



SOUTHWEST GAS CORPORATION

® **ENGINEERING STAFF**

MATERIAL SPECIFICATION

Section No:	MS C-20
Page No.:	1 of 15
Issue Date:	06/11/18
Superseded Date:	03/01/16

Prepared By: Engineering Staff 

Approved By: Jerome T. Schmitz 

PIPE COATING

Abrasion Resistant Protective Pipe Coating

1. SCOPE

This specification defines the minimum requirements for materials, application and inspection for abrasion resistant overcoat of fusion bonded epoxy (FBE) dual powder systems. The dual powder system is designed to provide a hard, mechanically strong, abrasion and impact resistant topcoat that is applied over an undercoat of FBE coating. This overcoat protects the FBE coated steel pipe from severe handling conditions such as being pulled under a crossing or directional drilling applications.


2. APPLICABLE DOCUMENTS

- 2.1 ASTM International (ASTM) D-149, "Test Methods for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies."
- 2.2 ASTM International (ASTM) D-543, "Test Practices for Evaluating the Resistance of Plastics to Chemical Reagents."
- 2.3 ASTM (ASTM) D-570, "Test Method for Water Absorption of Plastics."
- 2.4 ASTM International (ASTM) D-695, "Test Method for Compressive Properties of Rigid Plastics."
- 2.5 ASTM International (ASTM) D-2240, "Test Method for Rubber Property-Durometer Hardness."
- 2.6 ASTM International (ASTM) D-2370, "Test Method Tensile Properties of Organic Coatings."
- 2.7 ASTM International (ASTM) D2583-95, "Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor."
- 2.8 ASTM International (ASTM) D-4060, "Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser."
- 2.9 ASTM International (ASTM) D4541, "Standard Test Method for Pull-Off Strengths of Coatings Using Portable Adhesion Testers."



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2. APPLICABLE DOCUMENTS (Cont'd)

- 2.10 ASTM International G-8, "Test Method for Cathodic Disbonding of Pipeline Coatings."
- 2.11 ASTM International G-14, "Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)."
- 2.12 CSA Z245.20-06. "External Fusion Bonded Epoxy Coating for Steel Pipe."
- 2.13 National Association of Corrosion Engineers (NACE International) Recommended Practice RP-0394, "Application Performance and Quality Control of Plant-Applied, Fusion-Bonded Epoxy External Pipe Coating."
- 2.14 United States Department of Transportation (DOT), Code of Federal Regulations, Title 49, Part 192, "Transportation of Natural and Other Gas Pipelines Minimum Safety Standards."

NOTE: Unless otherwise specified, the editions of the above documents incorporated by DOT 49 CFR 192 are applicable. Documents not incorporated by DOT 49 CFR 192 will be the most recent edition.

3. TERMINOLOGY

3.1 General

- 3.1.1 "Southwest Gas," "Southwest" or "SWG," wherever used in this specification and other related documents will refer exclusively to Southwest Gas Corporation.
- 3.1.2 The terms "approved," "as approved," "satisfactory," "as directed," "or equal" or other similar terms, wherever used in this specification and other related documents will mean "as determined by Southwest Gas," unless specifically stated otherwise.
- 3.1.3 "Product Information Package" or "PIP" wherever used in the specification and any other related documents will mean the required technical product information that a manufacturer must submit to SWG to determine if the product is suitable for use by SWG, unless specifically stated otherwise.



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4. MATERIALS AND MANUFACTURING

4.1 The following information is specific to factory applied ARP Coatings:

- 4.1.1 Prior to blast cleaning, surfaces shall be inspected and pre-cleaned according to SSPC-SP1 to remove oil, grease and loosely adhering deposits. Visible oil and grease spots shall be removed by solvent wiping which do not leave a residue shall be used.
- 4.1.2 Pipe shall be checked for possible chloride contamination using Potassium Ferra-Cyanide strips for qualitative and a Kitigawa for qualitative or approved equals. If the chloride level is above 0.2 milligrams/ft², it shall be cleaned to remove all chloride or to bring it below 0.2 milligrams/ft².
- 4.1.3 The exterior pipe surface shall be blast cleaned to SSPC-SP10 near white metal using steel grit or steel grit-shot mixture after pre-heating of pipe to sufficient temperature to remove all moisture. Very light shadows, very slight streaks or slight discoloration shall be acceptable. However, at least 95% of the surface shall have the gray appearance of a near-white metal blast cleaned surface.
- 4.1.4 The abrasive used shall be continually cleaned and controlled as to particle size distribution by air wash separation. The anchor pattern profile shall have a minimum height of 1.5 mils and a maximum height of 4.5 mils as measured with a suitable profilometer or replication tape.
- 4.1.5 Any slivers or bristles of steel remaining on a newly blasted surface shall be removed by using high speed wire brushes, sanders, files or other approved means. This shall be done after the grit blasting operations and prior to the coating application. Remaining surface imperfections such as slivers, scales, burrs, weld splatter, gouges, etc. shall be removed by grinding. If the grinding results in a surface profile below 2 mils, the surface shall be re-blasted to meet the above criterion.
- 4.1.6 Following the acceptance of the blast cleaning and immediately prior to heating, all grit-shot, sand, dust, or other foreign matter remaining on the external and internal surfaces of the pipe shall be thoroughly cleaned by air blast or vacuum type cleaning.




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4. MATERIALS AND MANUFACTURING (Cont'd)

4.1 The following information is specific to factory applied ARP Coatings: (Cont'd)

4.1.7 The cleaned pipe surfaces shall be protected from conditions of high humidity, rainfall, or moisture. The surrounding air around the pipe shall be clean and dry. A daily blotter test shall be conducted for checking the air source for moisture and oils. The pipe surface shall not be allowed to flash rust before coating, which is no more than 3 hours after blasting.

4.1.8 Clean pipe with the proper profile for the acceptance of the base coat of FBE coating shall be pre-heated in a continuous, uniform process t a temperature of 232°C (450°F) to 253°C (488°F) or in accordance with the Technical Data Sheet of the product being applied.

4.1.9 The heat source shall not leave a residue or contaminant on the pipe surface. Graduated Templistik® crayons may be used to measure the temperature. Only a small spot of the pipe shall be touched to minimize surface contamination of the pipe. Other approved temperature measuring devices include roller contact or optical pyrometers and infrared sensing.


4.1.10 Apply base coat using electrostatic spray or fluidized bed dipping to a film thickness of 16-18 mils followed by 40 mils of overcoat in a continuous process providing the base coat enough time to gel but not fully cure. Gel and curing times for the base coat are provided as follows:

FAST GEL	SLOW GEL	LONG GEL
Gel Time: ≈ 8 Seconds ± 20% @ 204°C/400°F	Gel Time: ≈18 Seconds ±20% @ 204°C/400°F	Gel Time: ≈25 Seconds ± 20% @ 204°C/450°F
Cure Time: ≈ 45 Seconds @ 232°C/450°F	Cure Time: ≈ 90 Seconds @ 232°C/450°F	Cure Time: ≈ 150 Seconds @ 232°C/450°F



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4. MATERIALS AND MANUFACTURING (Cont'd)

4.1 The following information is specific to factory applied ARP Coatings: (Cont'd)

4.1.11 Gel and curing times for the over coat material are provided as follows:

FAST GEL	SLOW GEL
Gel Time: ≈ 12 Seconds ± 20% @ 204°C (400°F)	Gel Time: ≈ 22 Seconds ± 20% @ 204°C (400°F)
Cure Time: ≈ 45 Seconds @ 232°C (450°F)	Cure Time: ≈ 90 Seconds @ 232°C (450°F)

4.1.12 Shelf life for these products shall be 12 months if stored between 25°C-27 °C (77°F-80°F).

4.1.13 Operating temperature of these coatings shall be between -73°C to 110°C (-100°F to 230°F).

4.1.14 Upon completion of the coating operation, but prior to storage, the coating shall be tested for holidays in the coating. NACE International Standard SP 0490 shall be followed using a test voltage of approximately 7,000 volts.

4.1.15 Coating Repair:

Acceptable allowance for holidays shall be a maximum of one holiday per 25Ft².

Pipe with excessive coating defects should be completely re-blasted to near white finish and re-coated.

For pin holes and small areas that require repair, the repair methods as recommended by the coating manufacturer shall be followed.



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4. MATERIALS AND MANUFACTURING (Cont'd):

4.2 The following information is specific to High Build Epoxy (HBE) Coating that would normally be applied in the field:

- 4.2.1 High Build Epoxy is solvent-free, and the medium pot life epoxy coating is primarily designed for hot airless spray or manual applications. High Build Epoxy is resistant to water immersion, seawater, cathodic disbondment and ground waters over a broad pH range.
- 4.2.2 High Build Epoxy products are a two part epoxy coatings used for pipeline fittings and field joints to provide an abrasion-resistant surface for directional drilling and boring applications. High Build Epoxy is supplied in kits containing pre-measured components of Part A-HBE Cure (small container) and Part B-HBE Base (large container). All kits are supplied with installation guides and MSDS's.
- 4.2.3 High Build Epoxy products must be shipped and stored in temperatures between 40°F and 105°F and never allowed to freeze. The HBE products must be kept in original packaging until just prior to use. Exposure to direct sunlight, rain, snow, dust or other adverse environmental elements must be avoided. If stored as specified, the shelf life shall be 3 years.
- 4.2.4 Prior to using High Build Epoxy products the MSDS should be thoroughly reviewed. Installation of High Build Epoxy products should be done in a well ventilated area and in accordance with local health and safety regulations.
- 4.2.5 High Build Epoxy shall contain 100% Volume Solids and NO V.O.C.'s.
- 4.2.6 The Flash Point of the High Build Epoxy products shall be 200°F with a closed cap.



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4. MATERIALS AND MANUFACTURING (Cont'd):

4.3 Using the High Build Epoxy product:

4.3.1 Steel Surface Preparation:

All surfaces should be dry, free from grease, oils, salts and other contaminants. The surface shall be cleaned with a solvent cleanser that will not leave an oil residue (i.e. ethanol, MEK, etc) to remove the presence of oil, grease and other contaminants.

The pipe should be no less than 5°F above the dew point before abrasive cleaning. Clean surfaces should be abraded to attain near white (SSPC-SP 10) or equivalent using suitable hand or power tools or particle blasted. The surfaces shall not be burnished. A 2-4 mil blast profile is recommended.

Lightly abrade no less than 2 inches (50mm) by removing the gloss from the line coating using a light abrasive blast or power tool.

Abraded steel cutback and line coating must be wiped clean with a lint-free cloth or air blasted to remove foreign contaminants. All surfaces to be coated must be completely dry, free from moisture, soil, dust and grit at the time the coating is applied.

4.3.2 Mixing Instructions:

Part A & Part B components must be warmed to at least 68°F prior to mixing.

Formulated mixing ratio is 3 Parts B (Base) to 1 Part A (Cure) by volume.

Pour Part A (Cure) into Part B (Base) making sure that Part A is entirely emptied out of its container ensuring that all the product is used. Slowly begin to mix Part A and Part B so that no air bubbles are introduced into the coating. **DO NOT** contaminate the HBE mixture with any solvent.



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4. MATERIALS AND MANUFACTURING (Cont'd):

4.3 Using the High Build Epoxy product (Cont'd):

4.3.2 Mixing Instructions (Cont'd):

Continue to mix at a speed that ensures a uniform mix, but does not create a vortex in the liquid. At temperatures between 68°F and 105°F mix for 1 minute with a drill stirrer (2-4 inch paddle) or 4 minutes with a spatula, blending both parts to create one uniform color with no streaks.

The workable pot life after mixing is approximately 15 minutes at 68°F or about 8 minutes at 100°F. Pot life will be extended at lower temperatures and shortened at higher temperatures. Consult the installation guide for cure type options.

4.3.3 Methods of Application:

General:

Ambient conditions for successful application of this product include relative humidity less than 85% and a temperature above 50°F and when the ambient temperature is greater than 5°F above the dew point.

Refer to the installation guide supplied with the product when purchased for other application temperature criteria.

Pipe substrate may be pre-heated to 180°-200° in order to accelerate curing or to cure in cold conditions.

Use a Wet Film gauge to determine if the desired minimum thickness (45 mils) has been achieved.

Curing rate will vary according to pipe and ambient application temperature. A minimum of four (4) hours curing above 68°F is required prior to handling. Under no circumstances shall the pipe be installed before the coating has reached a minimum Type D Durometer hardness reading of 70.




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4. MATERIALS AND MANUFACTURING (Cont'd):

4.3 Using the High Build Epoxy product (Cont'd):

4.3.3 Methods of Application: (Cont'd)

Manual:

Apply thoroughly mixed epoxy by brush, roller, cartridge kit or trowel to prevent pulling material down and off the pipeline bottom.

Each pass of the application device can achieve a thickness of 20-40 mils. The theoretical coverage is 1605 mil-sq ft/gallon.

Cover at least 2 inches of any adjacent pipe coating.

Additional coating shall be applied while the preceding coat is still tacky. The maximum over-coating interval shall not exceed two (2) hours at 77°F without roughing the surface. If re-coating intervals has been exceeded, the surface must be blast roughened prior to the application of the top coat.

Airless Spray:

High Build Epoxy spray grade shall be applied to the specified Dry Film Thickness (DFT) in a single application using a 3:1 mix ratio with Graco Hydra-Cat two-component spray equipment or approved equal. Ideally, build a first coat of 15-20 mils around entire circumference followed immediately by a second coat to achieve specified film thickness.

Pot life of mixed components in spray hose is less than one (1) minute.

Detailed application instructions and technical support are available from the manufacturer.




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4. MATERIALS AND MANUFACTURING (Cont'd):

4.3 Using the High Build Epoxy product (Cont'd):

4.3.4 Coating Repair

All damaged or holidays detected by visual or electrical inspection shall be repaired using HBE coating.

The area to be repaired should be cleaned of coating to the pipe surface by hand or power tools. A dry cloth or brush should be used to remove any dust generated by the removed coating. The area(s) can be lightly heated to remove any moisture. Repairs shall overlap the surrounding undamaged coating by a minimum of 0.75 inch.


4.3.5 Clean Up of Equipment:

A solvent such as ethanol, MEK or other suitable solvent may be used to clean equipment, brushes and the surface of the steel pipe.



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5. PERFORMANCE REQUIREMENTS

The properties and performance of the Abrasion Resistant Protective Coatings (ARPC) and High Build Epoxy (HBE) Joint Kits shall be in accordance with the requirements outlined in the following table:

Property & Unit	ARPC	HBE Kits	Test Method
Specific Gravity	1.57 to 1.83± 0.05		
Compressive Strength, psi	10,000		ASTM D-695
Tensile Strength psi	6200		ASTM D-2370
Hot Water Resistance/Soak Adhesion, 167°F	1	1	CSA Z245.20-06
Gouge Resistance (Gouge Depth mils -30°F-122°F) 30Kg Load 40 Kg Load 50 Kg Load 75 Kg Load	8 11 13 to 14 34		TSI w/R33 Bit Pass Gouge of ≤ 50% of Coating Thickness
Dielectric Strength Volts/mil	1,000	400	ASTM D-149
Hardness (Shore D)	> 85	> 85	ASTM D-2240
Adhesion to Fusion or Steel Bonded Epoxy, psi	2,000	2,000	ASTM D-4541
Flexibility Degrees Per Pipe Diameter, degrees	<2.0°/Pipe Data		CSA Z245.20-06
Abrasion Resistance (g Loss)	0.091		ASTM D-4060
Taber Abrasion C17 Wheel, 1 Kg, 5,000 Cycles	55 mg		ASTM D-4060
Cathodic Disbondment (mm) 24 Hrs., 3.5 V, 3% NaCl, 149 Deg F 48 Hrs, 1.5V, 3% NaCl, 149 Deg F 28 Days, 1.5V, 3% NaCl, 176 Deg F	< 1.0 – 3 1.8 4.0 – 4.8	<8	ASTM G-8 or CSA Z245.20-06
Max Operating Temperature, Deg F	180°F		
Color	Gray/Brown/Black	Light Green	



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6. INSPECTION

- 6.1 Successful review of the Product Information Package (PIP), as well as any future reference by SWG to the Seller's part number or internal code number in any future contract or purchase, will mean only that no conflict with the specification was found and will not relieve the seller from meeting all the requirements of the specification.
- 6.2 SWG retains the option to inspect the manufacture and testing of any and all materials, products or systems referenced in this specification that are sold to SWG.
- 6.3 SWG will make appropriate inspections and tests of any and all materials, products or systems supplied to this specification. SWG will have the right, at their option, to reject any material which fails to conform to this specification. Any such rejection may take place at the manufacturer's facility; the supplier's warehouse or any subsequent delivery location, before or after SWG assumes possession. Notice of the rejection will be made promptly to the supplier by SWG. The defective product will be replaced or returned for credit at the manufacturer's expense.
- 6.4 Any changes in the manufacturing of previously approved materials, products or systems described in this material specification for sale to SWG must be approved by SWG's Engineering Staff. **Failure to obtain SWG's approval may be cause for rejection and disqualification as an approved supplier.**

7. CERTIFICATION

The manufacturer's or supplier's certification will be furnished to SWG. This certification will state that samples representing each lot have been manufactured, tested and inspected in accordance with this specification and that all requirements have been met. When requested or specified in the purchase order or contract, a report of test results will be provided.

Upon the request of Southwest, the certification of an independent third party indicating conformance to the specification may be considered at Southwest's expense.



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8. SAFETY DATA SHEETS

In accordance with law, the Seller will supply Safety Data Sheets for all applicable items supplied under this specification to the following:

- 1) The Receiving Location
- 2) Engineering Staff
- 3) Southwest Gas Corporation
Corporate Safety
Mail Station LVA-1201
P.O. Box 98510
Las Vegas, NV 89193-8510

9. PRODUCT MARKING

- 9.1 The identification marking of the bare pipe (information per API 5L) shall be legibly reproduced on the O.D. of the coating along with the following:
- Coater's Name
 - Coating Type
 - Date the coating was applied
- 9.2 Pipe of different wall thickness for the same project shall have a specific colored stripe painted at both ends of the pipe over the coating to differentiate that wall thickness from any other wall thickness.



10. PRODUCT PACKAGING

- 10.1 Pipe shall be handled, coated, moved and stored in a manner to prevent damage to pipe walls, beveled ends, pipe roundness and coating.
- 10.2 External coated pipe shall be stacked upon supports that have broad padded bearing surfaces or covered sand rows that are free from rocks, sticks or other objects with sharp edges which might damage the coating.
- 10.3 Under no circumstances shall coated pipe be pyramided, each layer of pipe shall be supported separately by the use of padded skids. The ends of the padded skids shall be blocked to prevent the coated pipe from rolling off the end of the skid.



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10. PRODUCT PACKAGING (Cont'd)

10.4 Pipe sizes and maximum tier heights shall be as follows:

Pipe Size	Maximum Height
≤3	Stacked using pipe bundles-6 High per bundle
4 Inch to 6 Inch	8 Tiers High
8 Inch to 10 Inch	6 Tiers High
12 inch to 16 Inch	4 Tiers High
20 Inch to 24 Inch	3 Tiers High

10.5 This method of stacking provides for each layer of pipe to be supported separately. The boards and blocks used shall be a permanent part of the bundle.

NOTE: Short lengths of pipe shall always be stacked on the top tier to prevent flattening of the ends.