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Product Guide Specification

Specifier Notes: This product guide specification is written according to the Construction Specifications Institute (CSI) *MasterFormat* (1995 Edition), Three-Part *SectionFormat,* and *PageFormat,* contained in the CSI *Manual of Practice.*

The section must be carefully reviewed and edited by the Engineer to meet the requirements of the project and local building code. This section must be coordinated with other specification sections and the drawings.

Delete all "Specifier Notes" when editing this section.

SECTION 03935

RESTORATION AND CORROSION BARRIER COMPOSITE LINER (Mainstay® Composite Liner)

Specifier Notes: This section covers Madewell Products Corporation Restoration and Corrosion Barrier Composite Liner (Mainstay® Composite Liner) for concrete and brick structures using Mainstay ML-72 Sprayable Microsilica Cement Mortar and Mainstay DS-4, DS-5, or DS-6 Epoxy Mortar Corrosion Barrier, and Madewell 806 Flexible Epoxy Manhole Frame Seal.

Mainstay® Composite Liner can be used to quickly restore, water proof, and corrosion proof concrete and masonry structures exposed to industrial and municipal corrosive environments including trenches, clarifiers, wet wells, sumps, manholes, sewer pipelines, pumping stations, and digesters. Can also be used to repair any concrete structure that has suffered deterioration caused by exposure to aggressive environments. Restores structural integrity, seals rough deteriorated surfaces, and resists external hydrostatic water pressure. Suitable for permanent water immersion service.

Consult Madewell Products for assistance in editing this section for the specific application.

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Restoration and corrosion barrier composite liner for concrete and brick structures.

1.02 RELATED SECTIONS

Specifier Notes: Edit the following list as required for the project. List other sections with work directly related to the Restoration and Corrosion Barrier Composite Liner.

Reference this section in Section 09960 - High-Performance Coatings and Section 09980 - Coatings for Concrete and Masonry.

A. Section 02500 - Utility Services.

B. Section 02955 - Restoration of Underground Piping and Utility Units.

C. Section 03300 - Cast-in-Place Concrete.

D. Section 03370 - Shotcrete.

E. Section 03400 - Precast Concrete.

F. Section 03900 - Concrete Restoration and Cleaning.

G. Section 09960 - High-Performance Coatings.

H. Section 09980 - Coatings for Concrete and Masonry.

1.03 REFERENCES

Specifier Notes: List standards referenced in the section, complete with designations and titles. This article does not require compliance with standards, but is merely a listing of those used.

A. ACI 305R - Hot Weather Concreting.

B. ACI 503R - Use of Epoxy Compounds for Coating Concrete.

C. ASTM C 78 - Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading).

D. ASTM C 109 - Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).

E. ASTM C 157 - Length Change of Hardened Hydraulic-Cement Mortar and Concrete.

F. ASTM C 876 - Half-Cell Potentials of Uncoated Reinforcing Steel in Concrete.

G. ASTM D 4138 - Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means.

H. International Concrete Repair Institute (ICRI) Technical Guideline No. 03730 - Surface Preparation Guidelines for the Repair of Deteriorated Concrete Resulting From Reinforcing Steel Corrosion.

I. National Association of Corrosion Engineers International, NACE RP 0188 - Discontinuity (Holiday) Testing of Protective Coatings.

1.04 SUBMITTALS

A. Comply with Section 01330 - Submittal Procedures.
   1. Product substitutions to be submitted by Contractor and approved by Engineer at least 10 days before bid date.

B. Product Data: Submit manufacturer's product data, including physical properties, surface preparation, application instructions, and curing instructions.

C. Test Reports: Submit manufacturer's test reports of in-place testing performed by an independent testing ag ency including: County of Los Angeles (Redner Report) testing program results and independent in-situ test results, City of Los Angeles Hyperion Intake Chamber test results or City of Monterey Regional Water Pollution Control Agency test results (Jacques/Holden).

D. List of three Restoration and Corrosion Barrier Composite Liner projects, with at least three years of successful service history, including project name and location, names of owner and engineer, and description of products used, substrates, and application procedures. As a minimum, at least one of three projects must be accessible for physical inspection prior to acceptance of restoration mortar/corrosion barrier mortar system.

   Written certification that both the Restoration Mortar and Corrosion Barrier Mortar were applied consecutively (essentially simultaneously) on each of the three projects submitted (both products applied within 4 hours of each other).

E. Certification that all products (restoration mortar and corrosion barrier mortar) are from a single source. Single source being defined as a single entity (person or company) that owns all rights to both the restoration mortar and corrosion barrier mortar formulations and testing data.

F. Applicator Qualifications: Submit qualifications of applicator.
   1. Certification by the manufacturer stating that the applicator is trained and approved in the application of the specified products.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications:
   1. Trained and approved by the manufacturer in the application of the specified products.
   2. Employs persons trained for the application of the specified products.

Specifier Notes: Describe requirements for a meeting to coordinate the application of the restoration and corrosion barrier composite liner and to sequence related work.

B. Pre-Application Meeting: Convene a pre-application meeting [2] [_____] weeks before the start of application of Restoration and Corrosion Barrier Composite Liner. Require attendance of parties directly affecting work of this section, including the Contractor, Engineer, applicator, and manufacturer's representative. Review surface preparation, application, curing, field quality control, and coordination with other work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage:
   1. Store materials in accordance with manufacturer's instructions.
   2. Keep containers sealed until ready for use.
   3. Store materials in a cool dry environment.
   4. Storage Temperature of Corrosion Barrier Mortar: 40 to 80 degrees F.

C. Handling: Protect materials during handling and application to prevent damage.

1.07 ENVIRONMENTAL CONDITIONS

A. Do not apply materials under the following conditions:
   1. Temperatures exceeding the manufacturer's recommended maximum or minimum allowable.
   2. Dusty or smoke-laden atmosphere.
   3. Over flowing water.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Madewell Products Corporation, 7561 Industrial Court, Alpharetta, Georgia 30004. Phone (770) 475-8199. Fax (770) 475-8167. Internet: www.madewell.net.

2.02 RESTORATION AND CORROSION BARRIER COMPOSITE LINER

A. General:
   1. Restoration mortar, corrosion barrier coating and manhole frame seal from single manufacturer.
   2. Materials compatible with substrate and with each other. A minimum of three years of successful service history in aggressive sewer environments where the restoration mortar and corrosion barrier coating were applied simultaneously (the same day).
   3. Corrosion Barrier Coating approved for use by City and County of Los Angeles testing program (by Redner) with a perfect score of 3 (imperfect scores higher than 3 are not acceptable).
   4. In-place testing by City and County of Los Angeles Hyperion intake chamber testing or Monterey Regional Water Pollution Control Agency protective coatings evaluation (by Jacques / Holden).

B. Hydraulic Cement Mortar: Mainstay ML-10. Fast-setting mortar used to stop leaks through cracks and holes.
   1. Composition: Blend of hydraulic cements and fillers.
   2. Compressive Strength, ASTM C 109:
      a. 1 Day: 3,500 psi.

b. 7 Days: 4,900 psi.
c. 28 Days: 5,500 psi.

3. Tensile Strength, ASTM C 190:
   a. 7 Days: 290 psi.
   b. 28 Days: 575 psi.
4. Working Time: 45 to 90 seconds at 77 degrees F.
5. Color: Dark gray.

Specifier Notes: Mainstay ML-72B contains a polymer admixture and is used for applications which do not remain continually wet during and after curing. Consult Madewell Products for assistance in selecting restoration mortar for the specific application.

C. Restoration Mortar: Mainstay ML-72 Sprayable Microsilica Cement Mortar. Low shrinkage, high strength, sprayable microsilica mortar.
   1. Composition: Blend of cements, microsilica, thermoplastic fibers, densifiers, and modifiers. Mortar shall not contain calcium aluminate cements or aggregates.
   2. Compressive Strength, ASTM C 109:
      a. 1 Day: 3,000 psi.
      b. 28 Days: 10,000 psi.
   3. Flexural Strength, ASTM C293:
      a. 1 Day: 535 psi.
      b. 28 Days: 1,400 psi.
   4. Tensile Strength, ASTM C-496:
      a. 1 Day: 330 psi.
      b. 28 Days: 790 psi.
   5. Shrinkage, ASTM C-596:
      a. 28 Days @ 90%: 0.01 percent.
   6. Uniaxial Tensile Bond Strength, ACI 503R, Appendix A:
      a. 28 Days: Greater than 500 psi over high strength concrete (5,000 psi compression strength concrete - bond strength governed by substrate tensile strength). Minimum acceptable bond = 145 psi.
   7. Color: Dark gray.

Specifier Notes: Specify **one** of the following **three** corrosion barrier mortars and delete the other two. Specify minimum corrosion barrier mortar thickness of 100 mils for highly aggressive environments. Consult Madewell Products for assistance in determining the appropriate corrosion barrier mortar and thickness for the specific application.

D. Corrosion Barrier Coating: Mainstay DS-4 Ultra High Build Epoxy Coal Tar Coating.
   1. Composition: 100 percent solids, modified epoxy coal tar coating.
   2. Thickness: Minimum of [60] [100] mils in 1 or 2 coats.
   3. Number of Components: 2.
   4. Finish: Gloss.
   5. Color: Black.

D. Corrosion Barrier Coating: Mainstay DS-5 Ultra High Build Epoxy Coating.
   1. Composition: 100 percent solids, modified epoxy coating.
   2. Thickness: Minimum of [60] [100] mils in 1 or 2 coats.
   3. Number of Components: 2.
   4. Finish: Gloss.

Specifier Notes: Specify one of the following three standard colors or specify a custom color. Custom colors are available by special order.

5. Color: [White] [Light gray] [Light blue] [_____].

D. Corrosion Barrier Coating: Mainstay DS-6 Ultra High Build Novolac Epoxy Coating.
   1. Composition: 100 percent solids, novolac epoxy coating.
   2. Thickness: Minimum of [60] [100] mils in 1 or 2 coats.
   3. Number of Components: 2.
   4. Finish: Semigloss.
   5. Color: Light gray.

E. Manhole Frame Seal: Madewell 806 Flexible Epoxy
   1. Composition: 100% solids, flexible epoxy trowel-grade mastic
   2. Thickness: Minimum of ¼"
   3. Number of Components: 2
   4. Finish: Semigloss.
   5. Color: Light gray

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive restoration mortar. Notify the Engineer in writing if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

B. Provide the Engineer with a minimum of 3 days advance notice of completion of surface preparation and start of application.

C. Before application of each material, surfaces to be lined will be inspected by the Engineer. Correct defects or deficiencies before application of subsequent material.

D. Inspection by the Engineer or the waiver of inspection of any portion of the work shall not relieve the Contractor of responsibility to perform the work as specified.

3.02 SURFACE PREPARATION

A. Prepare surfaces in accordance with manufacturer's instructions.

B. Cleaning: Clean surfaces by water or abrasive blasting (minimum 3,500 psi water blast), or hand or power tools as required to remove all unsound concrete, contaminants, dirt, debris, and deteriorated reinforcing steel.

C. Inspection:
   1. Inspect cleaned surfaces to identify and mark corroded reinforcing steel; and to locate cracks, leaks, and joints.
   2. If indicated, perform electrical potential testing in accordance with ASTM C 876.

D. Replace or treat corroded reinforcing steel, repair cracks and leaks, and treat joints in accordance with manufacturer's instructions and as approved by the Engineer.

E. Refer to ICRI Technical Guideline No. 03730 - Surface Preparation Guidelines for the Repair of Deteriorated Concrete Resulting From Reinforcing Steel Corrosion.

F. Apply Madewell 1312P epoxy putty after cleaning reinforcing steel to protect the steel from contamination and re-rusting.

G. Prepare surfaces to have a minimum profile of 1/16 inch, with aggregate exposed.

H. Inspect surfaces for soundness.

I. Saturate all surfaces thoroughly with clean water.

J. Apply restoration mortar as soon as water sheen is no longer visible (saturated surface dry).

K. Hydrostatic Leak Correction:
   1. Stop visible hydrostatic leaks by application of Mainstay ML-10 hydraulic cement mortar, after completion of surface preparation.
      a. Mix only 1 to 2 pounds of Mainstay ML-10 at a time.
      b. Add water to form a viscous mass with consistency of modeling clay.
      c. Apply by hand or trowel.
      d. Press mixed material firmly into place, starting at top of leak and working downward.
   2. Inject flowing leaks or cracks using a suitable polymer gel or foam approved by the Engineer. Remove excess or spilled material from concrete surface before application of restoration mortar.

3.03 APPLICATION OF RESTORATION MORTAR

A. Apply restoration mortar in accordance with manufacturer's instructions.

B. Apply by one of the following methods:
   1. Low pressure, low volume spray equipment (rotor/stator or piston pumps such as those manufactured by Putzmeister).
   2. Wet mix shotcrete equipment.
   3. Hand trowel into place.
   4. Centrifugal application by use of the Mainstay Mortar Applicator.

C. Apply uniformly to substrate to the specified thickness. Do not apply to manhole frame.

D. Do not trap air in corners, behind exposed reinforcing steel, or between lifts.

Specifier Notes: Consult Madewell Products for assistance in determining the minimum thickness of the restoration mortar. Mortar can be applied to a thickness of 1/2 to 5 inches in a single layer.

E. Mortar Thickness: Apply a minimum thickness of 1/2 inch above peaks of existing profile after surface preparation.

F. Finishing: Finish surface with wood float, sponge float, broom, or brush to produce a textured surface upon which to apply Corrosion Barrier Mortar.

G. Hot Weather Application:
   1. Follow manufacturer's instructions to reduce evaporation rate of surface moisture until Corrosion Barrier Mortar can be applied.
   2. If applying mortar under conditions such as high temperatures of mortar, substrate, or air; high winds; and low humidity; alone or in combination; rapid evaporation of surface moisture can occur and cause plastic shrinkage cracking. Apply Mainstay DS-4 Epoxy Corrosion Barrier Mortar or Madewell 927 primer/ sealer a maximum of 1 hour after placing Mainstay ML-72 Restoration Mortar.
   3. If conditions prevent application of Epoxy Corrosion Barrier Mortar or primer, refer to ACI 305R-91, Figure 2.1.5 to estimate the evaporation rate of surface moisture from the mortar, based on temperatures, relative humidity, and wind velocity. Cover with plastic film or wet burlap to limit evaporation rate to a maximum of 0.1 pounds per square foot per hour.

H. Cold Weather Application:
   1. Follow manufacturer's instructions for minimum application temperature and minimum number of days to protect from freezing.
   2. During cold weather (a period when for more than 3 successive days the average daily outdoor temperature drops below 40 degrees F) place Mainstay ML-72 mortar at a minimum temperature of 55 degrees F and protect mortar from freezing for a minimum period of 3 days at a temperature between 55 and 75 degrees F. Gradually reduce mortar temperature during the protection period so that the final 24 hours is held as close to 55 degrees F as practical.
   3. During periods not defined as cold weather, but when freezing temperatures may occur, protect the mortar against freezing as specified for cold weather for the first 24 hours after application.

3.04 APPLICATION OF EPOXY CORROSION BARRIER COATING

A. Apply Epoxy Corrosion Barrier Coating in accordance with manufacturer's instructions. Do not apply to manhole frame.

B. Apply Epoxy Corrosion Barrier Coating as soon as possible after finishing of restoration mortar, but before it is allowed to cure for more than 4 hours. If the Epoxy Corrosion Barrier Coating cannot be applied within this time frame, the surface of the Restoration Mortar shall be primed within that time frame with Madewell 927 Penetrating Primer to hold the surface for up to 72 hours.

C. Do not allow surface contamination to the finished restoration mortar before application of Epoxy Corrosion Barrier Coating. Remove any contamination of primed mortar before application of Epoxy Corrosion Barrier Coating by means of high pressure (min. 3,500 psi) water blast.

Specifier Notes: Consult Madewell Products for assistance in determining the minimum thickness of the Corrosion Barrier Mortar. Specify minimum Corrosion Barrier Mortar thickness of 100 mils for highly aggressive environments.

D. Corrosion Barrier Coating Thickness: Apply a minimum thickness of [60] [100] mils.

3.05 CURING OF CORROSION BARRIER COATING

A. Foot Traffic: Allow a minimum cure time of 24 hours at 70 degrees F.

Specifier Notes: Minimum cure time for chemical service will range from 3 hours to 3 days, depending on the chemicals involved and the temperature. Consult Madewell Products for assistance in determining the minimum cure time for chemical service.

B. Chemical Service: Allow a minimum cure time of _____ [hours] [days] at _____ degrees F.

C. Curing Conditions:
   1. Continue to protect Composite Liner from freezing throughout protection periods specified for cold weather application.
   2. Shelter Composite Liner from direct impingement of water until 1 to 3 hours after application of Corrosion Barrier Coating, depending on substrate temperatures, after which cure sufficiently to be undamaged by water impingement or immersion at ordinary velocities.
   3. Sanitary Sewer Systems: It may be necessary to plug services or main lines temporarily in order to achieve these environmental conditions, but bypass pumping should seldom be required.

D. Immersion Service: Reach a tack-free condition before being immersed.

3.6 APPLICATION OF MANHOLE FRAME SEAL

A. Surface Preparation
   1. Epoxy Corrosion Barrier Coating: Clean/decontaminate epoxy corrosion barrier coating if required. If within recoat window of epoxy corrosion barrier coating (72 hours), no further surface preparation is necessary. If recoat window has been exceeded, sand, sandblast, or wire brush, followed by a solvent wipe of, the epoxy corrosion barrier coating surface after cleaning/decontamination.
   2. Manhole Frame: Wire brush clean to SSPC SP-3 (Power Tool Cleaning) condition to remove all loose rust and any restoration mortar or epoxy corrosion barrier coating overspray. Surface shall be clean and dry before application of manhole frame seal material.

B. Apply Madewell 806 to a minimum thickness of ¼" to manhole, grade rings and manhole frame. Height of application depends on overall height of chimney, but minimum height will be 4" (2" above and below joint). Apply material with a putty knife to a uniform thickness and texture.

C. Allow Madewell 806 to cure at least 24 hours in load bearing applications. Do not apply below 50°F. Protect from freezing for at least 48 hours after application.

3.07 FIELD QUALITY CONTROL

A. Field Quality Control Testing: Performed by the Engineer or a NACE International Certified Coating Inspector at the Owner's expense.

B. Field Mock up: For projects greater than 3000 ft^2, the contractor shall install a 5' x 5' field mockup to be tested in accordance with C, D and E below before additional application work can proceed.

C. Destructive Dry Film Thickness Tests, ASTM D 4138:
   1. Perform 1 test for every 500 square feet of surface lined. If the thickness is correct, no further testing is required for that area.
   2. If the initial thickness test does not indicate correct film thickness, an additional 4 measurements will be made, the average of which must equal minimum specified thickness, although individual measurements may under run this amount by a maximum of 20 percent.
   3. Any area that does not meet the specified thickness as tested in 1. and 2. above, shall receive additional Epoxy Corrosion Barrier Coating (depending on the time and environment, additional surface preparation may be required).
   4. If the areas tested are of proper thickness, destructive test sites shall be repaired with the appropriate barrier mortar at the contractor's expense prior to placing the system into service.

D. Spot Adhesion Testing of Restoration and Corrosion Barrier Composite Liner to Substrate:
   1. Perform minimum of 1 uniaxial pull-off adhesion test for every 500 square feet of surface lined.
   2. Remove and replace areas not meeting required 145 psi at 28 days minimum adhesion requirement.
   3. If the condition of the substrate is such that minimum pull-off adhesion requirement cannot be met by removal of the upper 1/4" of the substrate, work shall not proceed until a course of corrective action has been determined that will effectively produce the required adhesion results. When an effective course of remedial action has been determined, the owner's representative and the contractor shall negotiate a mutually agreeable settlement to cover the costs associated with the surface evaluation and remedial action.

E. Visual and Electrical Inspection for Holidays in Epoxy Corrosion Barrier Coating:
   1. Visual Inspection: Perform visual inspection for holidays in Epoxy Corrosion Barrier Coating. Mark areas identified for repair and reapplication of Epoxy Corrosion Barrier Coating.
   2. Electrical Inspection: Perform spark testing in accordance with NACE RP 0188 or as recommended by the manufacturer. Mark areas identified for repair and reapplication of Corrosion Barrier Coating.
   3. Areas Marked for Repair or reapplication of Epoxy Corrosion Barrier Coating: Sand or grind down to substrate, clean, spray with Madewell 927 primer/sealer, and recoat with specified Mainstay Epoxy Corrosion Barrier Coating.

END OF SECTION