

## SECTION 03 01 30.71

### MAINTENANCE OF CAST-IN-PLACE CONCRETE REHABILITATION OF CAST-IN-PLACE CONCRETE

#### PART 1 - GENERAL

##### 1.1 GENERAL DESCRIPTION OF WORK

- A. Provide all labor, products and equipment required to properly install semi-rigid filler in interior concrete floor slab joints and cracks.

##### 1.2 SUMMARY

- A. Purpose: This Section includes materials and methods to repair deteriorated floor joints in interior concrete slabs on ground that meet the following:
  - 1. Slab is at least one year old, and significant slab shrinkage is not anticipated in the future
  - 2. Slab is fully supported by subgrade, and not rocking. Where rocking or slab deflection exists, utilize Slab Stabilizations procedures prior to commencement of joint, crack, or spal repair.
- B. Work includes the following activities:
  - 1. Removing deteriorated concrete and foreign material so surfaces are clean and ready for repair and rebuilding.
  - 2. Repairing deteriorated floor joints and fillers,
  - 3. Repairing uncontrolled floor cracks,
  - 4. Repairing spalled floor areas.
- C. Related Sections include the following:
  - 1. Division 3 Section "Cast-in-Place Concrete Floor Slab" for new floor installations.
  - 2. Division 3 Section "Concrete Shrinkage Control Joints and Fillers" for new floor installations
  - 3. Division 3 Section "Concrete Slab Patching And Repair" for minor concrete work in remodel projects.

##### 1.3 APPLICABLE STANDARDS

- A. Products and installation shall be in compliance or exceed the joint filling criteria established in the latest ACI 302 and ACI 360 Committee published documents.

##### 1.4 DEFINITIONS

- A. Floor Slab Joints: Joints deliberately created in regular, grid pattern intervals during construction, or added to weaken the slab.
  - 1. Construction Joints (C.J.) and Closure Strip Joints (C.S.J.): Formed joints between adjacent slab panels, where panels are separate concrete pours.

2. Shrinkage Joints (S.J.): Also called control or contraction joints, are saw-cut after slab troweling to control slab breaks caused by concrete shrinkage, and keep cracks in straight lines under the saw-cuts.
- B. Cracks in Floor Slab: Random, uncontrolled breaks in the floor slab.
1. Shrinkage Cracks: Caused by overall concrete shrinking beyond the capacity of shrinkage or construction joints to contain.
  2. Slab Curl Cracks: Caused by concrete shrinking faster at the slab top than the bottom, with resulting curl at pour edges, breaking may be from wheeled vehicle impact.
- C. Slab Spalls: Locations where slab surface has delaminated, chipped or broken off, exposing aggregate in the mix.

#### 1.5 CONTRACTOR QUALIFICATIONS

- A. Installer shall have a minimum of three (3) years experience in performing the types of work covered by this Section and shall be an Approved Applicator of the material manufacturer.
- B. Use only Metzger/McGuire Approved Applicators for work covered by this section.
- C. Approved Applicator shall use tools and equipment specifically designed for the preparation and placement of industrial joint fillers.

#### 1.6 SUBMITTALS

- A. Product Data: Include material descriptions, chemical composition, physical properties, test data, and mixing and application instructions.
- B. Source Limitations: Obtain materials through one source from a single manufacturer.
- C. Prepare mockups of repair materials and methods on the jobsite for review and approval by Owner/Architect. Including examples of repairs to each of the following conditions described in Part 3 "Execution" below:
  1. Joint Filler Repair
  2. Spall Repair Overlay
  3. Joint and Random Crack Repairs
    - a. Where overall width of crack is  $\frac{1}{4}$ " or less
    - b. Where overall width of crack exceeds  $\frac{1}{4}$ "
    - c. Where overall width of joint and slab spall is  $\frac{1}{2}$ " or less
    - d. Where overall width of joint and slab spall is between  $\frac{1}{2}$ "-1"
    - e. Where overall width of joint and slab spall exceeds 1"
  4. Small Surface Spall Repairs
  5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.
- B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

03 01 30 – 2

- C. Store aggregates, covered and in a dry location, where grading and other required characteristics can be maintained and contamination avoided.

**PART 2 - PRODUCTS**

2.1 JOINT FILLER AND SMALL CRACK REPAIR MATERIAL

- A. Provide a semi-rigid polymer resin manufactured and distributed for use as a floor joint and crack filler material to protect concrete joint edges. Use a rapid set, cold applied, gray colored, self-leveling, two-part filling system composed of 100% solids.

- B. Utilize products with physical properties meeting the following minimum values:

<u>PROPERTY</u> .....	<u>TEST METHOD</u> .....	<u>PROPERTY VALUE</u>
Shore A Hardness .....	ASTM D2240 .....	95 (-5, +5)
Compressive Yield.....	ASTM D695 .....	>1300 psi
Solids Content.....		100%
Acceptable for use in USDA regulated facilities		

- C. Available Products: Subject to compliance with requirements, utilize products manufactured by Metzger/McGuire Co. Concord NH 800-223-6680.

1. Metzger/McGuire: **“MM-80/MM-80P Semi-Rigid Epoxy Joint Filler”**
2. Metzger/McGuire: **“Spal-Pro 2000 Semi-Rigid Repair Polyurea”**
3. Metzger/McGuire: **“Edge-Pro 90 Semi-Rigid Polyurea Joint Filler”**

2.2 LARGE JOINT SPALL REPAIR MATERIAL

- A. Provide a high strength polymer resin material that is manufactured to repair and rebuild large openings and spalled concrete floor areas. Use a two-part, 100% solids, liquid system with high tensile strength, intended to be used alone or to be combined with aggregate to create a mortar.

- B. Use a product with the following physical properties before mixing with aggregate:

<u>PROPERTY</u> .....	<u>TEST METHOD</u> .....	<u>PROPERTY VALUE</u>
Shore D Hardness .....	ASTM D 2240 .....	75 (+/- 5)
Compressive Strength.....	ASTM D 790.....	10,500 PSI
Tensile Strength .....	ASTM D 638 .....	1,400 PSI
Adhesive Strength .....		Concrete Breaks
Acceptable for use in USDA regulated facilities		

- C. Available Repair Resin Products: Subject to compliance with requirements, utilize products manufactured by Metzger/McGuire Co. Concord NH 800-223-6680.

1. Metzger /McGuire: **“Armor-Hard / Armor-Hard Extreme Early Set Structural Epoxy”**.

- D. Sand Aggregate for Crack, Spall, and Joint Repair: Use fine, oven-dried, washed silica sand ranging from 20 to 40 or mortar pre-packaged with Armor-Hard Kit

- E. Spall and Crack Repair Mortar: Mix Polymer Repair Resin with sand aggregate, following manufacturer’s instructions. The mortar mix will be approximately 3 to 6 parts aggregate to one part repair resin.

2.3 SMALL SURFACE SPALL REPAIR MATERIAL

- A. Provide a low viscosity, high strength polyurea/polyurethane repair polymer resin material that is manufactured to repair and repair and resurface spalled concrete floor areas. Use a two-part, 100% solids, liquid system with high tensile strength.
- B. Use a product with the following physical properties before mixing with aggregate:

<u>PROPERTY .....</u>	<u>TEST METHOD .....</u>	<u>PROPERTY VALUE</u>
Shore D Hardness .....	ASTM D 2240 .....	70-75
Compressive Strength.....	ASTM D 790.....	4000 PSI
Tensile Strength .....	ASTM D 638 .....	5,500 PSI
Adhesive Strength .....		Concrete Breaks
Acceptable for use in USDA regulated facilities		

- C. Available Repair Resin Products: Subject to compliance with requirements, utilize products manufactured by Metzger/McGuire Co. Concord NH 800-223-6680.
  - 1. Metzger/McGuire: **“Rapid Refloor”**
  - 2. Metzger/McGuire: **“Rapid Refloor XP”**
  - 3. Metzger/McGuire: **“SRG”**

2.4 FULL PANEL REFSURFACING REPAIR MATERIAL

- A. Provide a trowelable, high strength epoxy flooring system manufactured to repair and repair and resurface spalled concrete floor areas. Use a two-part, 100% solids, liquid system with high tensile strength.
- B. Use a product with the following physical properties before mixing with aggregate:

<u>PROPERTY .....</u>	<u>TEST METHOD .....</u>	<u>PROPERTY VALUE</u>
Shore D Hardness .....	ASTM D 2240 .....	86
Compressive Strength.....	ASTM D 790.....	10,500 PSI
Tensile Strength .....	ASTM D 638 .....	1,400 PSI
Adhesive Strength .....		Concrete Fails
Acceptable for use in USDA regulated facilities		

- C. Available Repair Resin Products: Subject to compliance with requirements, utilize products manufactured by Metzger/McGuire Co. Concord NH 800-223-6680.
  - 1. Metzger/McGuire: **“Armor-Hard HDR Resurfacer”**
  - 2. Metzger/McGuire: **“Armor-Hard HDR Primer”**
  - 3. Metzger/McGuire: **“Armor-Hard HDR Sealer”**

2.5 DUST FREE PREPARATION EQUIPMENT

- A. **Subject to compliance with project requirements, provide equipment manufactured by the following:**
  - 1. US Saws
  - 2. Gorilla Concrete Tools
  - 3. Pulman-Ermator

4. Diamatic
5. Husqvarna
7. HTC
8. Perfect-Trac

B. DUST EXTRACTION SYSTEM FOR GRINDING/SAWING:

1. HEPA filtration vacuum, designed for use with all hand tools when grinding sawing concrete (minimum 125CFM air flow).
2. Provide one of the following:
  - a. S26/S36, by Pullman-Ermator
  - b. D30/D60, by HTC
  - c. Approved equal

C. JOINT FILLER REMOVAL AND PREPARATION

1. Dust Buggy (MKIII or Standard) by U.S. Saws
2. GCT-10/X Tank by Gorilla Concrete Tools
3. JS-130/JS-100E by U.S. Saws
4. Perfect-Trac Saw by Perfect-Trac.
5. Approved equal

D. CRACK REPAIR:

1. GCT-4.5/GCT-9 by Gorilla Concrete Tools
2. CC-100 by U.S. Saws
3. 5" Premium Handheld Crack Chaser by U.S. Saws
4. Approved equal

E. SURFACE GRINDER: Handheld 5"-7" electric surface grinder with dustless shroud/housing:

1. 5" Pro GC Metabo with Shroud by U.S. Saws
2. Approved equal

### **PART 3 - EXECUTION**

3.1 FLOOR SURVEY

- A. Repair floor joints and cracks in the concrete floor slab where indicated on the drawings, where identified by Owner's Representative at specific locations, or generally identified by existing crack or joint conditions.
- B. Visually examine the floor joints and cracks in the slab observing the following -
  1. Where semi-rigid joint filler is most appropriate material.
  2. Where spall and crack repair mortar is most appropriate material.
  3. Notify the Owner's Representative where other defective areas are observed and not indicated for repair work, but where repair is appropriate.

## 3.2 FLOOR SLAB REPAIRS AT JOINTS AND CRACKS

### A. Shrinkage and Construction Joint Repairs

1. Joints where overall width of joint and edge spall is 1/2" or less -
  - a. Where narrow joint conditions exist with little to no edge spalling, clean both joint sidewalls to full original depth utilizing a diamond blade equipped dust free saw.
  - b. Where minor edge raveling or spalling exists, prepare joint by making 1/2" minimum depth (3/4" preferred) vertical sawcuts at spall edges, then remove material to provide a channel to accept repair material.
  - c. Where necessary, clean dry silica sand can be placed at the bottom of the joint (1/4" maximum layer) to seal off any opening and prevent excessive filler seepage or run through.
  - c. Following Manufacturer's mixing and installation instructions fill the joint with Polymer Filler Resin, "MM-80/MM-80P Epoxy" so top of resin is slightly crowned above floor surface. Monitor top to assure fill remains crowned.
  - d. After resin has cured, trim the overfill using a stiff, sharp razor so top of Filler Resin is flush with concrete floor on both sides. Heating of "MM-80/MM-80P Epoxy" prior to shaving may be necessary to provide a smooth, flush finish profile.
  
2. Joints where overall width of joint and edge spall is 1/2" to 1" -
  - d. Prepare joint by making 1/2" minimum depth (3/4" preferred) vertical sawcuts at spall edges, then remove material to provide a channel to accept repair material.
  - e. Where necessary, clean dry silica sand can be placed at the bottom of the joint (1/4" maximum layer) to seal off any opening and prevent excessive filler seepage or run through.
  - c. Following Manufacturer's mixing and installation instructions fill the joint with Polymer Filler Resin, "MM-80/MM-80P Epoxy" sand modified with clean, dry bagged silica sand at approximately 1:1 by volume so top of resin is slightly crowned above floor surface. Monitor top to assure fill remains crowned.
  - d. After resin has cured, grind the surface of the overfilled joint flush to the slab surface utilizing an appropriate abrasive blade equipped right angle grinder to provide a smooth, flush finished profile.
  
3. Joints where overall width of joint and edge spall is more than 1" -
  - a. Prepare joint by making straight, vertical sawcuts at spall edges, then remove delaminated material and deteriorated concrete surface material.
  - b. Where necessary, clean dry silica sand can be placed at the bottom of the joint (1/4" maximum layer) to seal off any opening and prevent excessive filler seepage or run through.
  - c. Prime sides and bottom of repair area using brush applied Polymer Repair Resin, "Armor-Hard / Armor-Hard Extreme", liquid (without aggregate).
  - d. Blend "Armor-Hard / Armor-Hard Extreme" liquid with aggregate creating a mortar. Fill area with the Repair Mortar: Trowel top of repair mortar to be flush with concrete surfaces on both sides.

- e. After Repair Mortar has cured, grind top and edges to be flush and smooth with concrete floor on both sides.
- f. Create a RELIEF cut through the center of the repair mortar by re-sawcutting so as not to structurally bond both sides of a moving joint or crack together. The relief cut should extend down through the structural mortar repair.
- g. Following Manufacturer's mixing and installation instructions re-fill the relief cut with Polymer Filler Resin, "MM-80/MM-80P Epoxy" so top of resin is slightly crowned above floor surface. Monitor top to assure fill remains crowned.
- h. After resin has cured, trim the overfill using a stiff, sharp razor so top of Filler Resin is flush with concrete floor on both sides. Heating of "MM-80/MM-80P Epoxy" prior to shaving may be necessary to provide a smooth, flush finish profile.

B. Floor Slab Random Crack Repairs:

- 1. Random cracks less than 1/4" wide, not subject to movement, which are specifically identified to be repaired:
  - a. Utilizing a soft wire wheel on a right angle grinder chase crack with wire wheel to remove debris and any islands concrete which is not structurally sound. Vacuum clean after chasing with wire wheel.
  - b. Following Manufacturer's installation instructions and fill crack with low viscosity structural resin "Rapid Refloor," so top of resin is slightly crowned above floor surface. Monitor top to assure fill remains crowned.
  - c. After resin has cured, grind off overfill using dustless shrouded grinder equipped with medium grit abrasive finishing pad (Gator Grit Medium Stripping Pad, Norton Rapid Strip Pad or =).
- 2. Random cracks greater than 1/4" wide, subject to movement, which are specifically identified to be repaired:
  - a. Utilizing dust-free cleanout and crack chasing saws as outlined in Section 2.3, cut along the crack to a depth of approximately 3/4" (1/2" minimum) creating a straight, clean vertical edge. Ensure that this defining cut has removed all previously adhered fillers, concrete "islands", and any loose or weak concrete from the crack edge.
  - b. Following Manufacturer's mixing and installation instructions fill the joint with Polymer Filler Resin, "MM-80/MM-80P Epoxy" so top of resin is slightly crowned above floor surface. Monitor top to assure fill remains crowned.
  - c. After resin has cured, trim the overfill using a stiff, sharp razor so top of Filler Resin is flush with concrete floor on both sides. Heating of "MM-80/MM-80P Epoxy" prior to shaving may be necessary to provide a smooth, flush finish profile.

### 3.3 WIDE AREA SPALL REPAIR (Greater than 4" Diameter)

#### A. Surface Preparation for Wide Area Spall Repair.

1. Clean surfaces free of oil, grease, coatings, sealers, paint, rust, etc. Verify surfaces are dry, and structurally sound.
2. Remove delaminated material and deteriorated concrete surface material. Roughen surface of concrete by sand blasting, shot blasting, scarifying, or milling. Sweep and vacuum roughened surface to remove debris.
3. Prevent feather edging by making vertical cuts at the spall outer edges.

#### B. Spall Repair Mortar Installation:

1. Mix Polymer Repair Resin, "Armor-Hard / Armor-Hard Extreme", per manufacturer's recommendations thoroughly blending Part A & Part B components.
2. Prime spalled area with brush-applied "Armor-Hard / Armor-Hard Extreme" liquid (without aggregate).
3. Blend "Armor-Hard / Armor-Hard Extreme" liquid with aggregate creating a mortar. Fill area with the Repair Mortar: Trowel top of repair mortar to be flush with concrete surfaces on both sides.
4. After Repair Mortar has cured, grind top and edges of mortar and the adjacent concrete to ensure flush, smooth surfaces on both sides.

#### C. Where WIDE AREA SPALL REPAIR is adjacent to existing joints or cracks:

1. Create a RELIEF cut through the center of the repair mortar by re-sawcutting so as not to structurally bond both sides of a moving joint or crack together. The relief cut should extend down through the structural mortar repair.
2. Following Manufacturer's mixing and installation instructions re-fill the relief cut with Semi-Rigid Filler, so top of resin is slightly crowned above floor surface. Monitor top to assure fill remains crowned.
3. After resin has cured, trim the overfill using a stiff, sharp razor so top of Filler Resin is flush with concrete floor on both sides. If using "MM-80/MM-80P Epoxy" heating prior to shaving may be necessary to provide a smooth, flush finish profile.

### 3.4 SMALL AREA SPALL REPAIR (Less than 4" Diameter)

#### A. Surface Preparation for Wide Area Spall Repair.

1. Clean surfaces free of oil, grease, coatings, sealers, paint, rust, etc. Verify surfaces are dry, and structurally sound.
2. Remove delaminated material and deteriorated concrete surface material. Roughen/clean surface of concrete using a right angle grinder with soft wire wheel (brass or soft steel).
3. Sweep and vacuum roughened surface to remove debris.

#### B. Spall Repair Installation:

1. Dispense Polymer Repair Resin, "Rapid Refloor or Rapid Refloor XP or SRG", per manufacturer's recommendations using dual cartridge kit or 2 gallon kit.
2. Slightly overfill defect and allow to cure.



3. Use medium grit abrasive finishing pad (Gator Grit Medium Stripping Pad, Norton Rapid Strip Pad or =) to grind off overfill and restore flush surface profile.

### 3.4 REPLACING UNSATISFACTORY JOINT FILLER

- A. Remove and replace the existing filler where the following unsatisfactory conditions are present at existing joints -
  1. Lost Adhesive Bond: Previous filler installation failed because adhesion is lost on both sides of the joint walls. Usually caused by inadequate cleaning or placement of original filler.
  2. Filler Push-Down: Previous filler placement was not full joint depth, adhesion to concrete sidewalls has failed, and filler has dropped below the joint surface.
  3. Missing Joint Filler: Filler is altogether absent in the joint.
  4. Unsuitable Filler Resin Mix; Previous filler had improper ratio of "A" and "B" mix and has not cured to meet the physical properties specified.
- B. After completely removing existing filler, prepare opening for new filler installation following procedures specified given the specific joint conditions (width, repair type, etc.) outlined in this specification.

### 3.5 FULL PANEL RESURFACING/REPAIR

- A. Surface Preparation for Full Panel Resurfacing/Repair
  1. Clean surfaces free of oil, grease, coatings, sealers, paint, rust, etc. Verify surfaces are dry, and structurally sound. Use warm (120-140F) caustic detergents or a chemical cleaner/degreaser if needed.
  2. Remove delaminated material and deteriorated concrete surface material. Roughen surface of concrete by sand blasting, shot blasting, scarifying, or milling. Sweep and vacuum roughened surface to remove debris.
  3. Prevent feather edging by making vertical cuts at the spall outer edges.
- B. Armor-Hard HDR Primer Application:
  1. Mix Epoxy Repair Resin, "Armor-Hard HDR Primer", per manufacturer's recommendations thoroughly blending Part A & Part B components.
  2. Apply "Armor-Hard HDR Primer" using a brush or short nap roller. A thin uniform coat is preferred.
- C. Armor-Hard HDR Mortar Installation:
  1. Mix Epoxy Repair Resin, "Armor-Hard HDR", per manufacturer's recommendations thoroughly blending Part A & Part B components.
  2. Add half of the troweling aggregate, let mix for 1-2 minutes, then add remaining troweling aggregate and mix for an additional 3 minutes.
  3. Immediately pour out the mixed kit onto the floor in 7-10" wide strips. Spread evenly with a clean trowel.
  4. After Repair Mortar has cured, grind top and edges of mortar and the adjacent concrete to ensure flush, smooth surfaces on both sides.

END OF SECTION 03 01 30

03 01 30 – 9