

SECTION 040120.63 – BRICK AND TERRA COTTA CLAY MASONRY REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Maintenance of unit masonry consisting of brick and terra cotta clay masonry restoration and cleaning.
2. Repairing unit masonry, including replacing units.
3. Preliminary cleaning, including removing plant growth.
4. Cleaning exposed unit masonry surfaces.
5. Paint removal (unless existing brick was intended to be painted).

B. Related Sections:

1. Section 040140.62 – Brick and Terra Cotta Masonry Repointing

C. Reference and Industry Standards

1. The following reference standards are applicable to this Section:
 - a. The current Enterprise Green Communities (EGC) Criteria, and the current New York City Overlay.
2. Brick Industry Association (BIA) Technical Notes
 - #20 Cleaning Brickwork.
3. Industry Standards
 - ASTM (American Society of Testing and Materials).

D. The current NYC Overlay of the current Enterprise Green Communities Criteria:

1. Mandatory Requirements: See the NYC Overlay of the EGC reference standard for full specifications.
 - a. All projects must achieve compliance with the mandatory criteria measures that are applicable:
 - Criterion 6.4: Healthier Material Selection
 - Criterion 6.9: Managing Moisture: Roofing and Wall Systems
 - Criterion 6.10: Construction Waste Management
2. Optional Project Requirements for Certification Points

- a. Additionally, rehab projects are required to achieve **55** optional points. Criteria with optional points related to this Specification Section include, but may not be limited to:
 - Criterion 6.1: Ingredient Transparency for Material Health
 - Criterion 6.3: Chemical Hazard Optimization
 - Criterion 6.5: Environmentally Responsible Material Selection
 - Criterion 6.7: Regional Materials
 - Criterion 6.10: Construction Waste Management

1.2 DEFINITIONS

- A. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.
- B. Very-Low-Pressure Spray: under 100 psi.
- C. Low-Pressure Spray: 100 to 400 psi.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Shop Drawings:
 - a. Include plans, elevations, sections, and locations of replacement bricks on the structure.
 - b. Show provisions for expansion joints or other sealant joints.
- B. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Documentation for compliance with Enterprise Green Communities criteria.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction testing is prudent where a New York City Landmarks Commission or National or State designated historic building requires restoration.
- B. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on masonry units as follows.
 1. Existing Brick and Terra Cotta: Test each type of existing masonry unit indicated for replacement, according to testing methods in ASTM C 67 for compressive strength, 24-

hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove five (5) existing units from locations designated by the Design-Professional-of-Record or by HPD. Take testing samples from these units.

2. Existing Mortar: Test according to ASTM C 295, modified as agreed by testing service and Design-Professional-of-Record for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength. Use X-ray diffraction, infrared spectroscopy, and differential thermal analysis as necessary to supplement microscopical methods. Carefully remove existing mortar from within joints at five (5) locations designated by the Design Professional of Record of Record or the testing service.
3. **Existing Mortar of tenement buildings erected before 1929**: Determine by testing if Portland cement was utilized. Portland cement is prohibited from mortar repairs if it had not been originally utilized. Carefully remove existing mortar from within joints at five (5) locations designated by the Design-Professional-of-Record or the testing service.
4. Temporary Patch: As directed by the Design-Professional-of-Record, provide temporary materials at locations from which existing samples were taken.
5. Replacement Brick and Terra Cotta: Test each proposed type of replacement masonry unit, according to sampling and testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).

1.7 SEQUENCING / SCHEDULING:

A. Perform brick repair work in the following sequence:

1. Remove biological growth
2. Remove coatings, stains and foreign material from all brick surfaces.
3. Rake-out existing mortar from joints of brick indicated to be repaired. *Refer to Section 040140.62 Brick and Terra Cotta Masonry Repointing before proceeding.*
4. Repair brick, including replacing existing brick with new brick materials as indicated.
5. Point mortar joints. *Refer to Section 040140.62 Brick and Terra Cotta Masonry Repointing before proceeding.*
6. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
7. Clean brick surfaces.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. Face Brick: As required to complete brick masonry repair work.

1. Brick Matching Existing: Units with colors, color variation within units, surface texture, size, and shape that match existing brickwork.
 - a. Physical Properties: According to ASTM C67.

- b. For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.
- 2. Special Shapes:
 - a. Provide molded, 100 percent solid shapes for applications where core holes or "frogs" could be exposed to view or weather when in final position and where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - b. Provide specially ground units, shaped to match patterns, for arches and where indicated.
 - c. Mechanical chopping or breaking brick, or bonding pieces of brick together by adhesive, are unacceptable procedures for fabricating special shapes.
- B. Building Brick: ASTM C62, Grade SW where in contact with earth or Grade SW, MW, or NW for concealed backup; and of same vertical dimension as face brick, for masonry work concealed from view.
- C. Precast Concrete, Stone: Provide precast concrete and stone units to match existing units in body composition, physical properties, color, gloss, surface texture, thickness, profile, and dimensions.
- D. Brownstone Terra Cotta: Provide new, unglazed, brownstone terra cotta units to match existing terra cotta units in body composition, physical properties, colors, color variation within units, surface texture, unit profile, and dimensions.
 - a. Physical Properties per ASTM C67.
 - b. For existing terra cotta that exhibits a range of colors or color variation within units, provide terra cotta that proportionally matches that range and variation rather than terra cotta that matches an individual color within that range.

2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C150, Type I or Type II, except Type III may be used for cold-weather construction; white [**or gray, or both**] where required for color matching of mortar.
 - 1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Mortar Sand: ASTM C144, unless otherwise indicated.
 - 1. Color: Provide natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
 - 2. For pointing mortar, provide sand with rounded edges.
 - 3. Match size, texture and gradation of existing mortar, compounded for mortar mixes. Blend several sands, if necessary, to achieve suitable match.

- D. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
- E. Water: Potable.

2.3 MANUFACTURED REPAIR MATERIALS

- A. Brick Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching brick masonry.
 - 1. Use formulation that is vapor and water permeable (equal to or more than the brick), exhibits low shrinkage, has lower modulus of elasticity than bricks being repaired, and develops high bond strength to all types of masonry.
 - 2. Formulate patching compound in colors and textures to match each brick being patched.

2.4 ACCESSORY MATERIALS

- A. Setting Buttons and Shims: Resilient plastic, non-staining to masonry, sized to suit joint thicknesses and bed depths of bricks, less the required depth of pointing materials unless removed before pointing.
- B. Terra Cotta Anchors: Type and size indicated or, if not indicated, to match existing anchors in size and type. Fabricate anchors from Type 304 stainless steel.
- C. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 - 1. Previous effectiveness in performing the work involved.
 - 2. Minimal possibility of damaging exposed surfaces.
 - 3. Consistency of each application.
 - 4. Uniformity of the resulting overall appearance.
 - 5. Do not use products or tools that could leave residue on surfaces.

2.5 MORTAR MIXES

- A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
- B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without the approval of the Design Professional of Record.
 - 1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent.
 - 2. Do not use admixtures in mortar unless otherwise indicated.
 - 3. Mixes: Mix mortar materials in the following proportions:

- a. Rebuilding (Setting) Mortar by Type: ASTM C270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to [**Portland cement and lime**] [**masonry cement**] [**or**] [**mortar cement**].
- b. Pigmented, Colored Mortar: Add mortar pigments to produce exposed, setting (rebuilding) mortars of colors required.

2.6 PAINT REMOVERS

- A. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming alkaline formulation for removing paint coatings from masonry.
- B. Solvent-Type Paint Remover: Manufacturer's standard water-rinsable, solvent-type gel formulation for removing paint coatings from masonry.
- C. Low-Odor, Solvent-Type Paint Remover: Manufacturer's standard low-odor, water-rinsable solvent-type gel formulation, containing no methanol or methylene chloride, for removing paint coatings from masonry.

2.7 CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F.
- C. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium polyphosphate, 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of 3. solution
- D. Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 2 cups of tetrasodium polyphosphate, 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gal of solution required.
- E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
- F. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.
- G. Mild Acidic Cleaner: Manufacturer's standard mildly acidic cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.

2.8. CHEMICAL CLEANING SOLUTIONS

- A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical-cleaner manufacturer.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Remove gutters [**and downspouts**] adjacent to masonry and store during masonry repair. Reinstall when repairs are complete.
- B. Provide temporary rain drainage during work to direct water away from building.

3.2 BRICK REMOVAL AND REPLACEMENT

- A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated [**or are to be reused**]. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
- B. Support and protect remaining masonry that surrounds removal area.
- C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
- D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- E. Remove in an undamaged condition as many whole bricks as possible.
 - 1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
 - 2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
- F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.
- G. Replace removed damaged brick with other removed brick in good condition, where possible, matching existing brick. Do not use broken units unless they can be cut to usable size.
- H. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
 - 1. Maintain joint width for replacement units to match existing joints.
 - 2. Use setting buttons or shims to set units accurately spaced with uniform joints.
- I. Lay replacement brick with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
 - 1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.

2. Rake out mortar used for laying brick before mortar sets according to *Section 040120.64 "Brick and Terra Cotta Clay Masonry Repointing."* Point at same time as repointing of surrounding area.
 3. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.
- J. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
- K. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.3 TERRA COTTA REMOVAL AND REPLACEMENT

- A. At locations indicated, remove terra cotta units that are damaged, spalled, or deteriorated. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
- B. Support and protect remaining masonry that was supported by removed units. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
- C. Notify the Design Professional of Record and HPD of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- D. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
- E. Install replacement units into bonding and coursing pattern of existing units.
1. If minor cutting of replacement brownstone terra cotta is required, use a motor-driven grinder or saw designed to cut masonry with clean, sharp, unchipped edges. Do not cut or grind more than 1/8 inch along any edge.
 2. Use setting buttons or shims to set units accurately spaced with uniform joints.
- F. Set replacement units in a full bed of mortar. Replace existing anchors with new anchors of size and type indicated.
1. Embed anchors in mortar and fill voids behind units with mortar.
 2. Tool exposed mortar joints in repaired areas to match joints of surrounding existing terra cotta in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.
 3. Rake out mortar used for laying terra cotta before mortar sets and point new mortar joints in
 4. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.

3.4 BRICK MASONRY PATCHING

A. Patching Bricks:

1. Remove loose material from masonry surface. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch thick, but not less than recommended in writing by patching compound manufacturer.
2. Mask adjacent mortar joint or rake out for repointing if patch extends to edge of brick.
3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
4. Rinse surface to be patched and leave damp, but without standing water.
5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
6. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of brick. Shape and finish surface before or after curing, as determined by testing, to best match existing brick.
8. Keep each layer damp for 72 hours or until patching compound has set.

B. Patching Terra Cotta:

1. Remove deteriorated material as determined by sounding gently with a small hammer. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4-inch thick, but not less than recommended by patching compound manufacturer.
2. Where mortar joints adjacent to patch are open, fill back of joints with pointing mortar and allow curing before patching terra cotta.
3. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of unit.
4. Rinse surface to be patched and leave damp, but without standing water.
5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
6. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
7. Do not apply patching compound over mortar joints. If patching compound bridges mortar joints, cut out joints after patching compound hardens.
8. Trowel, scrape, or carve surface of patch to match texture, details, and surrounding surface plane or contour of terra cotta. Shape and finish surface before or after curing, as determined by testing to best match existing terra cotta.
9. Keep each layer damp for 72 hours or until patching compound has set.

3.5 CLEANING MASONRY, GENERAL

- A. Proceed with cleaning in an orderly manner; work from **[bottom to top]** **[top to bottom]** of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.
- B. Use only those cleaning methods indicated for each masonry material and location.
 - 1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
 - 2. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
- C. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.
- D. Equip units with pressure gauges.
- E. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
- F. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
- G. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
- H. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.
 - 1. Water-Spray Application Method: Unless otherwise indicated, hold spray nozzle at least 6 inches from surface of masonry and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
 - 2. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces to comply with chemical-cleaner manufacturer's written instructions; use brush application. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.
 - 3. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
 - 4. Apply neutralizing agent and repeat rinse, if necessary, to produce tested pH of between 6.7 and 7.5.

3.6 PRELIMINARY CLEANING

- A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and

allowing to dry as long as possible before removal. Remove loose soil and debris from open masonry joints to whatever depth they occur.

- B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.
 - 1. Carefully remove heavy accumulations of material from surface of masonry with a sharp chisel. Do not scratch or chip masonry surface.
 - 2. Remove paint and calking with alkaline paint remover.
 - a. Repeat application up to two times if needed.
 - 3. Remove asphalt and tar with solvent-type paint remover.
 - a. Apply paint remover only to asphalt and tar by brush without prewetting.
 - b. Allow paint remover to remain on surface for 10 to 30 minutes.
 - c. Repeat application if needed.

3.7 PAINT REMOVAL

A. Paint Removal with Solvent-Type Paint Remover:

- 1. Remove loose and peeling paint using very low-pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
- 2. Apply thick coating of paint remover to painted masonry with natural-fiber cleaning brush, deep-nap roller, or large paint brush.
- 3. Allow paint remover to remain on surface for period recommended by manufacturer. Agitate periodically with stiff-fiber brush.
- 4. Rinse with hot water applied by very low-pressure spray to remove chemicals and paint residue.

3.8 CLEANING MASONRY

A. Detergent Cleaning:

- 1. Wet masonry with hot water applied by very low-pressure spray.
- 2. Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that masonry surface remains wet.
- 3. Rinse with hot water applied by very low-pressure spray to remove detergent solution and soil.
- 4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

B. Mold, Mildew, and Algae Removal:

- 1. Wet masonry with hot water applied by very low-pressure spray.
- 2. Apply mold, mildew, and algae remover by brush or very low-pressure spray.

3. Scrub masonry with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that masonry surface remains wet.
4. Rinse with hot water applied by very low-pressure spray to remove mold, mildew, and algae remover and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

C. Nonacidic Gel Chemical Cleaning:

1. Wet masonry with **[cold]** **[hot]** water applied by very low-pressure spray.
2. Apply nonacidic gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
3. Let cleaner remain on surface for period indicated below:
 - a. As recommended by chemical-cleaner manufacturer.
 - b. As established by mockup.
4. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
5. Rinse with hot water applied by very low-pressure spray to remove chemicals and soil.
6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once.

D. Nonacidic Liquid Chemical Cleaning:

1. Wet masonry with hot water applied by very low-pressure spray.
2. Apply cleaner to masonry in two applications by brush or very low-pressure spray. Let cleaner remain on surface for period indicated below:
 - a. As recommended by chemical-cleaner manufacturer.
3. Rinse with hot water applied by very low-pressure spray to remove chemicals and soil.

3.9 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low pressure spray.
1. Do not use metal scrapers or brushes.
 2. Do not use acidic or alkaline cleaners.

END OF SECTION 040120.63