



Puget Sound Energy, Inc.
P.O. Box 90868
Bellevue, WA 98009-0868

April 16, 2007

Carole J. Washburn, Secretary
Washington Utilities and Transportation Commission
PO Box 47250
Olympia, WA 98504-7250

Attn: Al Jones

RE: 16-inch Redmond Supply Main Phase 3 Pressure Authorization

Dear Mr. Jones:

Thank you for your time to review the pressure authorization for Phase 3 of the 16-inch Redmond Supply Main project. You requested information on land jurisdiction for the proposed construction, the specification for the fusion bonded epoxy coating, and a map or layout of the proposed pipeline (with emphasis on utility crossings and areas with less than 4 feet of cover).

The proposed construction will occur completely in unincorporated King county. Permit drawings are enclosed. These drawings show the alignment of the main and the utility crossings. There are 38 crossings over entire pipeline due to existing gas services (20), water lines (8), storm drains (9), and sewer (1). The majority of the existing utilities are shallow so the plan is to cross beneath them. Two of the larger storm drains are deep enough for the pipeline to be installed above them while still meeting the 4 feet of cover.

The fusion bonded epoxy coating will be applied in accordance with our standard specification (1480.0500), a copy of the specification is enclosed for your reference.

I appreciate your timeliness in dealing with this pressure authorization request. If you require any additional information please call me at (425) 462-3748 or email me at kaaren.daugherty@pse.com.

Sincerely,

Kaaren Daugherty, PE
Consulting Engineer - Standards and Compliance

Attachments

cc: Kimberly Harris
Karl Karzmar
Jim Hogan
Duane Henderson
Sue McLain

REC
APR 17 2007
UTILITY & TP. COMM

Scope

This specification establishes material requirements and quality requirements for external cleaning and fusion of line pipe with fusion bonded epoxy (FBE) corrosion coatings used in Puget Sound Energy's gas distribution system.

All line pipe furnished under this specification shall conform to all applicable provisions and requirements of the latest revision of the U.S. Department of Transportation Pipeline Safety Regulations (CFR) Title 49, Part 192, "Transportation of Natural and other Gas by Pipeline: Minimum Federal Safety Standards" and, by inclusion, all appropriate standards referenced therein.

References

- Title 49 CFR, Part 192 - Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Requirements
- ASTM C177 - Standard Test Method For Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus
- ASTM D870 - Standard Practice for Testing Water Resistance of Coatings Using Water Immersion
- ASTM D149 - Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
- ASTM D150 - Standard Test Method for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation
- ASTM D257 - Standard Test Methods For DC Resistance or Conductance of Insulating Materials
- NACE RP0490 - Standard Recommended Practice - Holiday Detection of Fusion Bonded Epoxy External Pipeline Coatings of 10 to 30 mils (0.25-0.76 mm)
- SSPC-SP 1 - SSPC Specification - Solvent Cleaning (Steel Structures Painting Manual, CH-2 Surface Preparation)
- SSPC-SP7 - SSPC Specification - Brush-Off Blast Cleaning
- SSPC-SP10 - SSPC Specification - Joint Surface Preparation Standard Near-White Blast Cleaning NACE No. 2: 1994 (Steel Structures Painting Manual, CH-2 Surface Preparation Specification)
- TM-01-70 - NACE Standard for Sand Abrasive
- TM-01-75 - NACE Standard for Steel Grit and Shot Abrasive
- API RP 5L1 - Recommended Practice for Railroad Transportation of Line Pipe
- API RP 5LW - Recommended Practice for Transportation of Line Pipe on Barges and Marine Vessels

Requirements

1. General

- 1.1 The following definitions shall apply:
 - A. The "Coater" shall be defined as the:
 1. Pipe mill producing externally coated pipe, *and/or*
 2. Coating contractor doing the work at the pipe mill, *and/or*
 3. Contractor doing the work in a coating yard, *and/or*
 4. Supplier providing coated pipe.
 - B. The "Purchaser" shall be defined as: **PUGET SOUND ENERGY**
- 1.2 The Coater shall furnish all labor, material, supervision, quality control, inspection, tools, supplies, and equipment necessary to coat and handle the pipe.
- 1.3 The Purchaser shall have the right to have a representative present during all or any part of the pipe coating process.
- 1.4 The Purchaser's representative shall be authorized to confer with the Coater's supervisory agent in regard to all issues arising in the process of work, including those concerning progress, sequence of activity and matters pertaining to the policy and procedure.
- 1.5 Purchaser's inspectors shall be designated by the Purchaser's representative.
- 1.6 The Coater shall handle, transport, and clean the pipe and apply the fusion bonded epoxy coating in strict compliance with this specification.
- 1.7 The fusion bonded epoxy coating system to be applied to the pipe shall consist of a fusion bondable epoxy resin powder (self-priming).
- 1.8 The materials for use in patching damaged coating in the mill shall be the same manufacturer as the pipe coating and shall be compatible with the pipe coating. These materials shall consist of:
 - A. Heat melting patch stick, *and/or*
 - B. Catalytically cured epoxy resin.

2. Handling Of Bare Pipe

- 2.1 Proper equipment for handling, unloading and temporary storage of bare pipe shall be used to avoid any damage to the bare pipe or pipe ends.
- 2.2 If the pipe has been internally coated prior to receipt at the Coater's plant, special care will be taken to avoid damage to the internal coating or obliteration of the internal pipe markings during any phase of operation covered by this specification.

3. Handling And Storage Of Coating System Material

- 3.1 The powdered epoxy resin material shall be packaged in containers adequate to keep the contents clean and dry during handling, shipping and storage. Handling and storage conditions and any temperature/time limitations for each of the coating system components shall be in accordance with manufacturer's recommendations.
- 3.2 The repair material shall be packaged in containers to give adequate protection during handling, shipping, and storage. Handling and storage conditions and any temperature/time limitations on repair materials shall be in accordance with manufacturer's recommendations.
- 3.3 Adequate precautions shall be taken during handling, shipping, and storage to prevent damage to the containers that would result in contamination of the coating material.

4. Surface Preparation

- 4.1 All pipe shall be supplied to the Coater externally bare and reasonably free of dirt, grease or any type of oil.
- 4.2 Coater shall inspect the pipe surface and clean it according to SSPC Specification SSPC-SP 1 to remove oil, grease and loosely adhering deposits. All foreign material remaining on the external surface of the pipe will be removed by use of a suitable non-oily solvent. Only approved solvents which do not leave a residue shall be used. Neither gasoline nor kerosene shall be used for this purpose.
- 4.3 All pipe shall be heated in a uniform manner to avoid distortion before it is blast cleaned to assure that all moisture, oil and grease are removed. Pipe temperature will be raised during this preliminary heat to between 110°F and 180°F.
- 4.4 All external pipe surfaces to be coated shall be cleaned by dry sand, grit, or shot blasting to near-white metal finish in accordance with SSPC-SP10 and NACE Standard TM-01-70 (for sand abrasive) or NACE Standard TM-01-75 (for steel grit and shot abrasive).

NACE near-white finish is interpreted to mean that all metal surfaces shall be dry sand, grit or shot blasted to remove all dirt, mill scale, rust, corrosion products, salt, oxides, paint and other foreign matter. Very light shadows, very slight streaks or slight discoloration will be acceptable. However, at least 95% of the surface shall have the uniform gray appearance of a near-white metal blast cleaned surface.

The abrasive used shall be continually cleaned and controlled as to particle size distribution by screening to ensure that the surface profile after blasting shall have a minimum height of 1.5 mils and a maximum height of 4.0 mils.

- 4.5 Any slivers or bristles of steel remaining on a newly blasted surface shall be removed by the use of high speed wire brushes, sanders, files or other means approved by Purchaser's representative or inspector. This shall be done after the sand, grit, or shot blasting operation but prior to the coating application. Presence of oil or other contaminants indicates a malfunction of the cleaning equipment, which shall be corrected immediately. Remaining surface imperfections such as slivers, scales, burrs, weld spatter, gouges, etc. shall be removed by grinding. When the pipe surface is burnished in any of the above processes, the anchor pattern shall be restored prior to coating application.

- 4.6 Following Purchaser's acceptance of the blast cleaning and immediately prior to heating, all shot, grit, sand, dust, or other foreign matter remaining on the external and internal surfaces of the pipe shall be thoroughly removed by air blast, water, brush or vacuum type cleaning.
- A. If air is used for the cleaning, it shall be dry and free of contaminants and all metal particles removed from the surface shall be extracted or collected in such a manner as to not contaminate cleaned pipe.
 - B. If water is used, it shall be directed through high pressure nozzles. All particles removed from the pipe while washing shall be screened and separated from the water supply by use of an incline screen device and water settling tank. The water wash unit will be properly grounded so that the static charge that has built up on the pipe and the dust particles will be depolarized through the use of water wash.
- 4.7 Blast-cleaned pipe surfaces shall be protected from conditions of high humidity, rainfall, or surface moisture. Any pipe that has been allowed to flash rust shall be blast-cleaned again before being coated.

5. Heating Prior To Coating Application

- 5.1 Pipe that has been blast-cleaned, inspected and approved by Purchaser for coating shall be preheated in a continuous, uniform procedure to a minimum temperature of 450°F and a maximum temperature of 488°F, in accordance with the material manufacturer's specification and optimum application conditions. This pipe temperature shall be maintained during the application of the fusion bond coating.
- 5.2 The heat source shall not leave a residue or contaminant on the pipe surface. Oxidation of the steel in the form of "blueing" or other apparent oxide formation is *not* acceptable.
- 5.3 Heat temperatures shall be monitored and controlled with an optical and recording pyrometer. Pyrometers shall be checked periodically with a Temp-stick to assure accurate calibration of the instrument. Care shall be exercised to minimize contamination of any surfaces to be coated by deposits left by the melt stick.
- 5.4 At no time during the coating process shall a pipe be heated to a temperature in excess of 500°F. Pipe heated above 500°F shall be subject to rejection. Cold expanded pipe heated higher than 600°F will be rejected. The cost of pipe so rejected will be borne by the Coater.

6. Application Of Fusion Bond Coat

- 6.1 The fusion bond coat shall be applied over cleaned, preheated surface as covered in Sections 4.0 and 5.0 of this specification.
- 6.2 The fusion bond coat shall be applied to the heated pipe by electrostatic spray in such a manner as to result in a total uniform cured film thickness of 14 mils (0.014 inches) nominal (Refer to paragraph 9.1.A. of this Specification for thickness tolerance).
- 6.3 The fusion bond coating shall be applied to the external surface of the full length of each pipe joint except for a "cut back" of 2 inches (± 1 inch) at each end. Coating material on the cut back and/or the beveled edge will not be acceptable.

- 6.4 The use of recycled coating powder shall be kept to a minimum. At no time shall the ratio of recycled powder to fresh powder exceed 25%. All recycled powder shall be subject to magnetic and particle size screening prior to re-use and shall be uniformly distributed among all coating spray heads.
- 6.5 The Coater shall supply samples of the powder to the Purchaser's inspector, at any time requested, for such tests as may be required to assure that the quality of the coating material is being maintained.

7. Cure

- 7.1 Special care shall be taken in handling the pipe during any cure or cooling operations to assure against damage to the coating.
- 7.2 After the coating is completely cured, the pipe may be force cooled to facilitate coating inspection and repairs, provided care is taken to avoid any damage from thermal shock to newly applied coatings.
- 7.3 Pipe with coating that is not satisfactorily cured (over-cured to under-cured) shall be completely cleaned, re-blasted, and re-coated at the Coater's expense.

8. Inspection and Testing

- 8.1 The Coater shall have full responsibility for the coating application in accordance with this Specification. The Coater's quality control inspector shall be responsible for stopping operations when conditions develop which could adversely affect the quality of the completed work.
- 8.2 The Purchaser's representative or inspector shall be provided free access to the Coater's plant at any time that there is any operation involving the pipe, with the right to inspect and approve or reject all work performed and material furnished by the Coater. When conditions with respect to surface preparation, material application, or performance exist which could adversely affect the coating operation, the Purchaser's inspector shall advise the Coater's plant superintendent or his designated representative that immediate corrective measures should be initiated. The Purchaser's inspector shall have the right to request tests, to witness the performance of the tests and to examine the results of any test conducted.
- 8.3 The Purchaser will perform tests as detailed in the Appendix A of this Specification during the application process and on the finished pipe. The results of these tests will be used in the qualification of the finished job for acceptance by the Purchaser.
- 8.4 Coated pipe requiring closer inspection of the cured coating film by the Purchaser's inspector or the Coater's quality control personnel shall be set aside at no additional cost to the Purchaser.
- 8.5 Any coated pipe that does not conform to the criteria or test result limits specified herein shall be repaired or re-coated as specified in Section 9.0 of this Specification at no cost to the Purchaser.

- 8.6 Although the principal purpose of the external coating inspection by Coater or Purchaser's inspectors is to ensure full compliance of the external coating with this Specification, such inspections shall also include examination of previously undetected defects in the pipe or on the pipe ends. Pipe having such defects shall be set aside for subsequent repair or replacement by the pipe supplier and for any necessary coating repair. Re-coating or coating repair that may be necessary by reason of defects in the pipe which do not involve fault on the part of the Coater shall be done at Purchaser's cost.
- 8.7 Failure of the Purchaser's inspector to discover or reject defective work or materials shall not be construed to imply acceptance of such work or material.
- 8.8 The Coater shall conduct gel time tests for each batch of powder coating or whenever requested by the Purchaser's inspector, and supply the results to the Purchaser's inspector.
- 8.9 The Coater shall furnish to the Purchaser the results of routine quality control tests and any special test(s) performed. The Coater shall also furnish to the Purchaser an inspection report recording each joint number with the length, coating thickness and number of holidays.

9. Repairs

- 9.1 The Coater shall repair any defects or damage to the external coating found during the inspection. If repairs are deemed impractical, the Coater shall re-clean and re-coat the entire pipe joint containing the defects or damaged areas. Specifically, the following guidelines apply to the choice between the repairing and the re-coating of a given pipe joint.
 - A. Coating Thickness: If any of the thickness tests on the pipe joint show coating thickness less than 12 mils the joint shall be set aside. After further testing, the Purchaser's inspector may, at his discretion, either allow repair of localized thin spots or require re-cleaning and re-coating. The Purchaser's inspector may accept some localized spots, provided that the coating meets all other requirements. However, no more than 3 percent of any day's run will be accepted with less than 14 mils thickness. In no case will coating of less than 12 mils be accepted.
 - B. Coating Cure: If on any joint the cure is found to be incomplete, the frequency of cure testing shall be increased to every joint until the cause of the cure deficiency has been found and corrected. In addition, a joint-by-joint, back-check shall be carried out on previously coated joints until there is no further evidence of insufficient cure. Any joint found to have insufficient cure shall be cleaned and re-coated.
 - C. Coating Bond: If on any joint a deficiency in bond is found in the adhesion test, the frequency of adhesion testing shall be increased to every joint until the cause of the bond deficiency has been found and corrected. In addition a joint-by-joint, back-check shall be carried out on previously coated joints until there is no further evidence of poor bonding. Any joint found to have defective bond shall be fully cleaned and re-coated.
 - D. Coating Damage and Holidays: Any joint where the area of damaged coating or holidays is excessive shall be fully cleaned and coated.

- 9.2 Pinhole and Small Area Repair - For pinhole and small areas where repairs are approved by the Purchaser, the following procedure shall be followed:
- A. Pipe surface imperfections such as scales, slivers, burrs, spatters, etc. shall be removed by grinding prior to coating repairs.
 - B. For pinhole and small area holidays, where repairs by the patching stick method are approved by the Purchaser, the original coated surface shall be thoroughly cleaned and lightly abraded with sandpaper. Patching stick material shall be compatible with the fusion bonded epoxy coating system. It shall be applied by heating the clean pipe surface until the patching stick begins to melt when it is rubbed over heated area. Continue heating the pipe while applying the patching stick like a brazing rod. Build up a small puddle of melted compound to obtain a minimum thickness of 25 mils (0.025 inches). Continue heating until the compound flows out smoothly.
 - C. An alternate method, for repairs to small area holidays, approved by the Purchaser is liquid epoxy. The material for patching shall be 100 percent solids catalytically cured epoxy coating normally supplied by the manufacturer of the fusion bonded epoxy coating system. The original coated surface shall be thoroughly cleaned and lightly abraded with sandpaper. All dust shall be wiped off before applying the patch coating. This type of repair coating shall be applied by spatula, brush, roller or spray to attain a uniform minimum thickness of 25 mils (0.025 inches). The patch coating shall not be applied when pipe temperatures are below 50°F unless provisions are made for complete heat curing, using methods and temperatures in accordance with procedures recommended by the patch coating manufacturer.
 - D. At the option of the Purchaser, completely cured coating repairs shall be inspected with the Coater's holiday detector as outlined in Appendix A (Section 2.5) of this Specification.
- 9.3 Large Area Repairs - For larger areas where repairs are approved by the Purchaser, the following procedure shall be followed:
- A. The pipe to be repaired shall be cleaned to remove all dirt, scale, rust, damaged or disbonded coating and other foreign material. Areas repaired before surface oxidation or rusting occurs may be prepared by hand sanding, power tool grinding, or other approved and suitable means. Areas repaired after surface oxidation or rusting occurs shall be cleaned using abrasive blasting prior to coating repairs. The edges of the original coating shall be "feathered out" around the area to be coated and all dust wiped off before applying the patch coating.
 - B. The material for patch coating shall be 100 percent solids catalytically cured epoxy coating supplied by the manufacturer of the fusion bonded epoxy coating system.
 - C. This type of repair coating shall be applied by spatula, brush, roller, or spray to attain a uniform minimum thickness of 25 mils (0.025 inches).
 - D. The patch compound shall over-lap the surrounding undamaged coating by at least 1 inch.
 - E. The patch coating shall not be applied when pipe temperatures are below 50°F unless provisions are made for complete heat curing using methods and temperatures in accordance with procedures recommended by the patch coating manufacturer.

- F. The patch-coated areas shall be allowed to completely cure prior to handling according to manufacturer's specifications.
- G. Completely cured coating repairs shall be inspected with the Coater's holiday detector as outlined in Appendix A (Section 2.5) of this Specification.

10. Handling, Temporary Storage, And Loading Of Coated Pipe

10.1 Handling of Coated Pipe

- A. The pipe, after being externally coated and cured, shall be sufficiently cooled for proper handling. All coated pipe shall be rolled or moved so as to prevent damage to the internal and external coating or to the pipe. Pipe shall be handled in a manner that will not create dents, nicks, gouges, permanent bends, "egging" or other damage to end bevels. Special attention shall be paid to preventing damage to end bevels.
- B. Pipe bevels that have been damaged during the coating or handling operations shall be repaired in compliance with API 5L Specification for Line Pipe, latest edition at the expense of the Coater. Pipe surface and/or internal or external coating damaged by the Coater in handling or other operations shall be repaired by the Coater at no cost to the Purchaser.
- C. In handling the pipe by hook line, only hooks fitted to the curvature of the pipe shall be used. All hooks shall be padded to prevent contact damage to the pipe. Use of brass or copper padding will not be allowed. Padding shall be approved by the Purchaser before use.
- D. Pipe shall be handled in such a manner as to prevent slamming the sharp part of the bevel into the coating of adjacent pipe.
- E. Hooks and slings shall not be dropped or banged into the pipe surface.
- F. All facilities for moving and handling the pipe must be approved by the Purchaser.

10.2 Temporary Storage of Coated Pipe

- A. Coated pipe to be temporarily stored shall be protected to avoid damage to the coating of the pipe. The coated pipe shall be stacked using separators to avoid contact between joints. These separators shall be free of any protruding objects. Each pipe shall be separated at least 1/4 inch from all other pipe. The pipe shall be at least 6 inches above ground.
- B. Pipe shall be stacked for storage or shipping in such a manner that weld beads on the pipe or projections from other sources (such as rail cars or ship holds) do not press against or bear on the pipe.
- C. Stacking height will be in accordance with the following:

Nominal Pipe Size (in)	Maximum Number of Stackable Tiers
3 - 4	8
6 - 12	6
16 - 24	4
over 24	3

- D. Facilities and methods of yard storage must be approved by the Purchaser.

10.3 Loading for Transportation of Coated Pipe

- A. All pipe to be shipped by truck, ship, barge, or rail shall be protected by padding, separators, and dividers approved by the Purchaser before shipment. Padding shall be a minimum of 1/4 inch of rubber, or equivalent padded strip, with no protruding metal objects that could contact the coated pipe.
- B. Each 60 foot joint of pipe shall be separated from other pipe with a minimum of 5 pads. One pad shall be placed near each end and the middle, and the remaining two pads placed at quarter points along the pipe.
- C. On 80 foot double-jointed pipe, a minimum of 6 pads shall be used, spaced near each end and at fifth points along the double joint.
- D. Adequate blocking and tie-downs shall be provided to prevent loads from moving or vibrating during transportation. When chains or cables are used for tie-downs, the pipe shall be protected by padding acceptable to the Purchaser's representative. Brass hooks or brass padding shall not be used.
- E. Facilities and methods for protection of pipe during transportation shall be approved by the Purchaser.
- F. When transporting pipe by rail, suitable wooden protection (cribbing, etc.) shall be applied at the ends of the rail cars to protect the pipe ends from damage. The transportation and handling of pipe shall meet the minimum requirements of the following practices (latest edition):
 - API RP 5L1 - Recommended Practice for Railroad Transportation of Line Pipe
 - API RP 5LW - Recommended Practice for Transportation of Line Pipe on Barges and Marine Vessels

11. Weatherability

- 11.1 FBE coated pipe furnished under this specification that will be stored for up to one year (temporary protection), shall be covered with tarps or shall have whitewash applied.
- 11.2 FBE coated pipe furnished under this specification that will be stored for more than 12 months shall have a 2-part aliphatic urethane coating to protect it from degradation due to exposure to sunlight.
 - A. Clean by abrasive blast (SSPC-SP7). Surface must be clean, dry, and free of oil, grease, dirt, or other contaminants.
 - B. Apply urethane coating in accordance with manufacturers recommendations. Film thickness shall be 5-mil dft.

12. Warranty

- 12.1 The Coater shall furnish the following additional warranties to the Purchaser:
- A. The Coater represents and warrants that it is familiar with the work to be performed pursuant to this Specification.
 - B. Coater shall be liable to the Purchaser for theft, loss, or damage of pipe from the time of receipt of the pipe until coated pipe is received and accepted by the Purchaser.
 - C. Coater shall guarantee that all material and workmanship is in accordance with this Specification.

13. Marking

- 13.1 Pipe furnished under this specification shall be marked in accordance with specification API 5L, "*Specification for Line Pipe*". Marking shall be legible and shall remain legible under normal handling and installation practices.
- 13.2 The following information shall be included:
- A. Manufacturer's name or trademark
 - B. Coater's name or trademark
 - C. Specification number and grade
 - D. Process of manufacture
 - E. Nominal size
 - F. Wall thickness

14. Certification

- 14.1 The manufacturer shall furnish certification with each shipment which states that the shipment meets all requirements of this specification. Upon request, a copy of all test results indicating qualification shall be furnished for any specified lot or shipment. Failure to furnish such test results can be cause for rejection of the order.

15. Technical Service

- 15.1 When requested by the Purchaser, the Coater shall provide technical representatives, at an enroute storage point for the coated pipe or on the pipeline right-of-way, to resolve any problems with coating quality or to provide technical assistance in the handling, transportation, or storage of the pipe.
- 15.2 The Coater shall also make arrangements for technical service from any of the coating material component manufacturers, when requested by the Purchaser.

16. Shipping

16.1 Shipping Destination

- A. Detailed shipping instructions regarding destinations will be sent to the Coater by the Purchaser.

16.2 All shipments must have the following information with the Bill of Lading:

- A. Manufacturer's name or trademark
- B. Coater's name or trademark
- C. Specification number and grade
- D. Nominal size
- E. Process of manufacture
- F. Wall thickness
- G. Quantity of material
- H. PSE MID number (if used on the Purchase Order)
- I. All mill specifications for the steel pipe.

17. Inspection

17.1 The purchaser reserves the right to inspect each shipment during processing prior to shipment or upon receipt.

If any lot or shipment does not meet these specifications, the lot or shipment may be rejected at the option of the purchaser. A lot shall mean all material covered by a single item on the order.

18. Plant and Organization Audit

18.1 The buyer or his agent has the right to perform a quality assurance program audit of the seller organization at least once during the contract and annually for multi-year contracts. The purpose of the audit is to evaluate the seller's capability of controlling processes, materials and procedures to satisfy requirements for the production of purchased products or services. These audits will be scheduled in advance. There will be a pre-audit and post-audit conference. The seller will be required to respond to the audit findings, if any.

19. Qualification

19.1 Introduction of any changes in design or materials shall be evaluated and accepted by Puget Sound Energy before being approved for purchase. Manufacturers are responsible for notifying Puget Sound Energy's Standards Department of product design or material changes. Upon request, the manufacturer shall furnish production samples and test information from product quality surveillance performed by the manufacturer. Test conditions and assumptions shall be provided.

APPENDIX A

MILL OR FIELD TESTING OF FUSION BONDED EPOXY COATING SYSTEM FOR EXTERNAL PIPE COATING

1. Cleaning And Surface Preparation

- 1.1 Visual Inspection of Surface Preparation: Tests for compliance with cleaning and surface preparation specification shall be visual.
- 1.2 Tests for Blast Anchor Pattern: The anchor pattern attained with the particular grit and blasting conditions can be determined by any of the following methods:
 - A. Method 1 - Micrometer
 1. Using rubber backed tape or other suitable method, attach a flat metal panel 1" x 1/8" thick to the external surface in the cutback area of the steel pipe being blasted.
 2. After the sample has passed through the blasting operation, remove from the pipe and grind or file a strip about 1/2" wide across the sample until the deepest valleys caused by the blast pattern just disappear.
 3. Using a micrometer with a flat stop, measure to the nearest 1 mil (0.001") the minimum thickness of the bottom of the ground section and the maximum thickness at the surface either side of the ground section.
 4. The anchor pattern is expressed in mils from the deepest valley to the highest peaks on the metal surface.
 - B. Method 2 - Micrometer Depth Gauge
 1. On the external surface in the cutback area of the pipe, grind or file an area 1/2 inch wide by 1 inch long circumferentially on the blasted pipe surface until the deepest valleys caused by the blast pattern just disappear.
 2. The anchor pattern is expressed in mils from the deepest valley to the highest peaks on the metal surface.
 - C. Method 3 - Profilometer

Subject to approval by the Purchaser's inspector, a profilometer or other instrument designed for measuring surface profile may be used.
- 1.3 Use of Visual Standards: To assist in routine inspection of the surface preparation and anchor pattern, a set of visual standards may be used for comparison. Such a set of standards may be NACE TM-01-70 (Visual Standard for Surface of New Steel Air-Blast Cleaned with Sand Abrasive) or TM-01-75 (Visual Standard for Surface of New Steel Centrifugally Blast Cleaned with Steel Grit and Shot). The standards used shall be approved by the Purchaser's inspector.

2. Fusion Bond Coating Tests

2.1 Material Requirement - The coating shall be a thermosetting epoxy and shall be capable of meeting the following properties:

Property	Test Description	Results
Impact	ASTM G-14 1/8" x 4" x 6" steel panel	160 in lbs. @ 75 deg. F 160 in lbs. @ 32 deg. F 60 in lbs. @ 0 deg. F
Elongation	ASTM D-2370 or G10-72	6.9%
Bending	Modified ASTM G10-72	@ 77 deg. F > 1.5 deg./dia. length @ 32 deg. F > 1.5 deg./dia. length
Tensile Strength	ASTM D2370	7460 psi avg.
Abrasion Resistance	ASTM D1044 CS17. 1000 gm. wt. 5000 cycles	0.124 gms. wt. loss
Hardness	Barcol ASTM D2583	60 Avg.
	Shore D. ASTM D2240-74	89 Avg.
Penetration	ASTM G17-12 40 deg. F - 240 deg. F	0%
Thermal Conductivity	ASTM C177	0.19 ± 0.02 Btu/hr./ft. ² /ft./F
Water Immersion	ASTM D870-54	3000 hrs. no blistering or other failure
Boiling Water Immersion	170 deg. F Immersion 1000 hrs.	No blistering, adhesion or surface softening
Dielectric Strength	ASTM D149	1200 ± 200 volts/mil
Dielectric Constant	ASTM D150	2.15 @ 1 MHz
Volume Resistivity	ASTM D257	3.3 x 10 ¹⁵ OHM-CM
Cathodic Disbondment	Accelerated ASTM G8-77 30 days, 6v 3% NaCl, 77 deg. F	9 mm Avg. dia.
	90 days, 6v 3% NaCl, 77 deg. F	20 mm Avg. dia.

2.2 Cured Film Thickness

- A. Tests to determine the cured film thickness of the fusion bonded epoxy coating shall be made with an approved magnetic type thickness instrument which shall be calibrated to certified coating thickness standards as frequently as necessary to ensure accuracy, but not less than once every four hours.
- B. Thickness tests shall be performed after the pipe has been cooled sufficiently to allow inspection.
- C. The finished cured film shall have an average nominal thickness of 14 mils and a minimum thickness of 12 mils.
- D. Determination shall be made at random points on each joint.

2.3 Coating Cure

- A. Cured coating shall be uniform in color, gloss and thickness and shall be free of blisters, pinholes, fisheyes, sags or other irregularities.
- B. The completeness of coating cure shall be verified for each joint. However, at the discretion of the Purchaser's inspector, the frequency of these tests may be reduced.
- C. Determination of cure shall be one of the following methods:

1. Method 1 - Bend Test

When directed by the inspector, an 18 inch ring shall be cut from a pipe joint. Straps, one inch wide, cut from the ring shall be subjected to bend tests by the Coater for cure verification. Cost for the bend test shall be borne by the Coater when inadequate cure is found. Any change of material or operation thereafter which affects the coating may be cause for further bend tests. Changes which may affect cure include: change in powder gel time, speed of operation, preheat or post heat temperatures, and pipe cooling procedure. Cost for rings cut for subsequent testing at the Purchaser's lab shall be borne by the Purchaser.

2. Method 2 - Manufacturer's Recommendations

Coating cure may be verified by comparing the fusion bond powder gel time and the time and temperature of the coating and curing processes with those recommended by the manufacturer of the powder. Information concerning actual gel times, coating line time and temperatures plus the manufacturer's recommendations shall be supplied by the Contractor to the inspector.

3. Method 3 - Thermal Analyzer

Complete cure may be verified by the use of a Thermal Analyzer. Shavings of the top 6 mils of coating shall be tested with a Thermal Analyzer to determine degree of cure.

4. Method 4 - Alternative Methods

Complete details of alternative methods for testing the completeness of cure must be submitted and approved by the Purchaser before the Coater has begun coating.

2.4 Adhesion Test

- A. The adhesion of the coating shall be verified periodically on at least one joint from each hour's production.
- B. Determination shall be near each end on each test joint and occasionally elsewhere on the coated surface.
- C. The knife test, whereby a sharp knife is pushed through the cured coating to the pipe surface shall be used. In a whittling motion, an attempt shall be made to remove the coating from the surface. The coating shall be fully adhered and shall not strip or peel from the steel or primer.

2.5 Holiday Inspection

- A. Complete holiday inspection shall be carried out on each coated joint when sufficiently cooled to allow inspection (below 200°F).
- B. The holiday detector may be either DC or AC type. If DC type, the instrument shall be set to a minimum of 2000 volts. If AC type, it shall be set to a minimum peak voltage of 2000 volts. In either case, the holiday detector shall be checked a minimum of every 4 hours and adjusted to ensure that it will detect an intentional holiday through the thickest coating on the pipe. Refer to NACE RP0490-90 for additional requirements.
- C. The audible signal initiated by a holiday in the coating shall be of sufficient volume to be detected above maximum background noise.
- D. The electrode for locating holidays shall be the wrap-around type or otherwise designed to test the entire coated area of the pipe surface.