

A&A COATING, INC.
FBE COATING SPECIFICATION
SP.001-10

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1) GENERAL

THIS SPECIFICATION COVERS THE MATERIAL, APPLICATION, AND HANDLING REQUIREMENTS FOR SINGLE LAYER FBE POWDERS USED FOR EXTERNAL PIPELINE COATING.

2) MATERIAL COMPLIANCE AND STORAGE

A) FBE POWDER

- 1) PRIOR TO USE OF MATERIAL, THE MANUFACTURER WILL PROVIDE TO COATER A COPY OF THE CERTIFICATE OF ANALYSIS. THIS DOCUMENT WILL INCLUDE VERIFICATION OF WET ADHESION, FLEXIBILITY, SCREEN RETN, GEL, CURE, SPECIFIC GRAVITY, AND DSC ANALYSIS.
- 2) POWDER MANUFACTURER WILL PROVIDE A LETTER CERTIFYING THE MATERIAL MEETS THE REQUIREMENTS OF CSA STANDARD Z245.20-02 (CLAUSES 5.2.2 AND 6.1.3) AND IS COMPATIBLE WITH REQUIREMENTS OF CLAUSE 7.3.1.
- 3) MATERIAL SHALL BE PACKAGED IN CONTAINERS ADEQUATE TO KEEP CONTENTS CLEAN AND DRY DURING HANDLING AND STORAGE. TEMPERATURE LIMITATIONS DURING STORAGE AND SHIPMENT SHALL BE IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.

B) BLAST MATERIAL

- 1) PRIOR TO USE OF MATERIAL, THE MANUFACTURER WILL PROVIDE TO COATER A COPY OF THE CERTIFICATE OF ANALYSIS. THIS DOCUMENT WILL INCLUDE HARDNESS SIEVE ANALYSIS, AND CHEMICAL ANALYSIS.
- 2) PACKAGING WILL PROVIDE MATERIAL TO REMAIN CLEAN AND DRY DURING HANDLING AND STORAGE.

3) HANDLING OF BARE PIPE

- A) WHEN PIPE ARRIVES AT A&A FACILITY, PIECE COUNT VERIFICATION SHALL BE OBTAINED ALONG WITH A VISUAL TO INSPECT THE PIPE FOR DENTS, GOUGES, AND BEVEL DAMAGE PER API 5L 45TH EDITION. ANY DAMAGE FOUND WILL BE NOTED ON THE INBOUND TALLIES AND THE CUSTOMER WILL BE NOTIFIED. ALL PIPE IN QUESTION WILL BE PLACED ON A QUARANTINE RACK PENDING FINAL DECISION FROM CUSTOMER.
- B) 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. REFER TO API5L9.
- C) SPECIAL CARE WILL BE TAKEN TO AVOID DAMAGE TO INTERNAL COATINGS OR OBLITERATION OF THE PIPE MARKINGS DURING ANY PHASE OF OPERATION.
- D) ALL TUBES SHALL BE SUPPLIED TO THE COATER EXTERNALLY BARE AND FREE OF CHLORIDES, GREASE, OR ANY TYPE OF OIL DETRIMENTAL TO THE COATING'S PERFORMANCE.
- E) IF THE PRESENCE OF OIL IS FOUND ON THE SURFACE, PIPE SHALL BE CLEANED ACCORDING TO SSPC-SP 1. ONLY APPROVED SOLVENTS WHICH DO NOT LEAVE A RESIDUE SHALL BE USED.
- F) PIPE WILL BE CHECKED FOR POSSIBLE CHLORIDE CONTAMINATION USING POTASSIUM FERROUSCYANIDE PAPER TEST METHOD. IF A CHLORIDE PRESENCE IS FOUND THE CUSTOMER WILL BE NOTIFIED IMMEDIATELY AND ADDITIONAL CLEANING WILL BE RECOMMENDED.(APPENDIX 1.A)
- G) PIPE IS TO BE PREHEATED TO 5 DEGREES F ABOVE DEWPOINT WHEN CONDITIONS OF MOISTURE EXIST. TEMPERATURES WILL BE MONITORED NOLESS THAN AT 2 HOUR INTERVALS. REFER TO NACE SP0394-2023 4.2.2.
- H) ALL EXTERNAL PIPE SURFACES TO BE COATED SHALL BE CLEANED BY SHOT/GRIT BLASTING TO NEAR-WHITE FINISH IN ACCORDANCE WITH NACE #2/SSPC-SP10.

- I) THE ANCHOR PATTERN PRODUCED BY THE BLAST CLEANING SHALL PRODUCE A PROFILE OF 2.0-4.5 MILS IN DEPTH. THE PATTERN WILL NOT BE ROUNDED BUT WILL BE SHARP AND ANGULAR, GIVING THE POWDER BETTER ADHESION. (APPENDIX 2.A) REFER TO NACE SP0394-2023 4.2.3.2
- J) SLIVERS AND BRISTLES OF STEEL REMAINING ON THE NEWLY BLASTED SURFACE THAT CAN BE DETECTED WILL BE REMOVED WITH HIGH SPEED WIRE BRUSHES OR FILES. REFER TO NACE SP0394-2023 4.2.5
- K) FOLLOWING THE ACCEPTANCE OF THE BLAST CLEANING AND PRIOR TO HEATING, ALL FOREIGN MATTER, SHOT, GRIT, AND DUST WILL BE THOROUGHLY REMOVED FROM THE ID OF THE PIPE WITH THE USE OF CLEAN HIGH PRESSURE AIR. A FLASHLIGHT OF A MINIMUM 20 CANDLEPOWER.
- L) SHOULD IT BE DETERMINED PHOSPHORIC ACID WASHING IS REQUIRED, COATER SHALL FOLLOW MANUFACTURERS RECOMMENDATIONS WHILE APPLYING THE PRODUCT. ALSO REFER TO NACE SP0394-2023 4.3
- M) HEAT NUMBER IDENTIFICATION WILL BE PLACED ON THE ID OF PIPE WITH A MARKALL PAINTSTICK PRIOR TO CLEANING OF PIPE SURFACE.

4) HEATING PRIOR TO COATING APPLICATION

- A) PRIOR TO COATING, PIPE TEMPERATURE SHALL BE MONITORED USING TEMPILSTIKS. CARE SHOULD BE TAKEN TO NOT OVERUSE IN ORDER TO AVOID LEAVING A RESIDUE ON THE PIPE. PYROMETERS CAN BE USED TO ASSURE ACCURATE READINGS OF THE STICK. REFER TO NACE SP0394-2023 SECTION 5
- B) THE FBE COATING 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 NOMINAL, OR AS SPECIFIED ON THE PURCHASE ORDER. REFER TO NACE SP0394-2023 SECTION 5

- C) THE FBE COATING SHALL BE APPLIED TO THE EXTERNAL SURFACE OF THE FULL LENGTH OF EACH PIPE JOINT EXCEPT FOR A "CUT BACK" NOT LESS THAN 1½ INCH MINIMUM NOR MORE THAN 3 INCHES MAXIMUM AT EACH END. CUT BACK AREA AND BEVELED ENDS SHALL BE FREE OF COATING.
- D) THE USE OF RECYCLED POWDER SHALL BE KEPT TO A MINIMUM. AT NO TIME WILL THE USE OF RECYCLED POWDER BE MORE THAN 20%. ALL RECYCLED POWDER SHALL BE SUBJECT TO MAGNETIC AND PARTICLE SIZE SCREENING PRIOR TO RE-USE AND WILL BE CONTINUOUSLY BLENDED INTO THE VIRGIN MATERIAL.
- E) AT THE REQUEST OF THE CUSTOMER, POWDER SAMPLES WILL BE DRAWN FROM THE FLUID BEDS FOR SUCH TESTS AS MAY BE REQUIRED TO ASSURE THE QUALITY OF THE COATING MATERIAL BEING MAINTAINED.
- F) POWDER WILL BE APPLIED TO THE POWDER MANUFACTURERS RECOMMENDATIONS CONCERNING TEMPERATURE, GEL, AND CURE TIMES.

5) INSPECTION AND TESTING

- A) PRIOR TO INSPECTION, PIPE WILL BE COOLED TO LESS THAN 212 DEGREES F TO AVOID DAMAGE TO THE COATING. THE APPLICATOR WILL BE RESPONSIBLE FOR STOPPING OPERATIONS WHEN CONDITIONS DEVELOP WHICH COULD ADVERSLY AFFECT THE QUALITY OF THE COMPLETED WORK. PER NACE SP-0490
- B) THE COATED PIPE WILL BE 100 % INSPECTED.
 - 1) COATING THICKNESS (APPENDIX 3.A)
 - 2) HOLIDAY INSPECTION (APPENDIX 3.B)
 - 3) ADHESION TEST (APPENDIX 3.C)
 - 4) CUT BACK
 - 5) HEAT NUMBER IDENTIFICATION
 - 6) STENCIL REQUIREMENTS (APPENDIX 3.D)
 - 7) RECORDED LENGTHS

- 8) NUMBER SEQUENCING
- 9) REPAIR DETERMINATION
- 10) PROTECTIVE SPACERS

6) COATING REPAIRS

- A) FOR REPAIRS LESS THAN 0.25" IN SIZE, PATCH STICK MATERIAL WILL BE USED. THE AREA TO BE REPAIRED IS TO BE LIGHTLY ROUGHENED USING A RASP FILE TO ALLOW FOR ADHESION. WIPE THE AREA CLEAN USING A CLEAN DRY CLOTH. WHILE THE PIPE SURFACE IS STILL WARM, HEAT THE STICK UNTIL IT BECOMES LIQUIFIED WHILE ALLOWING THE PATCH MATERIAL TO COVER THE ROUGHENED AREA TO BE REPAIRED. STIR THE MATERIAL INTO THE VOID UNTIL THE MATERIAL BECOMES TACKY. REMOVE THE PATCH STICK AND APPLY LOW HEAT ON THE PATCH UNTIL THE PATCH FLOWS. CARE SHOULD BE TAKEN WHILE APPLYING HEAT TO THE PIPE THAT YOU DO NOT OVERHEAT THE PATCH. ALLOW FOR PROPER CURE BEFORE HANDLING. DESIRED COATING THICKNESS SHOULD BE THE ORIGINAL COATING THICKNESS PLUS 5 MILS. PER MANUFACTURER RECOMMENDATIONS AND NACE SP0394-2023 Section 7
- B) FOR LARGER AREAS, 2-PART EPOXY SHOULD BE USED. A DESPENSE UNIT IS USED THAT WILL PROPERLY MIX THE COMPONENTS TO THE DESIRED RATIO. THE SURFACE TO BE REPAIRED SHOULD BE 50 DEGREES F OR GREATER PRIOR TO APPLICATION. THE SURFACE SHOULD BE ROUGHENED AND THE VOID REMOVED. OUTLINE THE AREA TO BE REPAIRED WITH TAPE. AFTER DESPENSING THE MATERIAL ONTO THE AREA TO BE REPAIRED, STIR THE COMPONENTS TOGETHER UNTIL THE MATERIAL BECOMES ONE. THEN SPREAD EVENLY OVER THE AREA TO BE REPAIRED. DESIRED THICKNESS SHOULD BE THE ORIGINAL COATING THICKNESS PLUS 5 MILS. ALLOW FOR PROPER CURE. PER MANUFACTURER RECOMMENDATIONS AND NACE SP0394-2023 Section 7
- C) COATED PIPE THAT HAS STEEL DEFECTS WILL BE SENT TO "HOLD" TABLE FOR FURTHER EVALUATION AND REPAIRED ACCORDINGLY. (APPENDIX 4.A) AND API5L 45TH EDITION

7) HANDLING/STORAGE OF COATED PIPE PER NACE SP0394-2023

- A) THE PIPE, AFTER BEING EXTERNALLY COATED AND CURED, SHALL BE ROLLED AND REMOVED FROM THE COATING PLANT SO AS TO PREVENT DAMAGE TO THE PIPE AND COATING.
- B) COATED PIPE WILL BE HANDLED WITH FORKLIFT THAT HAS PADDED TINES AND WILL BE TRANSPORTED TO A DESIGNATED RACK WHERE THE PIPE WILL BE PYRAMIDED AND SCOTCHED.
- C) RACK DESIGN WILL BE DOUBLE STACKED 4 X 4'S THAT ARE FREE OF NAILS AND DEBREE, CROSS TIES, OR EARTHEN BERMS THAT ARE PADDED WITH A LAYER OF CARDBOARD AND COVERED WITH PLASTIC. BERM HEIGHT IS 18".
- D) THE TYPE AND NUMBER OF PROTECTIVE SPACERS THAT ARE USED TO PROTECT PIPE FROM CONTACT WITH ADJECENT JOINTS IN STACK WILL BE AGREED UPON BETWEEN CUSTOMER AND COATER. STANDARD PRACTICE AT A&A IS 4 SPACERS FOR DOUBLE RANDOM, 5 PER TRIPLE RANDOM, AND 6 PER QUADS.
- E) STORAGE OF COATED PIPE IS CONSIDERED TO BE TEMPORARY. OTHER ARRANGEMENTS CAN BE MADE BETWEEN THE CUSTOMER AND COATER.

8) LOADING FOR TRANSPORTATION OF COATED PIPE PER API 5LT

- A) FORKLIFTS THAT LOAD COATED PIPE FOR SHIPMENT WILL HAVE PADDED TINES IN ORDER TO PREVENT COATING FROM BEING IN CONTACT WITH METAL.
- B) STANDARD LOADING OF PIPE WILL BE PYRAMID LOADING. IF STRIP STACKING IS REQUIRED PER LOAD, ARRANGEMENTS WILL NEED TO BE MADE BY CUSTOMER.
- C) IT WILL BE THE RESPONSIBILITY OF CUSTOMER TO ARRANGE LOADS FOR PICK-UP. THE TRUCKING COMPANY WILL BE RESPONSIBLE FOR OWN DUNNAGE

UNLESS ARRANGEMENTS HAVE BEEN MADE PRIOR TO SHIPMENT.

- D) ALL COATING TESTING, COATING REPAIRS, PIPE REPAIRS, AND PAPERWORK MUST BE COMPLETE AND APPROVED PRIOR TO RELEASING MATERIAL FOR SHIPMENT.

APPENDIX A

1) CHLORIDE CONTAMINATION

A) LEVEL OF CONTAMINATION IS DETERMINED AS FOLLOWS;

- 1) POTASSIUM FERRICYANIDE – AN INDICATOR OF THE PRESENCE OF THE CHLORIDE ION.
- 2) KAT SCAT – A DETAILED TEST THAT DETERMINES THE LEVEL OF THE CHLORIDE ION. LEVELS THAT EXCEED 2 MICROGRAMS/ SQUARE CM ARE CAUSE FOR NOTIFICATION TO THE CUSTOMER AND OPTIONS TO BE CONSIDERED.

2) ANCHOR PATTERN

A) THE PROFILE SHALL BE MEASURED BY THE PRESS-O-FILM REPLICA TAPE FOLLOWED BY MEASUREMENT USING A MICROMETER PER NACE SP0287

3) COATING INSPECTION

TESTS TO DETERMINE THE APPLIED FILM THICKNESS OF THE FBE SHALL BE MADE WITH AN APPROVED MAGNETIC TYPE THICKNESS INSTRUMENT. THE INSTRUMENT SHALL BE CHECKED FOR ACCURACY TO CERTIFIED COATING THICKNESS STANDARDS, AS FREQUENTLY AS NECESSARY TO

ENSURE ACCURACY, BUT NOT LESS THAN ONCE EVERY SHIFT. MAXIMUM THICKNESS SHALL BE 10 MILS ABOVE NOMINAL REQUIRED THICKNESS.

- A) COMPLETE HOLIDAY INSPECTION SHALL BE CARRIED OUT ON 100% OF THE COATED PIPE JOINT AFTER THE COATING IS CURED AND SUFFICIENTLY COOLED TO ALLOW INSPECTION (BELOW 220 DEGREES F). TESTING SHALL BE IN ACCORDANCE WITH NACE RP-0490. AUDIBLE AND VISUAL ALARMS ARE IMPLEMENTED INTO THE PROCESS TO INDICATE THAT A VOID IS IN THE COATING. DETECTOR WILL BE SET AT 125V/MIL.
- B) THE ADHESION OF THE COATING SHALL BE VERIFIED PERIODICALLY ON AT LEAST ONE JOINT EVERY 4 HOURS OF PRODUCTION. USING A UTILITY KNIFE, CUT THROUGH THE COATING TO SUBSTRATE, CREATING AN X PATTERN. AT THE INTERSECTION OF THE X, INSERT THE TIP OF THE KNIFE BLADE UNDER THE COATING. USING A LEVERING ACTION, THE COATING SHOULD DEMONSTRATE A DEFINITE RESISTANCE. THE COATING SHOULD FULLY ADHERE AND SHALL NOT STRIP OR PEEL FROM THE STEEL.
- C) THE COATED PIPE SHALL BE STENCILED ON EACH END OF THE TUBE WITH THE FOLLOWING INFORMATION; SIZE, WALL, GRADE, MANUFACTURER, API5L, (ERW/SMLS/DSAW), CUSTOMER, PO, COATING THICKNESS, TYPE COATING, DATE (MONTH/YR), COATER, JOB NUMBER, SPEC (IF APPLICABLE), AND HEAT NUMBER (1 END ONLY).

4) STEEL DEFECT REPAIRS

- A) UNLESS OTHERWISE NOTIFIED, COATED OR BARE PIPE NEEDING REPAIR WILL BE DONE TO API 5L SPECIFICATION 45th EDITION.

5) PRODUCTION TEST RING (Procedures outlined in NACE SP-0394 2023 Table 3)

TEST	PASS
A) CDT - 24 HR, -3.5V, 3%NACL, 150 F	8MM
B) HOT WATER SOAK - 24 HR, TAP WATER 167F	1-3
C) BEND @ -30C DEGREES P/D ARO	2.5 P/D FBE 1.0
D) CONTAMINATION	30% MAX
E) Porosity (INTERFACE)	1-3
F) Porosity (THROUGH FILM)	1-3

G) IMPACT TEST
Joules ARO

1.5 Joules FBE 3

H) DSC

+/- 4 Delta Tg

(When customer spec specifies or TPI requires)

6) APPROVED FBE POWDERS

A) Axalta-2508 FBE AND Axalta-2610 ARO

B) 3M-6233 FBE AND 3M-6352 ARO

C) Sherwin Williams 2000 FBE AND 2040 ARO

D) POWERCRETE DD

APPENDIX B

1. ABRASIVE RESISTANT OVERLAY COATINGS

A) HOLIDAY TESTING VOLTAGE SETTINGS WILL BE SET AT 5000 VOLTS PER COATING MANUFACTURERS RECOMMENDATIONS UNLESS OTHERWISE SPECIFIED BY CUSTOMER.

B) ALL REPAIRS WILL BE DONE USING LIQUID TWO-PART EPOXY.

C) LABORATORY BEND TESTING WILL BE CONDUCTED @ 1.5%PD @ 32° FOR MILLAGE UP TO 40 MILS. FOR MILLAGE OVER 40 MILS TESTING WILL BE CONDUCTED AT 1.5%PD @ 32° AS REPORTING PURPOSES ONLY, NOT AS A PASS/FAIL.