

DRAFT - Intended to be used as a draft, for general specification guidelines for typical considerations. Epoxytec is not an engineer or design consultant. Therefore, all guidelines herein must be customized to the specific requirements required for the structure and environment. Often times, each specific situation may require to include, exclude or revise sections. It is recommended that these guidelines be reviewed and revised as needed by a licensed, Professional Engineer.

LIFT STATION AND SIMILAR STRUCTURES REHABILITATION AND LINING WITH A 100% SOLIDS UME SYSTEM

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

- A. This section includes general steel preparation and lining of steel structures by a monolithic application of high-build, solvent-free UME coating system to eliminate leaks, repair steel pitting, voids and cavitation, and provide corrosion protection as a total lining system.
- B. Procedures for surface preparation, cleaning, application and testing are described herein. Different repair methods and procedures are listed in this section. All structures scheduled for rehabilitation and/or coating shall be cleaned, prepared, patched and/or sealed as required prior to the application of the UME coating system.

1.2 SCOPE OF WORK

- A. The Contactor shall be responsible for furnishing all labor, supervision, materials, and equipment required to complete all rehabilitation and lining work, testing, surface restoration and lining in accordance with this Specification.
- B. All Sections of this Specification are mutually complimentary and the overall intent is that the Contractor shall provide for everything in his portion of the work required to make a complete and operable job in every respect unless specifically noted otherwise.
- C. It is the intent of this Specification to ensure that the work, as completed shall meet all applicable codes, ordinances, rules and regulations of every authority having jurisdiction in the area where the construction is located. Failure of the Contractor to point out items that do not meet such requirements does not relieve the Contractor or the Subcontractors of the responsibility of meeting them.
- D. All supplies shall be stored and maintained by the Contractor in accordance with manufacturer's recommendations. Materials shall not be exposed to adverse conditions prior to the work. All materials shall be kept in secured area and away from general public access. The Contractor shall review and maintain all Safety Data Sheets (SDS), product labeling, and technical literature at the project site.

1.3 REFERENCES

- A. The latest codes and standards referenced herein and belonging to the following organizations shall be followed:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. National Association of Corrosion Engineers, NACE International (NACE)
 - 3. The Society for Protective Coatings (SSPC)
 - 4. Occupational Safety and Health Administration (OSHA)

1.4 SUBMITTALS

- A. Product Data
 - 1. Technical data sheets on each product proposed shall be furnished. The technical data, by validation of ASTM testing results, shall demonstrate conformity with these specifications.
 - 2. Safety Data Sheets (SDS) for each product proposed shall be furnished.
 - 3. If submitting an alternative product, please follow procedures set forth in **Section 1.4 (C)**.
- B. Application Data
 - 1. Project specific guidelines and recommendations.
 - 2. Proof of any required government permits or licenses necessary for the project.

3. Design details for any ancillary systems and equipment to be used on site for surface preparation, application and testing. Confined space entry, flow diversion and/or bypass plans shall be presented by Contractor to Owner as necessary to perform the specified work.
4. Applicator:
 - i. Company specializing in performing work of this section with minimum **three (3) year** documented experience.
 - ii. Company specializing in performing work of this section must be approved by manufacturer prior to bid date.
 - iii. Company specializing in performing work of this section must have and provide on-site foremen and/or supervisors with NACE CIP Level 3, PCT or PCS certification and/or SSPC PCI Level 3, CAS Level 2, or PCS certification.
5. Three (3) recent references of Applicator indicating successful application of coating product(s) of the same or similar material type as specified herein, within industrial environments.
6. Written warranty.
 - i. Material and labor shall be warranted by the Contractor for a period of ____ () years from date of project completion, once correctly applied by an approved applicator and inspected.
 - ii. Contractor shall warrant all workmanship of applied material systems for a period of ____ () years, unless otherwise noted, from the date of final acceptance of the project.
 - iii. Failure will be deemed to have occurred if the protective system fails to (a) prevent the internal damage or corrosion of the underlying structure due to bacteriological, chemical, gaseous attack. It does not include excessive atypical or non-disclosed chemical abuse or atypical acts of God which cause structural damage. (b) seal and protect the substrate or surface, and environment from contamination by effluent. (c) seal and protect from influent or infiltration.
 - iv. Contractor shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship which may develop during said warranty period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the Owner.

C. Or Equal Submittal

1. In order to be considered as an equal product, said product will have to meet the minimum physical and performance properties described herein as measured by the applicable ASTM and/or standards referenced. Testing results must be performed and presented in the form of technical data sheets.
2. Equal products' technical specifications/data and material safety data must be submitted to Owner a minimum of **three (3)** weeks prior to bid date. Samples of raw material and cured material must be submitted in order to cover at least **one (1)** square foot of surface area at specified thickness.
3. Written product pre-approval is required to determine if the prospective product may be bid and utilized on this project. A product will be rejected as unacceptable should submittal to Owner not be received by the deadline and should the bid package not have enclosed a written approval from the Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Coating materials and polymers are to be kept dry, protected from weather and stored under cover.
- B. Coating materials and polymers are to be stored between 15 deg C (60F) and 40 deg C (105F). Do not store near flame, heat or strong oxidants.
- C. Coating materials and polymers are to be handled according to their safety data sheets (SDS).

1.6 SITE CONDITIONS

- A. Contractor shall conform to all government, safety and environmental regulations.
- B. Confined space entry, lock out-tag out, flow diversion and/or bypass plans shall be presented by Contractor to Owner as necessary to perform the specified work.

PART 2 - REHABILITATION METHODS AND PROCEDURES

2.1 GENERAL

- A. All work shall be in strict accordance with the specifications and recommendation including application of all products as required and in accordance with manufacturer's directions.
- B. When freezing temperatures are expected in the area, the Contractor shall take measures to keep applied materials warm and provide the required heat in the structure before repair work is started and the 24-hour period following application.
- A. Any inverts or flow channels shall be covered during construction operations to prevent loose materials from collection in the invert. Any active flows shall be locked-out, plugged or diverted as required to ensure that the liquid flow is maintained below the surfaces to be coated. Any equipment shall be locked-out according to site safety requirements.
- C. Bypassing and/or blocking of the flow shall be done only with prior approval of the Owner.
- D. The Owner shall supply water necessary for the project to the Contractor at no cost, from locations indicated by Owner prior to the start of the project. Contractor shall be responsible for transporting the water.
- E. It shall be the contractor's responsibility to provide traffic control and required by the particular location and/or jurisdiction.
- F. Use approved equipment designed, recommended and/or manufactured by the material supplier specifically for the application of all materials.
- G. Contractor shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE, and SSPC standards and the UME coating system manufacturer's recommendations.
- H. Products are to be kept dry, in a climate controlled environment, protected from weather and stored under cover.
- I. Products are to be stored and handled according to their safety data sheets.

2.2 CLEANING AND PREPARATION

- A. Contractor shall inspect all specified surfaces prior to surface preparation. Contractor shall notify Owner of any noticeable disparity in the surfaces that may interfere with the proper preparation or application of the primer, repair material and/or hybrid epoxy coating.
- B. Contractor shall perform all surface preparation via blast cleaning and shall be in accordance with SSPC-SP6 / NACE 3 "Commercial Blast Cleaning."
- C. All loose scale, large deposits oil, grease, cutting oils, dirt and other contaminants shall be removed prior to abrasive blasting by washing with detergent and potable water, followed by a thorough rinsing with potable water or other pre-approved cleaning methods.
 - 1. The steel surfaces to be coated shall be abrasive blast cleaned.
 - i. Blast air shall be free of oil and water.
 - ii. Abrasive media shall be a clean-grade, medium to coarse grit, sharp and with hardness, to ensure an anchor profile. Approved media shall be MEDIUM grade, BLACK BEAUTY® abrasive media or similar to achieve a minimum 60 – 75 microns (2.5 - 3 mils) mil profile. Abrasive shall be clean-grade, not recycled.
 - iii. Remove all blasting residues from the structure/vessel by means of vacuum cleaning plus, as appropriate, shovels, brooms, clean compressed air, vacuum cleaners and other dry extraction methods.
 - iv. Chlorides after blasting shall not exceed levels of 10ppm.
 - 2. Surfaces shall be free of weld splatter.
 - 3. All welds shall be continuous.

2.3 PRIMING

- A. General
 - 1. Priming is optional, and is to occur if the first coat of the UME coating cannot be immediately applied. Should a primer be deemed necessary, priming shall be for a holding primer purpose, as the first step after surface preparation to eliminate the occurrences of flash rust.
 - 2. Priming shall be performed with an epoxy-based, rust inhibiting thin film build base coat.
 - 3. Prime to achieve a total of 4-6 mils DFT.
- B. Materials
 - 1. Specified material(s) are listed below, or prior approved equal (see Section 1.4 C):

Epoxytec A1 Primecoat (#MP1R)
877.GO.EPOXY

by Epoxytec (epoxytec.com)
954.961.2395 (fax)

2.4 METAL FILLING AND REPAIR

A. General

1. Repair products shall be used to fill voids, pinholes, and other surface defects which may affect the performance or adhesion of the coating product(s), and recommended by the coating manufacturer to ensure compatibility with top coating.
2. Repair products shall be installed to minimum thickness as recommended within manufacturers published guidelines.
3. Repair products shall be handled, mixed, installed and cured in accordance with manufacturer guidelines.
4. Fillers and patching material shall be trowel-applied to provide a smooth surface with an average profile equivalent to coarse sandpaper to optimally receive the hybrid epoxy coating.
5. The repair materials shall be permitted to cure according to manufacturer recommendations.

B. Materials

1. Specified material(s) are listed below, or prior approved equal ([see Section 1.4 C](#)):

Epoxytec CPP Gel (#C311)
877.GO.EPOXY

by Epoxytec (epoxytec.com)
954.961.2395 (fax)

C. Execution

1. Examination

- i. All specified surfaces and structures to be repaired shall be readily accessible to the Contractor.
- ii. Full surface examination must take place prior to application. Contractor must report any observations of structural irregularities prior to repair.
- iii. Appropriate actions shall be taken to comply with government regulatory and other applicable agencies with regard to environment, health and safety.
- iv. Any active flows shall be dammed, plugged or bypassed as required to ensure dry surfaces. All extraneous flows into the structures at or above the area coated shall be plugged and/or diverted until the repair materials have fully cured.
- v. Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify Owner, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

2. Application of material

- i. Application procedures shall conform to the recommendations of the product(s) manufacturer, including environmental controls, product handling, mixing, application equipment and methods.
- ii. Subsequent layering or additional coats of the product(s) shall occur within the product's recoat window. Additional surface preparation procedures will be required if this recoat window is exceeded.
- iii. Material is supplied in two (2) containers (base+cure) as a unit. If possible, always mix a complete unit in the proportions supplied. Use a calibrated scale to weigh out each component or use measuring cups to measure by volume. Adding more or less hardener will adversely affect the cured physical properties.
- iv. Measure the material temperature prior to mixing. If the material is cooler than 16 °C (60 °F), raise its temperature slowly to above 22 °C (72 °F). For published working time to remain manageable, do not exceed 32 °C (90 °F).
- v. After the components have been measured on a clean, flat mixing board, mix thoroughly with a trowel/spatula/putty-knife until the mixture becomes a uniform in color and viscosity with no visible streaks or lumps (2 - 3 minutes). Incomplete mixing will result in loss of physical properties and unmixed/mal cured patches.
- vi. With acceptance by the Owner, reinforcing fabric may be rolled into the resin for repair voids or holes, and added tensile and flexural strength where desired or required.

1. General filling:

- a. Utilizing repair material, apply product for resurfacing, filling, repair to any cavitation, pitting, or surface defects demonstrating valleys that exceeds 125 microns (5 mils) or have sharp irregularities that would interfere with the film build of the UME coating.
2. Weld reinforcement/repair. Reinforce weld seams, joints with repair material as a cold weld:
 - a. Apply 0.5cm film thickness coat above and below weld seams and joints at a minimum length of 8cm (3 inches) if space allows. Increase thickness at weld or seam to a maximum of 1.25cm (1/2 inch) and taper.

2.5 COATING / LINING

D. General

1. It is the intent of this specification to provide for the waterproofing, sealing, and corrosion protection of existing structure(s) by the safe, quick and economical application of a uniform and monolithic layer of design formulated 100% solids UME coating system specifically designed and approved for use in contact with potable, drinking water environments as per ANSI/NSF-61 standards.
 - i. If a monolithic liner cannot be achieved, consult with Manufacturer for an edge termination procedure.

B. Materials

1. The UME coating system must be a hybrid epoxy exhibiting the following features:
 - i. The hybrid epoxy coating must be a urethane-modified-epoxy (UME) technology.
 - ii. The hybrid epoxy coating must be self-priming, requiring no primer.
 - iii. The hybrid epoxy coating must be able to react/perform in the presence of water and high humidity.
 - iv. The hybrid epoxy coating must withstand freeze-thaw and wet-dry cycles without causing adverse changes to the cure and performance properties.
 - v. The hybrid epoxy coating must be able to be applied by brush, roller, or spray in order to have options in mobilization requirement and apply in limited access areas.
 - vi. The hybrid epoxy coating must hang with vertical and overhead thickness capability of 25 mils in one pass without sag.
 - vii. The hybrid epoxy coating must have an indefinite recoat window without preparation for simple repair requirements.
 - viii. The hybrid epoxy coating shall be resistant to all forms of chemical or bacteriological attack, intended and disclosed.
 - ix. The hybrid epoxy coating must be certified for compliance of ANSI/NSF-61 standards for potable drinking water contact.
2. Approved material shall exhibit the following physical properties:

1. Type	hybrid-novolac, urethane-modified-epoxy
2. Solids by Volume ASTM D2697	100%
3. Solvent (VOC) ASTM D3960	none
4. Adhesion Strength (concrete, dry) CIGMAT CT-2/3	substrate failure
5. Adhesion Strength (brick, wet) CIGMAT CT-2/3	substrate failure
6. Adhesion Strength (steel) ASTM D4541	1,500+ psi
7. Water Absorption ASTM D1653	< 0.1 g/sq.m.
8. Acid Exposure (pH 1, H2SO4) CIGMAT CT-1	passed
9. Tensile Strength ASTM D638	5,500+ psi
10. Flexural Modulus ASTM D790	55,000+ psi
11. Flexural Strength ASTM D790	8,000+ psi
12. Compressive Strength ASTM D695	7,000+ psi
13. Elongation ASTM D2370	30-40%
14. Complete Cure	18 hours (77F)

- ii. Specified material(s) are listed below, or prior approved equal (see Section 1.4 C):

Epoxytec Uroflex #UME38
(or Epoxytec Uroflex 61 #WUME for potable water)

by Epoxytec (epoxytec.com)
877.GO.EPOXY
954.961.2395 (fax)

E. Execution

3. Examination

- i. All specified surfaces and structures to be coated shall be readily accessible to the Contractor.
- ii. Full surface examination must take place prior to coating. Contractor must report any observations of structural irregularities prior to repair or coating.
- iii. Appropriate actions shall be taken to comply with government regulatory and other applicable agencies with regard to environment, health and safety.
- iv. Any active flows shall be dammed, plugged or bypassed as required to ensure dry surfaces. All extraneous flows into the structures at or above the area coated shall be plugged and/or diverted until the UME coating system has fully cured.
- v. Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify Owner, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

4. Priming (optional, see [Section 2.3](#))

- i. After surface preparation, prime at minimum 4-6 mils DFT.

5. UME coating

- i. Application procedures shall conform to the recommendations of the coating product(s) manufacturer, including environmental controls, product handling, mixing, application equipment and methods.
- ii. If spraying, spray equipment shall be specifically designed to accurately ratio and apply the coating product(s) and shall be in proper working order.
- iii. Before applying any coating, all welds, grooves, pits, other rough areas, difficult-to-spray areas, and other areas as specified shall be striped. Striping can be accomplished by spray application in accessible areas; and, hand-mixing product or spray followed by scrub-striping with a good-quality bristle brush in difficult-to-spray areas.
- iv. All surfaces shall be coated described herein to a minimum wet film thickness of 2 x 0.5mm each (2 x 20 mils) for total minimum DFT of 1mm (40 mils).
- v. Subsequent top coating or additional coats of the coating product(s) shall occur within the product's recoat window. Additional surface preparation procedures will be required if this recoat window is exceeded.
- vi. Coating product(s) shall interface with adjoining construction materials throughout the structure to effectively seal and protect substrates. Procedures and materials necessary to effect this interface shall be as recommended by the coating manufacturer.

2.7 QUALITY ASSURANCE AND ACCEPTANCE

A. Surface temperature / Ambient conditions.

1. Applicator shall record air temperature inside the tank and prevailing weather conditions at the time of coating application.
2. To avoid or minimize flash rusting, abrasive blasting shall not be performed when the air or steel temperature is below 20 deg C (68F), and/or when the relative humidity exceeds 80%, and/or when the steel is within 3 degrees C (5 deg F) than the dew point. The Contractor will provide dehumidification, and/or temperature control as necessary to meet these conditions, if required.
3. Temperature of the surface to be coated should be maintained between 20 deg C (68F) and 51 deg C (125F) during application. The surface temperature of the steel should be maintained at a minimum of 3 deg C (5 deg F) from the dew point during application.

B. Soluble salts.

1. Steel contaminated with soluble salts (ie. chlorides and sulfates) develops oxidation rapidly at intermediate and high humidity. Therefore, these salts must be removed from the steel surface preferably before blast cleaning and coating, and by eliminating sources of recontamination during and after blast cleaning and coating. A number of tests for soluble salts have been examined by SSPC, ASTM, the

National Shipbuilding Research Program, and the International Organization for Standardization. (refer to SSPC-Guide 15 Retrieval and Analysis of Soluble Salts)

2. Test steel surface and blasting media for traces of chlorides to ensure less than 10 ppm.
- C. During application, Contractor shall regularly perform and record epoxy coating thickness readings with a wet film thickness gage, such as those meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, to ensure uniform thickness during application or other similar measuring probe.
- D. Contractor shall perform holiday detection on all surfaces coated with the UME coating in the presence of the coating manufacturer's representative or designated inspector. After the UME coating has set hard to the touch, surfaces shall first be dried, an induced holiday shall then be made on to the coated concrete surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays at that particular area. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of film thickness applied but may be adjusted as necessary to detect the induced holiday (refer to NACE RPO188-99). All detected holidays shall be marked by the coating manufacturer's approved marking methods and repaired by abrading the coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional epoxy coating material can be hand applied to the repair area. All touch-up/repair procedures shall follow the coating manufacturer's recommendations.
- E. [Optional – Adhesion Testing is a destructive test method and should be used in moderation as an evaluation tool.] Random testing areas should be identified to use for testing. Testing shall be conducted in accordance with ASTM D4541 as modified herein. Owner's representative shall select the areas to be tested. A minimum of three 20 mm dollies shall be affixed to the coated surface at the cone area, mid-section and at the bottom of the structure. The adhesive used to attach the dollies to the coating shall be rapid setting with tensile strengths in excess of the coating product and permitted to cure in accordance with manufacturer recommendations. The coating and dollies shall be adequately prepared to receive the adhesive. Failure of the dolly adhesive shall be deemed a non-test and require retesting. Prior to performing the pull test, the coating shall be scored by mechanical means without disturbing the dolly or bond within the test area. Two of the three adhesion pulls shall exceed 600 psi with more than 50% of the subsurface adhered to the coating. Should a structure fail to achieve two successful pulls as described above, additional testing shall be performed at the discretion of the Owner's inspection agent. Any areas detected to have inadequate bond strength shall be evaluated by the Owner's inspection agent. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Contractor.
- F. A final visual inspection shall be made by the Contractor, coating manufacturer's representative or designated inspector. Any deficiencies in the finished coating shall be marked and repaired by Contractor according to the procedures set forth herein.
- G. The system may be put back into operational service as soon as the coating becomes hard to the touch and the final inspection has taken place, 72 hours from final coating application @ 25C temperate cure. Force cure by heat induction to the coated surfaces may be necessary for a return-to-service prior to 72 hours; should this be required, manufacturer's recommendations will be strictly followed.

END OF SECTION