

★ C) When repairs are to be made with different 2-Part Epoxies, the manufacturer of the epoxy shall be consulted, approved by the Corrosion Control engineer.

10.0. INSPECTIONS

★ 10.1 Visual

A) A visual inspection of the coating, both longitudinally and circumferentially, checking for voids, cracks, open seams, or any deficiency that may affect soundness of coating.

B) For natural gas pipelines operating at 125psig or greater, a NACE certified coating applicator (CCA) or a NACE certified coating inspector (CIP Level 1 minimum) is required for coating inspection. Coating Inspections shall be performed, at minimum, on a welded joint for straight lengths of pipe, at an elbow and/or bend, and any additional location(s) determined by the coating inspector.

10.0. INSPECTIONS (Continued)

★ 10.2 Anchor Profile

Where an anchor profile in accordance with SSPC standards are specified from the coating manufacturer, a suitable and calibrated anchor profile gauge shall be used (consult with Corrosion Control).

★ 10.3 Electrical Spark Test

A) For any natural gas pipeline operating at 125 psig or greater and for any distribution main of **100 feet or more** in length, the coating shall be electrically inspected using a calibrated Holiday Detector in accordance with Specification G-8201 prior to backfilling the pipe in the excavation.

B) For any distribution mains of **less than 100 feet** in length and/or services, the coating shall be electrically inspected using a calibrated Holiday Detector in accordance with Specification G-8201 prior to backfilling where practical.

C) For Electric Pipe-type feeder the coating shall be electrically inspected using a calibrated Holiday Detector in accordance with Specification G-8201 prior to backfilling where practical.

D) Electrical spark test verification is not required on repairs.

10.4 Adhesion Test

★ A) For System D, qualify the coating adhesion with a suitable and calibrated pull-off adhesion tester, number of tests, location(s) and pass/fail criteria shall be determined by the coating inspector with consultation by the Corrosion Control Engineer on a case-by case basis.

★ B) For System B - <u>Cold Applied Tape</u> only, an "X" test shall be performed by Corrosion Control to assure proper coating adhesion to the pipe surface.

10.0. INSPECTIONS (Continued)

10.4 Adhesion Test (Continued)

1) For a pipeline operating at 125 psig or greater, “X” test shall be performed, at minimum, on each welded joint for straight lengths of pipe, at each elbow and/or bend and any additional location(s) determined by Corrosion Control.

2) For any distribution main of 100 feet or more in length, “X” test shall be performed at each 100 foot interval.

3) For any distribution mains of less than 100 feet in length and/or services, “X” test shall be determined by Corrosion Control.

4) Location(s) of an “X” test shall be determined by Corrosion Control. The “X” test shall be performed at random locations around the pipe at the 3, 6 and/or 9 o’clock positions.

The “X” test shall consist of:

i. Two cuts, perpendicularly crisscrossed, through the tape and adhesive to the pipe surface.

ii. The cuts shall be approximately 4 inches in length.

iii. The four cut edges of the tape at the center of the "X" shall be pulled up.

iv. If the tape/adhesive does not pull off the pipe surface, repairs to the “X” test shall be in accordance with Section 9.4 completed by the coating contractor.

v. If a majority of the tape/adhesive is pulled off the pipe surface, the tape/adhesive was applied improperly, Corrosion Control shall determine the length of coated pipe and/or joint to be removed to bare steel, both longitudinally and circumferentially. The entire coating process shall initiate from the start, surface preparation, primer, coating and inspection.

★ C) For System A or C, coating adhesion verification is not required.

10.0. **INSPECTIONS** (Continued)

★ 10.5 Coating Thickness

A) For Systems D, a Dry Film Thickness (DFT) tester is required. Use a suitable and calibrated coating thickness gauge to verify dry film coating thickness, refer to Table 3.

B) For System A, B or C, coating thickness verification is not required.

★ 10.6 Defects Found

A) Any defects found during the inspections listed within this section, must be repaired in accordance with Section 9.0 and re-inspected in accordance with Section 10.0.

TABLE 2: Surface Prep, Primer and Validation Test

	Coating System A (Mastic)	Coating System B (Cold Applied Tape)	Coating System C (Hot Coal Tar)	Coating System D (Epoxy)	When Coatings are applied over Existing Coatings
Surface Prep	Yes, power tool method to bare metal.	Yes, power tool method to bare metal.	Yes, power tool method to bare metal.	Yes, grit blast method to bare metal with specific anchor profile.	Yes, hand/power tool method to scuff surface
Primer	No	Yes, when ambient temperature is below 40°F	Yes	Manufacturer specific requirement(s)	Depends upon the coating system being applied over existing coating.
Visual	Yes	Yes	Yes	Yes	Yes
Anchor Profile	Attempt to achieve an anchor profile to bare metal, not to a bright & shiny metal.	Attempt to achieve an anchor profile to bare metal, not to a bright & shiny metal.	Attempt to achieve an anchor profile to bare metal, not to a bright & shiny metal.	Manufacturer specific requirement(s)	Scuff surface to achieve an anchor profile
Electric Spark Test	Yes	Yes	Yes	Yes	Yes
Adhesion or "X" Test	No	"X" Test	No	Yes	No, unless cold applied tape is applied over existing coating
Coating Thickness	Verification not required, must meet minimal application thickness	Must meet minimal wrapped layers	Verification not required, must meet minimal application thickness	Verification is required, must meet minimal application thickness	Yes

★ 11.0. COATING INTERFACE & COMPATIBILITY

Where coatings are to be applied that are either (1) adjacent to existing coating or (2) overlapping onto existing coating, their coating compatibility shall be considered using Table 3 (below).

TABLE 3: COATING COMPATIBILITY SELECTION

	Coating System	New Coating & Repair Coating (to be applied over existing coating)			
		A (Mastic)	**B** (Tape)	**C** (Coal Tar)	**D** (2-Part Epoxy)
Existing Coating	**A** (Mastic)	Yes	Yes	No	No
	B (Tape)	No	Yes	No	No
	C (Coal Tar)	Yes	Yes	Yes	No
	D (2-Part Epoxy)	Yes	Yes	No	Yes
	Pritec	Yes	Yes	Yes	No
	Yellow-Jacket	Yes	Yes	No	No

A) If there is a coating compatibility and at the coating interface, the new & repair coating shall overlap the existing coating by a minimum of 4", refer to Figure 5 (below) as an example.

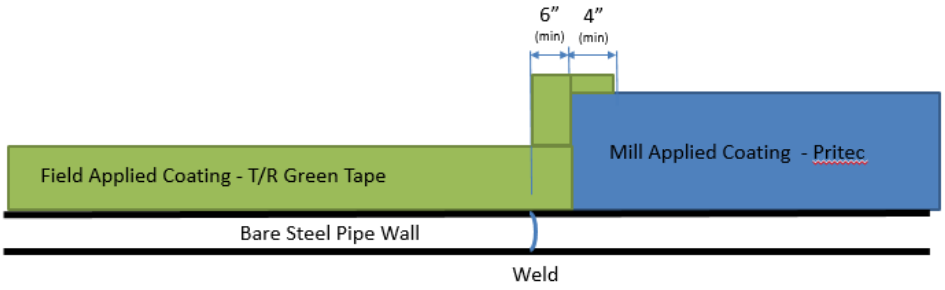


Figure 5
Example of T/R Green overlapping on Pritec

★ 11.0 COATING INTERFACE & COMPATIBILITY (Continued)

B) If there is no coating compatibility, the new coating shall not overlap the existing coating. At the coating interface, select a third coating that is compatible with both coatings and shall overlap each by a minimum of 4", refer to Figures 6 and 7 as example.

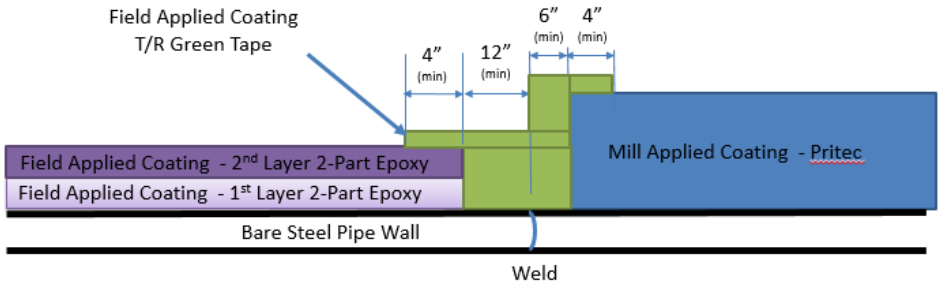


Figure 6
Example coating incompatibility of 2-Part Epoxy adjacent to Pritec & using T/R Green to overlap both coatings.

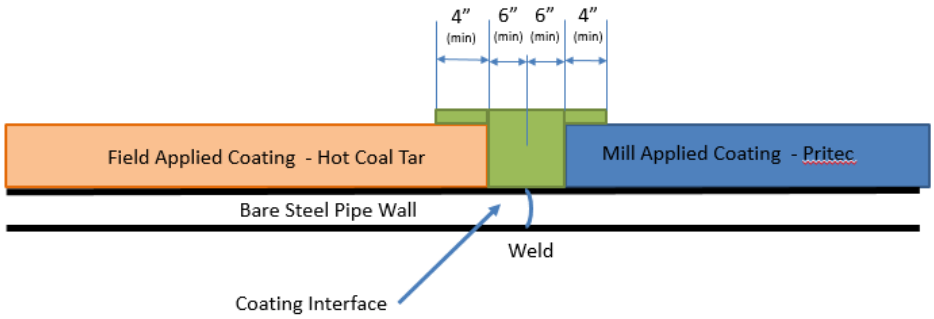


Figure 7
Example coating incompatibility of Hot Coal Tar adjacent to Pritec & using T/R Green to overlap both coatings.

★ 12.0. COATING AT AN EXOTHERMIC WELD

12.1 Where an exothermic weld is used, the thermite weld shall be coated with a coating pad or cut pieces of 4" Cold Applied Tape listed in Table 3.

12.2 On existing coated pipe using a coating pad:

A) Cut an opening smaller than the size of the pad to be applied, see Table 3.

B) The cut opening shall have the existing coating removed to expose the bare steel pipe. The pipe surface shall be prepared and cleaned to a metal surface to achieve an anchor profile free of any rust, dirt, dust, grease, oil, mill scale, burrs, weld splatter and/or sharp edges.

C) The exothermic weld shall be applied in accordance with EO-14134-C.

D) Refer to the coating pad manufacturer specification for application of coating pad, any additional surface preparation and/or primer required prior to applying the coating pad.

E) Ensure the coating pad covers the thermite weld and cut opening. Inspect for any gaps and/or misalignment of the coating pad and cut opening.

F) Consult Corrosion Control for guidance for any misalignment.

TABLE 4

Product	Manufacturer	Size	Coating Opening Cut Size	Stock No.
Handy Cap® IP	Chase Corporation	4" x 4"	3" x 3" cut	n/a
Handy Cap® XL IP	Chase Corporation	5" x 5"	4" x 4" cut	n/a
PATCH-PAD®	Trenton Corporation	4" x 4"	3" x 3" cut	n/a
PATCH-PAD®	Trenton Corporation	6" x 6"	5" x 5" cut	n/a
Cut Pieces of 4" Cold Applied Tape, follow procedure outlined in Section 12.3		4" x 4"	3" x 3" cut	631-3316

★ 12.0 **COATING AT AN EXOTHERMIC WELD** (Continued)

12.3 On existing coated pipe using cut pieces of 4” Cold Applied Tape

A) Cut a 3” x 3” opening on the existing coating, see Table 3.

B) The cut opening shall have the existing coating removed to expose the bare steel pipe. The pipe surface shall be prepared and cleaned to a metal surface to achieve an anchor profile free of any rust, dirt, dust, grease, oil, mill scale, burrs, weld splatter and/or sharp edges.

C) The exothermic weld shall be applied in accordance with EO-14134-C.

D) Refer to the 4” Cold Applied Tape manufacturer specification for application of the 4” cut pieces, any additional surface preparation and/or primer required prior to applying the 4” cut pieces.

E) Cut two 4” long pieces of 4” Cold Applied Tape, approx. 4” x 4”.

F) Each piece shall have a slit cut approx. half way or 2”, see Figure 8 (below).

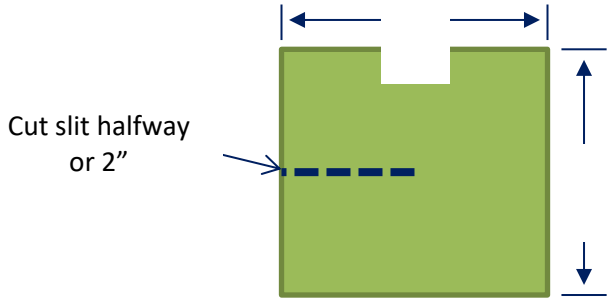


Figure 8
Example cut piece of 4” Cold Applied Tape with cut slit halfway.

★ 12.0 COATING AT AN EXOTHERMIC WELD (Continued)

12.3 (Continued)

A) Using one of the two the 4" x 4" piece of Cold Applied Tape, route the thermite weld wire into the cut slit and place over the cut opening applying hand pressure, removing

B) Using the second of the two the 4" x 4" piece of Cold Applied Tape and in the opposite direction, See Figure 9 (below). Route the thermite weld wire into the cut slit and place over the cut opening applying hand pressure, ensure that there are no wrinkles, bubbles, or voids.

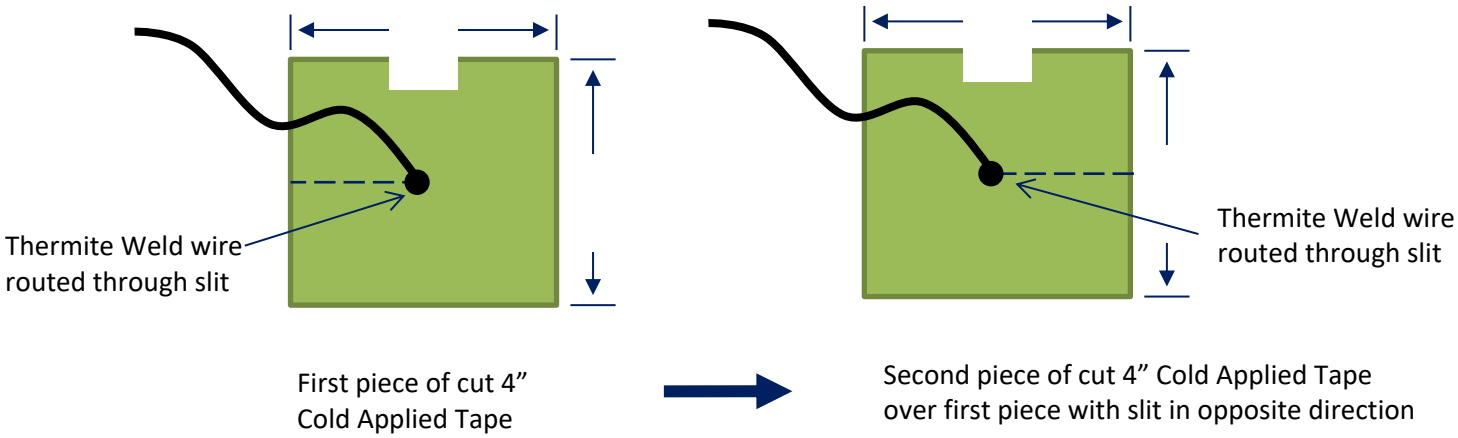


Figure 9

C) Ensure the 4" cut pieces cover the thermite weld and cut opening. Inspect for any gaps, misalignment, no wrinkles, bubbles, or voids of the 4" cut pieces and cut opening. Consult Corrosion Control for guidance.

13.0. PROTECTION, PRECAUTIONS, QUALITY CONTROL

13.1 The mastic and primer are flammable materials and must be kept away from open flames, sparks or high temperatures. Avoid breathing vapors and use only with adequate ventilation and/or approved respiratory protection. Keep containers closed when not in use. Contact with the skin shall be avoided.

13.2 The enamel pieces, placed in the heating kettles, shall be kept clean, dry and free of dirt, grass, weeds, or foreign matter.

13.3 All heating kettles, pouring buckets, daubers, etc., shall be cleaned once a day and kept in a workmanlike condition. Enamel left in the kettle overnight or from a previous day will be removed and disposed of in an approved manner.

13.4 Rolls of pipeline felt and cold applied tape shall be stored in sheds or on platforms under suitable cover to keep them dry. All rolls shall be carefully handled to prevent distortion of the rolls and damage to the edges which may interfere with their use.

★ 13.5 Unless proper environmental protections are in place, do not coat in rain, snow, fog, or windy weather which may cause moisture, dust or dirt to collect on the surface to be coated. Wet or dirty pipe or fittings shall not be coated until properly cleaned as per Section 6.0 and dried.

14.0. RECORDS RETENTION

Any records generated in the course of performing work in accordance with this specification shall be maintained as required by Corporate Instruction CI-870-1 “Records Management”. Guidance on the retention of Company Gas Operations records can also be found on the Records Management intranet site.

★ 15.0. REFERENCES

G-8195	-	QUALIFICATION OF GAS CONSTRUCTION AND GAS DISTRIBUTION SERVICES (GDS) CONTRACTORS
G-8213	-	FIELD APPLICATION OF WAX PETROLATUM TAPE AND PRIMER
G-8201	-	ELECTRICAL SPARK INSPECTION OF COATING ON STEEL PIPE
EO-14134-C	-	THERMIT WELD PROCESS FOR ATTACHING WIRE TO PIPE OR FITTING
CI-870-1	-	RECORDS MANAGEMENT
CEHSP S10.00	-	LEAD MANAGEMENT PROGRAM
GEHSI S17.01.01		ELECTRICAL ENCLOSED SPACE
GEHSI S17.02.01	-	GAS ENCLOSED SPACE ENTRY
AMM	-	ASBESTOS MANAGEMENT MANUAL
SSPC-SP1	-	SOLVENT CLEANING
SSPC-SP2	-	HAND TOOL CLEANING
SSPC-SP3	-	POWER TOOL CLEANING
SSPC-SP5, or NACE #1	-	WHITE METAL BLASTING
SSPC-SP6, or NACE #3	-	COMMERCIAL BLAST
SSPC-SP10, or NACE #2	-	NEAR WHITE METAL BLAST
SSPC-SP11	-	POWER TOOL CLEANING TO BARE METAL

16.0. ATTACHMENTS

Attachment A – Blasting Guidelines for Gas Facilities

ATTACHMENT A

Blasting Guidelines for Gas Facilities

Gas Operations has been adhering to the following guidelines when blasting occurs near gas facilities:

- CI-280 “Notices of Intent to Excavate or Blast by Company or Others”

- Review maps and records and determine if the gas facilities are needed. (e.g., redundant mains).

- Perform leakage surveys before, during and after blasting operations. Leakage survey shall be performed at the end of each day that blasting occurs.

- Special consideration should be given to services joined by solder.

- Peak particle velocity shall not exceed 50 mm/sec. at frequencies greater than 40 Hz or 20 mm/sec. at frequencies less than 40 Hz.

- The blasting contractor shall use a seismograph to monitor peak particle velocity on the closest gas facility to the blasting operations. This is usually a Fire Department requirement.

- Mechanical protection shall be provided around any gas facility that is located in an excavation where blasting will occur. This requirement is in addition to blasting mats.

  1mm = .03937 in
  50 mm/second = 1.9685 in / second
  20 mm/second = 0.7874 in / second

  Thomas W. Cowan
  September 27, 1995