SECTION 04940 – MARBLE CLEANING AND RESTORATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Removing paints and stains.
2. Repairing marble, including replacing damaged units.
3. Cleaning marble surfaces.
4. Repointing marble joints.

B. Related Sections include the following: Division 9 sections.

C. Unit Prices: marble restoration and cleaning to be provided under unit prices are described in Division 1 Section "Unit Prices."

1.3 SUBMITTALS

A. Product Data: For each product indicated. Include recommendations for application and use. Include test reports and certifications substantiating that products comply with requirements.

B. Samples for verification, before erecting the mockup, of the following:

1. Each type of mortar for pointing and marble rebuilding and repair in the form of sample mortar strips, 6 inches long by 1/2 inch wide, set in aluminum or plastic channels.
2. Each type of chemical cleaner.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Restoration program for each phase of the restoration and cleaning process, including protection of surrounding materials on the building and Project site during operations. Describe in detail the materials, methods, equipment, and sequence of operations to be used for each phase of the restoration and cleaning work.

1. If alternative materials and methods to those indicated are proposed for any phase of restoration and cleaning work, provide a written description, including evidence of successful use on other comparable projects, and a testing program to demonstrate their effectiveness for this Project.

1.4 QUALITY ASSURANCE

A. Restoration Specialist: Engage an experienced marble restoration and cleaning firm that has completed work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1. At Contractor's option, the work may be divided between 2 specialist firms: 1 for cleaning work and 1 for repair work.
2. Field Supervision: Require restoration specialist firms to maintain an experienced full-time supervisor on the Project site during times that marble restoration and cleaning are in progress.

B. Chemical Manufacturer Qualifications: A company regularly engaged in producing marble cleaners that have been used for similar applications with successful results, and with factory-trained representatives who are available for consultation and Project site inspection and assistance at no additional cost.

C. Mockups: Prepare field samples for restoration methods and cleaning procedures to demonstrate aesthetic effects and qualities of materials and execution. Use materials and methods proposed for completed Work and prepare samples under same weather conditions to be expected during remainder of Work.

1. Locate mockups on the building where directed by Architect.
2. Marble Restoration: Prepare sample panels of 3 linear feet for each type of restoration proposed. Maintain the sample panel throughout the restoration to demonstrate the quality of materials and workmanship expected.
3. Cleaning: Prepare sample approximately 2 linear feet in length overlapping restored marble for each type of surface condition.

    a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions, unless cleaners and methods are known to have a deleterious effect.
    b. Allow a waiting period of not less than 7 days after completion of sample cleaning to permit a study of sample panels for negative reactions.

4. Repointing: Prepare 2 separate sample areas for each type of repointing required; 1 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.
5. Notify Architect 7 days in advance of the dates and times when samples will be prepared.
6. Obtain Architect's approval of mockups before starting the remainder of marble restoration and cleaning.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

D. Preconstruction Testing: Owner will engage an independent testing agency to perform preconstruction testing. Submit samples of each proposed type of replacement brick for testing.

E. Preconstruction Testing: Engage an independent testing agency experienced in performing the type of tests indicated and approved by Architect to perform preconstruction tests.

F. Source of Materials: Obtain materials for marble restoration from a single source for each type of material required to ensure a match of quality, color, pattern, and texture.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Carefully pack, handle, and ship marble units and accessories strapped together in suitable packs or pallets or in heavy-duty cartons.

B. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.

C. Store cementitious materials off the ground, under cover, and in a dry location.

D. Comply with manufacturer's written instructions for minimum and maximum temperature requirements for storage.

1.6 PROJECT CONDITIONS

A. Do not repoint mortar joints unless air temperature is between and 40 and 80 deg F and will remain so for at least 48 hours after completion of Work.

B. Cold-Weather Requirements: Comply with the following procedures for marble repair and mortar-joint pointing:

1. When air temperature is below 40 deg F, heat mortar ingredients, marble repair materials, and existing walls to produce temperatures between 40 and 120 deg F.
2. When mean daily air temperature is between 25 and 40 deg F, cover completed Work with weather-resistant, insulating blankets for 48 hours after repair and pointing.
3. When mean daily air temperature is below 25 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after repair and pointing.

C. Hot-Weather Requirements: Protect restoration work when temperature and humidity conditions produce excessive evaporation of water from mortar and patching materials. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 90 deg F and above.

D. Clean marble surfaces only when air temperature is 40 deg F and above and will remain so for at least 7 days after completion of cleaning.

E. Prevent grout or mortar used in repointing and repair work from staining face of surrounding marble and other surfaces. Immediately remove grout and mortar in contact with exposed marble and other surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Oil paint on marble:

   a. Materials
      1. Baking soda or some other alkaline cleaner to be used to form the poultice paste: Available from hardware store.
      2. Liquid laundry bleach for making the paste
      3. Mineral water
      4. Plastic sheeting
      5. Clean dry towels for blotting the area after treatment
   b. Equipment
      1. Glass or ceramic container for mixing the solution
      2. Wooden utensil for stirring the ingredients
      3. Wood or plastic spatula
      4. Masking tape

2. Latex and acrylic paint on marble:

   a. Manufacturers
      1. ProSoCo, Inc.
         755 Minnesota Avenue
         P.O. Box 1578
         Kansas City, KS 66117
         800/255-4255 or 913/281-2700
   b. Materials
      1. Heavy liquid methylene chloride paint stripper such as "509 Stripper" (ProSoCo, Inc.), or approved equal.
   c. Equipment
      1. Wood or plastic spatulas and stiff fibre or jute brushes or removing the sludge and curdled paint.
      2. Stiff bristle brushes (non-metallic)

3. Dirt on marble:

a. Manufacturers:
   1. BASF-Wyandotte Corporation
      Chemical Specialties Division
      1609 Biddle
      Wyandotte, MI 48192
      313/246-6100
   2. ProSoCo, Inc.
      755 Minnesota Avenue
      P.O. Box 1578
      Kansas City, KS 66117
      800/255-4255 or 913/281-2700
   3. Eastern Marble Supply Company
      P.O. Box 392
      Scotch Plains, NJ 07076
      908/789-6400

b. Materials
   1. Liquid Marble Cleaner: A water-soluble non-acidic chemical cleaner manufactured specifically for restorative type cleaning of polished and honed marble surfaces. Cleaner shall contain no abrasives, grease,lye, or other caustic or corrosive ingredients, such as "Sure Klean Liquid Marble Cleaner" (ProSoCo, Inc.) or approved equal.

   -OR-

      Cleaning Detergent: A mildly alkaline phosphorous-free biodegradable liquid soap.

   -OR-

      Household ammonia and distilled water
   2. Cleaning Compound for Buffing a Honed Finish: An abrasive cleaning compound, containing no caustic or harsh fillers, manufactured specifically for restorative type cleaning of honed marble surfaces such as "Wyandotte Detergent" (BASF-Wyandotte Corporation) or approved equal.

   -OR-

      Polishing Agent for Buffing a Polished Finish: A finely ground buffing powder manufactured specifically for restorative type polishing of polished marble surfaces, such as "Marbalite #52" (Eastern Marble Supply Company) or approved equal.
   3. Clean, potable water

c. Equipment
   1. Buffing pads for Polished Finish: Fiber brush pads manufactured specifically for restorative type polishing of polished marble surfaces

   -OR-

      Buffing Pads for Honed Finish: Synthetic pads manufactured specifically for restorative type cleaning of honed marble surfaces
   2. Soft natural bristle brushes (DO NOT USE WIRE BRUSHES OR STEEL WOOL)
   3. Circular buffing machine (for floors)

-OR-

Hand-held buffing machine (for surfaces other than floors)

4. Mop and bucket (non-metallic)
5. Sponges
6. Clean, dry cloths

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II.

1. Provide white cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Quicklime: ASTM C 5, pulverized lime.

D. Aggregate for Mortar: ASTM C 144, unless otherwise indicated.

1. Colored-Mortar Aggregate: Natural or manufactured sand selected to produce mortar color indicated.
2. For pointing mortar, provide sand with rounded edges.
3. Match size, texture, and gradation of existing mortar as closely as possible.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in marble mortars.

F. Water: Potable.

2.3 CLEANING MATERIALS

A. Water for Cleaning: Potable.

B. Warm Water: Heat water to a temperature of 140 to 160 deg F.

C. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium polyphosphate (TSPP), 1/2 cup of laundry detergent (Tide, All, etc.), 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of warm water for each 5 gal. of solution required.

D. Nonacidic Gel Cleaner: Manufacturer's standard nonacidic gel containing detergents and chelating agents and specifically formulated for cleaning marble surfaces. Cleaner shall have a pH between 6 and 9 and shall not be considered a hazardous waste according to 40 CFR 261.

E. 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.

2.4 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 the desired consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.

B. Colored Mortar: Produce mortar of color required by using selected ingredients. Do not adjust proportions without Architect's approval.

1. Mortar Pigments: Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.

C. Do not use admixtures of any kind in mortar, unless otherwise indicated.

D. Mortar Proportions: Mix mortar materials in the following proportions:

1. Pointing Mortar: 1 part white portland cement, 1 part lime, and 6 parts colored- or natural-mortar aggregate.

a. Add mortar pigments to produce mortar color required.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Comply with chemical cleaner manufacturer's written instructions for protecting building surfaces against damage from exposure to their products.

B. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from injury resulting from marble 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 marble during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
3. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.

4. 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.
5. 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 marble restoration work.

C. Protect adjacent surfaces from contact with 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 written instructions. Do not apply liquid masking agent to painted or porous surfaces.

3.2 OIL PAINT ON MARBLE:

A. EXAMINATION

1. Examine the marble CAREFULLY to determine the cause of staining before proceeding with any cleaning operation.

B. ERECTION, INSTALLATION, APPLICATION

NOTE: DO NOT USE BLEACH ON DARK COLORED STONES AS THIS WILL CAUSE THE STONE TO LIGHTEN.

1. Protect adjacent painted surfaces.
2. Rinse the area to be treated with mineral water.
3. Pour the liquid laundry bleach in a glass or ceramic bowl.
4. Thoroughly moisten the stained surface with this liquid. Be sure to dampen well beyond the stain.
5. Mix the remaining liquid with the white absorbent material to form a paste the consistency of oatmeal or cake icing. (Approximately one pound of paste is needed for every square foot of surface area to be treated.)
6. Using a wooden or plastic spatula, apply the paste to the stained surface in layers no more than 1/4 inch thick. The poultice should extend well beyond the stain to prevent forcing the stain into previously clean stone.
7. Check the coating for air pockets or voids.
8. After the poultice has been applied, cover it with damp cloths to keep the poultice moist.
9. Leave the cloths in place overnight.
10. Remove the cloths and wet the poultice with mineral water.
11. Remove the poultice with a wooden or plastic spatula to avoid scratching the surface.
12. Thoroughly rinse the treated area with mineral water, blot, and allow to dry completely.
13. If there is residual staining, repeat the procedure.

3.3 LATEX AND ACRYLIC PAINT ON MARBLE:

A. Examination

1. Examine the marble surface CAREFULLY to determine the cause of staining before proceeding with any cleaning operation.

B. Application
1. Thoroughly rinse the stained area with clean, clear water.
2. Apply a thixotropic paste of methylene chloride paint stripper to the surface and allow to dry; follow manufacturer's instructions.
3. Remove dried paste with a wooden spatula.
4. Thoroughly rinse the surface with clean, clear water and allow to dry.
5. Repeat the process as necessary to sufficiently remove the stain.

3.4 DIRT ON MARBLE:

A. Preparation
1. Protection: Prevent chemical cleaning and stain removal solutions from coming into contact with other surfaces which could be damaged by such contact.
2. Surface Preparation:
a. Prior to cleaning, remove cellophane tape, masking tape, etc. from surface.

B. Application
NOTE: Perform each cleaning method indicated in a manner which results in uniform coverage of all surfaces, including corners, moldings, interstices and which produces an even effect without streaking or damage to marble surfaces. CLEAN TO ACHIEVE A DESIRED (NOT NEW) APPEARANCE.
1. Cleaning Honed Marble:
a. Machine buff with a cleaning compound (see Materials, Section 2.02 B. above):
1) Thoroughly wet honed marble surface with hot water.
2) Sprinkle cleaning compound onto surface.
3) Buff surfaces using a large circular buffing machine with a synthetic pad for floors or a hand-held machine for other surfaces to lift dirt build-up.
4) Treat edges and corners of surfaces not accessible with the hand-held machine.
5) Thoroughly rinse surfaces with clean, clear water to remove loosened dirt and standing water. Change rinse water frequently and repeat rinsing as required to completely remove water and dirt residue from surface.
6) Repeat process as to achieve the desired appearance.
7) Dry surfaces with clean, dry cloths or dry mop floors after rinsing to prevent streaking.

-OR-

b. Follow procedures in Section 3. below.

2. Cleaning Polished Marble:
a. Machine buff with a polishing agent (see Materials, Section 2.02 B. above):
1) Mix polishing agent with water to create a paste compound as recommended by manufacturer.

2) Apply paste mixture to surface and buff using a hand-held machine with a fiber brush buffing pad. Treat areas of approximately 9 sq. ft. at a time, first running the pad horizontally and then vertically across surface.
3) Repeat process as necessary to achieve the desired appearance.
4) Final polish by first wetting with clean water followed by running a clean buffing pad across the surface until dry.

-OR-

b. Follow procedures in Section 3. below.

3. Cleaning Either Honed or Polished Marble:
   a. Apply a liquid marble cleaner to the surface (see Materials, Section 2.02 A. above):
      1) Apply cleaner to honed or polished marble surface using a stiff bristle brush.
      2) Allow cleaner to remain on surface for period recommended by chemical cleaner manufacturer taking care not to allow cleaning material to dry.
      3) Sponge rinse surface thoroughly using clean, clear water to completely remove dirt and cleaner residue. Change rinse water frequently.
      4) Repeat process as necessary to achieve the desired level of cleanliness.
      5) Wipe the surface with a clean, dry cloth to prevent streaking.

   -OR-

   b. Apply a mild detergent solution to the surface (see Materials, Section 2.02 A. above):
      1) Mix mild detergent with warm water to create cleaning solution -OR- mix 1 ounce soft soap, 1 quart warm distilled water and 1 ounce household ammonia.
      2) Thoroughly wet the honed or polished marble surface with hot water.
      3) Apply cleaning solution with a cloth, sponge or soft-fibered brush. Wash in small overlapping areas.
      4) Sponge rinse surface thoroughly using clean, clear water to completely remove dirt and cleaner residue. Change rinse water frequently.
      5) Wipe the surface dry with clean, soft cloths to prevent streaking.

3.5 REPOINTING MARBLE

A. Examination
   1. Examine the marble surface CAREFULLY to determine the extent of loose and missing joints before proceeding with any raking and repointing operation.

B. Rake out joints as follows:

   1. Rake out loose mortar from joints to depths not less than 1/2 inch or not less than that required to expose sound, unweathered mortar.

2. Remove mortar from marble surfaces within raked-out joints to provide reveals with square backs and to expose marble for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
3. Do not spall edges of marble or widen joints. Replace damaged marble.

    a. Cut out old mortar by hand with a chisel and mallet, unless otherwise indicated.
    b. Do not use power-operated grinders without Architect's written approval based on submission by Contractor of a satisfactory quality-control program and demonstrated ability of operators to use tools without damaging marble. Quality-control program shall include provisions for supervising performance and preventing damage due to worker fatigue.

C. Point joints as follows:

1. Rinse marble surfaces with water to remove dust and mortar particles. Time rinsing application so, 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. 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.
4. Cure mortar by maintaining in a damp condition for at least 72 hours.
5. Where repointing work precedes cleaning of existing marble, allow mortar to harden at least 14 days before beginning cleaning work.

3.6 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed marble surfaces of excess mortar and foreign matter; use stiff-nylon or -fiber brushes and clean water, spray applied at a low pressure.

B. Do not use metal scrapers or brushes.

C. Do not use acidic or alkaline cleaners.

END OF SECTION 04940