

OWNER

External Coating of Buried Pipe and Field Joints

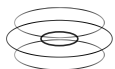


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TORUS

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ISSUE SUMMARY AND APPROVAL

This page records each issue of SPC-SPC-009. The preparer, reviewer and approver sign for each revision.

Rev.	Date	Issue purpose	Description
A	2026-09-29	Issued for Review	First issue

Contributors

Rev.	Discipline	Prepared by	Reviewed by	Approved by
A	Specifications			

SECTION PC-SPC-009
EXTERNAL COATING OF BURIED PIPE AND FIELD JOINTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes the materials, application, inspection, testing and repair of external corrosion coatings on all buried and partly buried carbon steel pipe, fittings, valves and fabricated assemblies of the :
1. Acceptance on receipt of plant-applied fusion-bonded epoxy (FBE) on Owner-furnished line pipe NPS 2 and larger, and all field work on it.
 2. Plant-applied abrasion-resistant overlay (ARO) over FBE on pipe installed by bore, or where the drawings designate a bore or rocky backfill section.
 3. Field joint coating of girth welds, tie-in welds and cut-backs: two-part liquid epoxy (default) or field-applied FBE by induction heating.
 4. Coating of buried fittings, valve bodies, insulating joints IJ-101 and IJ-102, branch connections and irregular shapes.
 5. Soil-to-air transitions at every riser where buried pipe emerges above grade: the IJ-101 riser, the outlet riser at (220, 160) at IJ-102, the T-101 drain lines and any buried fuel gas line.
 6. Holiday detection (jeeping) of 100 % of the coated surface before lowering-in, and coating repair.
 7. Coating of buried small-bore piping, including the D1 drains to T-101.
- B. The outlet lateral 12"-G-1042-A6, from IJ-102 at (220, 152.5) to the tap valve flange of (the receiving pipeline operator) at (220, 257), is included. It is about 96 ft of buried 0.500 in wall API 5L X52 PSL2 pipe plus the riser, with 0.500 in wall 3R riser bends, and crosses internal road R-3 by open cut per PIP-DWG-007 (final length by survey, HOLD H-04). Bends shall be plant or shop coated with FBE matching the line pipe. ARO applies at the road crossing only if the drawings show a bore.
- C. Buried stainless (class S1) vent piping, if any, shall not be FBE coated. It shall be wrapped with a chloride-free petrolatum or cold-applied tape system approved by the EOR, and electrically isolated from the carbon steel cathodic protection system per CP-CAL-001.
- D. Related sections: SPC-SPC-006, Piping Fabrication and Installation (lowering-in, bedding, backfill); SPC-SPC-010, Above-Ground Painting; SPC-SPC-015, Cathodic Protection Installation and Testing; SPC-SPC-019, Inspection and Test Plan; SPC-SPC-020, Construction Records and Turnover.
- E. Work by others: coating of the hot tap fitting and tap valve, and any trunkline repair coating, are by the receiving pipeline operator. Plant coating of equipment is by the vendors.

1.02 REFERENCES

A. Codes and standards:

1. 49 CFR 192.455 (external corrosion control of new buried pipelines) and 192.461 (external protective coating).
2. ASME B31.8-2022, Chapter VI, Corrosion Control.
3. AMPP SP0169, Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
4. AMPP SP0394, Application, Performance and Quality Control of Plant-Applied Single-Layer Fusion-Bonded Epoxy External Pipe Coating; CSA Z245.20, Plant-Applied External Coatings for Steel Pipe.
5. AMPP SP0490, Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coatings of 250 to 760 μm (10 to 30 mils); AMPP SP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
6. AMPP SP0402, Field-Applied Fusion-Bonded Epoxy Pipe Coating Systems for Girth Weld Joints; AMPP SP0109, Field Application of Bonded Tape Coatings.
7. SSPC-SP 1, SP 5/NACE No. 1, SP 10/NACE No. 2 and SP 11; SSPC-PA 2; SSPC-VIS 1.
8. ASTM D3359, D4285, D4417 and D4541; ASTM E337.
9. ISO 8502-3, 8502-6 and 8502-9 (dust and soluble salts).

B. Project documents: GEN-DB-001, Basis of Design; PIP-SPC-001, Piping Material Specification; MEC-LST-001, Line List; PIP-DWG-001 to PIP-DWG-003, Piping General Arrangement; PIP-DWG-004, Tie-in and Outlet Lateral; CP-PIP-DWG-007, Soil-to-Air Transition, Road Crossing and Buried Piping Details; CP-CAL-001, Cathodic Protection Design (which assumes the coating efficiency this section delivers); CP-DWG-001 and CP-DWG-002, Cathodic Protection Layout and Details.

1.03 DEFINITIONS

- A. Field joint: the uncoated cut-back at a girth weld, typically 4 to 6 in on each side of the weld.
- B. Jeeping: electrical holiday detection with a DC detector and a ring or brush electrode.
- C. Holiday: a discontinuity in the coating that exposes steel.
- D. DFT: dry film thickness.
- E. Coating inspector: an AMPP Coating Inspector Program (CIP) Level 2 inspector or higher.

1.04 SUBMITTALS

- A. The Contractor shall submit the items in Table 1-1 for the action shown.

Table 1-1: Submittal Schedule

No.	Submittal	Timing	Action
09-S1	Coating application procedure for each field system: surface preparation, equipment, ambient limits, mixing, application, cure, inspection and repair	21 days before field coating	EOR and Owner approval
09-S2	Product data sheets and safety data sheets for field joint epoxy, FBE powder (if used), repair sticks and patches, transition system and primer	With 09-S1	Review
09-S3	Manufacturer's written confirmation that the field joint material is compatible with the plant FBE and ARO, and of the holiday test voltage for each system (typical, confirm with vendor data, HOLD H-15)	With 09-S1	Review
09-S4	Applicator qualification: procedure qualification test on a test joint, and applicator training records (manufacturer-certified where the manufacturer runs a program)	14 days before production	EOR approval
09-S5	Coating inspector certification and instrument calibration certificates	14 days before field coating	Review
09-S6	Plant coating records for Owner-furnished pipe: batch certificates, thickness, holiday, cure, adhesion and cathodic disbondment reports (provided by the Owner; the Contractor confirms receipt against the pipe tally)	On pipe receipt	Owner review
09-S7	Daily coating inspection report QF-09-01, holiday test log QF-09-02 and repair log QF-09-03	Daily; compiled weekly	Review
09-S8	Field FBE procedure qualification report under AMPP SP0402 (cure, adhesion, DFT, holiday, cross-section porosity), if field FBE is used	Before production	EOR approval

1.05 QUALITY ASSURANCE

- A. Field coating shall be inspected by a Contractor coating inspector of CIP Level 2 or higher. The Owner's inspector shall be CIP Level 2 or 3.
- B. Each field system and each applicator crew shall be qualified on a procedure qualification test joint before production (hold point HP-09-02).
- C. Hold and witness points shall be as listed in 3.10 and in SPC-SPC-019.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Every coated pipe joint shall be inspected on receipt for coating damage, end caps and bevel condition, and recorded on the pipe tally with heat and joint numbers. Damage shall be reported to the Owner within 24 hours.
- B. Coated pipe shall be handled with wide nylon slings or padded hooks, never with chains, cables or bare forks, and stacked on sand-filled bags or padded skids with at least 4 in of ground clearance and no higher than the pipe manufacturer permits. Pipe shall not be dragged.

- C. Stored pipe shall be covered if outdoor storage would exceed the FBE manufacturer's ultraviolet exposure limit (typically 6 to 12 months, confirm with vendor data, HOLD H-15).
- D. Coating materials shall be delivered in original sealed containers with batch numbers and shelf-life dates, stored between 50 and 90 °F or as the manufacturer requires, and used within shelf life. Expired material shall be removed from site.

1.07 MEASUREMENT AND PAYMENT

- A. Pay item 09.01, Field joint coating, buried: each, by NPS (12, 10, 8, 6, 4, 3, and 2 and smaller). The price shall include surface preparation, materials, application, inspection, jeeeping, repair of plant and field coating, coating of buried fittings, valves and insulating joints, and records. Each soil-to-air transition is counted as one field joint. Field joints are counted from the weld map.
- B. Pay item 09.02, Holiday detection and coating repair: included in 09.01, including repair of damage caused by the Contractor.
- C. Plant coating defects on Owner-furnished pipe exceeding 144 in² per joint and reported within 24 hours of receipt shall be at the Owner's cost. Rework caused by failed acceptance criteria shall be at the Contractor's cost.

PART 2 PRODUCTS

2.01 OWNER-FURNISHED COATED PIPE

- A. Line pipe NPS 6 to NPS 16 is furnished by the Owner with plant-applied FBE meeting Table 2-1, which is also the receipt acceptance standard.

Table 2-1: Plant-Applied FBE

Property	Requirement
Coating	Single-layer FBE, product qualified to CSA Z245.20 or equivalent
Surface preparation	SSPC-SP 10/NACE No. 2 minimum (SP 5 where the powder manufacturer requires), after salt removal
Soluble chlorides before coating	3 µg/cm ² maximum
Anchor profile	1.5 to 4.0 mils, angular
DFT	14 mils minimum spot average, 16 mils nominal, 22 mils maximum; no single reading below 12 mils
Cut-back	4 to 6 in bare at each end, bevel protected
Holiday test at the plant	100 %, at the voltage in 3.09
Cathodic disbondment	Per the CSA Z245.20 qualification (plant report)
ARO, bore pipe	14 mils FBE plus 30 mils ARO minimum (44 mils total), ARO compatible with the FBE

2.02 CONTRACTOR-FURNISHED FIELD MATERIALS

A. Field materials shall meet Table 2-2.

Table 2-2: Field Coating Materials

Use	Material	Thickness
Girth weld field joints (default)	Two-part, 100 % solids liquid epoxy formulated for pipeline field joints, compatible with FBE, service temperature 150 °F minimum	25 mils minimum, 40 mils maximum
Girth weld field joints (alternate, bores)	Field-applied FBE by induction heating under AMPP SP0402, plus ARO at bored joints	14 mils FBE minimum, plus 30 mils ARO
Bored field joints with liquid epoxy	Liquid epoxy rated for bore abrasion	40 mils minimum
Buried fittings, valve bodies, insulating joints, irregular shapes	Two-part liquid epoxy, same product as the field joints	25 mils minimum
Holidays and pinholes up to 1 in ²	Hot-melt repair stick compatible with FBE, or two-part epoxy patch	Match surrounding coating
Repairs over 1 in ² up to 100 in ²	Two-part liquid epoxy, overlapping sound coating by 1 in	25 mils minimum
Repairs over 100 in ²	Recoat as a field joint; over 144 in ² on one joint reported to the Owner for decision	25 mils minimum
Soil-to-air transitions	Viscoelastic polyolefin system with UV-resistant outer wrap, or 100 % solids epoxy-urethane rated for transition service	80 mils minimum total, per manufacturer
Rock shield, only where backfill cannot meet SPC-SPC-006	Non-conductive open mesh or fiber rock shield	1/4 in minimum

B. Solid-sheet or closed-cell rock shield shall not be used, because it shields the pipe from cathodic protection current.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Weld spatter, slag and sharp edges shall be removed, and weld cap irregularities that would thin the coating shall be ground.
- B. Surfaces shall be solvent cleaned to SSPC-SP 1 to remove oil and grease.
- C. Soluble chlorides shall be tested by Bresle patch (ISO 8502-6 and 8502-9) on one joint in ten and on every joint where contamination is suspected. The limit shall be 3 µg/cm², or the manufacturer's value if lower. Surfaces that exceed it shall be washed with potable water or a

chloride-removal solution and retested, because salts under the coating cause osmotic blistering.

- D. The cut-back shall be abrasive blasted to SSPC-SP 10/NACE No. 2 (SP 5 if the product requires) with dry, clean, angular abrasive: garnet, aluminum oxide or steel grit. Silica sand shall not be used. Compressed air shall pass the blotter test of ASTM D4285 at the start of each shift.
- E. Anchor profile shall be 2.5 to 4.0 mils for liquid epoxy, or as the manufacturer requires, measured by replica tape (ASTM D4417 Method C) with at least one reading per joint.
- F. Plant FBE edges at the cut-back shall be roughened for at least 1 in by sweep blasting or sanding.
- G. Dust shall be removed to ISO 8502-3 rating 2 or better by clean dry air or vacuum.
- H. Coating shall be applied within 4 hours of blasting and before any visible flash rust. A surface showing rust bloom shall be re-blasted.

3.02 AMBIENT CONDITIONS

- A. Blasting and coating shall not take place when any limit in Table 3-1 is not met. Conditions shall be measured with a calibrated psychrometer or electronic gauge and recorded on QF-09-01 at the start of each shift and every 2 hours.

Table 3-1: Ambient Limits

Parameter	Limit
Steel temperature above dewpoint	5 °F minimum
Relative humidity	85 % maximum
Steel and ambient temperature	Within the manufacturer's range; typically 50 °F minimum for liquid epoxy unless the pipe is preheated
Precipitation or blowing dust	None, unless a shelter is used

- B. Where preheat is required, it shall be by induction or propane ring torch to the manufacturer's range, measured by contact thermometer or temperature-indicating crayon. Steel shall not exceed 525 °F for FBE application, or the manufacturer's maximum for liquid epoxy, and the plant FBE shall not be heated beyond the overlap zone.

3.03 APPLICATION OF FIELD JOINT COATING

- A. Liquid epoxy shall be mixed by volume with a mechanical mixer as the manufacturer directs, and applied by brush, roller, applicator mitt or plural-component spray to 25 to 40 mils, overlapping the roughened plant FBE by at least 1 in. Mixed material beyond its pot life shall be discarded.
- B. Field FBE, where used, shall be applied under the qualified AMPP SP0402 procedure: induction heating to the powder's application window, at least 14 mils, and quenching only after the cure time at temperature.

- C. Coated joints shall not be handled, lowered in or backfilled until the coating reaches the manufacturer's cure state for handling and backfill, verified by durometer (Shore D minimum per the manufacturer) or by the manufacturer's solvent-rub or hardness test and recorded on QF-09-01.
- D. Tie-in welds shall not be coated until their NDE acceptance under SPC-SPC-008 is recorded.

3.04 FITTINGS, VALVES AND INSULATING JOINTS

- A. Buried valve bodies, stems and extensions (to 6 in above grade), fittings and insulating joints shall be coated with liquid epoxy at 25 mils minimum. The external surface of the insulating flange rings of IJ-101 and IJ-102 shall be coated only as the joint manufacturer permits.
- B. Nameplates, test leads and cathodic protection connection points shall be masked before coating, and test lead attachments shall be coated with the patch compound specified in SPC-SPC-015 after attachment.

3.05 SOIL-TO-AIR TRANSITIONS

- A. Transitions shall be prepared to SSPC-SP 10 or as the transition system manufacturer requires, primed and wrapped from at least 12 in below to at least 12 in above final grade, overlapping the buried FBE by 6 in and the above-grade paint system of SPC-SPC-010 by 6 in.
- B. Final grade shall be established before transitions are coated, or the transition shall extend 12 in beyond the lower of the design and existing grades, because the zone at grade is where moisture and oxygen cause the most corrosion.

3.06 JEEPING AND LOWERING-IN

- A. The Contractor shall jeep 100 % of the coated surface of every joint, field joint and fitting immediately before lowering-in, as 49 CFR 192.461(c) requires, with the pipe suspended on padded skids or slings so that the full circumference is tested. Jeeping on a previous day shall not satisfy this requirement.
- B. Each holiday shall be marked with a waterproof marker, repaired under 3.07 and retested before lowering-in.
- C. Pipe shall be lowered with padded slings or roller cradles and shall not be dropped or pulled along the trench bottom. Bedding and padding shall follow SPC-SPC-006.
- D. A section damaged during lowering-in shall be inspected visually and jeeped again before backfill.

3.07 REPAIR

- A. Coating defects shall be repaired as Table 3-2 shows.

Table 3-2: Coating Repair

Defect	Repair
Pinhole or holiday with no visible steel, up to 1 in ²	Abrade to SSPC-SP 11 or sand to roughen; hot-melt repair stick or two-part epoxy patch
Damage to steel, 1 in ² to 100 in ²	Power-tool clean to SSPC-SP 11 with at least 1 mil profile, roughen 1 in of adjacent coating, apply two-part epoxy at 25 mils minimum
Over 100 in ²	Blast to SSPC-SP 10 and recoat as a field joint
Aggregate repairs over 144 in ² on one joint, or disbondment, blistering or cracking	Report to the Owner; strip and recoat the joint, or reject the joint
Gouge, dent or arc burn found under the coating	Stop and report to the Owner and EOR; assess under SPC-SPC-006 and ASME B31.8 before recoating

3.08 INSPECTION INSTRUMENTS AND FREQUENCY

A. Instruments shall be calibrated and verified as Table 3-3 shows.

Table 3-3: Inspection Instruments

Instrument	Verification and calibration
DC holiday detector with ring electrode	Voltage verified with a calibrated peak-reading voltmeter at the start of each shift and after each battery change; annual factory calibration
Magnetic DFT gauge (Type 2)	SSPC-PA 2 verification on certified shims at the start of each shift; annual calibration
Psychrometer or electronic dewpoint meter	Annual calibration
Surface temperature thermometer	Annual calibration
Replica tape and micrometer	ASTM D4417
Bresle patches and conductivity meter	ISO 8502-6 and 8502-9
Durometer (Shore D), if used for cure	Annual calibration

B. Inspection frequency shall be as Table 3-4 shows.

Table 3-4: Inspection Frequency

Check	Frequency
Ambient conditions	Start of shift and every 2 hours
Surface cleanliness against SSPC-VIS 1	Every field joint
Anchor profile	Every field joint (one reading) and every repair over 100 in ²

Check	Frequency
Soluble salts	One joint in ten, at least one per day
DFT	Every field joint: 12 spots (4 around the circumference on each side of the weld and 4 on the cap), each spot the average of 3 gauge readings
Holiday detection	100 % before lowering-in
Adhesion	Knife test on one field joint in 20, or wherever adhesion is suspected; pull-off test (ASTM D4541) on the procedure qualification joint
Cure	Every field joint before backfill

3.09 HOLIDAY TEST VOLTAGES

- A. Test voltages for FBE up to 40 mils shall follow AMPP SP0490, $V = 525\sqrt{T}$, where T is the specified minimum DFT in mils. For 14 mils FBE, $V = 525 \times 3.742 = 1,964$ V, set at 1,965 V.
- B. Liquid epoxy and dual-layer FBE with ARO shall be tested at 125 V per mil of specified minimum DFT, per AMPP SP0188 and the manufacturer, and never above the manufacturer's maximum. Table 3-5 gives the settings. If a liquid epoxy with a higher specified minimum is selected, the voltage shall be recalculated at 125 V per mil (for example, 3,750 V at 30 mils).
- C. The detector shall travel at no more than 1 ft/s with the electrode in continuous contact with dry coating, and the pipe shall be grounded to the detector by a trailing ground or direct clamp.

Table 3-5: Holiday Test Voltages

System	Specified minimum DFT, mils	Test voltage, V
Plant and field FBE	14	1,965
Field joint two-part liquid epoxy	25	3,125
FBE with ARO, after the ARO is applied (FBE tested at 1,965 V first)	44	5,500
Soil-to-air transition	Per manufacturer	Per manufacturer (HOLD H-15)

3.10 FIELD QUALITY CONTROL

- A. The Contractor shall record the work on QF-09-01 (daily coating inspection), QF-09-02 (holiday log), QF-09-03 (repair log), QF-09-04 (procedure qualification report) and QF-09-05 (receipt inspection of coated pipe), all turnover records under SPC-SPC-020.
- B. The hold and witness points in Table 3-6 apply. Party codes: C Contractor, O Owner, E EOR, W receiving pipeline operator; H hold, W witness, R review, S surveillance, P perform.

Table 3-6: Hold and Witness Points

ID	Activity	C	O	E	W	Record
HP-09-01	Coating application procedure and products approved (09-S1 to 09-S3) before any field coating	P	R	H	-	Approved procedure
HP-09-02	Procedure qualification test joint for each field system and each applicator crew	P	H	R	-	QF-09-04
WP-09-01	Receipt inspection of Owner-furnished coated pipe	P	W	-	-	Pipe tally, QF-09-05
WP-09-02	Surface preparation and profile, first 5 field joints and 1 in 20 thereafter	P	W	-	-	QF-09-01
HP-09-03	Jeeping and repair acceptance of each section immediately before lowering-in	P	H	-	-	QF-09-02
HP-09-04	Coating of outlet lateral field joints and IJ-102 within 50 ft of the trunkline right-of-way, before backfill	P	H	-	W	QF-09-02
WP-09-03	Soil-to-air transition coating at each riser	P	W	-	-	QF-09-01
HP-09-05	Coating records complete and accepted before backfill release	P	H	R	-	QF-09-01 to QF-09-03

3.11 ACCEPTANCE

A. Coating is accepted when it meets every criterion in Table 3-7.

Table 3-7: Acceptance Criteria

Parameter	Criterion	Method
Surface cleanliness	SSPC-SP 10 (SP 5 where the manufacturer specifies)	Visual against SSPC-VIS 1
Anchor profile	2.5 to 4.0 mils for field epoxy, or per manufacturer	Replica tape
Soluble chlorides	3 µg/cm ² maximum, or the manufacturer's lower value	Bresle patch
Dust	Rating 2 or better	ISO 8502-3 tape test
Steel temperature and humidity	5 °F or more above dewpoint; relative humidity 85 % maximum	Psychrometer
DFT, field epoxy	Every spot 25 mils or more; no reading above 40 mils	Type 2 gauge, SSPC-PA 2
DFT, field FBE	Every spot 14 mils or more; no reading above 22 mils	Type 2 gauge, SSPC-PA 2
Overlap on plant coating	1 in minimum	Rule
Holidays	None after repair, at the voltage in Table 3-5	DC detector
Cure	Manufacturer's handling and backfill criterion met	Durometer or manufacturer's test

Owner

Project No.:

External Coating of Buried Pipe and Field Joints

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Parameter	Criterion	Method
Adhesion	No peeling, lifting or disbondment on knife test; pull-off at least the manufacturer's minimum (typically 1,000 psi) on the qualification joint	Knife test; ASTM D4541
Visual	No runs, sags, pinholes, blisters, cracks, dry spray or inclusions	Visual
Transitions	12 in below and 12 in above grade, 6 in overlap each side, no holidays	Rule, detector

END OF SECTION

