

SECTION 04530 - STONE MASONRY RESTORATION AND CLEANING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Removing plant growth.
- B. Repairing damaged stone masonry.
- C. Cleaning exposed stone masonry surfaces.
- D. Repointing mortar joints.
- E. Stone consolidation treatment.

1.2 RELATED SECTIONS

- A. Section 07900 - Joint Sealants: Specified for restored stone masonry construction.

1.3 DEFINITIONS

- A. Repointing: The process of raking out (removing) mortar and replacing it with new mortar.
- B. Pointing: The process of placing new mortar in existing joint spaces that have previously been raked out. This term does not include the raking out process.
- C. Tuckpointing: The process of touching up existing mortar joints by filling in recesses with new mortar, without first raking out the joints.

1.4 SUBMITTALS

- A. General: Submit in accordance with Section 01300.
- B. Product Data for each product indicated including recommendations for their application and use. Include test reports and certifications substantiating that products comply with requirements.
- C. Samples for Verification Purposes, Prior to Erecting the Mockup, of the Following:
 - 1. Each new exposed masonry material to be used for replacing existing materials. Include in each set of samples the full range of colors and textures to be expected in the completed Work.
 - a. 12-by-12-inch minimum stone samples.
 - 2. Each type of mortar for pointing and masonry rebuilding and repair in the form of sample strips of mortar 6 inches long by 1/2 inch wide set in aluminum or plastic channels.
 - 3. Each type of chemical cleaning material.
 - 4. Each type of adhesive.
 - 5. Each type of anchor.
- D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.
- E. Restoration program for each phase of the restoration process, including protection of surrounding materials on building and site during operations. Describe in detail the materials, methods, and equipment to be used for each phase of the restoration work.

- F. Cleaning program indicating cleaning process, including protection of surrounding materials on building and site, and control of runoff during operations. Describe in detail the materials, methods, and equipment to be used.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A company regularly engaged in producing masonry cleaning compounds, which have been used on similar projects with successful results, and that retains factory-trained representatives who are available for consultation and jobsite inspection and assistance at no additional cost.
- B. Field-Constructed Mockups: Prior to start of general masonry restoration, prepare the following sample panels on the building where directed by Architect. Prepare sample panels using same materials and methods proposed for the Work, and under same weather conditions to be expected during time of the Work. Obtain Architect's acceptance of visual qualities before proceeding with the Work. Retain acceptable panels in an undisturbed condition, suitably marked, during construction as a standard for judging the completed Work.
 - 1. Cleaning: Demonstrate materials and methods to be used for cleaning each type of masonry surface and condition on sample panels approximately 25 sq. ft. in area.
 - a. Test cleaners and methods on samples of adjacent nonmasonry materials for possible reaction with cleaners, except where cleaners and methods are known to have a deleterious effect.
 - b. Allow a waiting period of the duration indicated, but not less than 7 calendar days, after completion of sample cleaning to permit a study of sample panels for negative reactions.
 - 2. Repointing: Prepare two separate sample areas approximately 3 feet high by 6 feet wide for each type of repointing required, one for demonstrating methods and quality of workmanship expected in removing mortar from joints and the other for demonstrating quality of materials and workmanship expected in pointing mortar joints.
 - 3. Masonry Repair: Prepare sample panels of size indicated for each type of masonry material indicated to be patched, rebuilt, or replaced. Erect mockup panels into an existing wall, unless otherwise indicated, to demonstrate the quality of materials and workmanship.
 - 4. Stone Consolidation Treatment: Demonstrate materials and methods to be used on a sample panel approximately 25 sq. ft. in area.
 - 5. Source of Materials: Obtain materials for stone masonry restoration from a single source for each type material required (stone, cement, sand, etc.) to ensure a match of quality, color, pattern, and texture.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Carefully pack, handle, and ship stone and accessories strapped together in suitable packs or pallets, or in crates or heavy-duty containers. Unload and handle to prevent chipping and breaking.
- B. Deliver other materials to Project site in manufacturer's original and unopened containers and packaging, bearing labels as to type and names of products and manufacturers.
- C. Protect masonry restoration materials during storage and construction from rain, snow, and ground water, and from staining or mixing with soil and other materials.
- D. Protect grout, mortar, and other materials from deterioration by moisture and temperature. Store in a dry place or in waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing.
- E. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

1.7 PROJECT CONDITIONS

- A. Clean masonry surfaces only when air temperature is 40EF (4EC) and above and will remain so until masonry has dried out, but for not less than 7 days after completion of cleaning.
- B. Do not repoint mortar joints or repair masonry unless air temperature is between 40EF (4EC) and 80EF (27EC) and will remain so for at least 48 hours after completion of Work.
- C. Apply stone consolidation treatment only when surface and air temperatures are between 50EF (10EC) and 90EF (32EC) and rain is not expected within 24 hours.

- D. Prevent grout or mortar used in repointing and repair work from staining face of surrounding masonry and other surfaces. Immediately remove grout and mortar in contact with exposed masonry and other surfaces.
- E. Protect sills, ledges, and projections from mortar droppings.

1.8 SEQUENCING/SCHEDULING

- A. Order replacement materials at the earliest possible date, to avoid delaying completion of the Work.
- B. Perform masonry restoration work in the following sequence:
 - 1. Repair existing masonry, including replacing existing masonry with new masonry materials.
 - 2. Rake out existing mortar from joints indicated to be repointed.
 - 3. Repoint existing mortar joints of masonry indicated to be restored.
 - 4. Clean existing masonry surfaces. Remove plants, paint, and soot prior to general cleaning.
 - 5. Point existing mortar joints of masonry indicated to be restored.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

- A. Stone: Provide natural building stone of type (classification), color, surface texture, and size to match existing stone.

2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type II.
 - 1. Provide nonstaining white cement complying with staining requirement of ASTM C 91 for not more than 0.03 percent water-soluble alkali.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Aggregate for Mortar: ASTM C 144, unless otherwise indicated.
 - 1. Colored Mortar Aggregate: Natural or manufactured sand selected to produce mortar color indicated.
 - a. For pointing mortar, provide sand with rounded edges.
 - b. Match size, texture, and gradation of existing mortar as closely as possible.
- D. Factory-Mixed Patching Mortar: Cement-based mortar, custom-manufactured for patching stone masonry and formulated to match the stone in color and texture. Mortar shall contain no acrylics, polymers, or metal constituents.
 - 1. Product: Subject to compliance with requirements, provide Jahn Restoration Mortar, Cathedral Stone Products, Inc.
- E. Water: Clean, free of oils, acids, alkalis, and organic matter.

2.3 CLEANING MATERIALS AND EQUIPMENT

- A. Water for Cleaning: Clean, potable, free of oils, acids, alkalis, salts, and organic matter.
- B. Warm Water: Heat water to a temperature of 140 to 180EF (60 to 82EC).
- C. Brushes: Fiber bristle only.
- D. Job-Mixed Detergent Solution: Solution prepared by mixing 3 oz. of trisodium phosphate (TSP), 1 oz. of laundry detergent (Tide, All, etc.), 1 quart of 5 percent sodium hypochlorite (bleach), and 3 quarts of warm water for each gallon of solution required.

- E. Nonacidic Gel Cleaner: Manufacturer's standard nonacidic gel containing detergents and chelating agents and specifically formulated for cleaning masonry surfaces. Cleaner shall have a pH between 6 and 9 and shall not be considered a hazardous waste according to EPA 40 CFR 261.
1. Product: Subject to compliance with requirements, provide Sure Klean 942 Masonry Cleaner, ProSoCo, Inc.
- F. Acidic Cleaner: Manufacturer's standard-strength acidic masonry restoration cleaner composed of hydrofluoric acid blended with other acids, including a trace of phosphoric acid, and combined with special wetting systems and inhibitors.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Diedrich 101-G Granite, Terra Cotta, and Brick Cleaner, Diedrich Technologies, Inc.
 - b. Sure Klean Restoration Cleaner, ProSoCo, Inc.
 - c. Prospec Heavy Duty Restoration Cleaner, Watson Bowman Acme Corp.
- G. One-Part Limestone Cleaner: Manufacturer's standard one-part acid formulation for cleaning limestone.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Sure Klean Limestone Restorer, ProSoCo, Inc.
 - b. Prospec Limestone and Precast Cleaner, Watson Bowman Acme Corp.
- H. Two-Part Limestone Cleaner: Manufacturer's standard two-part system consisting of an alkaline cleaner for prewash and an acid neutralizer for afterwash.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Diedrich Limestone Cleaner Prerinse and Afterrinse, Diedrich Technologies, Inc.
 - b. Sure Klean Limestone Prewash and Afterwash, ProSoCo, Inc.
- I. Chemical Paint Remover: Manufacturer's standard thixotropic/alkaline formulation for removing paint coatings from masonry.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Diedrich 505/606/606X Paint Remover, Diedrich Technologies, Inc.
 - b. Sure Klean Heavy-Duty Paint Stripper, ProSoCo, Inc.
- J. Water-Rinsable Chemical Paint Remover: Manufacturer's standard thixotropic water-rinsable solvent formulation for removing paint coatings from masonry.
1. Product: Subject to compliance with requirements, provide Sure Klean 509 Paint Stripper, ProSoCo, Inc.
- K. Soot Remover: Manufacturer's standard alkaline cleaner formulated to remove smoke stains and soot encrustation from masonry surfaces.
1. Product: Subject to compliance with requirements, provide Sure Klean Smoke Remover, ProSoCo, Inc.
- L. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from the damaging effects of acidic and alkaline masonry cleaners.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Diedrich Acid Guard, Diedrich Technologies, Inc.
 - b. Sure Klean Acid Stop, ProSoCo, Inc.
 - c. Prospec Glass Guard II, Watson Bowman Acme Corp.
- M. Spray Equipment: Provide equipment for controlled spray application of water and chemical cleaners, if any, at rates indicated for pressure, measured at spray tip, and for volume. Adjust pressure and volume, as required, to ensure that damage to masonry does not result from cleaning methods.

1. For chemical cleaner spray application, provide low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with a cone-shaped spray tip.
2. For water spray application, provide a fan-shaped spray tip that disperses water at an angle of not less than 15 degrees.
3. For heated water spray application, provide equipment capable of maintaining a temperature at flow rates indicated between 140 and 180EF (60 and 82EC).
4. For steam application, provide a steam generator capable of delivering live steam at the nozzle head.

2.4 MISCELLANEOUS MATERIALS

- A. Stone-to-Stone Adhesive: Two-part polyester resin stone adhesive with a 15 to 30 minute cure at 70EF (21EC), in formulation (knife or flowing grade) recommended by adhesive manufacturer for type of stone repair indicated, and in color indicated or, if not otherwise indicated, as selected by Architect from tinted or standard colors available from adhesive manufacturer.
 1. Product: Subject to compliance with requirements, provide Akemi adhesives distributed by Wood and Stone, Inc., Manassas, VA.
- B. Mortar-to-Stone Adhesive: High-modulus, high-strength, moisture-insensitive epoxy adhesive with a pot life of 30 minutes at 40EF (4EC).
 1. Product: Subject to compliance with requirements, provide Sikadur Hi-Mod Epoxy, Sikastix 370, Sika Corporation.
- C. Stone Consolidation Treatment: Ready-to-use product designed for the consolidation and water repellant treatment of masonry materials that have deteriorated due to weathering and pollutant exposure. Treatment shall be composed of silicic ethyl esters, a neutral catalyst, a silane water repellant, and solvents.
 1. Product: Subject to compliance with requirements, provide Conservare H Stone Strengthener, ProSoCo, Inc.
- D. Stone Consolidation Treatment: Ready-to-use product designed for the consolidation of masonry materials that have deteriorated due to weathering and pollutant exposure. Treatment shall be composed of silicic ethyl esters, a neutral catalyst, and solvents.
 1. Product: Subject to compliance with requirements, provide Conservare OH Stone Strengthener, ProSoCo, Inc.
- E. Stone Anchors: Type and size indicated or, if not indicated, to match existing in size and type. Fabricate anchors and dowels from AISI Type 302/304 stainless steel.

2.5 MORTAR MIXES

- A. Measurement and Mixing: Measure cementitious and aggregate material 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.
 1. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 1 to 2 hours. Add remaining water in small portions until reaching mortar of desired consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
- B. Do not use admixtures of any kind in mortar, unless otherwise indicated.
- C. Mortar Proportions: Mix mortar materials in the following proportions:
 1. Pointing Mortar for Stone: One part white portland cement, one part lime, and six parts colored or natural mortar aggregate.
 - a. Add colored mortar pigment to produce mortar color required.
 2. Rebuilding Mortar: One part white portland cement, one part lime, and six parts colored or natural mortar aggregate.
 3. Rebuilding Mortar: Comply with ASTM C 270, Proportion Specification, Type N, unless otherwise indicated, with cementitious material content limited to portland cement-lime.
 4. Patching Mortar for Stone: Provide mix composed of white and gray cement combined with lime and selected aggregates to produce a color matching the color of existing stone. Proportion mix with two parts cement, two parts lime, and six parts aggregate.

2.6 CHEMICAL CLEANING SOLUTIONS

- A. General: Unless otherwise indicated, dilute chemical cleaning materials with water to produce solutions of concentration indicated but not greater than that recommended by chemical cleaner manufacturer.
- B. Acidic Cleaner Solution for Unpolished Stone: Maximum hydrofluoric acid content of 3 percent.
 - 1. Use acidic cleaner only on unpolished granite, unpolished dolomite marbles, and siliceous sandstone.
- C. Acidic Cleaner for Polished Stone: In a concentration demonstrated by testing that does not etch or otherwise damage polished surface.
 - 1. Use acidic cleaner on only polished granites and polished dolomite marbles.
- D. Alkaline Cleaner for Prewashing Limestone: In a concentration recommended by chemical cleaner manufacturer.
- E. Acid Neutralizer for Afterwashing Limestone: In a concentration recommended by chemical cleaner manufacturer.
- F. Chemical Paint Remover: In a concentration recommended by chemical cleaner manufacturer.
- G. Soot Remover: In a concentration recommended by chemical cleaner manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Comply with recommendations of cleaner manufacturer's chemical cleaners for protecting building surfaces against damage from exposure to their products.
- B. Protect persons, motor vehicles, surrounding surfaces of building whose masonry surfaces are being restored, building site, plants, and surrounding buildings from injury resulting from masonry restoration work.
 - 1. Prevent chemical cleaning solutions from coming into contact with pedestrians, motor vehicles, landscaping, buildings, and other surfaces that could be injured by such contact.
 - 2. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - 3. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
 - 4. Erect temporary protection covers over pedestrian walkways and at points of entrance and exit for persons and vehicles that must remain in operation during course of masonry restoration work.
- C. Protect adjacent surfaces from contact with acidic chemical cleaners by covering them with a liquid strippable masking agent or polyethylene film and waterproof masking tape. Apply masking agent to comply with manufacturer's recommendations. Do not apply liquid masking agent to painted or porous surfaces.
- D. Protect adjacent surfaces from contact with alkali chemical cleaners by covering them either with liquid strippable masking agent or polyethylene film and waterproof masking tape.

3.2 CLEANING MASONRY, GENERAL

- A. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other. Work from bottom to top of the building for each scaffold drop.
- B. Use only those cleaning methods indicated for each masonry material and location.
- C. 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.
- D. Rinse off chemical residue and soil by working upwards from bottom to top of each treated area at each stage or scaffold setting.

- E. Removing Plant Growth: Completely remove plant, moss, and shrub growth completely from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible prior to removal. Remove loose soil or debris from open masonry joints to whatever depth it occurs.
1. Apply ammonium sulfamate or another acceptable root-killing material to plant roots according to manufacturer's instructions. Do not apply materials to plants or vegetation to remain on or around the building.
- F. Water Application Methods: Where water application methods are indicated, comply with the following:
1. Prolonged Spraying: Soak masonry surfaces by applying water continuously and uniformly to a limited area for the time period indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
 2. Spray Applications: Spray-apply water to masonry surfaces to comply with requirements indicated for location, purpose, water temperature, pressure, volume, and equipment. Unless otherwise indicated, hold spray nozzle no less than 6 inches from surface of masonry and apply water from side to side in overlapping bands to produce uniform coverage and an even effect.
 - a. Low-Pressure Spray: 100 to 400 psi; 3 to 6 gal. per minute.
 - b. Medium-Pressure Spray: 400 to 800 psi; 3 to 6 gal. per minute.
 - c. High-Pressure Spray: 800 to 1200 psi; 3 to 6 gal. per minute.
 3. Steam Wash: Apply steam to masonry surfaces at pressures not exceeding 80 psi. Hold nozzle no less than 6 inches from surface of masonry and apply steam from side to side or in the direction of the tooling in overlapping bands to produce uniform coverage and an even effect.
- G. Chemical Cleaner Application Methods: Apply chemical cleaners to masonry surfaces to comply with chemical manufacturer's recommendations using brush or spray application methods, at Contractor's option, unless otherwise indicated. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.
1. Spray Application: Apply chemical cleaners at pressures not exceeding 50 psi, unless otherwise indicated.
 2. Reapplying Chemical Cleaners: Do not apply chemical cleaners to same masonry surfaces more than twice. If additional cleaning is required, use a steam wash.

3.3 CLEANING STONEMASONRY

- A. Cold Water Wash: At locations indicated, clean stone surfaces by the following procedure.
1. Wet masonry with prolonged spraying for duration indicated below.
 - a. Continue spraying until surface encrustation has softened sufficiently to permit its removal by water wash.
 - b. Continue spraying for 72 hours.
 2. Remove Soil and Softened Surface Encrustation from Stone by Applying Cold Water as Follows:
 - a. Low-pressure spray.
 - b. Medium-pressure spray.
 - c. High-pressure spray.
- B. Warm Water Wash: At locations indicated, clean stone surfaces with warm water applied as follows:
1. Low-pressure spray.
 2. Medium-pressure spray.
 3. High-pressure spray.
- C. Detergent Cleaning: At locations indicated, clean stone surfaces with a detergent solution applied as follows:
1. Wet masonry with cold water applied by low-pressure spray.
 2. Wet masonry with warm water applied by low-pressure spray.
 3. Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes, as required, to remove soil from mortar joints and crevices. Dip brush in solution often to ensure adequate fresh detergent and that masonry surface remains wet.
 4. Rinse Masonry with Cold Water to Remove Detergent Solution and Soil.
 5. Rinse Masonry with Warm Water to Remove Detergent Solution and Soil, Applied as Follows:
 - a. Low-pressure spray.
 - b. Medium-pressure spray.
 - c. High-pressure spray.

6. Repeat cleaning procedure above where required to produce the effect established by the mockup.
- D. Acidic Chemical Cleaning: At locations indicated, clean stone surfaces with an acidic cleaner of dilution indicated, applied as follows:
1. Wet masonry with cold water applied by low-pressure spray.
 2. Wet masonry with warm water applied by low-pressure spray.
 3. Apply acidic cleaner to stone. Let cleaner remain on surface for period indicated below before rinsing away.
 - a. As recommended by chemical cleaner manufacturer.
 - b. 2 to 3 minutes.
 4. Rinse Stone with Cold Water to Remove Chemicals and Soil
 5. Rinse Stone with Warm Water to Remove Chemicals and Soil, Applied as Follows:
 - a. Low-pressure spray.
 - b. Medium-pressure spray.
 - c. High-pressure spray.
 6. Repeat cleaning procedure above where required to produce the cleaning effect established by mockup. Do not apply more than twice.
- E. Nonacidic Gel Chemical Cleaning: At locations indicated, clean stone surfaces with a nonacidic gel cleaner applied as follows:
1. Wet masonry with cold water applied by low-pressure spray.
 2. Wet masonry with warm water applied by low-pressure spray.
 3. Apply nonacidic gel cleaner in a 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so that the area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout the area being cleaned.
 4. Let Cleaner Remain on Surface for Period Indicated Below:
 - a. As recommended by chemical cleaner manufacturer.
 - b. As established by mockup.
 5. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
 6. Rinse Masonry with Cold Water to Remove Chemicals and Soil
 7. Rinse Masonry with Warm Water to Remove Chemicals and Soil, Applied as Follows:
 - a. Low-pressure spray.
 - b. Medium-pressure spray.
 - c. High-pressure spray.
 8. Repeat cleaning procedure above where required to produce the effect established by the mockup. Do not apply more than twice.
- F. One-Part Limestone Chemical Cleaning: At locations indicated, clean limestone surfaces with one-part system using one-part limestone cleaner of dilution indicated, applied as follows:
1. Wet stone with cold water applied by low-pressure spray.
 2. Wet stone with warm water applied by low-pressure spray.
 3. Apply one-part limestone cleaner to stone by using a soft-fiber brush or low-pressure spray equipment. Let cleaner remain on surface for period recommended by manufacturer.
 4. Immediately repeat application of one-part limestone cleaner as indicated above over the same area.
 5. Rinse stone with cold water applied by medium-pressure spray to remove chemicals and soil.
 6. Rinse stone with warm water applied by medium-pressure spray to remove chemicals and soil.
- G. Two-Part Limestone Chemical Cleaning: At locations indicated, clean limestone surfaces with two-part systems using chemical cleaners of dilution indicated, applied as follows:
1. Wet stone with cold water applied by low-pressure spray.
 2. Wet stone with warm water applied by low-pressure spray.
 3. Apply prewash alkaline cleaner to stone by brush or roller. Let cleaner remain on surface for period recommended by cleaner manufacturer, unless otherwise indicated.
 4. Rinse stone with cold water applied by medium-pressure spray to remove chemicals and soil.
 5. Rinse stone with warm water applied by medium-pressure spray to remove chemicals and soil.
 6. Apply acid neutralizer for afterwash to stone while it is still wet using low pressure spray equipment or deep nap roller or soft-fiber brush. Let neutralizer remain on surface for period recommended by manufacturer, unless otherwise indicated.
 7. Rinse stone with cold water applied to medium-pressure spray to remove chemicals and soil.
 8. Rinse stone with warm water applied by medium-pressure spray to remove chemicals and soil.

9. Repeat cleaning procedure above where required to produce the cleaning effect established by mockup. Do not apply more than twice.

H. Paint Removal: At locations indicated, remove paint from masonry surfaces as follows:

1. Apply chemical paint remover to dry painted masonry with brushes.
2. Allow chemical paint remover to remain on surface for period recommended by paint remover manufacturer.
3. Remove Chemical and Paint Residue by Rinsing with Water Applied as Follows:
 - a. Low-pressure spray.
 - b. Medium-pressure spray.
 - c. High-pressure spray.
4. Apply an afterwash acidic cleaner to masonry while it is still wet using low-pressure spray equipment or a soft-fiber brush. Let cleaner remain on surface for period recommended by manufacturer, unless otherwise indicated.
5. Rinse Masonry with Cold Water to Remove Chemicals and Soil, Applied as Follows:
 - a. Low-pressure spray.
 - b. Medium-pressure spray.
 - c. High-pressure spray.

I. Paint Removal with Water-Rinsable Chemical Paint Remover: At locations indicated, remove paint from masonry surfaces as follows:

1. Apply thick coating of water-rinsable chemical paint remover to painted masonry with natural-fiber cleaning brush, deep-nap roller, or large paint brush.
2. Allow chemical paint remover to remain on surface for period recommended by paint remover manufacturer. Agitate periodically with a stiff-bristle brush.
3. Remove Chemical and Paint Residue by Rinsing with Water Applied as Follows:
 - a. Low-pressure spray.
 - b. Medium-pressure spray.
 - c. High-pressure spray.

J. Soot Removal: At locations indicated, remove soot from masonry surfaces as follows:

1. Apply chemical soot remover to masonry with brushes.
2. Allow chemical soot remover to remain on surface for period recommended by soot remover manufacturer.
3. Remove Chemical and Soot Residue by Rinsing with Water Applied as Follows:
 - a. Low-pressure spray.
 - b. Medium-pressure spray.
 - c. High-pressure spray.
4. Apply an afterwash acidic cleaner to masonry while it is still wet using low-pressure spray equipment or a soft-fiber brush. Let cleaner remain on surface for period recommended by manufacturer, unless otherwise indicated.
5. Rinse Masonry with Cold Water to Remove Chemicals and Soil, Applied as Follows:
 - a. Low-pressure spray.
 - b. Medium-pressure spray.
 - c. High-pressure spray.

3.4 STONE REMOVAL AND REPLACEMENT

- A. Carefully remove by hand, at locations indicated, stone that has deteriorated, shifted, or is damaged beyond repair.
- B. Remove mortar, loose particles, and other debris from salvaged stone and stone surrounding removed units to prepare for resetting.
- C. Replace removed stone with salvaged stone, where possible, or with new stone matching existing, including size. Butter vertical joints for full width before setting and set units in full bed of mortar, unless otherwise indicated.
 1. Tool joints after setting to match joints of surrounding stone.
 2. Point new mortar joints to comply with requirements for repointing existing masonry, and rake out mortar used to set units before mortar sets.

3.5 STONE REPAIR

- A. Carefully remove loose stone fragments in areas to be repaired. Reuse only pieces of spalled stone that are in sound condition.
- B. Remove soil, loose stone particles, mortar, and other debris or foreign material from the surfaces to be bonded on both the fragment and the building stone from which fragment was removed by cleaning with a stiff brush.
- C. Apply adhesive to comply with adhesive manufacturer's directions. Coat bonding surface of building stone with stone-to-stone adhesive completely filling all voids and covering all surfaces. Fit stone fragments onto building stone while adhesive is still tacky and hold fragment securely in place until adhesive has cured.
- D. After adhesive has fully cured, anchor stone fragments further with 1/4-inch-diameter plain stainless steel rods set into 1/4-inch-diameter holes drilled at a 45-degree downward angle through the face of the stone. Center and space anchor rods between 3 and 5 inches apart and not less than 2 inches from any edge. Insert rods not less than 2 inches into backing stone and 2 inches into fragment with end countersunk at least 3/4 inch from the exposed face of the stone.
- E. Clean residual adhesive from edges. Wet stone and fill chipped areas and drill holes with patching mortar. Avoid featheredging. Finish patched areas to match texture of and be level with adjoining surrounding stone surfaces. Keep patching mortar damp for 72 hours.

3.6 STONE PATCHING

- A. Cut out deteriorated stone and adjacent stone that has begun to deteriorate. Remove additional stone so that patch will not have feathered edges and will be at least 1/4 inch thick.
- B. Remove loose particles, soil, debris, oil, and other contaminants from existing stone units at locations indicated by cleaning with a stiff-bristle brush.
- C. Brush-coat stone surfaces with mortar-to-stone adhesive complying with manufacturer's directions.
- D. Brush-coat stone surfaces with a slurry coat of patching mortar complying with manufacturer's directions.
- E. Place patching mortar in layers no thicker than 2 inches. Roughen surface of each layer to provide a key for the next.
- F. Build patch up 1/4 inch above surrounding stone and carve surface to match adjoining stone after mortar has hardened.
- G. Keep each layer damp for 72 hours or until mortar has set.
- H. Unacceptable patches are defined as those with hairline cracks or that show separation from stone at edges, and those that do not match adjoining stone in color or texture. Remove patches and refill to provide patches free of those defects.

3.7 STONE CONSOLIDATION TREATMENT

- A. Apply treatment to clean, dry surfaces according to manufacturer's instructions. Remove areas of blind exfoliation and delamination before applying.
- B. Apply in cycles (repeated applications) to relatively small sections of masonry, not more than 100 sq. ft. in area. Each cycle shall consist of three successive saturating applications, applied at 5- to 15-minute intervals, depending on drying conditions.
- C. Apply by low-pressure spray to the point of rejection in each application. Apply from bottom of section to top.
- D. Apply three cycles, allowing treated surface to dry for 60 to 90 minutes between cycles.

- E. Protect treated surfaces from rain for 48 hours after treatment.
- F. Allow treated surfaces to dry for not less than 21 days before repointing, patching, or applying water repellants or sealants.

3.8 REPOINTING MASONRY

A. Rake Out Joints as Follows:

1. Rake out mortar from joints to depths equal to 2-1/2 times their widths but not less than 1/2 inch nor less than that required to expose sound, unweathered mortar.
2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
3. Do not spall edges of masonry units or widen joints. Replace damaged masonry units.
 - a. Cut out old mortar by hand with a chisel and mallet, unless otherwise indicated.
 - b. Do not use power-operated rotary hand saws and grinders unless specific Architect's written approval is obtained based on submission by Contractor of a satisfactory quality control program and demonstrated ability of operators to use tools without damaging masonry. Quality control program shall include provisions for supervising performance and preventing damage due to worker fatigue.

B. Point Joints as Follows:

1. Rinse masonry joint surfaces with water to remove dust and mortar particles. Time the rinsing application so that at the time of pointing excess water has evaporated or run off and joint surfaces are damp but free of standing water.
2. Apply the first layer of pointing mortar to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Compact each layer thoroughly and allow it to become thumbprint hard before applying the next layer.
3. After joints have been filled to a uniform depth, place remaining pointing mortar in three layers with each of first and second layers filling approximately two fifths of joint depth and third layer the remaining one fifth. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing stone has rounded edges, recess final layer slightly from face. Take care not to spread mortar over edges onto exposed masonry surfaces, or to featheredge mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints, unless otherwise indicated. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in a damp condition for not less than 72 hours.
6. Where repointing work precedes cleaning of existing masonry, allow mortar to harden not less than 30 days before beginning cleaning work.

3.9 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter using stiff nylon or bristle brushes and clean water, which is spray-applied at a low pressure.
- B. Using metal scrapers or brushes is not permitted.
- C. Using acid or alkali cleaning agents is not permitted.

END OF SECTION 04530